

**Table of Contents**

[Introduction: The Researcher's Life 1](#_Toc356388989)

[Chapter Summaries 8](#_Toc356388990)

[Chapter 1 Coping and Health 12](#_Toc356388991)

[Chapter 2 Personality Psychology: Havings, Doings, and Beings in Context 30](#_Toc356388992)

[Chapter 3 Industrial/Organizational Psychology 2010: A Research Odyssey 52](#_Toc356388993)

[Chapter 4 The Next Frontier in Neuroscience? Believe It or Not, It's Physiological Psychology 71](#_Toc356388994)

[Chapter 5 Cross-Cultural Psychology in the 21st Century 98](#_Toc356388995)

[Chapter 6 Dr. Jekyll Meets Mr. Hyde: Two Faces of Research on Intelligence and Cognition 116](#_Toc356388996)

[Chapter 7 Social Psychology: Past, Present, and Some Predictions for the Future 133](#_Toc356388997)

[Chapter 8 Psychology of Women and Gender in the 21st Century 165](#_Toc356388998)

[Chapter 9 Sensation and Perception 180](#_Toc356388999)

[Chapter 10 Trends in Human Development 221](#_Toc356389000)

[Chapter 11 Psychology and Law, Now and in the Next Century: The Promise of an Emerging Area of Psychology 254](#_Toc356389001)

[Chapter 12 Psychopathology 286](#_Toc356389002)

[Chapter 13 Comparative Psychology and Animal Learning 312](#_Toc356389003)

[About the Editors 335](#_Toc356389004)

# Introduction: The Researcher's Life

Jane Halonen, James Madison University and  
Stephen F. Davis, Emporia State University

Research is a mental groping by starlight  
towards the daylight of clearer vision.  
It begins in the slow laborious search for facts in a narrow field.  
As material accumulates, relations appear.  
The mass ferments, and finally organizes itself  
into the semblance of a new living idea.  
--Harry Kirke Wolfe, May 29, 1918

Harry Kirke Wolfe founded his teaching career in psychology on the principle that the training of the mind would be served best by actively involving his students in psychological research. The consummate teacher, Wolfe clearly understood the interrelation between teaching and research, an emphasis we appreciatively emulate in this volume. It is the preparation of those individuals who choose the rewarding path of careers in psychological research (and those who will be teaching them) that we had in mind when we conceived the idea for this book. Therefore, we thought it would be helpful to bring together researchers of distinction to discuss the origin, development, and implementation of their own research ideas in the context of the current status of research in their specialized fields. The stories of their professional lives amply illustrate the process Wolfe described in the opening quotation.

Our primary audience for The Many Faces of Psychological Research in the 21st Century is the psychology student who is considering a career in research. Although both undergraduates and graduates should find this book quite valuable as a course text or a reference work, we think the book's most important value will be to serve as a source of inspiration and guidance in becoming involved in the research process. We carefully selected our chapter authors based on their current contributions to, and knowledge of, their respective specialty areas and their acknowledged expertise as teachers. The teacher-researcher combination resulted in chapters that we think are very readable and representative of contemporary research. As students strive to identify where their own potential can be expressed to maximum impact, we think this volume can assist in refining their choices, concentrating their energies, and enriching their repertoire of research strategies. The chapter authors not only offer advice and inspiration about specific fields of research within psychology, but they also serve as inspiring models in their own right for the contributions they have made to understanding behavior.

This book serves other secondary audiences as well. Our chapter authors provide a substantial resource for current, lecture-enhancing material for teachers of introductory psychology, who want their courses to reflect cutting-edge research. Although it is easy to envision this book becoming a staple in the teaching resources of graduate teaching assistants and neophyte faculty, teachers at all levels of experience can use this text to make their aging lecture notes more contemporary. As psychology continues to fragment and splinter, the need to acquire a general overview of the field becomes apparent; this book serves that function. Professionals who want to achieve an overview of research in the various areas of their discipline can also benefit from the researchers' stories.

Harry Kirke Wolfe's wisdom about the nature of science faithfully captures the excitement of the challenge of research in psychology. Our chapter authors have exhibited this willingness to grapple with mystery, careful observation skills, patience and discipline, creativity, and the insight to recognize a sound conclusion when it ultimately emerges from the chaos. Despite the difference in their areas of specialization, their common struggles to understand human behavior emerge from a complex evolution of psychological research.

A Brief History of Research in Psychology

Historians routinely point to 1879 as the birth of scientific psychology when Wilhelm Wundt began conducting original scientific research on mental processes in Leipzig, Germany (Goodwin, 1999; Schultz & Schultz, 1996). Wundt and his first American student, James McKeen Cattell, purposefully emulated the established natural sciences in their research practices, a pattern that was enthusiastically adopted by the early structural psychologists. However, not everyone understood why adherence to scientific methods was such an important aspect of the emerging science of psychology. Wolfe, Wundt's second American student to receive a PhD in psychology, attempted to clarify the intentions of psychology researchers and the nature of psychological research in a description that he wrote to the Nebraska Board of Regents in 1891. He acknowledged that psychology was having difficulty gaining recognition as a science. He drew attention to the essential role of experimentation in helping to establish psychology as equivalent to any other branch of experimental science. He suggested,

The measurement of the Quality, Quantity, and Time Relations of mental states  
is as inspiring and as good discipline as the determination of, say the percent  
of sugar in a beet or the variation of an electric current. The exact determination  
of mental processes ought to be as good mental discipline as the exact determination  
process taking place in matter.  
(Benjamin, 1991, p. 43)

Wolfe committed his own research energies to exploring mental processes as psychology in America continued to define its boundaries and its practices. Psychologists were not content to devote themselves solely to human mental processes. There were new and different worlds to conquer. Reports of animal research began to appear in the literature. In 1901, W. S. Small published the initial report of rat maze learning and Norman Triplett described the development of learned helplessness in perch. Within a few decades, the study of animal learning and behavior would become an integral component of the field of psychology, spearheaded by behaviorists Clark Hull, E. C. Tolman, Edwin R. Guthrie, Kenneth Spence, and B. F. Skinner.

The lure of applying psychology to practical human problems began to capture the imagination of other psychologists whose concerns were decidedly pragmatic. Lightner Witmer established the first psychological clinic in Philadelphia in 1896, ushering into being the largest specialty area in psychology, a specialization that continues to flourish. The pioneering work of Walter Dill Scott and Hugo Munsterberg in the early 1900s established the new specialty of industrial/organizational psychology. The development of the Army Alpha and Army Beta tests during World War I created a different kind of beachhead for psychology. The success of those assessment tools created many new opportunities for applying psychology to real world problems.

The Contemporary Landscape of Psychological Research

Subsequent decades have witnessed an explosion of specialized research interests in psychology. The American Psychological Association identified through its divisional affiliation structure at least 50 research communities devoted to unlocking the mysteries that remain unsolved in their chosen areas of inquiry. These areas include such broad-ranging specialties as military psychology, peace psychology, pediatric psychology, psychology and law, teaching of psychology, experimental analysis of behavior, and community psychology, among others.

It isn't just the topic areas that have changed and broadened since Wolfe's passionate defense of psychology as legitimate science. Research technology has undergone impressive changes. Puzzle boxes and brass instruments gave way to electromechanical relay racks, which, in turn, were replaced by a dazzling array of computers and computer-related devices used to create experimental conditions and record responses. The advent of electronic databases for psychological research facilitated faster and more efficient literature reviews contributing to the exponential growth of research across specialized discipline areas and, ironically, compounding the problem of "staying current" in one's own burgeoning research area. At the outset of a new century, we are likely to continue to see changes in technology that will compound the advantages and increase the hazards.

In a more literal sense, the "faces" of psychologists have also changed. Many textbooks have written extensively about scientific psychology as a white, male enterprise. Thanks to the splendid scholarship of historians, such as Laurel Furumoto and Elizabeth Scarborough, psychology has rediscovered the invaluable contributions of psychology's "foremothers." The research contributions of pioneering women, such as Mary Calkins and Christine Ladd-Franklin, provide exciting information not just about research on human behavior but about how human behavior among psychologists influenced the definition and evolution about how people gain acceptance as full-fledged members of the larger research community. Similar issues have challenged other minority constituents of psychology in the wake of the pioneering contributions by individuals such as Mamie and Kenneth Clark.

At the threshold of a new century, we recognize that the composition of faces of those persons who will be our future researchers is also shifting. The majority of students at the undergraduate and graduate levels of education are women. As attracted as women have become to the science and practice of psychology, we still have much work to do in helping psychology attract and retain ethnic minority researchers and practitioners.

We have also witnessed during the last decade some major changes and challenges to the values and ethical practices involved in research. Our growing expertise about the frailties of human observers led to a challenge related to the practice and value of objectivity. Captive in our own cultural constraints, we recognize the ease with which biases can filter even the most careful observations and research designs. Some researchers have begun to mount forceful arguments for revisiting the value of qualitative forms of research.

Most important, psychology has embraced the absolute necessity of enacting ethical safeguards for the protection of research participants. In psychology's earlier zeal for finding answers to behavioral questions, our community has enacted suspect, and in some instances, probably harmful actions to those we were trying to help with our research. Our widely-adopted institutional review practices have helped us choose a wiser and more humane path for answering the many mysteries that remain.

With the enterprise of scientific psychology continually expanding, it becomes increasingly challenging to identify where and how one should invest research energies. We asked for help from individuals who have carved out significant roles in various areas of research in psychology and typified the kind of spirit Harry Kirke Wolfe so eloquently described in the quote we used at the opening of this chapter. Each has a distinctive story to tell that explains their individual journeys in developing their distinctive niches in contemporary research.

Joining in the Research Enterprise

Beginning psychology students often seem mystified by the process of research. Students struggle to learn the rudiments of research processes from articulating an original idea through an elegant analysis of a sound research design. Neophyte researchers sometimes fret that the supply of good research opportunities may be exhausted before they get a chance to make meaningful contributions. Yet, many budding researchers learn to overcome their fears and discover that meeting the challenge is not only very rewarding, but life-defining.

To address how that process unfolds, we asked the authors to tell their individual stories. We prompted them to describe what forces drew them into the area in which they chose to specialize. Why would they choose one area and not another? For some researchers, early life experiences stoked natural curiosity about behavioral phenomena. For others, tutelage of a mentor inspired them to follow in the mentor's path. And for some, happy accidents helped them to identify the content that would give shape to their professional lives.

To model for beginning researchers how research gets underway, we asked the authors to describe how they get specific ideas for their research. What factors tend to inspire them when they derive testable hypotheses? How might that be process have changed over time? Most authors describe a process quite contrary to the stereotype of the lone scientist slaving away in a laboratory. They discuss the process as highly collaborative, regularly drawing inspiration from the energy of the students who move in and out of their research streams, mutually enriching each others' lives. Some authors describe how they overcame challenging problems in the development of their research. Many also describe how they maintain vitality in developing the research stream that has defined their professional contributions. As the authors dealt with these questions and issues, they also addressed the important issue of how aspiring researchers can learn to develop research questions. Their consistent use of specific, relevant examples brings this process to life in each of the research areas covered in this book.

We also asked our authors to capture the excitement of the fields in which they have become specialized. This background helps to establish the context in which the researcher's own work can be recognized as outstanding. Understanding the past and present also allowed our researchers to speculate about the most exciting directions that their specialized areas may move in the future. We think these speculations offer some of the most fertile suggestions for aspiring researchers who may be looking for just the right field that will give definition to their life's work.

Finally, we asked our authors to talk personally about the characteristics and skills that emerging researchers will need to make contributions in these specialized areas in the future. Their advice includes everything from the kinds of experience that you need to pursue to maximize the undergraduate experience through the qualities of personal discipline that will be necessary for a successful research career. We think their advice offers a well-tailored advising session, which addressed this important question: If this is the future I want, how do I get there?

Common Themes in Preparing for Life in Research

No matter what their specialization, our chapter authors consistently point to a number of general strategies that help them generate research ideas, design viable research strategies, and move ahead in the scientific understanding of behavior forward. We summarize many of those strategies here in the hopes that aspiring researchers can adopt the approaches that offer the greatest promise in getting them started.

* Finding and developing research ideas. No, you will not have only one research idea and then never find another one. Ideas for good research projects are all around you! Here are a few suggestions for where to find them. One excellent place to look is in the psychological journals. After reading a published article ask some of the following questions; trying to answer them can lead to very fruitful research projects. Is there a different way to conduct the research? Will I obtain different results if I do this project on my own campus? What if I use different participants? What does this article suggest is the next step in the research process? Each journal article should be able to provide several potential research ideas. Your textbooks also offer an excellent source of research ideas. Jot down your ideas in the margins as you are reading your assignments. The same thing can be said for class lectures; if you are paying attention to and involved with the material, you should not leave a class session without at least one good research idea.
* Look carefully at life around you. Every day occurrences also offer a wonderful source of research ideas. Here are just a few of the fascinating possibilities we came up with just by observing the world around us. What can restaurant waitstaff do to increase tips? Do store clerks discriminate against certain types of customers? Is student responsibility associated with certain personality types? Whatever the source, your supply of research topics is endless.
* Be realistic about the ingredients of a good research project. In our technological age, it is easy to think that you must have lots of money and fancy equipment in order to conduct meaningful research. In some instances, such as conducting some research projects on the biological bases of behavior, money and equipment may be important. However, you will find that many excellent projects require no fancy equipment and very little financial support. The main ingredient of the good research project has always been, and remains, the good, creative research idea. You can conduct excellent research projects on a shoestring budget.
* Research is not a one-shot endeavor. Be prepared to be hooked into a life-long passion. Once the research bug bites you, you will not be able to stop with one project. The results of your first project will lead to another project, which will prompt another, and so on. If you enjoy the ongoing challenge of solving riddles and answering question, you are going to love research.
* Recognize why you should get an early start. Never has competition to get into graduate school been more fierce. If you are to fulfill your dreams of becoming a researcher in psychology, you must demonstrate your research imagination and skill during your undergraduate years. Good grades, high board scores, and enthusiastic letters of reference help establish your research potential, but having legitimate research experience as a team member, a co-author, or a poster presenter at a psychology conference offer the kind of evidence that admission committees find most useful. The more specifically you can articulate your research interests, the more likely you will have the keys to open the door to graduate school.
* Learn the literature. Research ideas rarely spring fully formed from a simple observation Although you will see a few really great examples of just that process, it is much more likely that research ideas emerge from carefully study of existing literature. Researchers often find their best ideas in the discussion sections of published research that makes explicit suggestions for future refinements.
* Identify the key players. As you read the literature, you will notice that some names begin to appear repeatedly in different sources that you read. This occurrence marks an individual whose research efforts have led to a concentration on a particular topic or issue. You may want to change search strategies from reading about a general concept to reading about the research history of a given individual in that area. Following the publication trail gives you a good sense of what that researcher's unique history has been in helping our understanding about a given concept unfold. Ultimately this strategy may prove helpful because you can define where the most exciting research is occurring. The result may shape your application strategies for graduate school.
* Start small. As you begin to conceptualize new research avenues, you may fare best if you think in terms of small research ideas. Beginning researchers are sometimes tempted to want to solve enormous problems for which they have neither the time nor skill. Good research mentors will help you see how even small scale projects fit the overall growth of knowledge about human behavior.
* Read beyond the boundaries. Read voraciously, not just in the psychology literature but other sources as well. Current events, research in other disciplines, and even good literature may provide just the inspiration you may need to develop a new twist.
* Prepare for a full range of emotions in your chosen life. Research in psychology offer exquisitely exciting moments. For example, it is hard to characterize the thrill when an idea breaks out of the chaos or a statistical analysis confirms just the prediction you were seeking. However, some aspects of research are not only unexciting, they are downright tedious. Being successful in a research career means that you are willing to exercise self-discipline to weather the nonthrilling aspects of generating research.
* Identify faculty whose interests match your own. Many of our authors spoke to the critical importance of finding a mentor in their chosen area. That connection routinely starts in advanced courses in which faculty members have the opportunity to explain research processes that have fueled their individual interests. You may be surprised to discover that material that you thought initially was not very appealing takes on much greater significance through the eyes of researchers genuinely excited about their work. In many cases, these faculty members may have research programs that would benefit from having a new team member. If you do secure a place on a research team, remember there is usually a clear hierarchy for the tasks that must be shared. Most researches expect that people new to the research enterprise need to start out with smaller responsibilities. Brand new members often face the work that requires the most drudgery. As you prove yourself to be a reliable assistant, you will be granted more independence and more exciting things to do.
* Ask for help in finding a faculty mentor. If your faculty members are not actively engaged in research, they may be able to connect with others in the community who are doing research. If you haven't had the good fortune of identifying such an individual from class experience, visit your department's website. Typically departments will list faculty research interests. Some departments post research opportunities on the web or in the department newsletter.
* Prepare to present yourself to potential mentors. Many researchers have an overfull agenda and will be very pleased at the prospect of a new team member. Others may initially respond to your request as though it is a burden. Either way, you should strive to create the most positive first impression possible. Be prepared to explain clearly why you wish to join a specific team. It will help if you are familiar with a researcher's accomplishments before you schedule your interview. Explain how refining your research skills fits into your future plans. If you reveal that you "have to do research for your requirements," chances are good the prospective mentor will not be terribly impressed with your personal motivation.

Our hope is that this text will contribute to keeping the science of psychology a vital research enterprise as we move into the 21st Century We thank the authors for their generosity and patience in developing this distinctive volume. We are also indebted to a hard-working corps of reviewers and editors to help us develop the right voice. We dedicate this book to the spirit of Harry Kirke Wolfe and all those reseacher/teachers who followed him by choosing to "grope by starlight towards the daylight of a clearer vision."

Notes on the E-Book Format

This electronic book represents an interesting experiment for the Society of Teachers of Psychology and the e-book editors. We wanted to bring you some fresh and personal perspectives primarily to assist people on the front end of their research journey as well as those teachers and researchers committed to helping them realize their dreams. Working in an e-book format can be a bit challenging. For example, you will note uniformity in the appearance of all the chapters but one. One set of authors (Woods and Krantz) delivered their chapter ina coherent HTML package so we chose to retain their original design choices. The other chapters have a more uniform and standard appearance. Because of some current peculiarities of HTML in dealing with italics, our references depart from APA format requirement in each chapter.

Despite those minor difficulties, we are very excited about the advantages of e-publishing. At the conclusion of each chapter, you will find a picture and biography of the authors of that chapter. We also provide a direct feedback capacity in which you can talk to the editors or the authors about your opinions of our work. You can also suggest other topics or authors that you think would make a good addition. And if the cyber-gods are willing, you should be able to download and keep copies of the chapters to help you at no cost to you. We intend to make the e-book available for three years from the date of launching the e-book website.

We also want to thank Vinny Hevern, STP Webmaster, and Dave Johnson and Bill Hill, who are currently sharing presidential responsibilities for STP. Their support has been outstanding in helping this project see daylight. We owean unpayable deb to Brian Halonen for long hours in helping us resolve endless problems with web site publishing.

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# Chapter Summaries

Chapter 1

Coping and Health

Susan Folkman,  
University of California, San Francisco

Susan Folkman's chapter provides an exceptional overview of current frameworks that explain what makes us resilient in the face of stress and what makes us crumble. Her chapter provides some practical direction about how health psychology theories can be applied to improve our ability to cope.

Chapter 2

Personality Psychology:  
Havings, Doings, and Beings in Context

Brian R. Little  
Carleton University and Harvard University

Brian Little's sense of humor makes this chapter about personality theory a unique reading experience. He explains how three students with distinctive backgrounds illustrate various personality principles as they pursue admission to graduate school.

Chapter 3

Industrial/Organization Psychology 2010:  
A Research Odyssey

Brian W. Schrader,  
Emporia State University

Industrial/Organizational Psychology 2010: A Research Odyssey examines the many content and research changes that are set to happen in the next decade across the major areas of I/O Psychology: personnel selection, work motivation, leadership, training, work attitudes, organizational issues, and performance appraisal with a strong emphasis on the latter. The chapter also explores the current hot topics in I/O Psychology as well as provides advice for students interested in becoming an I/O Psychologist.

Chapter 4

The Next Frontier in Neuroscience?  
Believe It or Not, It's Physiological Psychology

Timothy M. Barth,  
Texas Christian University

Physiological psychology is one of the most enduring specialties in psychology. Yet, technological advances have made emerging studies in this area among psychologists most exciting adventures. This chapter explores many historical and contemporary aspects of physiological research including applications to behavioral assessment, neurodegenerative disease, and recovery.

Chapter 5

Cross-Cultural Psychology in the 21st Century

David Matsumoto,  
San Francisco State University

Everything you thought you knew in psychology may or may not be true for all people of all cultures. Cross-cultural psychology challenges the very nature of truth and principle in all areas of psychology, and promises to change those truths in fundamental ways.

Chapter 6

Dr. Jekyll Meets Mr. Hyde:  
Two Faces of Research on Intelligence and Cognition

Robert J. Sternberg,  
Yale University

Robert Sternberg uses Robert Louis Stevensonís tale of Jekyll and Hyde to explore the advantages and disadvantages of intelligence testing. His work highlights the nature of creativity in research design and execution as an essential characteristic of successful research.

Chapter 7

Social Psychology:  
Past, Present, and Some Predictions for the Future

Nyla R. Branscombe, University of Kansas and  
Russell Spears, University of Amsterdam

Social psychology provides insight into how our behavior is influenced by our own identities, and which are salient at any given moment. We emphasize the social identity and self-categorization theoretical perspective, and show how it can be used to unify the empirical findings obtained in the field as a whole. Our discussion of identity processes emphasizes new topics that are likely to increasingly capture investigators' attention in the new millennium.

Chapter 8

Psychology of Women and Gender in the 21st Century

Janet Shibley Hyde & Amanda M. Durik,  
University of Wisconsin

This engaging chapter interweaves three main themes: research focused on women and their psychological functioning; research on gender, both gender differences and gender as a stimulus variable; and feminist psychology. The authors offer solid advice for aspiring feminist scientists in carving our distinctive research careers.

Chapter 9

**Sensation and Perception:  
A Window into the Brain and Mind**  
Charles B. Woods, Austin Peay State University and  
John H. Krantz, Hanover College

Contemporary research in these areas represents a blend of interest in low level sensory processing to high level perceptual mechanisms that give meaning to human experience. This chapter explores vision and visual perception as both a basic and applied science. The authors conclude with some speculation about virtual reality research as an exciting venue for understanding and applying knowledge in sensation and perception.

Chapter 10

Trends in Human Development

Laura E. Berk,  
Illinois State University

Childhood specialist Laura Berk provides broad view of the nature of human development by examining major characteristics of this field of study. She highlights the theories of Vygotsky as an avenue for promoting integration across specialized fields in developmental psychology. She examines play, private speech development, and impulse control as just a few of the many exciting fields in which contemporary researchers do their work.

Chapter 11

Psychology and the Law,  
Now and in the Next Century

Matthew T. Huss,  
University of Nebraska at Lincoln

Forensic psychology stands at the intersection of clinical psychology and the law. This chapter details the manner in which basic psychological principles are applied to our legal system.

Chapter 12

Psychopathology

Richard P. Halgin,  
University of Massachusetts at Amherst

Richard Halgin speculates about the future of research in psychopathology based on the significant premise that the scientific truths of one era often become challenges and replaced through intellectual evolution in the field. He reviews major philosophical differences among perspectives that explain psychopathology and offers suggestions to neophyte researchers about the nature of graduate training that will help them achieve professional resilience even under the pressures of changing scientific truths.

Chapter 13

Comparative Psychology and Animal Learning

Jesse E. Purdy, Southwestern University and  
Michael Domjan, University of Texas at Austin

Zoos and animals trained for entertainment have been popular for centuries, and nature shows dealing with animal behavior can be seen on TV virtually any time of day. Most of us know firsthand that animals can be fun, interesting, and emotionally satisfying, but nonhuman animals can also provide information about learning, cognition, and the evolution of intelligence. This chapter explores the study of comparative psychology and animal learning from three perspectives--past, present, and future. Readers will learn that persons who have a personal fascination with animals and nature can turn that interest into studying comparative psychology and animal learning and end up knowing more about the human animal as well.

# Chapter 1 Coping and Health

Susan Folkman  
Department of Medicine and Center for AIDS Prevention Studies  
University of California - San Francisco

It is practically impossible to avoid daily advice on how to cope with stress. This advice is proffered almost nonstop by talk show pundits, authoritative writers in magazines and newspapers, ads for over-the-counter stress antidotes, friends, and of course family members. This barrage of advice is based on widely held assumptions that (1) stress is omnipresent in our lives, (2) stress can be harmful to health, and (3) these harmful effects can be avoided or reduced if we cope well.

Few would quarrel with the notion that stress, no matter how it is defined, is omnipresent. It is commonly experienced by most people on most days. But the generalizability of the effects of stress on health is not as broad as the media would have us believe. A review of the literature by Adler and Matthews (1994)shows that while there is evidence that stress can increase vulnerability to certain health problems including respiratory infections, infectious disease, and pregnancy complications, evidence is lacking that it affects the etiology of other diseases including cancer and endocrine disease. But even if stress affects only a subset of all health problems, that it does so at all is important. Respiratory infections and infectious diseases, for instance, affect virtually all of us at one point or another, and they are responsible not only for discomfort and misery, but for missed days at work or school and increased medical costs.

Just as we believe that stress affects health, so too do we believe that the harmful effects of stress can be mitigated if somehow we learn how to cope with it. Presumably, those who cope well with stress will have fewer illnesses, fewer infections, and fewer days lost from work than those who do not cope well. This argument is logical, and it is appealing because it gives us hope that even if we cant escape stress, there are things we can do to keep it from harming us. The burgeoning scientific literature on coping and health confirms that psychologists and other behavioral scientists find this idea appealing, too.

Studies of the relationship between coping and health can be placed in two categories. In the first, coping is looked at in direct relationship to health. Here the researcher is concerned with how the way an individual copes with a stressful situation or condition has a direct impact on his or her health. In the second, coping is looked at in indirect relationship to health. Coping, for example, is examined in relation to health behaviors or mood, with the idea that behaviors or mood in turn affect health; but coping is not expected to affect health directly. Instead, coping affects health through its impact on the }mediating" variable such as health behavior or mood.

In the first part of this chapter, I review a few selected studies to illustrate each of these perspectives and summarize what they do and do not tell us about the relationship between coping and health. In the second part of the chapter, I offer some thoughts on where I believe the field of coping needs to go next in order to increase our understanding of the relationship between coping and health. Before the review begins, I outline a few important conceptual issues regarding coping to provide a foundation for the rest of the chapter.

The Literature on Coping and Health

Conceptual Issues

Over the last twenty years most studies on coping and health have come to conceptualize coping in surprisingly similar ways. The conceptualization is based on a definition of coping as the changing thoughts and behaviors that people use to manage distress (emotion-focused coping) and the problem underlying the distress (problem-focused coping) in the context of a specific stressful encounter or situation (e.g. Moos 1974; Pearlin & Schooler 1978; Folkman & Lazarus 1980; Lazarus & Folkman 1984; Folkman & Lazarus 1985; Moos & Schaefer 1993).

Since this definition of coping is widely used, it is helpful to understand some of its nuances because they can complicate the study of the relationship between coping and health. First, the definition implies that coping is a dynamic process that changes as a single stressful encounter unfolds and across diverse encounters, depending on changes in what the person is coping with. The changing and variable nature of coping poses challenges for the researcher. If coping were stable, it would be easier to use it to predict health outcomes because a single assessment would be highly reliable. But coping is not stable; it is changeable. Its changeable quality was demonstrated in a number of early studies that showed, for example, that coping changes depending on whether the event is a harm, loss, or threat (McCrae, 1984) , the social role that is involved (Menaghan, 1982) environmental and social factors (Parkes, 1986) , and what is at stake and what the options for coping are (Folkman & Lazarus, 1980; Folkman, et al. 1986) .

Even a seemingly simple stressful event, such as taking a final exam, has different phases, each posing different demands for coping. Let’s say that the stakes are high: the course is an important prerequisite for graduate school, the exam is expected to be difficult, and the outcome is important because it determines the final grade. The encounter begins with a preparation phase, which requires organizing the environment so that it is possible to study, getting the right materials for study, and then actually studying. Then there is the exam itself, which requires managing anxiety so that it does not interfere with test taking, thinking clearly, and coming up with good answers. This is followed by a waiting period, while the exam is being graded. And then finally there is the outcome -- the grade itself. Each phase of the exam poses different coping demands, and as a consequence coping changes as the exam process moves from one phase to another (Folkman & Lazarus, 1985) .

Second, coping is multidimensional. Most coping measures include multiple kinds of problem- and emotion-focused coping, usually between 6 and 8, although sometimes more than 20 (McCrae, 1984). The multidimensional quality of coping poses challenges for analysis. Although the various types of coping are conceptually distinct, they tend to be related empirically. For example, in a study of men who had undergone coronary artery by-pass surgery, Scheier and his colleagues (1989) found that efforts to regulate distress, an emotion focused form of coping, interfered with making plans and setting goals for the future, a problem focused form of coping. As another example, the use of cognitive reframing or positive reappraisal is typically associated with planful problem-focused coping (e.g. Folkman, et al. 1986; Carver, et al. 1989) . This lack of independence makes it more difficult (although not impossible) for any one type of coping to stand out as a single, strong predictor.

Third, most coping scales are inherently less internally consistent than are measures of other constructs, such as attitudes. The internal consistency of a measure refers to the extent to which the items on a scale are measuring the same thing. The greater the internal consistency of a measure, the more reliable it is as a research tool. A person who responds to a questionnaire with good internal consistency about his or her attitude toward environmental preservation, for example, is likely to endorse all items that are consistent with that attitude. Unfortunately, it is difficult to achieve high levels of internal consistency with coping scales because of the nature of coping. If a specific coping strategy, e.g., turning to another task to get ones mind off the problem, is successful the person does not have to turn to other strategies within that category. The one strategy worked, and therefore there is no need to do more. This quality lowers the likelihood that an individual will check multiple strategies within a given category, thereby lowering the internal consistency of the measure of that category. This can be a problem because the coefficient that describes internal consistency puts a ceiling on the strength of the correlation that measure can attain with any other variable.

These quirky characteristics of coping create methodological obstacles in the study of the relationship between coping and health. Therefore, if a relationship is observed between coping, which is inherently variable and multidimensional, and a health outcome, such as recurrence of an illness, days in hospital, or recovery, that relationship should be taken seriously. It is there despite great odds.

The study of the relationship between coping and health also depends on characteristics of the dependent variable. The dependent variable must have the potential for change over the time of the study. General health status variables, for example, tend to be quite stable in the general population and the probability that such variables might change during a study period that is arbitrarily chosen is not great (Folkman, 1992) . On the other hand, health variables that are more changeable, such as upper respiratory infections, muscular and skeletal problems, and gastrointestinal infections are more likely to change over the course of several months and are more appropriate for the study of coping and health.

Fortunately, these conceptual and methodological issues have not brought research on coping and health to a halt. But it is helpful to understand these issues when reviewing the literature because they can help explain inconsistencies in findings across studies.

Questions about coping and health are generally asked in one of three ways: 1) Do the ways people cope with stress in their daily lives affect their health? 2) Do the ways people cope with a health problem affect outcomes related to the health problem such as illness progression or mortality? 3) Do the ways people cope with a health problem affect their mental health or adjustment to the health problem?

Coping with daily stress and health

Has research shown that the ways we cope with the stresses of our daily lives make a difference in our physical health? It would be nice if we could say }Yes, and heres how you should cope." Unfortunately, studies have not revealed any consistent insights about the direct effects of general coping with daily stress on general health in the general population. But coping with daily stress has been linked to health in the more specific cases of coping strategies that take the forms of injurious behaviors.

More than 40 years ago Conger (1956) formally proposed that people drink in response to stress as a method of reducing tension. Viewed from this perspective, drinking is a method of coping with stress. Drinking is normatively considered a maladaptive response because it neither helps resolve the underlying problems nor does it effectively regulate distress. In fact, alcohol use generally increases distress, and alcohol abuse has a deleterious effect on health.

That such behaviors are in fact often a response to stress was demonstrated in a study of abstinent male drinkers (Brown, et al. 1995) . Those abstinent drinkers who experienced high levels of stress were more likely to lapse than abstaining individuals not experiencing such stress. But whether or not drinking is the coping strategy of choice depends in part on the extent to which the individual generally relies on avoidant forms of coping, the availability of alternative ways of coping, social skills, and expectancies regarding the effects of alcohol (Cooper, et al. 1992) . A number of community studies have shown that avoidant coping in particular is strongly associated with alcohol use (Cronkite & Moos, 1984; Timmer, et al. 1985; Cooper, et al. 1988; Moos, et al. 1990) . For a review of research on coping and substance use, see Wills and Hirky (1996). Maladaptive health behaviors such as smoking and high risk sexual behavior (McKusick, et al. 1985; Chesney, 1988) and decreases in exercise (Ogden & Mitandabari, 1997) have also been interpreted as coping responses to stress. Alcohol, high-risk sexual behavior, and recreational drug use in particular are considered behavioral forms of escape-avoidant coping (Lazarus & Folkman, 1984) that can be directly injurious to health.

Coping with health problems and health outcome

The most fruitful explorations of the relationship between coping and health have taken place within the context of health problems. The literature is dominated by studies that explore the relationship from the two perspectives mentioned earlier: the effects of coping with a health problem on health outcomes related to that problem, and the effects of coping with a health problem on mental health.

Physical health outcomes. A number of studies have examined the relationship between coping with a disease such as cancer, myocardial infarction, rheumatoid arthritis, asthma, or HIV/AIDS, and a disease-related outcome such as recurrence, recovery, disease progression, or mortality. Rather than review all the studies in this area, I begin this section by describing a series of studies on coping with cancer that summarizes quite nicely what is known about coping and cancer and illustrates the complicated issues involved in investigating this question. Then I review a few selected studies from other diseases that illustrate other issues that are related to the question of coping and health in the context of specific disease.

A study by Epping-Jordan, et al. (1994) of the relationship between coping and disease progression demonstrates how the relationship between coping and health is ultimately quite complicated. They studied coping and health in a sample of 66 cancer patients diagnosed with a variety of different types of cancer including breast cancer, gynecologic cancers, hematological malignancies, brain tumors, and malignant melanoma. They focused on avoidance, which refers to efforts to suppress dysphoric feelings, because several studies had shown a relationship between avoidance and poor physical outcomes (Suls & Fletcher, 1985; Holahan & Moos, 1986) . Instead of relying on the self-report that has been used in earlier studies, Epping-Jordan and her colleagues measured disease variables by reviewing medical charts and patients reports of the prognosis they received from their oncologist. They measured disease status one year post diagnosis as a dichotomous variable: (a) no disease or (b) disease, including presence of original cancer, recurrence, of cancer, or death. Avoidance thoughts were measured with the Impact of Event Scale (IES) (Horowitz, et al. 1979) . They also assessed psychological symptoms. Participants answered the question on the IES with respect to their cancer.

One-year post-diagnosis, 48 patients (73%) were disease free, and 19 patients (27%) had their original cancers, had experienced a recurrence, or had died. After controlling for initial prognosis, avoidance predicted disease status one year later, but psychological symptoms did not. The authors commented that previous studies (e.g., Cassileth, et al. 1985; Jamison, et al. 1987) may have failed to find relationships between psychological symptoms and cancer progression because psychological symptoms did not clearly reflect the cognitive and emotional processes that are most closely related to subsequent disease progression in cancer patients. Presumably, avoidance -- the suppression of feelings -- is more closely related to subsequent disease progression than psychological symptoms.

The reasons avoidance might directly affect disease progression are not immediately clear. Epping-Jordan et al. (1994) offer two hypotheses: avoidance might affect immune functioning in cancer patients by contributing to continued high distress and emotional arousal; or avoidance might result in decreased compliance with cancer treatments, which in turn could lead to worsened disease status. We will return later to these hypotheses, because they are at the very core of the explanation about how coping might be related to health.

Other studies of coping and disease outcome in early breast cancer provide mixed support for the role of coping. A series of studies by Greer and his colleagues (Greer, et al. 1985; Greer, et al. 1990) and Dean and Suertees (1989, described by Buddeberg, et al., 1996) categorized patients as using one of four styles of coping assessed with structured interviews: denial (described as positive avoidance), fighting spirit, stoic acceptance, and helplessness/hopelessness. The earlier studies by Greer, et al. (1985) included longitudinal assessments of 62 women with nonmetastatic breast cancer. Fifteen years later, women who had used fighting spirit or denial were significantly more likely to be alive and free of recurrence than those with fatalistic or helpless responses. But as Buddeberg and his colleagues point out, the sample was small, and the histological node status, which is the best predictor of disease-free survival, was not documented.

Dean and Surtees (1989) replicated the study by Greer with a larger sample of 121 women. The women were interviewed twice, before and 3 months after mastectomy, and these data were related to disease outcome 6 to 8 years after the primary surgical treatment. Coping was assessed using the same method as Greer had used, only Dean and Surtees assessed coping twice. Dean and Surtees found a relationship between coping and disease outcome, but the relationship depended on when it was measured. The patients coping responses were not consistent over time, and no clear relationship could be determined.

Buddeberg et al. (1996) continued this line of research, focusing on the relationship between coping and survival in 107 breast cancer patients at a 5- to 6-year follow up. This study was strengthened by the inclusion of detailed medical data for each patient. Coping was assessed annually for the first three years. At the conclusion of the follow-up period, 25 patients had died, and 81 survived. (One patient was eliminated because she died of cardiac arrest.) Clinical variables, including tumor size and histological node status were related to survival. Coping was not.

These studies of coping and cancer illustrate the challenges in determining the role of coping in health outcomes. The changeable nature of coping makes it difficult to use it as a predictor of health outcomes. More important, the final study (Buddeberg, et al. 1996) shows that when dealing with a disease, biological variables rather than psychological ones are likely to have more influence on survival.

I would like to comment on a study by Reed, Kemeny, Taylor, Wang, and Visscher (1994) in which the focus is not cancer, but AIDS, because it reports some intriguing findings on coping and survival. From the early 1980s, when AIDS first appeared on the national public health agenda, until the mid 1990s when protease inhibitors and new antiretroviral treatments became available, the disease was largely untreatable. Most people who were diagnosed with AIDS died within a few years of that diagnosis. Although treatments became available to treat specific opportunistic infections, little could be done to significantly extend survival time.

During that period, Reed and his colleagues studied psychosocial factors that might affect survival time in a cohort of 74 gay men with AIDS. At the conclusion of their study in 1991, 61 had died of complications related to AIDS. The researchers found a relationship between realistic acceptance, a passive coping strategy, and decreased survival time in their prospective analysis. This study included a number of biological and medical measures (e.g., data from medical charts, measures of the immune system) and behavioral measures (e.g., smoking, alcohol use, and recreational drug use) in addition to psychosocial measures (e.g., optimism, distress, and coping). Six kinds of coping were assessed: community involvement and spiritual growth, active cognitive coping, avoidance and self-blame, seeking social support, realistic acceptance, and seeking information. Realistic acceptance (}Try to accept what might happen," }Prepare myself for the worst," }Go over in my mind what I would say or do about this problem") was associated with decreased survival time, even when the effects of other variables known to be important contributors to survival time were accounted for in the statistical models. These authors used only one assessment of coping in their predictions, so in this regard their study design was not as strong as others. On the other hand, they included a wide range of medical, biological, and behavioral variables in their analyses, and the coping variable still remained the most important predictor of survival time.

Reed et al. (1994) offer a number of possible explanations for the relationship between coping (realistic acceptance) and mortality, many of which will by now have a familiar ring. They suggest that men who report more accepting responses may engage in different behaviors relevant to health outcomes than their less accepting counterparts. Also though the study controlled for a number of such behaviors, other health-related behaviors, such as monitoring of relevant symptoms, seeking medical advice, and compliance with medical treatment may have been adversely affected by realistic acceptance. It is also possible that realistic acceptance was sensitive to unfavorable changes in health status that were too subtle to be captured by their measures. This would account both for realistic acceptance and increased mortality. Finally, they suggest that realistic acceptance may have an impact on immune or viral processes affecting health status in individuals diagnosed with AIDS. In short, Reed et al point out that realistic acceptance, rather than directly affecting health, probably operates through other mechanisms that affect health.

Occasionally we come across studies that illustrate how certain coping strategies may be maladaptive with respect to health in the contexts of certain diseases, but not in others. Studies of coping with coronary heart disease, for example, suggest that denial-like coping, which is traditionally considered maladaptive, can be health-protective at certain stages of disease. Meta-analyses by Suls and Fletcher (1985) were consistent with clinical observation that denial can be adaptive immediately following an acute myocardial infarction, but less adaptive in later stages. In their review of coping with chronic diseases, Maes, Leventhal and de Ridder (1996) summarize a number of studies that are consistent with this pattern. They cite studies, for example, reporting that strong deniers spend fewer days in the coronary care unit and have fewer signs of cardiac dysfunction during their hospitalization compared with weak deniers, but in the year following discharge they are less compliant with medical recommendations and are rehospitalized more often (Levine, et al. 1987) .

Studies of coping with chronic pain show that cognitive or behavior strategies that divert the patients attention from the pain to some other activity help reduce the patients awareness of pain (for review see Katz, et al. 1996) . Such strategies differ from denial in that diversion does not imply denial of what is happening. But diversion strategies are similar to denial in that they are a way of avoiding or reducing awareness of an aversive condition. Diversion types of coping, however, can be maladaptive if there are treatments or procedures that require the patients attention and effort. HIV+ individuals who are on complicated treatment regimens that require a great deal of vigilance, for example, would have adverse health outcomes if they engaged in diversion and denial (Ickovics & Chesney, 1997) . The same is true of diabetic patients whose disease requires close control.

As another example, information seeking is generally considered an adaptive form of coping. But information seeking is associated with adverse outcomes under certain conditions. For example, education and information were associated with increased reports of pain and disability in rheumatoid arthritis patients (Park, 1994) . Maes et al. (1996) explain this counterintuitive result by suggesting that the increase in education and information, which was provided through an intervention, increased the patients sense of vulnerability and diminished the adequacy of patients disability. A similar finding was reported by Chesney and her colleagues (1996) in a study of a coping intervention for HIV+ gay men. This study included a coping skills group, an HIV/AIDS education and information group, and a no-treatment control. The anxiety level of the HIV/ADS education and information group increased, suggesting that the additional knowledge, while possibly helpful with respect to strategies of the management of their illness, was also anxiety provoking, especially in the absence of training in skills for coping with the anxiety.

Finally, there is also a growing literature on the adverse health consequences of suppression of emotion, an emotion-focused coping strategy, such as that described by Epping-Jordan and her colleagues (1994) in the study of cancer that I mentioned earlier. Since 1983, James Pennebaker has conducted a number of studies based on a general theory of inhibition and confrontation. This theory assumes that inhibiting or holding back ones thoughts, feelings, or behaviors requires work. Over time, the work of inhibition can be viewed as a long-term form of low level stress that can create or exacerbate illness and health problems (Pennebaker, 1992) . In a number of studies, Pennebaker and his colleagues have found that individuals who suffered major trauma in childhood are far more likely to become ill if they never talked about the trauma (Pennebaker & Susman, 1988; Pennebaker, 1989) . Others have found that inhibiting forms of emotion-focused coping are also associated with poorer recovery from surgery. In their study of patients undergoing coronary artery bypass surgery, for example, Scheier and his colleagues (Scheier, et al. 1989) found that patients who tried to suppress emotion just before surgery had poorer recovery patterns six months later. This provocative line of research is still in its early and exploratory stages, but it has generated interest among health psychologists.

Mental health outcomes. Both acute and chronic illnesses and conditions create psychological stress for the individual. The most severe psychological challenges are posed by those illnesses or conditions that are painful, interfere with the individuals daily role functioning, disrupt personal relationships, cause disfigurement, and result in both temporary and permanent loss. Uncertainty, whether about test results, efficacy of treatment, recurrence of symptoms or the disease, effects of the disease, time until recovery, degree of recovery, and so on, is pervasive, and this is the source of a great deal of stress in any acute or chronic illness. To maintain well-being in the face of these kinds of stressors requires coping. The psychological stress caused by health problems is thus fertile territory in which to examine how coping with psychological health-related stress affects outcomes related to adjustment and mood. And, in fact, a great deal of research has been done to determine what kinds of coping seem to promote good adjustment outcomes to health-related problems and what kinds of coping seem to make things worse.

Mental health outcomes of coping with health-related stressors are important not only because they have inherent value with respect to patients well-being and quality of life, but also because they may be important mediators of the relationship between coping and physical health. For example, our study of the effects of the chronic stress of caregiving in the context of AIDS on the physical health of the primary informal caregiver showed that coping was not directly related to health symptoms, but it was related indirectly through its relationship to negative mood (Folkman, August, 1997) .

The findings regarding relationships among health problems, coping, and distress are quite consistent across diseases including cancer (e.g., Dunkel-Schetter, et al. 1992; Stanton & Snider, 1993; Chen, et al. 1996) , rheumatoid arthritis (e.g., Felton & Revenson, 1984; Zautra & Manne, 1992) , systemic lupus erythematosus (e.g., McCracken, et al. 1995) , myocardial infarction (e.g., Estreve, et al. 1992) , heart transplantation (e.g., Dew, et al. 1994) , and HIV/AIDS (e.g., Friedland, et al. 1996) . Avoidant forms of coping are generally associated with greater distress, and problem-focused coping and positive reappraisal are generally associated with less distress. The pattern is observed in both cross-sectional and longitudinal studies. This consistency of this pattern suggests that regardless of the disease, disease severity, or the specific kinds of adaptive tasks that confront the individual, taking an active stance and trying to look at the situation as positively as possible is beneficial in terms of mood, whereas engaging in cognitive and behavioral forms of escape and avoidance is detrimental.

The danger of making a sweeping generalization of this sort is that inevitably there are exceptions. In this case, the exceptions are found when characteristics of the person and the situation are taken into account. Both exceptions have to do with the fit between the personal or situational characteristic and the type of coping. With respect to person characteristics, for example, Suzanne Miller (e.g., Miller, 1987) has examined dispositional coping styles related to information-processing behavior. *Monitors* are disposed to seek information about threat, and *blunters* are disposed to avoid threat-relevant information. Miller and her colleagues have examined the relationship between preferences for monitoring and blunting, information, and health behaviors and distress and found that high monitors and low blunters fare better with more information and more attention and reassurance and low monitors and high blunters fare better without information, attention, and reassurance (for review, see Miller, et al. 1988) .

With respect to situational characteristics, the extent to which the situation is one that can be changed or that has to be accepted affects the relationship between coping and mood and behavioral outcomes, too. Theoretically, people fare better psychologically when there is a fit between options for coping and actual copingprocesses. Problem focused coping is more appropriate in situations where something can be done, less so in situations that have to be accepted; and emotion focused coping is more appropriate in situations that have to be accepted, and less so in situations where something can be done. This hypothesis, which has been called the }goodness of fit" hypothesis (Folkman, et al. 1979; Folkman, 1984) , has been examined in a variety of settings including natural disaster (Baum, et al. 1983) and stressful life events (Forsythe & Compas, 1987; Mattlin, et al. 1990; Vitaliano, et al. 1990; Conway & Terry, 1992) . With respect to health, Christensen, Benotsch, Lawton and Wiebe (1995) found that it helped explain adherence to fluid intake in hemodialysis patients. For controllable stressors related to hemodialysis, problem focused coping was associated with more favorable adherence, and for less controllable stressors, emotion focused coping was associated with more favorable adherence.

One of the unanswered questions is whether coping affects mood, or mood affects coping. Although longitudinal designs in which coping is used to explain changes in mood over time indicate that coping is associated with changes in mood (e.g., Felton & Revenson, 1984; Stanton & Snider, 1993; McCracken, et al. 1995; Folkman, et al. 1996) , this does not rule out the possibility that mood also influences coping. The relationship between escape-avoidant forms of coping and depressed mood, for example, suggests a bi-directional process in which depressed mood leads to escape-avoidant (passive) forms of coping, which in turn increases depressed mood (possibly because the underlying problem remains or even gets worse in the absence of more active coping). The vicious cycle between avoidant coping and negative mood was proposed by Felton and Revenson as a way of understanding deterioration in adjustment indices of patients with chronic illness.

To the extent that the relationship between depressed mood and escape-avoidant coping is indeed reciprocal, the causal relationships can be established in both directions. Why, then, do most researchers focus on the coping ----> mood direction rather than the mood ----> coping direction? One compelling reason is that coping is potentially amenable to change. Cognitive-behavior interventions, for example, that try to alleviate depressed mood involve the teaching of coping skills. The assumption is that the vicious cycle between escape-avoidant coping and depressed mood can be interrupted by reducing reliance on maladaptive escape-avoidant coping and increasing the use of adaptive problem-focused coping and strategies for reframing or reappraising a situation.

Conclusions

The vast literature on coping and health is evidence of the widespread belief that the ways people cope is somehow linked to their health. Direct effects of coping on health are probably relatively infrequent, and are most likely limited to behavioral forms of coping that can be injurious to health, such as substance use and high risk sexual behavior. Indirect effects of coping on health, on the other hand are probably relatively frequent. One likely causal pathway suggested by research is the pathway through mood. Coping is strongly associated with mood, which in turn can affect health behavior and ultimately health. Another pathway that merits consideration is when active and avoidant forms of coping directly influence health behaviors, such as entry into the medical system, adherence to a treatment program, or ordinary behaviors of eating and exercising. There are also hypotheses, largely untested, that coping can affect immune function, possibly through mood, and immune function can in turn affect resistance to infectious diseases.

Research on Coping and Health: Where to Go from Here?

The overarching conclusion that emerges from research on coping and health is that to the extent that such a relationship does exist, it is most likely mediated through behavioral, affective, or immunological pathways, or some combination of all three. I am not expert enough to comment on possible immunological pathways. For those interested in the specific relationship between immune function and coping I recommend the work of Margaret Kemeny, Janice Kiecolt-Glaser, and Arthur Stone.

One of the most obvious directions for research on coping and health has to do with the subject of adherence. Advances in treatment have transformed some diseases that were previously fatal, such as HIV/AIDS, into chronic diseases that require adherence to treatment regimens over many years, and they have increased the complexity of other treatment regimens, such as Type I diabetes. As more and more previously terminal illnesses are transformed into chronic diseases that require long-term management, adherence becomes an increasingly important mediator of the coping-health relationship. We need more research on factors that interfere with adherence and factors that promote adherence. Coping is implicated in this research to the extent that stress affects individuals motivation and capacity to adhere.

It is clear that research about the relationship between coping and health will be helped along by improved measures of coping and coping outcomes. With respect to coping, paper-and-pencil measures can always be improved, but I would like to suggest that we turn to more qualitative techniques. It is time to supplement what we can learn with paper-and-pencil measures of coping with the analysis of narrative data. Peoples stories can provide us with different ways of thinking about coping and how it might be related to health. Our study of caregivers of partners with AIDS contained narratives that gave us exciting insights into meaning-based coping. In fact, the narratives that the men provided at the time of their partners deaths were so rich that I believed no one set of analyses would do them justice. So I invited four sets of investigators, each with experience in narrative analysis in the areas of bereavement, or emotion, to analyze the same set of narratives from 30 men. This study resulted in four articles on the same data, each using a different theoretical framework and a different method of qualitative analysis, and each producing different insights into responses to bereavement (see Folkman, 1997; Pennebaker, et al. 1997; Stein, 1997; Weiss & Richards, 1997; Nolen-Hoeksma, et al 1997) .

The measurement of coping outcomes also needs improvement. Thought needs to be given to the domains of outcomes that coping can reasonably be expected to affect. Currently, little thought seems to be given to this question. Measures of distress or psychological symptoms seem to be included in most coping studies almost automatically, without a clear rationale. Likewise, measures of physical health are included without a clear rationale as to why or how coping might be related to them. One entire domain of coping outcome that is rarely assessed has to do with the individuals ability to sustain his or her social roles in the face of stress and distress. People who are in the midst of severe stress may have high levels of distress no matter how well they cope, but they may still need to be able to function in their roles at work, with their family, or in the community. A good measure of coping outcomes should therefore also include an assessment of role functioning (Folkman & Moskowitz, 1998) .

In this section, however, I want to discuss coping and positive affect in the context of stress, a topic that has intrigued me for years. Although positive affect is sometimes included in studies of coping and mental health, little thought seems to have been given to its significance in the coping process. The domain of positive affect holds the potential for an exciting expansion of our understanding of how coping affects health. Let me make my case.

Coping and positive affect: Future directions

My interest in positive affect was reinforced by findings from our study of caregiving partners of me with AIDS that we conducted from 1990 until 1997. The 253 participants were for the most part in their late 30s and early 40s when the study began. This is a time of life when most people devote themselves to establishing long-lasting relationships, not bringing such relationships to a close. The participants were their partners primary caregivers, and as such they were confronted with challenges that were extraordinary in their complexity, intensity, duration, and requirements for expertise. These caregivers needed empathy, clinical knowledge, technical expertise, advocacy skills in the formal health care system, and what seemed to be unlimited emotional, mental, and physical stamina (Wrubel & Folkman, 1997) . As if this were not enough, about one-third of the participants were themselves HIV+. We assumed that this group would be doubly stressed because of the double-whammy of the caregiving and their own vulnerability to AIDS. Participants were interviewed every two months for the first two years and then every six months for three follow-up years. In addition to caregivers, the study also included a comparison group of 61 HIV+ men who were in relationships with healthy partners. The inclusion of this group allowed us to specify effects in the HIV+ caregiver group that were attributable to their HIV serostatus vs. their caregiver status.

We used multiple measures of both positive and negative psychological states. We expected and found high levels of negative psychological states. Throughout caregiving, participants levels of depressive symptomatology were typically more than one standard deviation above the norm in the general community, rising to two standard deviations above the norm at the time of the ill partners death (Folkman, et al. 1996) . Among the 156 caregivers whose partners died, levels of depressive symptoms reported during their first seven months of bereavement were comparable to those of bereaved spouses, and at seven months following the partners death, mean scores for depressive symptoms were still one standard deviation above the general community norm (Folkman, et al. 1996) . We were not surprised by these findings, given the extensive literature on the profound and enduring effects caregiving and bereavement have on depressed mood.

What we did not expect was that participants also reported high levels of positive psychological states during the course of caregiving and bereavement (Folkman, 1997) . Caregivers whose partners did not die during the course of the study reported positive states of mind at a level that was comparable to a community sample of urban university students not experiencing unusual stress (Horowitz, et al. 1988) . Throughout this same two year period, caregivers whose partners did not die experienced positive affect with at least as much frequency as they experienced negative affect (Folkman, 1997 ). Among caregivers whose partners died during the two-year period, the death of the partner was associated with modestly lowered scores on measures of positive psychological states during the month leading up to the partners death and for the five after the partners death. But after five months, scores on measures of positive states returned to their pre-bereavement levels.

A number people suggested that our finding might be limited to the community of gay men living in San Francisco, possibly because of the social support network that evolved in this community during the 1980s and 1990s, and possibly because of the upbeat influence of }New Age" beliefs. We were offered the opportunity to include the measures of depressive mood (CES-D, Radloff, 1977) and positive and negative affect (modified Bradburn, 1969) that we had used in our study of AIDS caregivers in Dr. Miriam Stewart's study of mothers of chronically ill children (diabetes, spina bifida, or cystic fibrosis) at Dalhousie University, Halifax, Nova Scotia. Dr. Stewarts sample differed from the San Francisco sample of AIDS caregivers not only in that it was all female, but unlike the San Francisco sample, the Nova Scotia sample was not advantaged educationally or financially, and they lived about as far from San Francisco as is possible within the North American continent. Despite these demographic differences, we found the same patterns in the mothers of chronically ill children as we had in the sample of gay men in San Francisco: depressive mood was elevated, but at the same time the frequency of positive affect was not only comparable to the frequency of negative affect, it was even significantly greater .

Zautra and his colleagues (Zautra, et al. 1990) examined positive and negative events in a longitudinal study of mental health in disabled and bereaved older adults. Both kinds of events were reported, again indicating the co-occurrence of positive and negative events. Zautra and his colleagues also made the interesting observation that the value of daily positive events vis a vis mental health was variable across groups. Bereaved individuals showed no positive effects of these events on their mental health, whereas disabled individuals showed sizable impacts. These researchers suggest that the major loss suffered by the bereaved group may overshadow all other experiences, changing the way in which positive events are interpreted. In contrast, for those who are disabled, daily positive events can represent significant achievements that can boost morale.

Affleck and Tennen (1996) focus on the related question of discovery of benefits from living with adversity. This phenomenon has been documented in the context of numerous medical problems. Affleck and Tennen distinguish between benefit-finding, which refers to beliefs about benefits from adversity, and benefit-reminding, which is the use of such knowledge as a deliberate strategy of coping with the problem. Thus, a person with a new medical condition that limits her mobility might come to believe that this is an opportunity for her to develop new strengths (benefit-finding), and she might draw on this belief (benefit-reminding) in situations where the limits to her mobility are particularly stressful.

I go even further in considering co-occurrence of positive and negative events or moods in terms of coping. My colleagues and I have suggested that positive psychological states -- whether in the form of positive events or positive affect -- serve three important coping functions under conditions of chronic and severe stress (Lazarus, et al. 1980; Folkman, 1997; Folkman, et al. 1997) . Positive emotions, such as eagerness and excitement, help **motivate** people to initiate coping under adverse conditions. These emotions -- challenge emotions -- go hand in hand with threat emotions such as anxiety, fear, and worry. Positive emotions, such as pleasure in what one has accomplished, or love for the one is caring for, help**sustain** people when the going gets tough. Positive emotions such as happiness at seeing a beautiful sunset or the enjoyment of a humorous comment, provide **relief** from distress. Events that give rise to these emotions might ordinarily be considered unremarkable or unnoteworthy. The need for relief -- for a psychological time-out -- from distress is what motivates these emotion responses. All three functions could help explain the finding by Zautra, Reich et al. (1990) that positive events had a salubrious effect on the mental health of disabled individuals.

Further, I don't think people are passive with respect to generating these emotions. I think people generate these emotions through a deliberate and effortful coping process. A number of very fine scientists, including Shelly Taylor and her colleagues (e.g., Taylor & Brown, 1988; Taylor & Brown, 1994 ), Ronnie Janoff-Bulman (1989) , Roxane Silver and Camille Wortman (Silver & Wortman, 1980; Silver, et al. 1983; Wortman, et al. 1993) , and Glenn Affleck and Howard Tennen (Affleck & Tennen, 1996) have written about psychological and social processes that people use to generate positive states when bad things happen. In our own research, we identified four meaning-based coping mechanisms that help account for positive affect: positive reappraisal, which is cognitive reframing of what has happened or that which might happen; goal-directed problem-focused coping, which includes knowing when to abandon goals that are no longer tenable and substituting new goals that are both tenable and meaningful; using spiritual or religious beliefs to seek comfort; and the infusion of meaning into the ordinary events of daily life in order to gain a psychological time-out from distress (Folkman, 1997; Folkman, et al. 1997; Stein, et al. 1997) .

Because most coping research has focused on negative affective outcomes and states of mental health, we know only part of the story. We need to address this imbalance in coping research by researching questions related to positive outcomes, including the coping processes that sustain them, underlying characteristics of the person and the social environment that promote these coping processes, and the functions of positive affective outcomes in the overall process of coping with health-related stress. The methodological issues that both characterize and impede research on coping and health, including the variability of coping processes, the problems inherent in trying to measure appropriate health outcomes, and the measurement of coping itself, apply to the study of coping and positive affect every bit as much as they do to the study of coping and other health-related outcomes. There are some excellent discussions of these methodological issues (for reviews see Aldwin, 1994; Zeidner & Endler, 1996) . Taking these methodological problems into account, and with the belief that future researchers in this area will be creative and thoughtful enough to solve them, I strongly encourage researchers on coping and health to look more carefully at positive as well as negative affective outcomes, to understand the relationship of these outcomes to health related behaviors, and to identify the cognitive and behavioral coping processes that uniquely support positive outcomes.

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[Flourish Line]

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# Chapter 2 Personality Psychology: Havings, Doings, and Beings in Context

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**Introduction: Voices in the Cafeteria**  
  
Imagine that we are listening in on a conversation between three students in the college cafeteria. Their discussion weaves around many topics but the dominant theme is their common project of applying to graduate school in psychology. Speaking animatedly and downing her third cup of coffee, Eve declares that she is only applying to her top three choices and she's looking forward to dragging her boyfriend to Ann Arbor. She suddenly bolts from the group realizing she's late for her stats class. Adam says little, nods often, and is wondering whether he really is grad school material. Besides, his parents want him to go back home after graduation to work in the family business. Nikki isn't really listening at all; she's hung over again, hadn't realized grad application deadlines were coming up, and frankly is fed up with Adam and Eve and the whole human condition. She mumbles something they can't quite hear and heads for the restroom.   
  
If you are sitting in the adjacent booth in the cafeteria, would you linger a bit, intrigued by the differing styles, contrasting concerns, and singular stories you hear emerging in the snatches of conversation? If so, then you probably have a natural affinity for personality psychology. This chapter surveys the past and present state of personality psychology as a core specialty within psychology and examines how it goes about understanding the lives of the Eves, Adams, and Nikkis of this world.   
  
The field of personality psychology is flourishing. In many respects the current buoyancy of the field reflects important shifts, both methodological and conceptual, that have occurred over the past two decades. Some of these changes arose in response to conceptual crises within the field, particularly the Great Trait Debate that occupied much of the field in the seventies. (Mischel's (1968) critique, which launched the debate, and reactions to it are discussed in a later section) .Other shifts reflect the gradual maturing of intellectual agendas that were present at the modern inception of academic personality psychology in the nineteen thirties (Craik, 1986). After sketching very briefly the nature and challenges of the field of personality psychology, I will present a perspective (admittedly an idiosyncratic one) on some of the currently active research programs in the 'new look' in personality psychology.   
  
The Core Project of Personality Psychology: The Integrative Challenge  
  
Within the social and behavioral sciences, personality psychologists have chosen to specialize in comprehensiveness (Little, 1972). As an intellectual field its scope of inquiry is inordinately extensive. Personality psychology seeks to integrate diverse influences on human conduct ranging from the genetic and neurophysiological underpinnings of traits to the historical contexts within which individual life stories can be rendered coherent. Pervin (1996) has provided a thoughtful definition of personality which, in part, characterizes it as "the complex organization of cognitions, affects, and behaviors that gives direction and pattern (coherence) to the person's life" (p.414). The study of personality seeks to understand how individuals are like all other people, some other people, and no other person (to revise slightly the classic phrase of Kluckhohn & Murray, 1953, p.53). It formulates theories about the nature of human nature, the role of individual differences, and the study of single cases. Personality psychology provides one of the core basic sciences underlying many of the fields of applied psychology, including clinical, counseling, health, and organizational psychology.

Classical Voices and the Conceptual Foundations of Personology  
  
Even a cursory history of the classical theoretical and methodological perspectives in personality psychology exceeds the limits of this chapter, but fortunately two recent reviews provide authoritative and concise accounts of the history of personality psychology (McAdams, 1997; Winter & Barenbaum, 1999). But it will advance the purpose of this chapter if we have some major historical figures in the field, metaphorically descend (or ascend) from their places in posterity to offer their perspective on the cafeteria conversation with which we began this survey. Their role will be like that of the Greek Chorus in classical drama that offered commentary about the ongoing action. (Except that none will speak in Greek and some won't speak, but sing. Or hum.) They will introduce some of the concerns and admonishments of classical personology and provide a bridge to contemporary discourse about the field.   
  
Let us start with a Freudian chorus (perhaps the Vienna Old Boys Choir?). There is little doubt that psychoanalysis has had a profound impact on the intellectual climate of the twentieth century. Many in fact would claim that its impact has been greater in the arts and humanities than in the social and behavioral sciences. In essence the Freudian psychodynamic perspective held that unconscious wishes and the vicissitudes of their expression comprised the core integrative concepts necessary to understand the complexities of both normal and abnormal personality. Thus the reach of psychoanalytic theorizing extended from the clinical couch to the psychopathology of daily life, from the deepest neuroses to the seeming innocence of typing misrakes. Through the theoretical lenses provided by Freudian theory, Eve's tardiness, Adam's ambivalence, and Nikki's petulance might reflect the subtle operation of unconscious wishes and defenses against them. Such influences would likely be sexual or aggressive at root. A Freudian chorus might choose Nikki as the most obvious case for explication of the possible influences of unconscious and destructive forces in human personality because of the welling up of impulses that compromise her ability to muddle through this particular Monday. But they would also have comments to make about why Eve is late only for her stats class and why Adam has never fully been able to break away from the Edenic security of his home.  
  
The Personological Chorus would feature Henry Murray with counterpoint commentary by Gordon Allport, both of whom would be draped in Harvard Crimson. Like Freud, Murray would insist that the motivation of the students would run deep. Rather than focusing exclusively upon sex and aggression, he would insist that there are diverse needs that underlie human motivation, such as the need for affiliation or need for achievement. He would voice concern that the environments within which human motives play out should also receive our attention, and that for each need operating in personality there is a corresponding "press" in the environment that can facilitate or frustrate its achievement. Finally, Murray would be concerned that we expand the time line to look at "serials"--the sequences of action that extend over longer periods of time and without which the significant motivational agendas of people's lives may be given shorter shrift than they deserve.   
  
Allport would generally concur, but would suggest that traits are the substantively real and dynamic sources of human personality and that both the nature and organization of such dispositions are patterned idiosyncratically. He would also argue that although pursuits may originally be undertaken for one set of motives, they may eventually become independent or "functionally autonomous" of the originating motivation.   
  
For these personologists, the ways in which the three students are approaching their last weeks as undergraduates may reflect different patterns of needs and the ways in which the environments are fulfilling or frustrating the achievement of the needs. Eve may be primarily concerned with a need for power, and her seeking admission only to the elite schools may help her to develop influential connections. This would contrast with her classmates, high in achievement motivation, who may apply to a greater range of schools to optimize likely success. (See Winter (1996) for an excellent description of need research in the tradition of Murray and his followers such as McClelland). Adam may have a strong need for self-abasement--a need his parents are only too happy to satisfy when he broaches the topic of heading off for grad school. Nikki might be particularly intriguing to the personologists. Not satisfied to dismiss her behavior simply as aggressive or neurotic, they may see her as a complex person--perhaps a highly creative personality whose needs are being systematically frustrated by environmental press that keeps her from exploring ideas that she and others find strange and disturbing.

We might hear next from the Behaviorist Chorus comprising the early learning theorists and joined by those such as Dollard and Miller who attempted to translate psychodynamic theory into behaviorist principles and of course Skinner whose clear voice of confidence about the power of operant conditioning would likely drown out the rest of the Chorus. The behavioral analytic units would be stimulus-response bonds that would allow an integration not only of human personality but the behavior of all organisms. This perspective placed considerable emphasis upon the shaping of personality by environmental contingencies, particularly by the rewards and punishments that reinforced behavior. For the behaviorists, the differences between our three students, Eve's ascendancy, Adam's diffidence, and Nikki's emotionality (and drinking problems), arise from differences in their reinforcement histories and the commonalities arise from their desire to avoid painful stimulation and seek out rewards.   
  
A third distinctive voice can be heard in the cafeteria: that of George Kelly. At the same time as behavioral theories were in ascendancy in psychology, Kelly proposed an original and audacious theory. His integrative mission was to weave theoretical, assessment, and clinical concerns into a seamless model of human personality. Kelly postulated that to understand individuals was to understand the personal constructs through which they viewed their worlds. Kelly saw each of us as a "lay" scientist--testing out hypotheses about ourselves and our worlds and revising those hypotheses (constructs) in the light of experience. These personal constructs are organized into systems such that some of them become core role constructs, centrally important to the lives of individuals. Their preservation and continued validation have a profound effect on emotional experience. For example, according to Kellian theory, threat is awareness of an imminent and comprehensive change in one's construct system. Guilt is awareness of being dislodged from one's core constructs, aggression is the expansion of core constructs to subsume new domains, and hostility is the attempt to extort validation for a construct one already feels has been invalidated (Kelly, 1955). So how would the Kellian Chorus in the cafeteria (more likely an Irish tenor solo) attempt to understand our three students? Kelly would likely see all three students as feeling threat at the prospect of being in transition between undergraduate life and their futures. Adam may feel guilt in that he is being dislodged from a core construct of being loyal to his family. Eve may be aggressively pursuing confirmation of her construct of herself as successful. Nikki, we can now disclose, has experienced a series of abusive relationships. She may have experienced what Kellians refer to as serial invalidation of her core constructs, in which each attempt to anticipate her world is painfully disconfirmed. Her only strategy left is to attempt to extort validation of her worth by acting abrasively toward those who have failed to notice her pain. For Nikki, only a worthy person has the temerity to tell her friends to "piss off". Or so she tells herself.   
  
These classic voices from personality psychology each approach the integrative task by developing overarching theories of considerable scope, though each selectively highlights a particular aspect of human conduct as its integrative center. Thus classical psychodynamic theory is primarily concerned with emotional experience, learning theory with overt behavioral processes, and Kellian theory with the cognitive systems through which personality unfolds. Yet each extends the range of its theoretical constructs to include phenomena that are of more focal concern for alternative perspectives. Indeed, within psychodynamic theory, a major historical progression involved a shift from emphasis upon unconscious motivation, to a conflict free domain in which conscious goal pursuit could be carried out without being subordinated to the pressures of irrational impulses and wishes. Thus, psychodynamic theory was able to push its conceptual agenda into an area that would be regarded as more the domain of cognitive psychology. Similarly, learning theorists over the century have moved from drive-reduction and peripheralist theories to cognitive social learning theories (e.g., Bandura, Mischel), in which the influence on human action has shifted from classical and operant conditioning, or rewards and punishments to more cognitive concerns, such as schemata, encoding skills etc. (e.g., Mischel, 1990).   
  
Critical Voices: Challenge and Restoration in Personology  
  
The field of personality psychology was thrown into considerable conceptual turmoil with the publication of Walter Mischel's (1968) Personality and Assessment. Mischel mounted a detailed critique of broad dispositional traits as units of analysis in personality psychology. Specifically, he argued that there was little evidence for broad-based generalities of trait dispositions (e.g., an Adam may be submissive around his fellow students and his parents but assertive and confident when playing in his jazz band). He also provided evidence that specific tests of personality traits had little predictive validity in accounting for actual behavior and seldom exceed a "personality coefficient" limit of .30. Thus, Mischel's attack was antagonistic to the classical personological perspectives and particularly to those who offered fixed traits as analytic units for the field. His allies, interestingly, were rather strange bedfolk: behaviorists (who by then were transforming into cognitive social learning theorists) and personal construct theorists--a direct reflection of Mischel having been a student of George Kelly's. Mischel's central contentions were that human action was finely attuned to situational influences, and that such action was less the product of fixed traits than of the personal constructs or conceptual lenses through which individuals viewed the world.   
  
The impact of Mischel's critique was pivotal for the field of personality in three ways. First, it had a major effect upon personality testing by calling into question the validity of such tests. Second, it encouraged greater collaborative linkages with social psychologists, who had traditionally regarded the major sources of human action to lie in the situations and environmental contexts with which individuals were confronted (Endler & Magnusson, 1976). Finally, and most significantly, it stimulated an immediate, protracted, and eventually successful defense of the orthodox trait model by personality psychologists. While feeling that the strengths of the personological tradition had been underestimated by Mischel, they also conceded that greater conceptual grappling with some of the foundational issues in personality measurement were now urgently needed (Wiggins, 1997). The result of the clash between these critical voices was an enrichment and broadening of the conceptual base of personality psychology. The social cognitive learning alternative, espoused by Mischel, continues to generate considerable research (e.g., Cervone & Shoda, 1999; Mischel & Shoda, 1995). But a full scale restoration of trait psychology also came about as a result of the Great Trait Debate and, as we shall see, it now constitutes one of three major contemporary perspectives in the field. It is to these contemporary voices that we can now turn.   
  
Contemporary Voices: Three Tiers for Personality Psychology  
  
Contemporary personality psychology is multifaceted, complex, and dynamic. One particularly helpful way of organizing this complexity for expository purposes has been proposed by McAdams (1995). I will adopt this as a starting point to review three different levels at which personality psychologists are exploring the nature of human nature and explaining the ways in which individuals live out their lives.   
  
Havings, Doings, and Beings in Personality Research  
  
The first level of inquiry in contemporary personality research is that of relatively fixed features of individual differences emphasizing personality traits. The second level explores more contextually sensitive and dynamic units of analysis that McAdams labels personal concerns. (McAdams includes many more constructs at this level than I will treat in this chapter. I have tried to make the case that the central integrative units at this level are Personal Action Constructs (PAC units) (Little, 1989, 1996)). The third level addresses individuals' life stories and the narrative identities that people construct to make sense of their lives. Invoking terms introduced by Allport and re-introduced by Cantor (1990), we can refer to Levels 1 and Levels 2 as reflecting the "having" and "doing" aspects of human personality respectively. "Having" refers to that which we are endowed with and carry with us and "doing" refers to that which we intentionally perform. Because Level 3 is concerned with identity and the sense of self that individuals construct, and to preserve the gerundial form of depicting the field, we can refer to this as the "being" aspects of personality. Collectively this structure of the contemporary field of personality research can be thought of as exploring the havings, doings, and beings of individuals.   
  
For initial expository purposes, we can conceive of these three levels as different tiers or floors of a house. Thus, personality psychology can be thought of as having trait psychologists on the ground floor exploring the nature of stable dispositions. On the second floor are a group of psychologists who are interested in people's personal concerns, and carry out research with PAC units, such as current concerns, personal strivings, personal projects, and life tasks (Little, 1996, 1999a). On the third floor are the narrative theorists and psychobiographers who are examining identity and life stories. As I have suggested elsewhere however, (Little, 1996), the "house of personality" would be incomplete unless we added a basement in which would be housed two other active groups of contemporary personality psychologists, psychodynamic theorists and evolutionary psychologists. I wish to turn now to a description of some of the important questions, methodological tools, and research findings on the three main levels of personality psychology. We shall deal with the cellar in due course.  
  
**Level I ("Havings"): Traits as Enduring Dispositions**  
  
Stable traits of personality were not only a foundational unit of analysis in academic psychology, they have been invoked ever since humans have communicated about their lives and those of others. The notion that stable individual differences arise out of differences in bodily humors is an ancient one and there has been an enduring interest in attempting to classify and predict individuals on the basis of traits assumed to be part of the constitutive nature of human beings. These have often been thought of as aspects of people that they "have" and that they carry with them through the contexts, challenges, and pivotal moments of their lives.   
  
The Big Five: Major Factors of Personality Traits  
  
Consensus has gradually emerged that stable features of human personality can be adequately described by five factors of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (e.g., McCrae & John, 1992; Wiggins, 1996). Neuroticism is characterized by attributes such as being nervous, worried and feeling emotionally insecure. Extraversion is depicted by attributes such as excitement seeking and activity level. Openness entails broad interests and imaginative dispositions. Agreeableness involves tendencies toward being good natured and trusting. Conscientiousness is associated with characteristics such as being organized and disciplined.   
  
Thus, at first blush, Eve, in our opening image, might be described by others as being a rather extraverted, open individual; Adam could be regarded as agreeable and conscientious, while Nikki might be seen as at least incipiently neurotic.   
  
Much of the current conceptual and empirical research in the field of personality is concerned with the descriptive, explanatory, and predictive implications of the five factor model. The five factor model is seen by most psychologists as primarily a taxonomic description of personality structure rather than a causal model that precisely predicts behavior. Indeed, there are a number of different explanatory models for each of the big five factors of personality, two of which in particular, extraversion and neuroticism, have been well developed. As one example, extraversion has been postulated by Eysenck (1970) as a dispositional tendency to seek out stimulation, particularly social stimulation, as a result of chronically low levels of activation in the neo-cortex.  
  
A somewhat different model of extraversion formulated by Gray (1981), assumes that extraverts are particularly sensitive to reward cues, while introverts are more sensitive to punishment cues (particularly so if the individuals in both cases are also high in neuroticism). Both these and other models of extraversion based on a biological model have been bolstered by evidence that there appears to be a strong genetic base underlying extraversion as well as the other big five factors.   
  
Thus, under these models, we might expect the extraverted Eve of our example to be particularly keen to seek out stimulation and to absorb herself in the conversation about grad school, and not to notice that it was time to go to class. We might also predict that she would be more likely than her introverted peers to need a good dose of caffeine in the cafeteria to sustain her through her stats class. And we might anticipate that she may not yet have thought through some of the down side issues in applying for graduate school ("Hey, what are these GRE thingies we're supposed to take"?).   
  
As well as having descriptive and explanatory functions, traits are increasingly being used for purposes of prediction in applied areas. For example, there is evidence that conscientiousness is a robust predictor of success in many areas where achievement is important, particularly achievement based on conformity to clearly specified goals (see Hough, Eaton, Dunnette, Kamp,& McCloy, 1990). However, there appears to be one intriguing exception. Hogan and Hogan (1993) have reported that conscientiousness is negatively correlated with peer rated success among Tulsa jazz musicians. Given that the ability to "jam" involves being able to "flex" to the shifting cadence and intonations of others, the goal-oriented persistence of the conscientious person may become a liability. This exception may not, in fact, be so exceptional. It is interesting to speculate whether organizational life, particularly in fast-paced high tech companies, is more likely to require the skills of juggling and jamming than those of dogged linear pursuit. So even though traits may be fairly stable, the personality psychologists using them as predictive instruments are fully aware of the need to monitor their predictive validity in domains that are changeable and dynamic.   
  
How might our three students be understood in terms of the Big Five trait approaches to contemporary personality psychology? Eve would appear to be an open, agreeable extravert, seeking stimulation, confident in her expectations, and generally engaged in zestful project pursuit. Adam might be seen as more introverted and conscientious. He seems to be agonizing over the question of grad school and is trying to balance it against other claims on his life. We might see Nikki as distinctly neurotic: she is angry, anxious, hurting, and inexpressibly sad.  
  
**Level II ("Doings"): Personal Projects, Tasks, and Strivings**  
  
Over the past couple of decades, another family of conceptual units of analysis in personality psychology has arisen which complement, and in some ways challenge, trait units. They have as a common focus an emphasis upon personal action: on the doing side of personality (Cantor, 1990; Little, 1999a). These personal action constructs (or PAC units) include personal projects (Little, 1972, 1983; 1989), personal strivings (Emmons, 1986), and life tasks (Cantor, 1990).   
  
Personal projects are extended sets of personally salient activity that can range from short bursts of action, such as "meeting Adam for coffee" to the defining commitments of one's lifetime, such as "try to respect my parent's wishes." Projects are conceived of as middle level units in personality (Little, 1987, 1989) in that they are influenced by superordinate goals such as core values, and they generate subordinate acts through which the project is implemented. Though projects are action units, the fact that they are personal means that they cannot be directly inferred from mere observation of an individual's acts. Personal projects typically proceed through the stages of project inception, planning, action, and termination. However, the fact that they are embedded in a daily ecology that involves flu bugs, returning boyfriends, irate roomates and computer system crashes (sometimes simultaneously) means that projects are in continual flux and their successful management involves a blend of tenacity and suppleness. Quintessentially, personal projects analysis is about the social ecology of muddling through.   
  
To illustrate, let's follow Adam for a while. We catch sight of him as he arrives on campus on Wednesday morning. He sits alone in the cafeteria, skims a few pages of his Personality text, and heads off to a Physics lecture. He sits frozen faced, trying to suppress his yawning, leaves quickly after class, pauses momentarily in the hallway, and then slowly walks along the river to his residence. He slams the door, puts on a CD, and starts to cry: What's up?  
  
From a trait perspective we might say that he is showing signs of introversion by avoiding much contact with others and perhaps that he is a bit neurotic (his crying might be seen as dysphoric). But at Level II his behavior is approached rather differently. From a personal projects perspective we would ask the crucial question "What have you been up to today" to which he may well respond with "trying to get a date with Jennifer". The outward and visible signs of his behavior may have made little thematic sense until we get that crucial piece of personal construing. His cafeteria stop prior to class had been a reconnaissance mission to see if Jenn was there that morning. His boredom in class may have made more sense to the physics professor (who may have been attributing unwarranted "thickness" to the student) if he had known that Adam wasn't even registered in the course: the only reason he was there was to be near Jennifer, a physics major. Adam's dithering in the hall was a failed implementation of his intention to approach Jennifer, who only knows him as a rather "wimpy" person who seems to be following her around. His emotional release back in residence was in frustration that once again he lacked the courage to ask her out.   
  
Research on personal projects involves asking people what their current personal projects are, and then to appraise each project on a set of approximately twenty dimensions that have both theoretical and applied importance for personality psychology (e.g., enjoyment, stress, control). These ratings, which can be appraised at both the individual level of analysis and normatively, can be summarized as falling under five major theoretical factors: project meaning, structure, community, efficacy, and stress. Research to date confirms the proposition that subjective well-being is related to the extent to which people are engaged in personal projects that are worthwhile (meaning), managed effectively (structure), supported by others (community), likely to succeed (efficacy), and not unduly onerous (low stress) (Little, 1989, 1999a, b, 2000a, b).   
  
The content of personal projects has also been shown to be important. For example, being engaged in intrapersonal projects, those dealing with trying to change or deal with aspects of one's own personality (e.g.,"be less subservient to my parents", "try to figure out why I am always so angry", "be more outgoing"), is positively associated both with a tendency to experience depressive affect but also with the Big Five factor of Openness to Experience (Little, 1989). From a personal projects view then, Nikki might be expected to be engaged in a number of such intrapersonal projects. But whether she sees them as likely to succeed or not might well influence whether she flourishes as a creative intellectual or becomes immobilized in self-hatred.   
  
Two other PAC units, each in part derived from personal projects methodology, have stimulated considerable research interest. Nancy Cantor and her colleagues (e.g., Cantor, 1990) have examined personal action in the context of what they term "life tasks". Life tasks are undertakings that are important to accomplish at different stages of life. Cantor explored these in her influential study of the transition of University of Michigan students through undergraduate life (Cantor, Norem, Niedenthal, Langston, & Brower, 1987). Students generated lists of personal projects which they then categorized in terms of alignment with several types of life task deemed important for university students. Subjects were able to categorize many of their projects as being in the service of life tasks such as "getting independent of parents," "forming friendships," or "succeeding academically."  
  
Cantor's research has shown how the successful management of life tasks requires social intelligence, particularly the sensitive deployment of appropriate strategies through which tasks can be successfully accomplished (Cantor & Fleeson, 1994). Two such strategic approaches have been identified by researchers on life tasks: defensive pessimism and illusory glow optimism (Norem, 1989). The former strategy involves envisaging a worst case scenario ("I'm going to fail this exam") and harnessing the anxiety to motivate studying and task persistence. The opposite strategy involves imaging best case scenarios ("I'm going to ace this exam!") and having this positive incentive motivate studying. The life task researchers have shown some intriguing implications of the adoption of these two strategies. They seem to be equally effective in terms of actual academic attainment, but the defensive pessimists seem to incur social costs in terms of being more of a burden on others. Thus, Nikki's repeated bemoaning of the difficulties of finishing up term without falling apart may work just as well as a motivational strategy for studying as Eve's optimism. But friends start to tune Nikki out and potentially valuable resources for her appear not to be answering their phones at college that month.   
  
Another PAC unit that has stimulated considerable research activity is that of Emmons' personal strivings (Emmons, 1986). A personal striving is something that a person is typically trying to do. Thus, Adam's acts of listening empathetically to Nikki and writing a letter home may be in the service of the personal striving of "being nice to people." Emmons and his colleagues have shown that human well-being is enhanced to the extent that personal strivings are appraised as likely to be accomplished and are not in conflict with each other. If Adam's "Be nice" striving is in conflict with a "be intellectually tough" striving, his well-being is likely to be compromised (Emmons & King, 1988).  
  
Clearly, these three PAC units are closely related, though each has a particular zone of applicability that suggests it is worthwhile to preserve the subtle distinctions between them (cf. Krahe, 1992). My own perspective sees personal projects as middle level units that can be in the service of both personal strivings and life tasks. Eve's personal project of completing her stats assignment may serve both her striving of "competing with her brother" and the normative life task of "doing well in academic tasks." But she may also be involved in personal projects that are only loosely coupled with a personal striving or life task such as "talking to Nikki about the way she dresses."   
  
Nikki's whole project system at college may be a protracted exercise in meaningless pursuits, unlinked to superordinate goals, and bereft of intrinsic meaning. Each of the PAC perspectives would see this state of affairs to be problematic. It should also be noted here that one of the major differences between the Big Five and PAC units is that the former are postulated to be relatively unchangeable after about the age of thirty (Costa & McCrae, 1994). So, while there may be some latitude left for Nikki to change her trait of neuroticism as she stumbles through her early twenties, there is greater tractability for change in her personal projects, and perhaps in her life tasks and personal strivings . At the very least there is the possibility of helping to clarify them and enhance the likelihood of them being pursued effectively. And, unlike traits, these reformulations and transformations can be tried on throughout the life-span--even when Nikki gets old and wobbly.   
  
**Level III ("Beings"): Life Stories and Personal Narratives**  
  
A third major growth area in contemporary personality theory and research is the narrative turn that has occurred in recent years (Sarbin, 1986). The major thrust of this perspective is that humans have a deeply rooted need to construct narratives within which their lives make sense. We construct stories not only about our relationships, our achievements, and our aspirations, but we also tell stories in order to establish an identity, to establish validation about the type of "being" we are or are becoming.   
  
McAdams (1993) has developed an elegant theory of personality in which life stories form the central focus. Life stories are built around various representations of self. Indeed, the very process of "selfing" as McAdams calls it, emerges only in the construction of a compelling life story that meets certain critical features such as being coherent. A key element of the life story is the development of "imagoes" which are like stock characters in a story and are often personifications of the themes of agency and communion.   
  
The narrative theorists in contemporary personality psychology would have much to say about our cafeteria conversations. First and most obviously, the students are conversing! During conversation we typically tell each other stories about how things are going, what's up, who's doing what (and where and why). Second, the stories we tell as we talk with others enable us to tie together personally salient information from the other two levels of personality research. Eve doesn't just list her trait characteristics or her projects, she casts them in narrative form ("I know I'm too pushy with Eric, and he really doesn't want me to go to grad school, but I think he's fooling himself and I'll straighten him out before the end of April. More coffee Adam?" ) In these conversations and story telling, Eve's imago seems to be a blend of agency and communion--perhaps seeing herself as the Directive Therapist. Eric, on the other hand, may see her as Eve, the Avenging Traveler.   
  
A third consequence of the narrative perspective to personality is that the mere telling of our tales can have a salutary effect. Pennebaker (1989) has shown that when students are asked to write personal narratives that deal with previously unshared painful material, there is an initial increase and then a long term decrease in measures of autonomic arousal. The effect is particularly notable with students who choose to tell deeply revealing stories. These results are consistent with the research of Wegner (1994) who has shown that "not thinking" about certain things can be taxing. (Wegner directs his subjects, for example, to not think of a White Bear. I admonish the reader not to think about this example.) Thought suppression actually increases the likelihood of thinking about the suppressed image and can extract an autonomic cost. If Nikki, then, were finally to get the chance to unload, to open up and tell her story, she may be less likely to anesthetize herself against the unspoken aspects of her life.  
  
**Voices from the Cellar: Psychodynamic and Evolutionary Perspectives in Personality**  
We have tried to capture the kind of theoretical conversations that we would hear at each of three different levels in the house of personality. In some respects, the metaphor is fitting-- often the research being carried out on one floor is done in ignorance (not necessarily willful) of work going on at the other two levels. I also think that the second floor offers ways of "listening in"on conversations on the narrative upper deck and down below with the trait-ers. But, to extend the metaphor one level further, I think there is a need to acknowledge some very strong rumblings from the basement cellar. Here is where power plants and sump pumps are chugging along and the kind of discourse going on down there about personality is similarly foundational and, some would say, earthy.   
  
I see two basement areas operating at this deepest level of personality: psychodynamic theory and evolutionary psychology. The first provides a line of continuity with the modern origins of personality theory. The second provides a link with the Darwinian roots of modern life sciences.  
  
A spirited treatment of the contemporary revival and sustained relevance of psychodynamic theory for personality psychology can be found in Westen (1990). One of the most noteworthy accomplishments of contemporary psychodynamic theory has been wide spread acceptance of one of its most basic assumptions: the pervasive impact of unconscious influences on personality functioning (Erdelyi, 1974). For example, when patients are exposed to subliminal stimuli that are symbolically related to their particular problem, there appears to be some relief of symptoms ( Silverman & Weinberger, 1985). That such messages are not consciously recognized yet have a discernible impact on human functioning means that at least some of the dynamics going on in the college cafeteria are not accessible to the participants or to their personality research professors (not unless armed with hidden portable tachistoscopes). A general sense of tension and pervasive unease between Nikki and Adam, for example, may be the result of the continuous influence of impulses that each has imperfectly repressed. To an astute psychodynamicist, there may be subtle hints revealed in gesture and the parapraxes (such as slips of the tongue and memory lapses) that lead to mixed messages and missed meetings. Such influences are perplexing and their detection requires probative work that is both demanding and subtle.  
  
On the other side of the basement are the evolutionary psychologists. David Buss (1991), in particular, has pioneered the study of how evolutionary adaptation has shaped human personality. The essential argument of this perspective is that in the course of evolution various strategies which conferred adaptational advantage were selectively retained and transmitted to the next generation. Though these adaptations evolved in adaptive landscapes radically different from those that confront us today, the mammalian brain still shows evidence of these primordial adaptations.  
  
One of the important claims of the evolutionary perspective is that there will be sex differences in the criteria that guide selection of future mates. It is argued that women will place a premium on the status of prospective mates, while men will regard the physical attractiveness of mates as differentially important. Note that it is not being claimed that these will be the most important or the only important criteria, in fact pleasantness of personality is the top criterion in mate selection for both sexes. But it is argued that the sexes should differ in the rankings of these attributes for evolutionary reasons. Physical attractiveness serves as a marker of potential fecundity in the female, and status cues serve as markers that a male will be able to provide resources that will support the viability of offspring.  
  
Evolutionary personality theory also posits that there will be important sex differences in emotions, such as jealousy. Males are more jealous when their mates engage in sexual infidelity and women more if their mates establish emotional romantic interests in another woman.   
  
An early and similar perspective to the evolutionary personality psychologists is Hogan's (1982) socioanalytic theory. Hogan was one of the first to emphasize the significance of the fact that human personality evolved in the context of group life. Group living requires that individuals be particularly sensitive to two key issues--establishing social bonds with others and negotiating the power hierarchy: in short of "getting along" and "getting ahead" (Hogan,1982).  
  
Like psychodynamic forces, those arising from evolutionary principles may have an influence that eludes awareness. Adam may not have consciously chosen to ask Jennifer out because she was "drop dead gorgeous" (let alone likely to bear his child), though she is sure that this is the main reason he keeps hanging around. He may well have consciously formulated the goal of taking her out because she seemed nurturing and responsive at a party in September. Meanwhile Eve will feel deep frustration when Nikki asks her why she wore provocative clothes when Professor Buss gave a colloquium in their department. "Give me a break" says Eve, and rolls her eyes, while Nikki responds with a smile that is part twinkle, part smirk.  
  
My own view of the evolutionary perspective in personality theory is that it provides some intriguing hypotheses about the distal roots of human personality that otherwise seem inexplicable. My concern is that we not underestimate the importance of another achievement of mammalian evolution--the development of a neocortex that allows us to formulate and carry out core projects that can override the primitive motivational processes of more ancient origin. In my view, peoples' accounts of what they are doing should take initial priority particularly when we are dealing with things that are important to them in their lives. Thus, I would be more inclined to believe Adam's explanation of his reasons for pursuing Jennifer than those that might be offered under the evolutionary hypothesis. Such a "credulous" approach, which is consistent with Kelly's view of the individual as co-scientist, works well within the normal boundaries of daily conduct. If, however, there is consistent evidence that all of the people Adam finds nurturing just happen to be beautiful women, I would be inclined to look to evolutionary theory to help explain why this is so. Perhaps it is in the dark passages of personality and the extreme edges of human conduct that both the psychodynamic and evolutionary perspectives deservedly attract our attention. The prevalence of violent jealousy and the pervasiveness of "powerful man, nubile woman partnerships" reminds us that we are, after all, an evolved mammalian species with adapted minds and that this heritage has the potential to influence us in powerful ways. (Do not think of a White House.)   
  
**Personality in Context: Situations, Places and Environments**  
  
One of the central tenets of behaviorism, as well as the Mischellian critique of traits, was that human conduct is often generated by the context within which it is embedded. Murray, too, it will be recalled, insisted on the need to appraise the press of the environments within which human needs were satisfied or frustrated. A brief word, then, about the role of contextual features in contemporary personality. How do the theorists on the three levels view the environments within which personality processes are played out?7  
  
On the first floor, trait psychologists are concerned with the extent to which there is an appropriate degree of "fit" between persons and their environments. Extraverts, for example, require stimulating environments for optimal functioning, while more introverted individuals require more structured and modulated environments. While Eve may thrive on a week filled with parties and recreational diversions, Adam may find walking by the river for getting his thoughts together about Jennifer, his folks and the upcoming GRE exams. Along with tools for the assessment of personality characteristics, there are abundant scales and inventories for the appraisal of the "personality" of environments, so that there are practical ways of determining the degree of fit between people and their contexts along a number of key dimensions. Such tools allow us to formulate and answer the essential question about persons and environments talked about on the first floor:"got a match"?  
  
On the second floor, the PAC theorists are more concerned with the extent to which environmental contexts serve to generate, facilitate, or frustrate personal action. The pursuit of one's core projects, cherished strivings, or vital life tasks requires an environment within which such pursuits are valued, or at the very least not impeded. Personal contexts may be the major source of the projects that people regard as worthy of exploration , but they may also proscribe the kind of pursuits that people even dare to consider. Eve's home environment may have been such that the thought of doing anything other than pursue a graduate degree after college was simply not an option. Nikki's home environment may have been one in which the possibility of graduate school brought blank stares of incredulity and the blunt question of "who the hell is going to pay for that?" Unlike trait perspectives, then, second floor theorists are more likely to look at the environment less in terms of "fit" than in terms of ecological factors such as affordances, resources, impedances, and constraints (Little, 1999b; Phillips, Little & Goodine, 1997).   
  
The third floor narrative theorists are positioned to view the environment with a broader sweep and they are particularly interested in locating individual life stories in their historical contexts. Sarbin provides a fascinating analysis of how life trajectories can be entrained to the cultural myths that define a particular historical time and place--for example, the pervasive myth of the avenging hero who sacrifices his life to avenge wrongs done against his people in the past (Sarbin, 1996).  
  
**Linking Levels: A Contemporary Example of Meeting the Integrative Challenge**  
  
Personality theorists have argued that the enduring mission of personality psychology has been to provide both theoretical and methodological tools for integrating the diverse system of influences affecting the lives of individuals and accounting for their differences. We have also shown that much of contemporary personality research is taking place in three relatively independent sectors concerned with traits, action, and narratives, each of which has its own integrative task. Trait psychology provides an impetus for integration of taxonomic work on stable personality characteristics with, as just one example, neurophysiological research thus providing an integrative bridge to the neurosciences. Personal action psychology, particularly in the focal role given to the concept of goals, provides a natural bridge to cognitive science as well as to social ecological perspectives that explore the ways in which goal pursuit is embedded in and contributes to middle level dynamic contexts. Narrative psychology provides a natural bridge to the humanities and to a broad corpus of literary, historical, and political scholarship that charts the larger currents of thought, tradition, and myth that define culture.   
  
Although we may well have horizontal integration within each of these three levels of contemporary personality research, is there a way of vertically integrating them so that we might bridge the full spectrum of influences on human personality? Not only do I think the answer is a strong "yes, indeed", I also think that it is precisely in this bridging research between levels in personality that some of the most interesting new findings are emerging. Such bridging or linking research should also allow us access to the theoretical insights of the classical perspectives in personality whose voices guided us through the early history of the field.   
  
Not surprisingly, given my own theoretical orientation, I feel that it is on the second floor--where the action is--that we are offered the best opportunity for conceptual commerce with the trait-ERs downstairs and the narrative theorists up in the loft. We shall even show how our understanding of personal projects can be enriched by taking a trip down to the basement on occasion. I want to illustrate this by showing how research on personal projects allows us to move through each of the different levels of research in personality and, in this way, to continue to struggle with the broad band integrative challenge that defines our field.   
  
To illustrate this, let's return to the cafeteria and take "Getting into graduate school in psychology" as a prototypical personal project and one shared by all three students. Research studies from several different theoretical perspectives and levels of analysis in personality have addressed the content, appraisal, and dynamics of personal projects.   
  
We can start in the basement. Although the evidence from this level is more indirect than at the other levels, it offers one of the most intriguing areas of interlevel influences on personality and one of the most challenging areas for future research.   
  
Unconscious Influences: Particularly at the inception stages of a personal project, it is likely that unconscious processes may play a subtle, even powerful role, in directing its course of including whether the project is even considered in the first place. For example, Baldwin, Carrell & Lopez (1990 ) reported an intriguing study in which graduate students at the University of Michigan appraised the likely success of their research projects for the next term. For half the students, prior to their ratings, a tachistoscopic image was flashed of the scowling face of a highly distinguished and rather threatening Michigan professor. For the other half, the smiling face of a less threatening post-doctoral fellow was flashed. Those exposed to the threatening face rated the likely success of their research projects to be lower.   
  
In other words, pre-conscious images that involve threat may lead us to evaluate our projects in powerful ways. Indeed, such images may actually serve to proscribe a project as something that one simply cannot do or should not do. Thus Adam's ruminations about grad school as he walks by the river, may well be guided by the image of his parents' disapproving looks and snippets of conversation about grad school being a waste of time.   
  
Do the other cellar dwellers have relevance to the pursuit of our students' projects? Though more speculative, I think the evolutionary perspective offers some intriguing possibilities for explaining project choice (see Buss, 1989). When we look at the content of the projects generated in the listing of our student research collaborators, it is easy to see projects that represent quintessential evolutionary tasks of mate selection, competition, social bonding, etc. It would be possible to create an evolutionary task template (based on relevant project appraisal dimensions such as the extent to which this project involves competing with other males, etc.) that would allow a researcher to estimate the degree to which appraisals of projects can be explained by their match with the theoretical expectations of evolutionary theory.   
  
Moving up a level to that of the trait psychologists, there has been extensive research showing the relationships between traits and the content and appraisal of personal projects (e.g., Little, Lecci, & Watkinson, 1992; Salmela-Aro, 1992). Among the most robust findings have been that conscientiousness is strongly related to the personal project factors, such as efficacy and absence of stress. Perhaps more surprisingly is the consistent evidence that conscientiousness is also strongly related to the perceived meaningfulness of projects, particularly to its enjoyment. The image of someone who is highly conscientious as a rather joyless creature slogging away on her ANOVAs at the computer terminal is more myth than reality. If Eve happened to score high on conscientiousness, her seemingly cavalier tactic of applying only to three schools may not be so cavalier at all. She may already have thrown herself into researching the schools, having email correspondence with prospective advisors, and actually visiting the campuses before sending off her applications. And our research would suggest that for Eve these projects would be a delight, not a drag. Nikki, on the other hand, has probably procrastinated again, and regards the whole application process as a Royal Pain. This pattern likely reflects Nikki's status on another of the big five dimensions, neuroticism. Salmela-Aro (1992) has provided important evidence that depression is significantly associated with the tendency for personal projects to be pursued with less effectiveness and less likelihood of successful completion, and Pychyl's extensive program of research on procrastination and well-being provides clear evidence of the deleterious effects of Nikki's style of dealing (or not dealing) with her projects (e.g., Pychyl & Little, 1998).   
  
Two aspects of environmental influences have also been shown to be associated with appraisals of our personal projects. For example, Ruehlman and Wolchik (1988) have explored the extent to which people in our social networks can both help and hinder the likelihood of successful project pursuit. Eve's project of going to Ann Arbor may be frustrated by Erik's apparent disapproval, but facilitated by the fact that beyond any one else, Erik has challenged her intellectually and given her the confidence to aspire well beyond where she had thought possible in September. The reason we choose to undertake certain projects rather than others has been approached in a very imaginative way by Ogilvie and Rose (1995) who, after grappling with the difficulties of categorizing projects in terms of content, realized that projects fall neatly into four categories that are rooted in classical learning theory: whether the project is a positive or negative goal and whether it is something that is being sought or avoided.  
  
Omodei & Wearing (1990) provided a clear demonstration of the relationship between the classical Murrayan needs, personal projects, and well-being. They had respondents rate each of their current personal projects on dimensions that represented each of the major needs posited by Murray as central to individual differences, and found that the extent to which projects were satisfying their needs, overall life satisfaction was higher. Indeed, they were able to show that need satisfaction of personal projects served as an excellent proxy for overall life satisfaction ratings. Thus, Nikki may be deeply unhappy at this point in her life because she has been unable to formulate and act upon personal projects that satisfy some of her most important needs. Though changing the needs may be very difficult, finding projects through which they might be met may offer greater tractability for Nikki at this stage in her life (Little & Chambers, 2000).  
  
Finally, there are also compelling theoretical reasons to see personal projects as interpenetrating with the narrative level of personality theory and research. Sarbin (1996), in tracing through the importance of cultural myth and its impact on lives, suggests that tragically conceived projects, such as terrorist campaigns, may derive their motivational force from the myths to which children are exposed from an early age, and which are reinforced by media attention and the collective stories about heroes and villains which saturate our cultural landscape. Under such a view, and depending on one's belief systems, another Adam's project ("Do not eat that Apple") may be seen as a generative proto-project of humankind.   
  
**The Prospects for Personology: Consolidating the Integrative Center in Psychology**  
  
It should be apparent that I feel that the field of personality psychology is an exceptionally exciting place in which to take up permanent residence. I see its aspiration to provide the integrative center for psychology as a continuing challenge. The three levels that we have discussed in this chapter, will, I believe, continue to grow in importance and yield insights that will advance both theoretical understanding and applications in fields such as clinical, health, and organizational psychology. So too, undoubtedly, will the personologists in the basement continue to expand our understanding of the remote roots of human conduct. In addition to these, I think there are five areas that deserve to be promoted to positions of importance in our collective research agenda.   
  
First, I think there are rich possibilities for expansion of our understanding of the biological base of personality traits, particularly given the rapid advances in techniques for monitoring brain activity on-line. Though there is a fairly substantial research literature on the neurophysiological substrates of extraversion and neuroticism, work on the rest of the big five dimensions is still in the early stages. Recent advances in the neurobiology of temperament (with its own Big Three factors) seems particularly promising (Clark & Watson, 1999).   
  
Second, I think that non-human studies of personality, particularly among the higher primates, but involving a whole range of species, will pay very rich dividends in understanding how evolutionary forces have shaped human personality. There are already signs that an emerging animal personality psychology research agenda is well under way (Gosling, in press). Given my conviction that project pursuit is an inherently mammalian propensity, I do not see such research as restricting itself to trait-like behaviors. Extended sets of salient activity in the pursuit of valued goals applies to Nikki's cat as well as Nikki. While we will never be able to herd either Nikki or her cat, I think the comparative psychology of unpredictability is itself an intriguing focus for collaborative research between ethologists and personality psychologists.   
  
Third, particularly at Level II, I believe there is considerable scope for expanding personality psychology's intellectual collaboration with the fields of ethical philosophy, legal theory, and the philosophy of action (Little, 1987, 1999a). Scholars in these areas are already grappling with questions of how the nature of our ground projects or core tasks bear upon issues of ethics and of different conceptions of justice. (For a compelling treatment of such issues see Nussbaum (1992). Nussbaum looks at various Hellenistic philosophies through the eyes of Nikidion--a probably fictitious student of Epicurus, who is seeking instruction on living a flourishing life. Nikki in the present chapter is a modern descendent of Nikidion. Some day I hope to take her on a more extensive trip through what contemporary personality psychology can say about human flourishing.) I believe that such discourse will be enriched by the importation of empirical work of personality psychologists, and that our work will be enriched by the conceptual precision afforded by philosophical inquiry.   
  
As one example of this kind of interdisciplinary analysis, I have recently been exploring the concept of free traits, which I see as trait-like behavior carried out in the service of a personal project even though it may run against one's "first nature". For example, some of us are "pseudo-extraverts," by which I mean we are Eysenckian introverts who, because of professional duty or love, act extravertedly in order to accomplish valued goals. I believe such apparently disingenuous behavior can extract a toll on the autonomic nervous system and that this can lead to burn out. However, such a consequence can be mitigated by the availability of restorative niches in which we can, every now and then, indulge our first natures ( Little, 1999b, 2000a). One of the intriguing questions raised by such an analysis (which integrates research from Levels I and II), is whether such disingenuous behavior is, in fact, a "bad thing" (not only in the sense of possibly being stressful, but in terms of being unnatural, even phony). If Adam decides to go back to the family business and forego grad school, how should we think about the tradeoff between fidelity to family and honesty to oneself? Clearly these are questions of value that can not be exclusively adjudicated by empirical inquiry. But I strongly believe they can be informed by such inquiry, and personality psychologists are ideally positioned to provide precisely the kind of rich textured information about the complexities of people's lives.   
  
Fourth, I believe the narrative perspective in personality will continue to flourish and I hope that the traditional ways of getting individuals to tell their stories will be enriched by adoption of new technologies and methodologies. For example, simply asking individuals to tell about their daily lives by providing us with images and captions from an imaginary videotape (called an idio-tape machine), allows individuals some adaptive flexibility in bringing into conceptual focus concerns and elements of emotional significance to them (Little, 2000a). Similarly, just as computing science and cognitive psychology have proceeded in virtual lock step, I believe that the field of personality can benefit from joining forces with the "New Media", including the imaginative use of interactive multi-media to assist individuals in exposing and exploring their personal wishes, needs, projects, traits, and life narratives. For example, Nikki has been depicted throughout this essay as someone who has pain beyond words. Perhaps by using media that do not rely solely upon words, she will be able to construct images and scenarios with greater richness and precision. Such multimedia meditations might help her both express and expunge some of that hurt.   
  
If students ask me if I think they should pursue graduate work in personality psychology, I usually schedule two meetings. In the first meeting I tell them that I cannot think of a more fascinating area of research and proceed to tell them much of what has been compressed into this chapter.   
  
They occasionally ask me how I got into the field of personality psychology. Depending on how much time they have to indulge what I call my "anecdotage", I tell them the following. I have long felt a strong attraction to both the humanities and the biological sciences, with classics and microbiology being among my favorite undergraduate courses. When it came time to choose a major, psychology seemed to be the most likely field in which I could maintain a joint focus on ions and Ionians. Though I had originally been accepted at Berkeley to study neuropsychology, a chance event in the library just prior to leaving for graduate school launched me on another trajectory. I was searching for a book called the Stereotaxic Atlas of the Brain when I accidentally pulled down a wayward copy of George Kelly's Psychology of Personal Constructs. I leafed through the first few pages, developed a very severe intellectual itch and have been scratching it ever since. I do not recommend to my students that they take this random walk through the stacks as a strategy for choosing their specialties in psychology, though it is an honest account of how our professional lives can sometimes wind their ways along unpredictable paths (Bandura, 1982).   
  
In the second meeting, I am usually rather more cautious. Personality psychology is a fundamentally intellectual pursuit--it is concerned with themes that go back to antiquity and challenges its serious students to ponder issues that cut across the full spectrum of the humanities and sciences. I point out that if the student's overriding concern is with a particular practical problem, such as abuse or depression or occupational success or criminal behavior, then that student should seriously consider going into an applied field such as clinical or organizational psychology. But if they are interested in how all of these disparate phenomena are linked together, then they may well have found an intellectual home. We usually discuss where the strong programs are in personality psychology and I direct them to the splendid website called the Personality Project run by Bill Revelle at Northwestern. I am also delighted as of a few months ago, to be able to direct them to the Association for Research in Personality website and urge them to join the Association immediately. The philosophy and sense of excitement for the personality field in this new Association overlaps exactly with my own and I see it as a major source of stimulation and support for the field in the future.   
  
If the student comes back for a third meeting, I know that the line of succession from Freud, Murray, Allport, Kelly, and all the secular saints of personology will likely remain unbroken. But if that particular student doesn't come back, I can take some solace from knowing that there are three other students waiting outside at this very moment. They want me to go have a coffee with them in the cafeteria and chat about grad school. In fact there's loud banging on my door even as I wrap up this chapter. Hang on, Nikki, I'm coming.

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[Flourish Line]

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# Chapter 3 ****Industrial/Organizational Psychology 2010: A Research Odyssey****

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During the first decade of the 21st century, Industrial/Organizational Psychology (I/O, for short) will reach the 100-year-old mark. Hence, it is appropriate to reflect on the many changes that have, and will, come to pass in I/O Psychology's next century. It is clear to see that trying to adapt to the current work world and apply psychological concepts is a demanding and fast-changing task for researchers, practitioners, consultants, and academicians alike. However, these same issues also offer us a glimpse of what I/O psychologists are likely to face in the next 15 years. Business guru, Peter Drucker (1993) has illustrated how every few hundred years the world undergoes a very sharp, discontinuous, and dramatic transformation that completely changes the fundamental state of humankind. Industrial/organizational psychology (and likely the world) is in the beginning of one of those transformations. The next century will be one of unprecedented change, but one that can be partially predicted by examining current trends. Perhaps Paul Muchinsky (2000) said it best when he stated, "The axiom that 'the best predictor of the future is the past' may have to be modified in the next century, at least as it applies to I/O Psychology. A few caveats or modifiers may be in order, such as 'the best predictor of the future is the *very recent* past'" (pg. 503). In the following pages we explore the current hot topics and future trends and where they may take I/O Psychology in the next quarter-century. Students interested in I/O Psychology should consider researching these areas more thoroughly to be on the "cutting edge" of the 21st century as it happens.

**What's Hot in Industrial/Organizational Psychology**

The field of I/O Psychology can be roughly divided into seven primary areas of research: personnel selection, training, performance appraisal, leadership, work motivation, work attitudes, and organizational issues. The first three areas are traditionally considered the "I" or Industrial Psychology aspects, the latter four are the "O" or Organizational Psychology areas. Although there are a variety of other pertinent I/O areas that fall beyond these primary seven (e.g., environmental issues, human factors, unions, compensation systems), these seven main areas effectively make up the bulk of what I/O psychologists study. We explore some of the current research issues germane to each of these areas.

Personnel Selection

Personnel selection deals with measuring and predicting individual differences in behavior and job performance so as to hire the best person for the job based on reliable and valid tests. Job analysis is also a primary focus whereby researchers attempt to break a job down into its basic components and generate job descriptions. Perhaps one of the most widely examined areas in personnel selection is compliance with the law. Increasing numbers of textbooks are devoting entire chapters to legal issues and selection (e.g., Cascio, 1998), and a review of some of I/O Psychology's more prestigious journals (e.g., *Journal of Applied Psychology*) finds at least one article devoted to the topic in each issue. As we attempt to develop screening and selection batteries for the future, not only must they be valid and reliable but they must also fall within current legal guidelines; this task is enormous. The size of this task is reflected by the following partial list of work-related laws (and highlights of the law) that I/O Psychologists must abide by:

\* *The 5th, 13th, and 14th Amendments of the U.S. Constitution* (allows for "due process" in employment-related legal hearings; abolished slavery and involuntary servitude as types of employment; and all people must be given equal and fair treatment).

\* *Civil Rights Acts of 1866 and 1871* (allows citizens to make and enforce work-related contracts and sue when violated; allows citizens to sue if constitutional rights have been deprived; federal government can become involved in matters of racial discrimination in private employment settings).

\* *The Equal Pay Act of 1963* (prohibits employment-related discrimination on the basis of sex in regard to the payment of wages; equal jobs require equal pay irrespective of gender).

\* *Civil Rights Act of 1964* (Title VII of this landmark anti-discrimination law prohibits employment-related discrimination on the basis of race, color, religion, sex, or national origin; also created the Equal Employment Opportunity Commission (EEOC) to enforce the law; later amended by the Equal Employment Opportunity Act of 1972, the EEOC was given the power to initiate discrimination-based lawsuits against employers).

\* *Executive Orders 11246, 11375, and 11478* (Signed in 1965, 1967, and 1969, respectively, these orders prohibited employment-related discrimination in the federal government; created the Office of Federal Contract Compliance to supervise and enforce government contracts with all contractors; emphasized merit-based employment practices; set the foundation for the creation of affirmative action).

\* *The Age Discrimination in Employment Act of 1967 (ADEA)* (Later amended in 1986, prohibited employment-related discrimination on the basis of age but only for workers over the age of 40; allows companies the opportunity to discriminate against (i.e., fire) older employees unable to perform satisfactorily if it can be proven in court that age is a problem).

\* *The Rehabilitation Act of 1973* (a precursor to the Americans with Disabilities Act this act required federal contractors and subcontractors to actively recruit and hire people with disabilities; part of its intent was to prevent any systematic discrimination results in lessening an equal employment opportunity).

\* *Vietnam Era Veterans Readjustment Act of 1974* (prohibits employment-related discrimination on the basis of being a military soldier during the Vietnam War era for all federal contractors and subcontractors; essentially affirmative action for Vietnam veterans).

\* *Pregnancy Discrimination Act of 1978* (prohibits employment-related discrimination on the basis of a pregnancy or pregnancy-related condition).

\* *The Immigration Reform and Control Act of 1986* (prohibits all employers from hiring or continuing to employ illegal aliens and requires them to verify employment eligibility of all new employees).

\* *The Americans with Disabilities Act of 1990 (ADA)* (prohibits employment-related discrimination on the basis of a disability; requires employers to make "reasonable accommodations" for disabled workers; requires all new businesses to be accessible to the disabled and existing businesses to make improvements in accessibility when possible).

\* *Civil Rights Act of 1991* (alters a variety of employment-related law interpretations and practices; prohibits the adjustment of employment test scores on the basis of race; protects employers from certain actions when advance notice was given to employees and they failed to challenge the action at that time; changed legal interpretations of adverse impact in the courtroom).

\* *Family and Medical Leave Act of 1993 (FMLA)* (allows for employees to be given up to 12 weeks of unpaid leave for births, adoptions, foster care, care of a seriously ill spouse, or care if the employee is seriously ill; employers must give the workers their previous job after the leave or an equivalent job; companies with 50 or fewer employees are exempt).

\* *Uniformed Services Employment and Reemployment Rights Act of 1994* (prohibits employment-based discrimination on the basis of a person's affiliation with the armed services; in many instances the employer must rehire a returning service member).

Additionally, the Uniform Guidelines on Employee Selection Procedures (for the Federal Government) and the Principles for the Validation and Use of Personnel Selection Procedures (developed by the Society for Industrial and Organizational Psychology) are being heavily relied on by I/O practitioners and human resource (i.e., personnel) departments as a primary source of information.

Researchers are attempting to identify which personnel selection instruments are the most predictive and yet do not exhibit concepts such as "disparate impact" (intentional discrimination) or "adverse impact" (unintentional discrimination). For example, researchers have identified cognitive ability tests (i.e., intelligence tests) as being one of the most highly predictive instruments available for many jobs (Hunter & Hunter, 1984; Schmidt, Ones, & Hunter, 1992). Unfortunately, such tests are highly prone to adverse impact with minorities often scoring a half or whole standard deviation below whites on these tests (Hunter & Hunter, 1984). Schmitt, Rogers, Chan, Sheppard, and Jennings (1997) attempted to combine alternative predictors with cognitive ability tests in hopes of creating a higher validity with lower adverse impact using multiple correlation. The results showed that the use of additional predictors (i.e., biodata, personality tests, and structured interviews) in combination with cognitive ability tests increased validity and reduced adverse impact; however, adverse impact was still sufficiently high to be considered discrimination. Researchers will continue to try and find that elusive fit between high predictiveness and low discriminatory value within legal limits well into the next century. I/O Psychology students will need to be considerably more legal-minded as additional laws and court cases further expand the ever-growing body of employment legislation.

Training

Training is big business. Each year, roughly 30 billion dollars is spent on formal training programs and an additional 180 billion dollars is spent on informal "on the job" training (Schultz & Schultz, 1998). Although much of the training literature deals with traditional topics (e.g., what are the best types of training programs, how does training knowledge and behavior transfer to the job, how can learning be improved, etc.), a currently hot topic is the advent of diversity training. Whereas most training programs involve teaching an employee a particular skill or behavior to enhance job performance, diversity training is really more about re-training peoples' attitudes, prejudices, and stereotypes (and the accompanying behaviors). Many global (i.e., international) companies take diversity training a step further to include educating their employees on the cultures of other countries when they will be dealing extensively with foreign organizations. According to Noe and Ford (1992), the goal of diversity training is to reduce attitudinal barriers that constrain employee performance on the job, reduce organizational effectiveness, and limit personal development. Currently, there is little research that illuminates the success of this type of training. Rynes and Rosen (1995) found that less than one-third of companies even bother to evaluate the success of the training programs or conduct some type of follow-up research. Given the changes that are expected in the demographic make-up of the work population in the next 15 years alone, it is important that researchers develop effective diversity training programs or we are likely to see increased problems in employee interactions. According to the American Psychological Society (1993), by the year 2000, almost 30 percent of new workers entering the labor market will be minorities and almost two-thirds will be women. Nemetz and Christensen (1996) examined anecdotal evidence from diversity training programs and found that many programs actually create *negative* reactions in participants. Furthermore, participants often felt that these "politically correct" interventions were done only for corporate appearances without addressing real diversity issues. I/O psychologists have their work cut out for them.

Leadership

Although, leadership is one of the most heavily researched topics in I/O Psychology, it lacks firm "conclusions." Consider all the different competing theories that exist: trait theories, behavioral theories, situational theories, contingency theories, normative theories, power/influence theories, and leader-member relationship theories. Meindl and Ehrlich (1987) proposed that a theory of leadership may not even really exist at all. Hence, it is not surprising that researchers cannot agree on a good formal definition of leadership. As Jewell (1998) so eloquently states, "Perhaps 'leadership' is akin to the Loch Ness monster phenomenon: We believe that there is something big, mysterious, and powerful out there, we have a rough idea of where to look, and we have launched some elaborate and expensive expeditions. But hard evidence remains sparse, and the pictures we have managed to obtain are fuzzy" (pg. 530). Nonetheless, researchers strive to get a handle on the concept.

Currently, leadership theorists are experimenting with variations to create a sort of "new age" leadership. Yukl (1994) proposed a multiple linkage model that identifies six key components (e.g., material resources, direction on the project, coordination of the unit) necessary for a work unit to function. The leader is the individual who provides the work unit with these components or compensates for them in some way when missing. Clearly, this theory draws from many theories. So far the initial research is scarce but encouraging (Kim & Yukl, 1995). Sims and Manz (1996) are working together on the development of a "superleadership" theory. These authors argue that superleadership occurs when a leader becomes an effective self-leader and then passes on these leadership skills to his or her subordinates turning them into self-leaders. However, it would appear that what is needed is a "super" theory of leadership that combines important elements from the existing theories to create a meta-theory of leadership; unfortunately, few researchers seem interested in pursuing this research avenue. Ardent I/O Psychology students should consider taking up this pursuit of the elusive leadership meta-theory.

Work Motivation

Like leadership, work motivation is inundated by theories, hence, future efforts will endeavor to integrate multiple theories into a single meta-theory, such as Klein's (1989) control theory model. Kanfer (1991) has identified three of the most viable integrative approaches for the amalgamation of work motivation theories. However, there is an emphasis on exploring new variables associated with the most widely researched and best supported theory of motivation, goal-setting theory (Dipboye, Smith, & Howell, 1994). Podsakoff, MacKenzie, and Ahearne (1997) are examining the moderating effects of goal acceptance on group productivity and group cohesiveness. Their research identifies the need for groups (and individuals) to accept work goals in order to increase motivation and hence productivity. Recent work by Phillips and Gully (1997) using structural equation modeling (LISREL) examined numerous variables in relation to goal-setting theory. The authors look at self-efficacy, need for achievement, locus of control, and goal orientation to provide a revised model for understanding how goal-setting works. Finally, VandeWalle and Cummings (1997) examined how individual differences in goal orientation affected feedback-seeking behaviors in participants. An employee's predisposition towards certain goals may have a pronounced impact on what types of motivational techniques will be used and which ones will be successful.

Work Attitudes

Job satisfaction has always been the predominant attitude researched in this area; Spector (1996) found that by 1991, over 12,400 published research studies focused on job satisfaction. Job satisfaction has been correlated with performance, pay, turnover, absenteeism, health and stress, life satisfaction, education, sex, race, and age to name some of the more common correlates. However, more recent research endeavors have shifted towards measuring job involvement and organizational commitment (Keller, 1997). In the 1990s, organizational commitment became a hot topic.

Although strongly related to job satisfaction, organizational commitment (OC) is a distinct concept that relates to an employee's desire to remain with a company out of a sense of loyalty, emotional attachment, and financial need (Meyer, Allen, & Smith, 1993). Additional research (e.g., Irving, Coleman, & Cooper, 1997) found strong support for this model and will likely spur more research endeavors. Of particular interest to researchers are which variables lead to an increase in organizational commitment. Although job satisfaction is considered a dominant topic, organizational commitment may be of more importance to employers. Any factors which increase both job satisfaction and organizational commitment are likely to be hot topics. Of course, it is presumed that employees higher in organizational commitment will be more productive, however, this relationship has yet to be shown, and an interesting dilemma will develop if employees who are high in OC are not more productive when it comes time to give promotions.

The classic nature vs. nurture controversy is a fundamental issue surrounding job satisfaction. Several studies have suggested that job satisfaction may have a genetic basis (Arvey, Bouchard, Segal, & Abraham, 1989; Bouchard, Arvey, Keller, & Segal, 1992; Keller, Bouchard, Arvey, Segal, & Davis, 1992). These data generated several theories associated with measuring job satisfaction, the most notable of which involved positive and negative affectivity (i.e., the dispositional tendency towards positive or negative emotional states). George (1989, 1991) found strong correlations between affectivity and emotional moods as well as job satisfaction. However, not all researchers are convinced that the genetic version is the right approach. Cropanzano and James (1990) are outspoken critics. Likewise, a study by Hershberger, Lichtenstein, and Knox (1994) involving 540 pairs of twins failed to find a significant genetic influence on job satisfaction. Most recently, Steel and Rentsch (1997) examined the stability of job satisfaction ratings over a 10-year interval. Using multiple regression they determined that *both* dispositional and situational factors accounted for portions of the variance in satisfaction ratings. This controversial theme will be continue to generate studies from both hereditary and environmental supporters. I/O Psychology students should recognize that a comprehensive knowledge of basic and applied psychology is necessary to explore many work-related issues.

Organizational Issues

This area is quite broad, encompassing topics such as organizational behavior, organizational development, organizational structure, organizational theory, and organizational change. Although many tangential workplace issues such as humor, violence, and spirituality are finding their way into the published literature, perhaps the two most pervasive topics currently dominating psychological research in organizations are sexual harassment and citizenship behaviors.

The Equal Opportunity Commission (1980) identified two types of sexual harassment: (a) *quid pro quo* sexual harassment which involves mandatory sexual compliance in return for favors, retaining one's job, and/or promotions, and (b) hostile environment harassment where verbal or physical conduct creates a hostile, intimidating, or offensive work environment and/or interferes with an employee's job performance. Much of the research since that time has focused on either different models of sexual harassment or how men and women's definitions and perceptions of sexual harassment differ (Muchinsky, 2000). For example, Gutek, Cohen, and Konrad (1990) developed a model that focuses on the frequency of interactions between the two sexes. Not surprisingly, they found that sexual harassment occurred most often in environments where male-female interactions were high. A study on harassment perceptions by Hemmasi, Graf, and Russ (1994) found that superior-subordinate relations are more likely to be perceived as having credible (i.e., more believable) incidents of sexual harassment than peer-peer relations. Further, despite recent Supreme Court rulings that harassment can occur both within as well as between the sexes, harassment directed against women is more likely to be perceived as harassment than harassment directed at men. Schneider, Swan, and Fitzgerald (1997) found that even low levels of periodic sexual harassment can have decimating physical and mental consequences for the victims. These studies are very important to help researchers isolate the specific behaviors, perceptions, models, and terminology that will aid the courts in prosecuting and defending accused harassers.

At the opposite end of the spectrum from sexual harassment are citizenship behaviors. Citizenship behaviors include altruism, conscientiousness, civic virtue, sportsmanship, and courtesy (Van Dyne, Graham, & Dienesch, 1994). In essence, this line of research reflects employees who display "extra" pro-social behaviors that are neither required nor expected. Further, Moorman (1991) has found that when individuals (particularly supervisors) model these behaviors, it has a positive influence on others in the organization. Organ and Ryan (1995) suggest that organizational citizenship behaviors unify multiple organizational constructs such that these behaviors may be the equivalent of what *g* (general intelligence) is at the individual level. In other words, organizational citizenship behaviors may represent a basic foundation for several other organizationally-related characteristics. Finally, Podsakoff, Ahearne, and MacKenzie (1997) found that performance quantity and performance quality in work groups were significantly higher for groups higher in citizenship behaviors. Taken together, organizations may wish to begin measuring and selecting individuals who score high in these job-related behaviors.

Performance Appraisal

Some authors (e.g., Berry & Houston, 1993; Lowenberg & Conrad, 1998) posit that performance appraisal (evaluating the effectiveness of employees' job behaviors) will continue to be a key area for both current and future research. I am inclined to agree with them; of all the major areas in I/O Psychology, the evaluation of work performance will be at the forefront, now and well into the 21st century. I highly encourage avid I/O Psychology students to become more knowledgeable with performance appraisal systems and concepts as the area will continue to draw lots of attention in the future given its fundamental importance in the entire personnel system.

Performance appraisal (PA) is one of the best researched and well-defined areas in I/O Psychology. For example, as early as 1980, researchers felt confident enough that they had exhausted research on PA rater scales and formats such that Landy and Farr (1980) proposed a moratorium on further studies. Despite this comprehensive analysis of PA, Jewell (1998) noted that, "In virtually every survey ever conducted, both raters and ratees condemn performance appraisal practices in their organizations as resounding failures" (pg. 388). As such, current research is investigating "how" to improve the quality of existing PA systems. There are several primary avenues being pursued, including the use of multiple raters, 360-degree feedback systems, and rater training.

Preliminary research on the use of multiple raters in a 360-degree feedback system appears to be superior in comparison to the traditional methods of PA which relied almost exclusively on the employee's supervisor. The 360-degree system uses not only the supervisor, but also peers, self-rating by the employee, subordinates, and in some instances, customers/clients, outside consultants, and even family and friends. In essence, this system draws on virtually anyone who has familiarity with the employee in regards to his or her job performance. Campbell, Curphy, and Tuggle (1995) led the way in identifying key practices that make for a successful system such as accountability, review by superiors, periodic feedback, and having a flexible system. Research by Bracken (1994) found that multirater systems are reliable, valid, well-received by employees, easy to use, and job relevant. Although these data are encouraging, there is still little empirical data about 360-degree feedback's effectiveness, making it a prime candidate for additional studies.

Rater training prior to the 1990s often experienced mixed reviews; some aspects of a rater's performance got better, whereas other aspects became worse. This situation was often due to a debate over the importance of rater accuracy training versus rater error training. However, a meta-analytic study by Woehr and Huffcutt (1994) found that each of the various rater training programs has at least a moderate effect on improving PA ratings, reducing rating errors and/or improving rating accuracy. Of the various training programs, frame-of-reference (FOR) training emerges as the most promising. FOR training attempts to provide raters with common performance standards (references) such that each rater understands what constitutes good and bad performance on each relevant job dimension (Sulsky & Day, 1992). In essence, raters are "calibrated" so they agree on what behaviors and characteristics comprise effective performance. Research by Day and Sulsky (1995) and Woehr and Huffcut (1994) has provided initial support that FOR training increases rater accuracy across dimensions. Ideally, additional research will serve to pinpoint the most effective techniques to calibrate the raters. Given the paramount role that performance appraisal will play in the coming years, due in part to the increased demands for personnel evaluations in a fast-paced work world, it seems appropriate to devote additional space on examining the future of the field.

**The Future of Performance Appraisal**

Of the different areas in I/O Psychology, the one that I find the most fascinating is performance appraisal. Although the field is quite atheoretical, this lack has not limited research in the area; for PA is essentially the penultimate goal of the entire personnel system. If researchers are unable to adequately measure who performs the best on-the-job (and identify the poor ones), then recruiting, selection, testing, training, etc. become considerably less important.

I became interested in the field because of critical performance appraisal=s critical nature in a personnel system. In particular, my own research has focused on how we can improve agreement among different rating sources by using explicit comparison standards (so that raters have a common frame-of-reference). I think that developing a comprehensive theory of performance (and PA) and increasing inter-rater agreement are two of the biggest challenges for PA in the future. The student of I/O Psychology will quickly realize that the often subjective nature of performance ratings and the lack of a sound performance theory are definitive obstacles for developing sound PA instruments. The following section focuses on some of the important future strides in PA.

There are a variety of predictions that could be made concerning where PA is likely to be headed in the next 15-20 years. Although such extrapolations are always tentative there are four key areas of change in PA research: (a) a shift to new methods, (b) changes in ways of measuring performance, (c) responses to the changing nature of work, and (d) the strategic counseling of organizations in PA.

New Methods

One of the biggest shifts in PA is an increasing reliance on the multirater, or 360-degree feedback system. As previously illustrated, not only is this a hot topic in I/O Psychology, but I predict this is where the future of PA is headed. The multirater system has several advantages that enhance our ability to create innovative appraisal systems. For one thing, a multirater system creates a "team" environment for providing feedback as well as increasing the awareness of all involved in the aspects of different jobs and their requirements. Additionally, 360-degree feedback can be customized to the individual organization, allowing for external and internal customers, other company representatives, and subordinates. This adaptability is necessary in a work environment where people quickly move from one project to another and from one company to another. Ultimately, multirater feedback systems will be used both for developmental purposes as well as administrative (pay, promotion, termination) purposes. Of course, multirater systems also require a lot of people, can be time intensive, and need the support of executive management. As such, researchers will be forced to show management and organizations the inherent benefits of using such a system.

A second methodological change will be the reliance on computer technology. Some researchers and organizations are already adopting electronic monitoring devices to "observe" the performance of employees and collect data. This approach goes well beyond the traditional telephone and video camera systems of the past, computer technology allows organizations to record every keystroke, transaction, and interaction. Supervisors need not even be physically present (or even nearby) to collect the information. Through computer databases, researchers can collect enormous amounts of information that relate to job performance, thus aiding in the design of new techniques and systems. Of course, some critics (e.g., Hedge & Borman, 1995) argue that this approach may violate employee privacy rights, another topic of concern for I/O psychologists in the next century.

Finally, the way performance research is conducted will have to change in two significant ways. First, there is a need for more longitudinal designs. The vast majority of performance appraisal publications rely on "snapshot" data that take performance appraisal ratings at a single moment in time and attempt to correlate them with any multitude of variables. If PA is going to move forward, it will require studies that focus on performance trends over time using large cohorts of employees. However, this approach faces difficulty because organizations are hesitant to allow researchers access to performance information, let alone access over a multi-year time frame that may tie up significant amounts of employee time. Nonetheless, in order for PA to move forward and develop a comprehensive theory of performance, researchers must focus on longitudinal studies.

The second design change will be the increased use of field studies. PA research has relied much too heavily on the undergraduate college students as their primary sample (Banks & Murphy, 1985). Although student data may be generalizable in some instances, often the differences between a full-time college student's reactions to a PA instrument and the reactions from a 40-year department manager are miles apart (Ilgen & Favero, 1985). Academicians must make the effort to conduct more studies at the job site. Organizations must be educated to understand the overall "big picture" on why such research is necessary and the advantages it can offer in improving PA systems.

Measurement of Performance

The way we define performance is changing beyond the simple mastery of individual efforts and assigned tasks (May, 1996). The individual is clearly being replaced by the team; many employees now function as part of a work team with additional demands beyond their individual set of capabilities (e.g., conflict management, communication skills, and collaboration). Given that these skills and abilities are critical for group and organizational effectiveness, we can no longer measure only the individual. We must develop new measures and instruments that measure "group" job performance without losing accountability for the individual. These measures must take into consideration the subtle interactions between members required for a team to function effectively. For example, do certain personality types (e.g., Type A, high self-confidence, low authoritarian) work better together as a team (or alone)? Also, how do we compensate teams as opposed to individuals and still keep individuals team-focused? Perhaps the areas of team athletics and the military will serve as a beginning model for such developments.

Another measurement concern has to do with the organizational "fit" of a potential employee. No longer will it be sufficient to simply determine if the job applicant has the necessary skills to do the job, but also, whether the applicant fits well into the organizational culture. We must be able to measure both organizational culture and the person and know which combinations lead to enhanced performance (Huszczo, 1996). Ultimately, we need to know what are the best types of organizational cultures for particular individuals to thrive in; this approach creates an interesting dilemma if our best performing applicant/incumbent is not a good fit in our organizational culture. Given that organizational values help influence the importance of performance dimensions, such contextual variables will become increasingly more valued in generating the organizational "citizen." At the same time, I/O psychologists must develop methods that show these organizational factors' measures are job relevant. Perhaps the measurement of organizational citizenship behaviors will lead the way in creating not only a proper job-person fit but an organizational-person fit as well.

Changing Nature of Work

The fundamental nature of work and organizations is changing at an unprecedented rate. Corporations are "flattening out" by eliminating layers of management, increasing employee responsibilities, and restructuring themselves afterwards in previously unheard of configurations. One of the trends that will result from this approach is that fewer individuals will be available to evaluate performance. They will have less time and more non-appraisal responsibilities. Researchers must respond by exploring new ways of measuring performance without compromising validity and reliability. Clearly, computer technology and the utilization of raters beyond the supervisor (e.g., self-ratings by the employee) will help. Furthermore, with the appearance of telecommuting, employees may not even be physically present for their supervisor to observe them. Hence, Murphy and Cleveland (1995) have suggested that PA may have to change with the work, focusing more on outcomes and results than on individual performance dimensions.

Organizational Consulting and Counseling

The last area of the PA future involves a combination of changing research agendas while increasing researcher advocacy concerning performance appraisal. One of the responsibilities of an I/O psychologist, particularly a practitioner, is persuading, educating, and counseling the business world on the necessities and virtues of PA. Simply developing psychometrically sound methods, tools, and measures to evaluate performance is not enough. Researchers will be forced to generate more research that links PA to the strategic goals of organizations, reinforces organizational values and structure, provides developmental information on the employee, and shows how PA integrates into the larger human resource system (May, 1996). In other words, we cannot rely on corporate executives to pick up our research journals and suddenly "see the light"; we must conduct research that connects PA with the larger corporate picture and empirically demonstrates its inherent value.

Taking this view one step further, researchers will be forced to become more actively involved in "selling" PA systems and research. For PA research to move forward, we need to have organizations collaborating with I/O psychologists to determine what types of strategies, techniques, and interventions work. Thus, research agendas will change to include the presentation of published literature that demonstrates what techniques are effective in getting organizations to participate, understand, and incorporate PA into their structure.

**Current and Future Trends in I/O Psychology and Their Relations to Performance Appraisal**

Many researchers have identified likely trends that will affect I/O Psychology in the 21st century. These trends, if accurate, will have definitive consequences for the field of I/O Psychology as well as PA in particular. Knowledge and prediction of the anticipated patterns prior to their actual occurrence will enable the well-prepared I/O Psychologist (and student) to adjust personnel systems *a priori* instead of *post hoc*. Below are the predicted trends and the influences they may have on PA.

Cognitive Psychology Explosion

The last two decades of the 20th century witnessed an explosion of information in the area of cognitive psychology. This rapid growth is likely due to newer methodologies and technologies which allow researchers to better examine and understand human thought processes and neurology. I/O Psychology has been involved in this trend particularly as it regards social cognition, decision-making strategies, design of "intelligent" machines, and worker perceptions in social situations (see also Lord & Maher, 1991; Wickens, 1993).

Understanding social cognition and perception as well as decision-making processes in the work place will become critical. We know that people are prone to systematic errors (i.e., biases). Whether we are talking about training, selection, PA, or actual performance on the job, I/O psychologists need to have a deeper understanding of how the human mind processes information, particularly the role that these errors and biases play in the larger picture (Martinko, 1994).

The impact of the microprocessor and computers in the workplace cannot be overstated. These sophisticated machines not only allow us to model human cognition; some possess limited "thinking" capability and can adapt to changes in the environment. However, we must also develop software and interfaces that allow for human user interaction (i.e., make them user-friendly). Thus, the next quarter century will see computer technology and methodologies utilizing that technology as a common occurrence in the published literature.

PA has already been significantly impacted by cognitive psychology in the redesign of methodologies that focus on "how" raters observe, remember, organize, evaluate, and encode performance data. The future of PA and cognitive psychology likely rests on the development of more sophisticated computer tools that can aid people in handling vast amounts of information.

Empirical Emphasis on Work Behavior

Given the ties that I/O Psychology has to the business world, it should not be surprising that the business world's concern with "the bottom line" is gradually influencing the development of interventions, training programs, PA, and methodologies for the study of people at work. Organizations are becoming increasingly aware of the need for detailed work records, turnover and absenteeism rates, documented performance evaluations, employee suggestions and inputs, as well as customer feedback on the company's performance.

I/O psychologists have responded and will continue to respond in several key ways including the continued use of advanced statistical methodologies and techniques such as meta-analysis and structural equation modeling. Meta-analysis is a statistical technique that has become increasingly popular in the I/O psychology research literature (Steiner, Lane, Dobbins, Schnur, & McConnell, 1991). Meta-analysis is essentially a quantitative literature review whereby a group of similar studies are located using a set of defined criteria, analyzed collectively, and an overall summary conclusion is drawn (thus creating an enormous N-size). For example, Iaffaldano and Muchinsky (1985) collected numerous studies to examine the overall correlation between a worker's performance and their satisfaction with the job. When these research studies were analyzed together, a small, but positive correlation was found. Although, the positive correlation was expected, the relatively small size was not. Only by analyzing hundreds of studies simultaneously were researchers able to identify the "true" relation between satisfaction and performance.

Structural equation modeling (also known as covariance structure modeling) is one of the most advanced and complex statistical techniques used in I/O methodologies to date (see Coovert, Penner, & MacCallum, 1990 for a complete review). This "cutting edge" tool allows a researcher to examine the complex interactions of many variables. By acquiring a measure of each of the pertinent variables, testing the hypothesized, directional relationship between these variables, and determining if the proposed model "fits" the data, the researcher is provided with a "goodness of fit" test that suggests the likelihood of the proposed model being accurate. The advantage of this technique is its ability to analyze dozens of variables simultaneously that may be interacting with one another. Given the complexity of work behavior, structural equation modeling is likely to be a continued phenomenon in I/O psychology's methodologies.

Together, meta-analysis, which allows the aggregation and synthesis of hundreds of PA studies, and structural equation modeling, which allows for the examination and testing of complex performance variable interactions, will lead the way in research methodologies. Given the constant changes occurring in the workplace and the infinite number of interactions, structural equation modeling will undoubtedly prove to be a more commonly used technique in the advancement of PA research.

Groups, Teams, and Quality

The total quality management (TQM) movement, inspired by W. Edwards Deming, caught on in the corporate world during the 1980s and has continued to present day. The fundamental core of TQM suggests that organizations must become more focused on quality not quantity; high quality products and services are required if organizations are going to compete in a global market. One notable change in organizations as a result of TQM is the transformation in organizational structure and utilization of employees. Employee empowerment is achieved by allowing employees and managers to work in a more group or team-oriented environment.

Low-level employees are allowed a voice in how the product should be made and ways to improve it. This empowerment often extends to equipment, safety, policies, and self-management. Quality circles and self-managed work teams are just two of the more common names used to describe work groups that meet to discuss quality-related issues and implementation of continuous, work improvement programs (Omachonu & Ross, 1994; Waldman, 1994). However, the use of work teams and an emphasis on quality creates several interesting measurement problems for I/O psychologists as illustrated earlier.

Psychologists specializing in PA will be required to develop instruments that measure team performance (e.g., work groups, departments) in addition to the traditional individual measures. Thus, as indicated by Katzell (1994), psychologists must change their "unit of analysis" from the individual to the work group. Furthermore, PA specialists will be forced to develop instruments which can measure the "quality" of a product, process, or procedure.

Cultural Diversity

Sometime in the first half of the 21st century, it is projected that white males will no longer be a majority in the workplace (Goldstein & Gilliam, 1990; Loden & Rosener, 1991). However, changes in sex and race are not the only expected changes. Significant changes in worker education, age, religious diversity, career mobility, and full vs. part-time status are expected to impact the organizations of tomorrow.

The recruitment, selection, training, and retention of this diverse work world will become key to a company's survival to say nothing of the potential litigation that will follow a business that fails to keep up with federal mandates concerning the fair hiring of employees. Moreover, cultural diversity is not limited to just typical demographic variables. The world is becoming an increasingly competitive global market where organizations must "rub shoulders" with companies all over the world. No longer may a major corporation be concerned only with domestic markets. As such, companies must implement new training programs to prepare their managers and employees to deal with international cultures, other business procedures, differences in values and ethics, and relocation to new countries if necessary (Rothwell, 1992).

The challenge for I/O psychologists studying PA will be to develop rating scales, rating systems, appraisal interviews and feedback, performance dimensions, and rater training to handle the diverse workgroup which will perform the work and be evaluated. Research studies have already shown that raters tend to give more favorable rating to members who are most similar to them (i.e., race, age, sex, culture, etc.), although many studies indicate the effects are small (Saal & Knight, 1995). This situation will be problematic for PA designers who not only must attempt to improve a dynamic system, but do so when the employees being evaluated are becoming increasingly more diverse in behaviors, beliefs, attitudes, and values. Triandis, Kurowski, and Gelfand (1994) argue that roughly 50% of all Western psychology is universal, the other half is specifically a product of our Western culture. Thus, many psychological theories, concepts, and techniques may have to be significantly revised for a successful PA system.

Organizational Downsizing

As defined by Freeman and Cameron (1993), downsizing is an organizational strategy aimed at reducing a company's workforce under the assumption that it will result in enhanced competitiveness, productivity, and/or efficiency. Although many researchers think that this strategy is often flawed in many situations (e.g., Nagy, 1996), it is nonetheless, a strategy that will continue through the early years of the next century. As this downsizing trend continues, there will be many more opportunities to redesign organizations, jobs, departments, and systems. Allan Church (1995) has outlined several ways in which I/O psychologists can have an impact on the downsized organization, including PA. Those individuals who do research and implement PA systems will be required to aid in the termination of employees. This action requires a very well-developed PA system to decide which employees will remain and which employees will be terminated. Although PA is typically used to assess good, average, and poor performance, more advanced research will be required to adjust PA for its differential functions.

**Advice for Future I/O Psychologists**

Based on the current and predicted trends in Industrial/Organizational Psychology, there are several recommendations that I would make for anyone beginning or contemplating a career in I/O Psychology. First and foremost, any individual must have a strong, working knowledge of the field. Research and theory in I/O Psychology is abundant, complex, involved, and quantitative in nature. There is no substitute for understanding such in-depth concepts as validity generalization, job analysis, assessment centers, affirmative action, comparable worth, leaderless group discussion, true halo, predictive validity, and work samples. A graduate degree is highly encouraged because it exposes students to the most recent, state-of-the-art theories, research, measures, controversies, and methodologies.

Second, the I/O psychologist of the future must have a firm grasp of advanced statistics. Although correlations, t-tests, and simple ANOVAs should be tools in every psychologist's arsenal, I/O psychology often utilizes more advanced statistical techniques, most likely associated with the larger sample sizes that are germane to the field. Preferred areas of statistical specialization would include the following: two- and three-way ANOVAs and their subsequent interactions; understanding of moderator variables; factor analysis; multiple regression (including stepwise, blocked, and backward techniques); structural equation modeling; discriminant analysis; intraclass correlations; canonical correlation; and meta-analysis. The prepared I/O psychologist will need to understand the theory and proper use of these statistics and be familiar with their utilization via computer software packages. Similarly, the future I/O psychologist will also have to develop skills in communicating the interpretations of such analyses to those who lack sophistication in these statistical procedures.

A third requirement is a sound understanding of personnel law. It is somewhat sad to say, but an effective I/O psychologist must almost be part lawyer. Given the ever-growing number of federal guidelines, mandates, and laws that relate what can and cannot be done concerning employment, I/O psychologists will find it necessary to be current on the legality of the various statistics, techniques, and measurement instruments used, and recommendations they make. Evidence of validity and reliability, job-relatedness, minimization of adverse impact and illegal discrimination, documentation of organization policy and procedures, and general compliance with the law will become mandatory. Failure to heed this advice may land an I/O psychologist in the midst of a sizable lawsuit or competency hearing.

The fourth recommended component of the future I/O psychologist is a good working knowledge of the business world preferably derived from actual experience in the "real world." Potential I/O psychologists should seek out every opportunity to interact with companies and businesses. Whether this interaction takes the form of internships, practicums, consultation, invited addresses/seminars, a business degree, or actual employment, practical experience in business is truly a learning necessity. I/O psychology cannot function apart and separate from the corporate environment; the work place is our domain. As such, no applied psychologist can be effective without sufficient field experience. Becoming a commensurate liaison between the academic world and the business world will be a valuable skill.

Finally, the future I/O psychologist must be comfortable and experienced with computer technology. This competence extends beyond simply using basic computer knowledge and statistical software packages. Being computer literate in a variety of software programs will be necessary. Competence with word processors, databases, spreadsheets, mainframes, networking, graphics, and multimedia presentation software will be required skills. Exposure to computer classes and office software will undeniably be a valued commodity in the 21st century.

In short, the I/O psychologist of the future must be a "jack of all trades" (i.e., a generalist). He or she will be required to be part statistician, part computer expert, part scientist, part business executive, part researcher, part academician, part consultant, part lawyer, part human resources specialist, and part practitioner. All of these attributes must be juggled in a fast-paced, constantly changing work world, full of international and cultural diversity. I/O psychology will be an exciting, challenging, and heavily-relied upon discipline in the next century.

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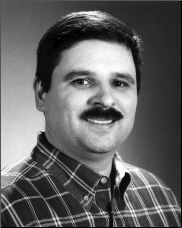
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[Flourish Line]

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# Chapter 4 ****The Next Frontier in Neuroscience?**** ****Believe It or Not, It's Physiological Psychology****

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Congress declared the 1990s as the "Decade of the Brain". The idea, I think, was to devote the nineties to the study of neurological and neuropsychological disorders in the hopes of finding treatments or cures for diseases, such as Parkinson's, Huntington's, Alzheimer's, Attention Deficit Disorder, stroke, head trauma, and many others. Like so many past ventures, neuroscientists and clinicians approached this challenge by blending basic and applied science in an attempt to gain a better understanding of disease and discover new treatments. Progress was made. However, we find ourselves in a familiar situation: the ultimate goal has not yet been achieved. We will likely move into the next century with the feeling that we have been very productive, but that somehow we still have fallen short of the mark. We can easily justify this state of affairs by reasoning that these are complex problems that need more time for study and experimentation. Although I believe this to be an accurate assessment, I would take this a step further by stating that research in the 21st Century will likely bring with it a noticeable change in emphasis. I believe behavioral studies of brain function and dysfunction will once again come to the forefront of neuroscience and that this will likely bring us closer to attaining our stated goals.

Before I address the issue of why I think the discipline of physiological psychology will come to the forefront of neuroscience, we must first consider the multidisciplinary nature of neuroscience research. In order to do this, an idea from one of my former mentors, Dr. Steve Wise, comes to mind. Wise likened the field of neuroscience to a chair, with each leg representing a necessary foundational field of inquiry. For example, one leg represents neuroanatomical research (morphological study of the brain), another, neurophysiological research (the study of the electrical properties of the brain), a third, neuropharmacological research (the study of brain chemistry), and the fourth leg, neurobehavioral research (the study of brain-behavior relationships). He reasoned that if any of these legs were removed, then the chair would fall and research would fail or stagnate.

The fourth leg of the neuroscience chair consists of two disciplines: physiological psychology and neuropsychology. Experimentation within the field of physiological psychology may be viewed as }basic research." Results from these studies provide foundational knowledge regarding brain-behavior relationships, such as what areas of the brain are involved in learning and memory. Often there is an obvious application to clinical or applied issues, but the intent of the research is to reveal basic mechanisms. These studies usually require invasive techniques that manipulate the nervous system. Experimentally destroying or electrically stimulating the brain, the administration of drugs directly into the nervous system, or measuring neurochemical levels from a brain area are examples of invasive techniques. These procedures necessarily use animals as subjects because it is considered unethical and risky to invade the human nervous system for experimental reasons.

Research in neuropsychology mostly focuses on applied questions, specifically those aimed directly at understanding neurodegenerative disorders (i.e., Parkinsons disease) and nervous system trauma (i.e., brain or spinal cord injury resulting from a car accident or stroke). Neuropsychological research uses brain-imaging technology in conjunction with behavioral assessment. An exciting brain-imaging technique currently used is functional magnetic resonance imaging (fMRI). This technique represents a non-invasive method of visualizing the metabolic activity of brain areas while the person is engaged in some cognitive or sensorimotor task. Ideally, the results from both physiological psychology and neuropsychology laboratories would be integrated to help us understand the behavioral side of neuroscience.

It is clear that in recent history, behavioral studies of the brain and physiological psychology have taken a back seat to the other three disciplines. Currently, there are only a few basic science journals devoted to behavioral studies of brain function compared to the total number of journals devoted solely to neuroscience. There are roughly 50 or 60 neuroscience journals, of which perhaps less than 10 publish predominately behavioral studies. Even the word "psychology" seems to have disappeared from the titles of these journals. For example, the APA journal once named The Journal of Physiological and Comparative Psychology is now two journals, The Journal of Comparative Psychology and Behavioral Neuroscience. The Psychonomic Society journal Physiological Psychology is now Psychobiology. You may begin to wonder if the field of psychology has become the crazy aunt kept hidden in the attic. Although I think that idea might be a little extreme, I do think that experimental psychology has been speaking with a softer voice in recent times.

Another recent trend is that many academic departments of psychology are hiring neuroanatomists, neurophysiologists, or neuropharmacologists, rather than someone trained in the basic principles of psychology. I believe this trend can be attributed to the development of neuroscience as a major field of study at the undergraduate level, and the desire to integrate behavioral science with the other natural sciences. Faculty in the departments of biology, chemistry, pharmacology, mathematics, physics, and psychology typically maintain neuroscience programs, so it might make sense that there would be crossover hiring. If there is reason for concern, it is in the desire for the continuance of neuroscience research that integrates the basic principles and approach of experimental psychology with other sciences. In other words, neuroscientists must continue to engage in those very long and tedious behavioral experiments that require numerous control groups and take months of data collection that are so typical of experimental psychology. It does not matter if this type of research is done in psychology, pharmacology, biology, or chemistry departments. It is the emphasis on behavioral analysis, experimental design, and statistics (i.e. the training of experimental psychologists) that is important. This approach is crucial, because without it the field of neuroscience will advance very slowly.

At the 1997 Society for Neuroscience meeting (New Orleans), there were 951 sessions, each of which typically had 10-20 presentations. This data mean that there were close to 15,000 presentations at our annual meeting! Perhaps it will put things into perspective if I point out there were only 179 sessions under the theme Neural Basis of Behavior, or roughly 2500 presentations. You can interpret these data in a couple of different ways. On one hand, you could say that only 17% of the research in the field focuses on brain /behavior relationships. On the other, you might conclude that 2500 presentations at a single meeting certainly does not suggest a dying field. Both interpretations are probably accurate (There were only about 13,000 presentations at the 1998 meeting in Los Angeles, with 14 % being in the Neural Basis of Behavior sessions). However, I predict that research focusing on neurobehavioral questions will increase dramatically over the next 15 years. I say this because in 1997 and 1998 a large part of the remaining presentations at the annual neuroscience meeting (i.e., those that did not include behavioral analysis) suggested that the brain, and indeed the neuron, are dynamic. That is, the nervous system has the potential for change in structure, relative neurochemistry, and electrical reactiveness. These dynamic events have brought to the forefront of neuroscience the idea of "neural plasticity." What could these dynamic events be related to? The obvious answer is that neural plasticity is related to behavioral plasticity. In other words, dynamic changes in the brain most likely reflect a concomitant change in behavior, cognition, or emotion. For example, neural plasticity is viewed as the mechanism of learning and the basis for recovery of function after brain damage. Ultimately, neuroscientists must be able to construct experiments that allow for correlations between neural and behavioral plasticity. One very important place they will find the tools to attain this goal is in the discipline of experimental psychology.

Ultimately the trends in neuroscience research must lean towards behavioral or psychological studies, why has there been a relative paucity of study in the area upto this point? I think part of the answer has to do with our fascination for the most current technology. For example, the recent history of neuroscience has featured the development of high resolution brain imaging, simultaneous recording of single-neurons in various parts of the nervous system, transplantation of fetal neurons into the brains of adult organisms, the measurement of neurotransmitter levels in the brains of animals while they perform simple behaviors, more accurate techniques for counting neurons and glia in the brain, methods for patch-clamping dendrites, techniques that allow for the visualization of dying neurons, more accurate methods for measuring cerebral blood flow, and the list goes on and on. Technology allows us to do things that we never thought were possible. The development of new technology is exciting: it is what we call "cutting edge" science. However, cutting edge science does not stop here, because the impact of technological development is gauged by the how it is applied to important questions. I think the current and intense interest in neural plasticity suggests that it is time for this new technology to be applied to questions about behavioral plasticity.

Although the development of new technology will put you on the cutting edge, its application to the study of behavior brings with it still new and significant challenges. In his book, Brain Plasticity and Behavior, Bryan Kolb (1995) writes, "Behavior is not sexy, but it is as difficult to study as molecules" (p 10). Kolb believes that most people think understanding behavior is a simple task. After all, most of us observe the behavior of others everyday. However, to study the complexities of behavior, scientists commit themselves to a tedious and time-consuming journey.

**Setting the Stage for the 21**st**Century**

One example of what I consider to be sophisticated behavioral analysis may be found in the area of sensorimotor behavior. Whishaw and colleagues have provided a detailed analysis of forelimb and paw use in a variety of rodents (Whishaw, Sarna, & Pellis, 1998) and linked these behaviors to the corticospinal pathway (i.e., a neural pathway that originates in the motor cortex and terminates in the spinal cord). Whishaw has used the Eshkol-Wachman Movement Notation (EWMN) in order to identify the specific sequences of movement used in }handling" different foods during eating. The EWMN allows for behavior to be described in terms of changes in limb segments (i.e., part of the limb that lies between two joints, or a joint and the extremity) in relation to the body, the environment, or the next limb segment. This type of analysis led Whishaw and colleagues to gain a better understanding of the normal movement sequences used in eating and how they are changed after damage to the corticospinal pathway (Whishaw & Coles, 1996; Whishaw, Dringenburg, & Pellis, 1992; Whishaw & Gorny, 1994; Whishaw & Pellis, 1990; Whishaw, Pellis, Gorny, & Pellis, 1991). You could imagine using this behavioral analysis to study the motor dysfunction of patients with movement disorders (i.e., Parkinsons disease, Huntingtons disease, head trauma) and the effects of various treatments (i.e., drug or physical rehabilitation).

In the area of cognitive behavior, much of the recent work with rodents has focused on establishing behavioral dissociations among brain areas involved in memory. These studies typically attempt to link different aspects of cognition (i.e., spatial memory, temporal memory, or attention) with specific neural substrates (i.e., hippocampus, prefrontal cortex, parietal cortex). To attain this goal, variations of standard tests of memory (i.e., radial arm maze, Morris Water Maze, delayed nonmatching to sample, conditioned discriminations) have been used in very creative ways (Jackson, Kesner, & Amann, 1998; Ragozzino & Kesner, 1999). It may take weeks or months to train animals on these tasks, create a brain lesion, and then test for any amnesic effects.

A question regarding the incorporation of these techniques into a research program is }Are they worth the effort?" Recent history suggests that the majority of neuroscientists have not taken on this burden. However, this situation will change as curiosity regarding the dynamic brain increases. Could the crazy aunt in the attic become the wise sage of the 21st century? At the very least I am confident that with the beginning of the new century there will be a new emphasis on sophisticated behavioral analyses that will ultimately help elucidate the nature of the dynamic changes taking place in the brain. In other words, it is time for the fourth leg of the neuroscience chair to take center stage.

Sophisticated behavioral analyses will be critical if we are to accomplish the goals set by Congress with the Decade of the Brain. Although understanding the neuropathology and etiology of neurological disorders is essential, in the end the neuropsychologists will evaluate the effectiveness of proposed treatments on behavioral grounds. Does the treatment lead to a higher quality of life for those individuals affected by the disease? This question can only be answered through the study and measurement of behavior, and not with experiments that limit their scope to neuron morphology, physiology and chemistry. Ideally, the 21st century will bring a true and equal marriage between neuroscience and behavioral science. In the case of neurological disorders, the development of new and effective treatments will include a more complete understanding of the behavioral syndrome and an application of the current models of neural plasticity. I believe that this approach will allow us to evaluate the effectiveness of proposed treatments better and to understand why these treatments have (or do not have) beneficial effects.

For example, the number of accepted treatments for Parkinsons disease has expanded considerably in the past five years. The need for new treatments is based on the problem that long-term drug therapy with levodopa (i.e., the most widely used drug treatment) leads to a return of the Parkinsonian symptoms and additional behavioral dysfunction in most cases. Two examples of new treatments are the surgical procedure known as }pallidotomy" (i.e., carefully destroying the ventral pallidum, a brain area found towards the bottom of the forebrain), and a new drug called }ropinirole." To assess the effectiveness of these treatments accurately, we must have a clear understanding of the behavioral syndrome associated with Parkinsons disease. This understanding will allow us to determine the extent to which the new treatments alleviate Parkinsonian symptoms, as well as if the treatments generate new and unwanted behaviors or additional behavioral dysfunction. Although some researchers have taken this approach and produced some positive results (Masterman, et al., 1998; Sethi, et al., 1998), the future will likely bring with it a more extensive analysis of the behavioral effects of these treatments.

At the neural level, it is possible that plasticity has been diminished in Parkinsons patients. For example, some animal studies have suggested that one area of the brain affected in Parkinsons disease, the neostriatum, is a region that controls the acquisition and generation of motor sequences (Aldridge & Berridge, 1998; Graybiel, 1998). Is it possible that one symptom of Parkinsons disease may be characterized as an impairment in motor learning? If so, the brain of the person with Parkinsons disease may be deficient in forms of neural plasticity. This finding would be important because models of neural plasticity have been associated with particular chemical and electrical events that can be manipulated through the administration of drugs very different from those currently used to treat Parkinsons disease. Thus, a more complete knowledge of the behavioral syndrome associated with Parkinsons disease (i.e., through neuropsychological testing), combined with basic research findings regarding neural and behavioral plasticity done with animals, could yield the most effective treatment strategies. Although research in this area would require knowledge of the present neural models of plasticity and pharmacologic manipulations, the fruits of the approach would ultimately require behavioral assessment of treatment effectiveness.

The following is a review of some of the current models of neural plasticity and how they may relate to the mission set forth in the Decade of the Brain. These models emphasize dynamic changes in neuron morphology and synaptic activity. The first section, }Does the Brain Control Behavior or Does Behavior Control the Brain?," discusses the influence of the environment on brain morphology and function. For example, what are the effects of an enriched environment on brain anatomy and behavior? Does an enriched environment increase neural and behavioral plasticity? I also introduce the idea that our behavior has significant impact on brain anatomy. In the next section, the neocortex takes center stage as the best example of a dynamic brain. In this section, }My, What a Dynamic Cortex You Have!," I discuss changes in the physiology of the cortex following sensory and motor experience. In the final model, I outline how behavioral experience may affect the communication between neurons. }The Synapse is a Two-Way Street", outlines new developments in neuronal communication and how they might reveal the neural mechanism of learning. After discussing these models of neural plasticity, I will focus on the study of recovery of function following brain damage, the possibility that magnesium supplements could prove to be beneficial, and demonstrate how some of these principles can be applied to a detailed behavioral analysis. I will conclude with some thoughts on future directions that combine physiological psychology, neuroscience, and neuropsychology.

**Some Recent Advances in Neural Plasticity**

Does the Brain Control Behavior or Does Behavior Control the Brain?

Consider the following scenario. Al and Pete die at about the same age and leave their brains to science. They were roughly of the same height and weight. When the two brains are compared, it is discovered that Al has a heavier brain with a thicker neocortex. What is a possible reason for this difference? You may be surprised to find out that the differences in brain weight and cortical thickness are probably due to the growth of dendrites and increased number of glia in Al's brain. It is almost certainly not due to a larger number of neurons. Moreover, the differences in brain size are likely due to individual differences in their environment. That the morphology of neurons and number of glia have the potential for change is not a new concept. In fact, experiments done in the 1960s and 70s by Rosenzweig and colleagues suggested that being reared in an enriched environment can lead to differences like those described in the scenario with Al and Pete (Bennett, Diamond, Kretch, & Rosenzweig, 1964; Diamond et al., 1966; Diamond, Lindner, & Raymond, 1967; Globus, Rosenzweig, Bennett, & Diamond, 1973; Rosenzweig, Bennett, & Diamond, 1972a; 1972b; Rosenzweig, Kretch, Bennett, & Zolman, 1962). More recent studies indicate that a relatively short period of exposure (i.e., 4 days) to the enriched environment may be sufficient to produce some of these morphological changes (Wallace, Killman, Withers, & Greenough, 1992).

In the studies by Rosenzweig and others, researchers put infant rats into "enriched environments" where they had opportunities to interact with other rats, toys, bridges, and ladders. These environments promoted social interaction, exploratory behavior, and the development of motor skills; they also produced anatomical changes in several brain areas---the most dramatic appeared to be in the neocortex. Gross physical changes in the neocortex included increased length, thickness, area, and weight. Given these changes it is somewhat surprising that relative neuronal density was actually decreased when compared to control rats. In contrast, the density of glial cells was actually increased along with the diameter of capillaries (Diamond, Kretch, & Rosenzweig, 1964; Sirevaag & Greenough, 1987; Szeligo & Leblond, 1977). Moreover, increases in the extent of dendritic branching (Greenough, Volkmar, & Juraska, 1973; Holloway, 1966; Volkmar & Greenough, 1972) and the number of dendritic spines (Globus et al, 1973) were found in rats reared in the complex environment. This latter finding suggests that there might also be an increase in the number of synapses, a result verified in later studies (Bhide & Bedi, 1984; Turner & Greenough, 1983). However, more recent data suggest that although the number of dendritic spines is increased, the spine density actually decreases (Kolb, 1995). Thus, although the number of synapses per neuron may actually increase, these synapses are farther apart.

The animal research data suggest the brain reacts to the environment in ways that indicate an increase in neural plasticity. The next question is whether there are any data that suggest this increase in neural plasticity translates into a correlated change in behavioral plasticity. In other words, does being reared in an enriched environment translate into a behavioral advantage? The answer to this question may be found in a convent in Mankato, Minnesota. The now famous Sisters of Mankato constitute a remarkable field study with far-reaching implications. Some of the nuns living in the convent have chosen to challenge their minds even as they grow old. These nuns earn college degrees, teach, hold current-events seminars, play Jeopardy, and work brainteasers. What is startling is that the nuns who have chosen this lifestyle are living longer and do not appear to be as susceptible to neurodegenerative diseases, such as Alzheimer's disease, when compared to the general population. An exciting aspect of this field study is that the nuns of Mankato have donated their brains to neuroscience. David Snowden of the Sanders-Brown Center on Aging at the University of Kentucky will be examining their brains in ways very similar to those methods used in the enriched environment studies with rats. He expects to show that these nuns have significantly more cortex, dendritic branching, and synapses than their counterparts who have not engaged in the brain exercises. Moreover, he expects to show the "active" nuns recover better from strokes or other types of brain trauma. This result would be similar to the findings that "enriched" rats with cortical lesions show an acceleration of recovery from either cognitive or sensorimotor deficits when compared to their counterparts who lived in more standard housing conditions (Dalyrymple-Alford & Kelche, 1987; Einon, Morgan, & Will, 1980; Gentile, Behshti, & Held, 1987; Held, Gordon, & Gentile, 1985; Hughes, 1965;).

An enriched environment provides numerous novel stimuli for examination and a potential for the development of new motor skills. Thus, the corresponding changes in the neocortex may be due to the environment as a whole rather than any specific experience. If progress is to be made in linking the neuroanatomical changes to behavior, studies that focus on a specific behavioral experience are necessary. Greenough and his colleagues (Greenough, Larson, & Withers, 1985) found that rats trained to reach for food placed in a tube showed an increase in the number of dendritic branches in the forelimb motor cortex contralateral to the used limb. Moreover, if both forelimbs were used in a bimanual task, branches in the motor cortex of both hemispheres increased (Kolb, 1995). Similar changes found in the occipital cortex were found in rats trained on a complex maze (Chang & Greenough, 1982: Greenough, Juraska, & Volkmar, 1979). Likewise, motor skill learning (i.e. rats trained on an obstacle course) caused an increase in the number of synapses in the cerebellum (Kleim et al.,1998). These studies suggest that specific experiences may enhance neuroanatomical plasticity. Interestingly enough, the dendritic changes correlated with task-specific practice are qualitatively different from those associated with enriched environments. Exposure to the enriched environment reportedly causes dendritic changes in the basilar dendrites (i.e., dendrites at the base of the cell body) whereas task specific changes are related to growth of apical dendrites (i.e., dendrites at the top of the cell body). The significance of this difference in apical vs. basilar dendritic growth is largely undetermined.

The results from the enriched environment studies, the effects of task-specific practice, as well as the potential data collected from the Sisters of Mankato raise an interesting and important question about the brain and behavior. To what extent does behavior affect the structure, physiology, and chemistry of the brain? We tend to think of the brain as a master control system, determining our actions, sensations, motivations, and thoughts. However, is it more accurate to suggest there is a closed loop between the brain and behavior where the brain generates behavior which in turn may cause a change in the brain? Kolb (1995) addresses this possibility: " The idea that activity might change the heart or muscles is seldom questioned. The possibility that behavior could change the structure and function of the brain is seldom considered" (p 5). The next frontier in neuroscience will no doubt include an intense examination of this issue. This idea is elaborated in the next section.

"My What a Dynamic Cortex You Have!"

Experience not only affects the morphology of neurons, but it can also affect their physiology. Perhaps one of the most important discoveries in the past 30 years of neuroscience research was that the somatosensory and motor homunculi in the neocortex can be modified. Researchers construct the somatosensory and motor representations of the body on the basis of receptive-field mapping (primary somatosensory cortex) and microstimulation (primary motor cortex) studies. For example, researchers determine somatosensory receptive fields by lowering a small insulated platinum wire into the postcentral gyrus of an anesthetized cat, monkey, or rat and recording the electrical activity of single neurons while tactile stimulation is applied to different parts of the body. If the tactile stimulation causes a change in the electrical activity, then the part of the body being stimulated is considered part of the receptive field of the neuron. They repeat this procedure throughout the primary somatosensory cortex until the entire body is "mapped." The primary motor cortex is mapped by sending a small amount of electrical current through an electrode and into the precentral gyrus in an attempt to elicit movement of some part of the body. The procedure is repeated until the entire body is mapped. Once we thought these somatosensory and motor maps of the body were unmodifiable or hard-wired; however, now we know they are dynamic. That is, the order of the somatotopic and motor maps can be changed, a phenomenon called cortical reorganization.

The malleability of the sensory map in the primary somatosensory cortex has been shown using several different manipulations. Perhaps the first demonstration of cortical reorganization was in response to deafferentation. For example, we know there is a part of the primary somatosensory cortex that corresponds to the ring finger. What happens to the cortical map if the ring finger is amputated? Because there is no longer a finger present to send sensory information into the nervous system and eventually the cortex, does the "ring finger area" simply go silent or does it somehow change? Merzenich and colleagues showed that if peripheral sensory nerves are damaged or if a digit was amputated, there was a change in the organization of the somatosensory cortex (Merzenich & Kaas, 1982; Merzenich et al., 1983a,b, 1984). Specifically, the once ring finger area of the somatosensory cortex may respond to tactile stimulation of another finger. In other words, the receptive fields of neurons in the somatosensory cortex have changed in response to the alteration of sensory information. Chen, Corwell, Yaseen, Hallet, & Cohen (1998) reported similar results have recently been reported in human. amputees. In another example, Jenkins, Merzenich, Ochs, Allard, & Guic-Robles (1990) trained owl monkeys on a task that produced repeated tactile stimulation of the fingers Subsequent mapping of the hand representation in the primary somatosensory cortex revealed an expansion of the finger areas stimulated in the task.

A similar result can be found in the primary motor cortex. For example, when Sanes, Suner, & Donoghue (1990) damaged the motor neurons that control whisker movement in rats, microstimulation of the whisker motor cortex area elicited movements of other muscles in the face indicating reorganization. In another experiment, Nudo, Jenkins, and Merzenich (1990) repeatedly stimulated the forelimb representation in the motor cortex of adult rats. The microstimulation elicited movement of the forelimb and eventually expanded the cortical representation.

The potential for reorganization in the neocortex of laboratory animals appears to be relevant for understanding brain-behavior relationships in humans. For example, Pascual-Leone and colleagues (1993) demonstrated that blind participants, who were well-trained in Braille, had an expanded finger representation in the hemisphere opposite to the "reading" hand (1993). In contrast, blind participants who did not use Braille often, showed no expansion. Researchers measured the size of the representation by using focal transcranial magnetic stimulation. In a second study using the same technique, Cohen et al. (1997) showed that people who were blind from birth demonstrated a somatosensory representation of the hand in the visual cortex! Thus, it is becoming clear that behavioral experience can have a strong influence on the morphology and physiology of the neocortex.

**The Synapse is a Two-way Street**

In the late 1940s D.O. Hebb argued that the neural basis of learning and memory would include the facilitation of synaptic activity. Hebb talked about "strengthening" synaptic activity through "reverberating" neural circuits triggered by a repeated experience. In the 1970s, the phenomenon of long-term potentiation (LTP) was discovered (Bliss & Gardner-Medwin, 1973; Bliss & Lomo, 1973). Researchers demonstrated that synaptic transmission is facilitated when it is preceded by intense high-frequency stimulation of the presynaptic neuron. For example, let us say you record the electrical resting membrane potential of the postsynaptic neuron and it is -70 mV. A low-level electrical stimulation of the presynaptic neuron causes a change in the postsynaptic membrane of about 5 mV. We know that this change in the postsynaptic membrane potential is due to the interaction between neurotransmitter being released by the presynaptic neuron and the postsynaptic receptors. LTP occurs if the presynaptic membrane is given an intense tetanic stimulation, and is manifested by a greater change in the postsynaptic membrane potential when the low-level stimulation is once again given. Following tetanic stimulation, the low-level electrical stimulation now causes a change in the postsynaptic membrane of about 8 mV. This "potentiated response" may last for hours, days, or weeks (Racine, Milgram, & Hafner, 1983). It is important to realize that in order for LTP to occur there must be the co-occurrence of electrical activity in the pre- and postsynaptic neurons. That is, there must be an action potential in the pre-synaptic neuron that leads to a change in the electrical membrane potential of the post-synaptic neuron. LTP appears to be similar to the "strengthening" of synapses first discussed by Hebb almost 30 years prior to its discovery. Moreover, LTP is currently believed to be a synaptic basis for learning and memory. You can imagine that an experience or behavior that is repeated over and over, may lead to the same potentiation of synaptic activity observed after tetanic electrical stimulation. Thus, the facilitated synaptic response may be the basis for a change in behavior (i.e., a learned response) or recollection of some event (memory).

How the potentiated response comes about in LTP? According to Hebb, strengthening a synapse requires a reverberating neural circuit. This view may imply that signals are sent in both directions across the synapse. The traditional model of communication between neurons is that an action potential is triggered at the axon hillock and is transported down the axon to the axon terminal without diminishing in strength. After the action potential arrives at the terminal, calcium enters and neurotransmitter is released into the synapse. The neurotransmitter moves across the synapse until it interacts with postsynaptic receptors. The interaction between neurotransmitter and receptor causes a local change in the electrical potential of the postsynaptic neuron. This local change is "graded" because it diminishes in strength as it moves toward the cell body and hillock. Local changes at different receptor sites are summated together in the cell body, and if there is enough of a change in the electrical membrane potential, then an action potential is fired and the process starts all over again. An important part of the traditional model is that information moves away from the "sending" or presynaptic neuron and towards the axon hillock of the "receiving" or postsynaptic neuron. Recent evidence suggests that this scenario, although logical and relatively easy to understand, greatly oversimplifies what is occurring at the level of the synapse. Moreover, the recent evidence may help us to understand how LTP comes about.

There is recent evidence that nitric oxide (a soluble gas) might serve as a retrograde messenger across the synapse allowing for the reverberating activity theorized by Hebb. Some of the neurons that contain receptors for the neurotransmitter glutamate allow for the entry of calcium into a cell when activated (e.g., the glutamate receptor called NMDA [N-methyl-D-aspartate]). It appears that the influx of calcium causes the release of nitric oxide from the postsynaptic membrane back into the synapse and onto the presynaptic axon terminal. Because nitric oxide readily diffuses through a cell membrane, it is possible that the retrograde message leads to a "strengthening" of synaptic activity. Indeed, if nitric oxide is prevented from leaving the postsynaptic membrane, then LTP cannot be maintained for more than 1 hour (Haley, Wilcox, & Chapman, 1992).

The evidence for nitric oxide as a retrograde messenger is surprising. However, what is even more eye-opening is the possibility that action potentials may work backwards from the cell body to the dendrites. Using a patch-clamping method on dendrites, Stuart and Sakmann (1994) showed that once an action potential is triggered in the traditional way, there is a back-propagation of the signal to the dendrites in some neurons. Patch-clamping uses smooth edged, tiny electrodes that press up against the cell membrane and allow for the recording of electrical activity at various locations along the neuron without damaging it. This event may trigger the release of a retrograde messenger such as nitric oxide. If this is the case, then the postsynaptic neuron is essentially "telling" the sending neuron that indeed it has just fired a neural impulse. Indeed, the reverberating circuit once proposed by Hebb now has a mechanism by which neuronal communication can go in both directions and cause a "strengthening" or facilitation of the synaptic activity.

Although the demonstration of LTP and the possibility that nitric oxide works as a retrograde messenger are thought to be major discoveries that validate the ideas of Hebb, the behavioral significance of these events remains largely undetermined. Attempts at studying the relationship between LTP and behavior have mostly relied on correlational studies. For example, Morris, Halliwell, & Bowery (1989) have suggested that LTP is the basis for spatial memory because drugs that block the action of glutamate at NMDA receptors block both the induction of LTP and the acquisition of a spatial memory task. Other examples include the facilitation of LTP via neural pathways that do not utilize the NMDA receptor (Buonomano & Merzenich, 1998; Racine & Trepel, 1997; Williams & Johnston, 1998). This finding may be important because it suggests there may be multiple memory systems, each having a different neural basis (Baudry, 1998).

An important test of the relationship between LTP and behavioral learning would be to show that during the acquisition of the learned response there is a facilitation of synaptic activity. For example, a relationship between LTP and spatial memory has been proposed because there appears to be a common neurochemical and neuroanatomical basis. Aspiring researchers could conduct he following studies to link this physiological and behavioral process more causally. Consider the hypothesis that the hippocampus is an important area for both LTP and spatial memory. We know that LTP can be induced at synapses within this neural structure specifically at the junction between the entorhinal cortex and the dentate gyrus of the hippocampus, the dentate gyrus and cells of the CA3 subfield, and the CA3 and CA1 subfield. A researcher could permanently implant microelectrodes into the hippocampus at one (or more) of these locations in rats, and then each animal could be trained on a spatial memory task. The microelectrodes would record the electrical activity of neurons in the hippocampus while the animal is learning the task. If potentiated synaptic activity is the basis for spatial memory, then as the rat learns the task there should be a voltage increase in the electrical potentials within the hippocampus that endures for days or weeks. Moreover, both the acquisition of the spatial memory task and the increase in electrical activity should be blocked by the administration of glutamate blocking agents. Although parallel neurophysiologic, pharmacologic, and behavioral studies have suggested these predicted results (Brown, Chapman, Kairiss, & Keenan, 1988; Castro, Silbert, McNaughton, & Barnes, 1989; Skelton, Scarth, Wilkie, Miller, & Phillips, 1987) to my knowledge there has been only one well-controlled experiment establishing a causal link (Izquierdo, 1995).

Our discussion of neural plasticity suggests the brain has the capacity for dynamic changes in cell morphology, synaptic activity, and receptive-field physiology. This potential for change within the nervous system is truly fascinating and it opens the door for considerable research in the next century. The nature of the research is what will be important. The emphasis could be on discovering the cellular and neurochemical basis that allows for these neural plastic changes to take place. On the other hand, the future could bring to the forefront of the field the need to understand the behavioral conditions that drive these changes. Are these models of neural plasticity the keys to understanding ways to enhance learning or recovery of behavioral function after brain trauma or stroke? Do they provide a window that allows us to see what must be done in order to provide a better quality of life for the Alzheimer's or Parkinson's patient? These latter questions can only be answered by bringing together the current technology with sophisticated behavioral analyses. To answer these questions it will be extremely important to challenge the correlations between neural and behavioral change. There is little doubt about there being sufficient motivation to continue the development of technology that will allow us to demonstrate new ways the nervous system can change. However, there must also be motivation to measure the sometimes subtle changes in behavior that are the driving force behind these neural events (Fox, Warrington, Seiffer, Agnew, & Rossor, 1998; Gelb, Oliver, & Gilman, 1998). Now more than ever we should engage in the tedious and time-consuming work of behavioral studies of brain function if we are to understand the significance of LTP, dendritic growth, and cortical reorganization.

To demonstrate this approach more clearly, I will now turn to a specific question that has been the focus of research in my laboratory: recovery of functions after brain injury. Researchers have made considerable progress in the last 20 years. The vast majority of progress has been in the understanding of what happens to the brain when there is a stroke or head-injury. We now know there is a cascade of neurochemical, cellular, and physiological events that are triggered by damage to the brain. These events lead to brain damage that is secondary to the initial trauma and may continue for minutes, hours, days, or weeks. It is generally believed that we must develop pharmacological treatments that will prevent or limit the occurrence of these events. However, does reducing the severity of these secondary events lead to a restoration of function? If so, does the drug provide a long-term solution? Do the treatments have beneficial effects on all behavioral aspects of the syndrome? Can pharmacologic intervention be harmful under certain conditions? Does drug treatment accelerate recovery of function, induce recovery when none is expected, or both? Does physical or cognitive rehabilitation enhance the effectiveness of drug treatment? Can the models of neural plasticity described at the beginning of this chapter help us to understand behavioral recovery? Behavioral studies can answer these questions best.

**Recovery of Function After Brain Damage**

An explosion of research has provided critical data on potential treatment strategies for recovery from brain injury in the last ten years. Much of this research has focused on the events that follow the damage and continue for hours, days, or weeks causing neurodegeneration outside the area of initial injury. This "secondary damage" is caused by the excessive release of neurotransmitter, the disintegration of cell membranes by free-radicals, swelling of the brain (i.e., edema), and disruptions in the integrity of the blood-brain barrier. Because these degenerative events persist for so long after the initial trauma, there is a "window of opportunity" within which neurons can be rescued through pharmacological treatment with "neuroprotective drugs." Although it is reasonable to assume that under most circumstances rescuing these neurons will enhance recovery of function, I do not believe that this is always the case. Indeed, Schallert, Jones & Lindner (1990) demonstrated that rescuing neurons actually had detrimental effects on behavioral recovery! Nonetheless, much research effort has focused on understanding the biochemical mechanisms and the resultant anatomical effects of neuroprotective drugs. In contrast, researchers have done very little work to establish their effects on behavioral function following brain injury. For example, one of the neurotransmitters released in excess after brain injury is glutamate,one of the most abundant excitatory neurotransmitters in the central nervous system. In this case, neuroprotective drugs would inhibit the action of glutamate and would be called glutamate antagonists. In a recent survey of the literature since 1985, less than 50 studies could be found that investigated the effects of glutamate antagonists on recovery of behavioral function following brain damage. This number hardly reflects the "explosion" of research reports on the potential use of glutamate antagonists for treating brain injury (Ginsberg, 1995). Behavioral measurements are not redundant to demonstrations of anatomical sparing; some of the few studies that reported both an anatomical and behavioral measure have found that although glutamate antagonists may provide anatomical sparing, researchers do not always observe a concurrent improvement in behavioral function (Grotta et al., 1990; Shapira, Yadid, Cotev, Niska, & Shohami, 1990). Although the demonstration of anatomical sparing and control of secondary factors (i.e., edema) by glutamate antagonists is a fundamental step in the development of pharmacological therapies for brain injuries, it is essential to combine the results of such studies with a detailed behavioral assessment.

**The Search for a Magic Pill is Clouded by Methodological Issues**

Although many glutamate antagonists have been synthesized as candidates for the treatment of brain injury and stroke, the existing body of literature does not provide a clear picture as to which of these agents is most effective in facilitating recovery of function. However, MK-801, a drug very similar in neurochemical action to phencyclidine (PCP or }angel dust"), is perhaps the most widely used glutamate antagonist in experimental studies. The lack of a candidate drug is largely due to the lack of consistent methodology among the various reports. Factors such as the onset and duration of drug administration vary widely among studies. Behavioral methodologies also differ, especially along the lines of the postoperative observation period, the number of tests given during that time, and the onset of postoperative testing. Other problems with behavioral methodology include the need for quantification of behavioral deficits and the unfortunate practice of combining the results of several behavioral measures together in an attempt to form an index of overall neurological function (i.e., neuroscore or neurological severity score).

The postoperative observation period and the number of tests within that time may be important considerations for recovery of function experiments. In our laboratory, postoperative recovery on some sensorimotor tests is dependent on the number of test trials rather than the time since the brain injury (Barbay & Barth, 1993), whereas for other tasks the reverse appears to be true (Schallert & Whishaw, 1984). These two variables may have played a role in the negative results with glutamate antagonists reported by several laboratories (DeGraba, Ostrow, Hanson, & Grotta, 1994; Follis et al., 1994; Holtz & Gerdin, 1991; Lanier et al., 1990). For example, Follis et al. (1994) reported that two glutamate antagonists, MK-801 and magnesium sulfate, failed to reduce the severity of paraplegia (paralysis on both sides of the body) 24 hr after rats received a stroke in the spinal cord. However, the authors note that with repeated testing over a 4-day period, both treatment groups showed more recovery than saline control animals. Only the magnesium sulfate group was significantly different from the saline group on the fourth day of testing. The authors point out, "Without a doubt a longer period of observation, 4 weeks for example, would have provided more definitive data and perhaps showed a beneficial effect also for the MK group" (p 231). Follis et al. also suggest that in many of the reports attempting to study neuroprotective effects, final observations were made between 2 hours and 7 days (Boast et al., 1988; Kochar, Zivin, Lyden, & Mazzarella, 1988; Yum & Faden, 1990). Although the immediate effects of the drugs are undoubtedly important, it may be the case that on certain behavioral tasks extended postoperative testing will be required to demonstrate that significant neuroprotection was observed. One standard that researchers should entertain is a postoperative testing time that allows the vehicle control group to return and maintain preinjury levels of performance. In this case, researchers can establish any potential benefit of the drug treatment. However, in some cases where the behavioral impairments are chronic or permanent, researchers should determine some reasonable cut-off should be established that would include at least 4 weeks of testing. In our laboratory that restoration of function by a drug treatment in a chronic deficit model (following electrolytic cortical lesions) is established within this time frame, but admittedly the declaration of a 4-week test period is arbitrary and may not generalize to other models of brain injury.

Combining the results on several tests in the form of a neuroscore has both advantages and disadvantages. On the one hand, the single score may give an estimate of overall neurological function in animals receiving neurotrauma or ischemia. Presentation of this type of data allows for a quick assessment of the sensorimotor capacity of brain or spinal cord damaged animals and easy comparison between drug and untreated groups. Moreover, it takes into account performance on a range of behaviors rather than focusing on the results of a single test. However, one advantage of using multiple behavioral tests is to determine the limits of any drug effect on recovery of function. That is, there is evidence to suggest that glutamate antagonists may accelerate recovery on some behavioral tasks but not others. By exclusively using combined neurological scores, the possible behavioral limitations of glutamate antagonists will remain largely undetermined. Moreover, by combining the results on several tasks there is a risk that the magnitude of any drug effect will be misleading. For example, if there is a small effect of the drug on several tasks, combining the results across tests will inflate the effectiveness of the agent. On the other hand, if there is a large drug effect on one or two tests and only a slight or nonsignificant effect on others, the combined score may reveal a nonsignificant treatment effect or only marginally significant results. In this case, although overall neurological function is only slightly impaired, the specific behavioral effect of the drug treatment may be lost.

Another issue concerning the behavioral evaluation of brain-damaged subjects is the need for quantification of the deficits. Researchers often use subjective rating scales to assess sensorimotor behaviors. These rating scales appear to have a high degree of interrater reliability and for this reason are acceptable measures of behavior. However, the use of these scales without any additional quantification of the impairment limits the types of statistical analyses that may be performed. In most cases, the behavioral measure is an ordinal scale and therefore requires a nonparametric statistic. There is no adequate nonparametric statistic that will allow for statements to be made about differences in the rate of recovery between groups. In contrast, an analysis of variance, where repeated testing over time may be measured as a within groups variable, allows for a treatment x test day (or hour) interaction and a comparison of the rates of recovery between groups. Differences in the rate of recovery between groups becomes an important issue if two groups of animals (e.g., treated and nontreated) fail to show a reliable difference on the first few test days but show significant differences thereafter. Such results have been shown in rats with lesions of the rat cortex and treatment with MK-801 beginning 16 hours after the brain injury (Barth, Grant, & Schallert, 1990; Barbay & Barth, 1993).

**A Behavioral Research Program Using MK-801: Timing is Everything**

We have studied the effects of MK-801 on the recovery and maintenance of function after lesions including the forelimb representation in the primary somatosensory and motor cortex (SMC) of the rat. MK-801 is known to reduce the amount of brain damage and edema as well as improve behavioral recovery in at least some cases following experimentally induced stroke, trauma, or cortical lesions.

The first step we chose to take in investigating the potential behavioral effects of MK-801 was to determine if it facilitated recovery on several sensorimotor tasks that evaluate functions of the forelimb. The SMC lesion produces a syndrome that includes impairments in tactile placing reflexes, placement of the forelimbs during locomotion, and removal of adhesive patches placed on the forelimbs. We create the lesion in one cerebral hemisphere (i.e., a unilateral lesion) so all sensorimotor deficits are seen only with the limb opposite to the side of the lesion (often called contralateral deficits). If we place the lesion in the left hemisphere, then we will observe sensorimotor deficits on the right forelimb. Depending on the extent of the lesion, these impairments typically recover in 1-4 weeks if postoperative tests begin 1 or 2 days following the injury, and are administered on a schedule of approximately 2-4 tests per week. Initial studies suggested that if the first administration of MK-801 is given 16 hours after the lesion, then drug effects would be seen only on the adhesive patch test (Barth et al., 1990). However, in this study recovery on the placing tests occurred in 10 days. Most recovery of function studies with glutamate antagonists begin injections 15 min - 1 hr after the injury. This relatively fast rate of recovery, along with the initial injection occurring at 16 hours after surgery, left open the possibility that MK-801 might have an effect on a wider range of deficits if the duration of the behavioral deficit could be extended in untreated rats with SMC lesions. When the duration of the deficit was extended to 24-35 days (in untreated rats) by increasing the size of the SMC lesion, MK-801 given at 16 hours facilitated recovery of forelimb tactile placing but still had no effect on locomotor placing (Barbay et al., 1992). This limitation on the effects of MK-801 could be removed if treatment began sooner after the lesion; hence, Hoane et al. (1997) reported that MK-801 significantly facilitated recovery on all of the sensorimotor tests if it was administered 15 min after the larger cortical lesion. It is important to realize that the recovery pattern (defined as the time taken to reach preoperative baseline performance) for saline treated rats was around 24 days. Thus, increasing the size of the lesion extended the time to recovery and a facilitative effect for MK-801 is now shown for all sensorimotor tests examined if treatment begins soon after the brain damage. These data suggest that there are no apparent limitations of MK-801 on recovery from sensorimotor deficits if the drug is administered soon (i.e., 15 min) after the brain injury. Moreover, these data may indicate different windows of opportunity for the various sensorimotor tests.

Previous studies have suggested that there is a window of opportunity following brain damage within which neuroprotective drugs may have their beneficial effects. Treatment with the neuroprotective agent outside this window will have either no effect or may even be detrimental to recovery and maintenance of sensorimotor functions. In our next study (Saponjic, 1994), we began to define this window of opportunity for MK-801. We gave a single injection of MK-801 at 15 min, 2 hours and 48 hours after the unilateral SMC lesion and tested the rats on the same battery of tests mentioned earlier. When a single injection is given at 15 min, rats treated with MK-801 showed a significant sparing of function on the first postoperative test day when compared to a group of saline-treated controls rats (performance on postoperative day 1 is better in the MK-801 treated rats). If MK-801 treatment is delayed until 2 hours after surgery, the sparing is no longer observed, however, there is a clear facilitation of recovery over time when compared to the saline-treated lesion control rats. This difference in the rate of recovery is supported by a significant treatment x days interaction. In this case, the repeated testing over numerous postoperative test days was an extremely important factor necessary to see the effect of MK-801. Finally, if MK-801 administration is delayed for 48 hours, the effect of the drug on sparing and recovery of function is lost. If we combine these data with those of previous work that showed a drug effect at 16 hours after the lesion, we may conclude that at least for some behaviors the "treatment window" for MK-801 extends up to 16 hours with there being no effect at 48 hours These data suggest a much longer window than those reported by others that suggest MK-801 may be effective only up to about 1 hr after the lesion (Shapira et al., 1990). This difference may be due to the type of behavioral tests, quantification of the behavioral deficit, or the duration of postoperative testing.

Up to this point we have discussed the effects of MK-801 on the restoration of functions that would otherwise still recover even if no treatment was given (albeit at a slower rate). Although acceleration of recovery by MK-801 is a significant finding, it is questionable whether such an effect would generalize to cases where there is little or no expected recovery. We have found that if the electrolytic lesion was enlarged, forelimb placing deficits appear to be permanent. Rats with these large lesions showed no signs of recovery of forelimb placing during a 6-month postoperative testing period. This more severe deficit may reflect a more complete destruction of corticospinal neurons that innervate the forelimb spinal cord. We tested the effects of MK-801 given 16 hours after the lesion and found no significant improvement in recovery of forelimb placing. However, in a more recent study (Hoane et al., 1995) we found that MK-801 "induces" a significant, yet still incomplete, restoration of forelimb placing if administered 15 min after the large SMC lesion. These data are important because they suggest that at least partial recovery is possible after this larger lesion, and that the window of opportunity may be different depending on the extent of the brain injury. An important question for future studies will be to determine the area or areas that are mediating the forelimb placing in these animals with large SMC lesions.

Although MK-801 appears to have a beneficial effect on recovery after brain damage, it also produces adverse anatomical and behavioral effects. For example, MK-801 produces transient structural changes in cortical neurons of intact rats including the expression of heat shock protein 70 which is a characteristic of injured neurons (Auer & Coulter, 1994; Olney, Labruyere, & Price, 1989; Sharp, Kinouchi, & Koistinaho, 1993). Moreover, behavioral studies have shown that MK-801 may disrupt learning and memory (Whishaw & Auer, 1989; Morris et al., 1989) and cortical plasticity during development (Rauschecker & Hahn, 1987).

MK-801 also appears to interfere with the maintenance of recovered functions. Barth et al. (1990) showed that a single injection of MK-801, given after behavioral recovery from very small unilateral SMC lesions, reinstated the function in the contralateral forelimb (i.e., the forelimb on the side of the body opposite to the hemisphere containing the brain damage). This recovery placed deficits for up to 7 days after the injection (i.e., reinstatement effect). MK-801 did not affect placing with the forelimb ipsilateral to the lesion (i.e., the forelimb on the same side of the body as the hemisphere containing the brain damage), nor did it affect placing reactions in intact control rats. In a more recent study, the SMC lesions were slightly extended in order to produce a longer time to recovery. In this study, the saline-treated rats recovered from the placing deficits in about 35 days. They were then given a single postrecovery injection of MK-801. As expected, MK-801 reinstated the forelimb placing deficits. However, in this case the reinstated deficits lasted for approximately 30-35 days. Thus, postrecovery injections of MK-801 appear to trigger behavioral deficits for a time period similar to that observed after the cortical lesion. These data suggest that although there is recovery following the cortical lesion, the maintenance of this recovery is fragile and potentially vulnerable to later drug treatments. This issue of the maintenance of function is especially important given the duration of the reinstated deficits.

A next question might be whether or not there is a way to stabilize the recovered functions such that they are not vulnerable to postrecovery injections of MK-801. We hypothesized that the reinstatement effect might occur because the neural circuits that maintain the restored functions are insufficient to withstand the drug challenge. The neural circuits likely would include subcortical as well as cortical areas remote from the cortical damage. If this were the case, then treatment with MK-801 beginning soon after the cortical lesion might block the reinstatement effect by keeping the appropriate remote circuits intact. Previous experiments have shown that both the striatum and substantia nigra pars reticulata are affected by the cortical lesion and that these anatomical effects could be prevented or at least reduced by MK-801 given up to 16 hours after the brain injury. For example, following a SMC lesion there is a concomitant atrophy of the posterior striatum and a loss of neurons in the substantia nigra. Both of these remote events are blocked by early treatment with MK-801 (Barth et al., 1990). It may be the case that the presence of this subcortical deterioration is a contributing factor in the inability of the rats to maintain the recovered behavior; likewise, the preservation of these sites may block the reinstatement effect.

In another study, rats received unilateral SMC lesions and either saline or MK-801, 16 hours after surgery. The animals were tested on forelimb placing tests until they returned to preoperative baseline levels of performance on two consecutive test days. After recovery appeared to be complete, the rats were then given an injection of either MK-801 or saline. Thus, the experiment consisted of four groups (early treatment/late treatment): saline/saline; saline/MK-801; MK-801/saline; MK-801/MK-801. We expected that the saline/MK-801 group would show the reinstatement effect and the saline/saline and MK-801/saline groups would fail to show any reappearance of the forelimb placing symptoms. The important question was whether the MK-801/MK-801 group would show the reinstatement effect. These rats show a sparing of neurons in subcortical areas due to the neuroprotective effects of an early injection of MK-801, and therefore might be resistant to the reinstatement effect. The MK-801/MK-801 group failed to show a reinstatement of forelimb placing deficits following the postrecovery injection of MK-801. Subsequent studies have shown that the lack of reinstatement effect in these animals is probably not due to repeated exposure to MK-801 (Barbay et al., 1992). These data support the view that the cortical lesion and concomitant subcortical degeneration leaves the animals vulnerable to a reappearance of forelimb placing deficits after recovery. However, the preservation of subcortical neurons with early treatment of the neuroprotective agent MK-801 appears to be important for the maintenance of recovered functions. Thus, early treatment with MK-801 not only facilitates recovery of sensorimotor function, it also allows for a stable maintenance of those recovered functions.

Behavioral studies have shown the potential for glutamate antagonists to facilitate recovery of function after cortical or spinal cord damage. These behavioral studies also suggest that the duration of glutamate antagonist treatment is an important factor to consider when designing human clinical trials, because late administration of MK-801 may be harmful to recovery of function. Many questions that are best addressed through behavioral studies remain largely unanswered. Most importantly, the effects of glutamate antagonists on permanent deficits and whether those recovered functions can be maintained are questions that should be addressed. Ultimately it will be important to identify those neural circuits that allow for recovery and maintenance of function. In the case of cortical injury, we have alluded to the possibility that these answers may be found in the pattern of secondary degeneration in subcortical structures associated with the primary injury. Preventing or limiting the amount of subcortical degeneration may lead to a restoration of function and a stable maintenance of those recovered functions. If these subcortical systems are critical for recovery, we must ask whether their integrity allows for the restoration of the function lost or whether they represent a parallel system that encourages the development of alternative behavioral strategies. Only through extensive behavioral analyses can these questions be answered.

**Recovery of Function Studies in the 21**st**Century**

Can we attain the goal of developing a pharmacological treatment for stroke and closed-head injury? Although the end of the 20th century gave us a deeper understanding of the events that occur around the time of the brain damage, we still do not have an obvious candidate that can be safely and effectively used as a treatment. I expect that it is going to become clear that an important part of that search will be to find an agent that can be given at time periods long after the injury occurred. It seems unrealistic that treatments whose effectiveness is limited to the time period soon after the brain injury (i.e., 15 minutes) will be of much value in the long run. Ideally, a treatment should be safe regardless of when it is given and even be effective at promoting restoration of functions long after the injury occurred. The focus of research in the 21st century should be on affecting chronic deficits. This approach might involve rehabilitative strategies, both pharmacological and behavioral, that encourage the development of alternate behavioral strategies that allow for compensation of the lost function. This approach might have as a neural basis those models of plasticity discussed at the beginning of this chapter.

Magnesium: A Possible Safe and Effective Treatment for Brain Injury

One of the events that follows an injury to the brain is a depletion of magnesium in the brain and spinal cord. We are just beginning to understand the importance of this occurrence. Magnesium is a critical element for neural transmission and basic cellular processes in the brain. It is essential for protein and RNA synthesis and the stabilization of cell membranes. Magnesium serves as a modulator of activity at some glutamate receptors. Magnesium blocks the activity of glutamate by directly binding to a receptor site within the calcium channel. When glutamate binds to it's receptor, calcium will enter the neuron and cause a depolarization. However, magnesium blocks the entry of calcium and therefore inhibits the activity of glutamate. Thus, magnesium serves as a glutamate antagonist and a neuroprotective agent.

Treatment with magnesium has been used in experimental models of stroke and head trauma. These studies have shown that treatment with magnesium reduce the amount of brain damage and accelerate the rate of behavioral recovery (Hoane, Raad & Barth, 1997; Izumi, Rousel, Pinard, & Selyaz, 1991; McIntosh, 1993; Vacanti & Ames, 1984 ). Because magnesium is relatively safe, it becomes an attractive option for treatment following brain injury. Moreover, magnesium has unique qualities that may make it useful beyond the time immediately following brain injury. Specifically, magnesium may be useful as a preventative treatment and long after the injury in cases where there are chronic deficits. In the latter case, magnesium may be effective in promoting neural and behavioral plasticity by indirectly affecting certain neurotransmitter systems.

Researchers have used magnesium treatment as a preventative treatment for several medical conditions, such as coronary heart disease and postoperative pain management (Bashir et al., 1993; Lassere, Spoerri, Moullet, & Theubet, 1994; Sjostrom & Weiner, 1996). Treatment in these cases suggests that magnesium supplements can elevate and maintain plasma levels for a prolonged period of time. Although there is little evidence pertaining to the long-term elevation of magnesium levels through the use of supplements, our data suggests that daily treatment with magnesium may lead to beneficial effects in the case of experimentally induced brain injury. We administered magnesium chloride to rats for 2 or 5 days with the last treatment ending 24 hours prior to a unilateral lesion in the SMC (Hoane, Irish, Marks, & Barth, 1998). When compared to saline-treated control rats, magnesium-treated animals showed less severe behavioral impairments, accelerated rates of recovery, and a reduction in the amount of atrophy in structures connected to but remote from the SMC. We believe that these data have far reaching implications for the preventative treatment of brain injury in high risk populations. For example, these data may be particularly important for individuals with a history of stroke or those participating in high contact sports like football or boxing. Could it be that daily magnesium supplements will "inoculate" these individuals against some of the secondary effects of brain injury?

A second potentially novel use of magnesium may be in the treatment of chronic deficits that occur following brain injury. As stated previously, although it is important to develop treatments that prevent the extent of brain injury through administration of agents around the time of the damage, it is equally important to develop treatments that can be used long after the initial trauma or stroke. The population of individuals with chronic neurological deficits due to trauma or stroke is getting larger and there is currently no effective treatment for these individuals. Is it possible that there is some type of intervention that can be used to help restore function long after the injury? In a pilot study, we produced chronic sensorimotor deficits in rats by making very large unilateral SMC lesions. As stated previously, this large SMC lesion produces impairments that do not recover for at least 6 months. In six rats with these large lesions we administered a daily regimen of magnesium chloride beginning 2 weeks after the lesion was created (Mishalanie, Stuntz, & Barth, 1997). Daily injections were given over a 2-week period. By the end of the injection period the treated rats were showing a partial restoration of forelimb placing behavior. However, after treatment was discontinued, the performance of the magnesium treated rats slowly worsened until they were as impaired as rats given no treatment. Several weeks later, we resumed magnesium chloride treatment and the rats once again showed a partial restoration of function that could only be maintained for a short time after the treatment was discontinued. These data suggest that the severity of chronic sensorimotor deficits associated with brain damage can be reduced, at least temporarily.

There are several possibilities for the mechanism of magnesium's effect on chronic deficits. A first possibility is that following brain damage there may be a population of neurons remote from the site of damage that becomes inactive. In the early 1900s, von Monakow introduced this idea in his theory of diaschisis. According to von Monakow, behavioral impairments following brain injury are due to the actual tissue lost, and to the metabolic depression of areas proximal and remote to the brain injury. Von Monakow called this metabolic depression, "neural shock" or diaschisis. Does magnesium somehow bring these neurons back from diaschisis? If so, what has made these neurons inactive and how does magnesium have its beneficial effect? If we take this idea to its logical conclusion, we may suggest that in people with chronic behavioral deficits due to brain injury, there are silent neurons that have the potential to become active again. This is an exciting possibility, because it suggests that the basic "hardware" is available, we just have to find a way to activate it.

Magnesium has the potential to affect the nervous system in a variety of ways. However, an understanding of the neurobiology of magnesium would not reveal its true potential as an effective treatment for brain injury. This potential is realized as we combine the neuroanatomical, neurophysiological, and neuropharmacological data with neurobehavioral studies of magnesium treatment.

**Neuroplasticity and Recovery of Function**

How do the neuroplastic events mentioned at the beginning of this chapter help us to understand recovery of function after brain damage? If we assume that these models are the basis for learning and memory, we find ourselves at the doorstep of an important concept in the study of recovery of function. This concept is behavioral compensation. Behavioral compensation is the idea that following brain damage the improvement in performance that we often label as a restoration of function is actually the development of an alternate behavioral strategy. Thus, the behavioral process following brain-damage is better characterized as the learning of a compensatory behavior rather than a restoration of a function.

If recovery after brain injury is due to learning a new motor skill or cognitive strategy to compensate for the lost function, then models like LTP become relevant. For example, if a unilateral brain lesion in the motor cortex of the rat produces contralateral sensorimotor deficits, then "recovery" may include the development of new motor skills and LTP-like phenomenon in other cortical areas. A solid research program would need to include both very sophisticated behavioral analyses to describe the alternate or compensatory behavior and physiological measurement to show the development of LTP. If a strong correlation in the time course of these behavioral and physiological phenomena can be demonstrated, then we may conclude that effective treatments would include those procedures that encourage the learning of new behaviors and the development of LTP. Moreover, researchers could support and strengthen the hypothesis that LTP is a mechanism of behavioral compensation if it can be shown that pharmacological manipulations affecting the time course of one, also affects the timing of the other. Experiments aimed at challenging the correlations between the behavioral and neurophysiological events would be most important for both understanding the process of recovery after brain damage and the development of effective treatments.

The second model of neural plasticity we have considered includes the experience-induced increase in dendritic branching and the possibility that behavior can drive morphological and neurophysiological changes in the brain. Jones and Schallert (1992; 1994) investigated this issue in regard to recovery of function after brain injury. They showed that rats with unilateral lesions in the SMC exhibited sensorimotor deficits contralateral to the brain injury. They also showed a hyperreliance of the forelimb ipsilateral to brain damage. If the SMC in the left hemisphere is damaged, then there are sensorimotor deficits with the right forelimb and a hyperreliance on the left forelimb). This hyperreliance appeared to be correlated with an increase in dendritic branching in the SMC of the intact cortex (which controls the unimpaired limb). This increase in dendritic branching was maximal 2-3 weeks after the injury, and was actually "pruned back" at later time points. The time course of dendritic changes appeared to correlate with the relative use of the corresponding unimpaired forelimb. The authors concluded that the overuse of the unimpaired limbs might be driving the reported structural changes. This hypothesis was challenged in the next series of experiments. Jones and Schallert decided to restrict the use of the unimpaired limb by placing a one-sleeved cast on rats immediately after the SMC lesion. In this case, it was impossible for the rats to use the unimpaired limb, so if the before-mentioned dendritic changes failed to occur it could be concluded that, in fact, the hyper-reliance on the unimpaired limb was a necessary factor to induce the neuroplasticity. Moreover, if casted nonlesioned animals showed the same dendritic changes, then the neuroplastic event could be specifically related to the behavioral experience. The results were that casted lesioned rats failed to show the increase in dendritic branching, but casted nonlesioned rats also failed to exhibit the effect. These results lead the authors to conclude that the behavioral experience produced the dendritic changes only if there was a cortical lesion present. These data suggested that following a brain lesion, intact areas of the brain may have a greater potential for neuroplastic changes. One question for future research will be to determine the factors or events that follow brain injury and allow for greater neuroplasticity. Is some substance that encourages neuroplasticity released following a trauma? Could changes in electrical gradients be responsible for the enhanced neuroplasticity? There are many candidates (i.e., neurotrophic factors) that once isolated, could be used to induce neuroplasticity. The discovery of the neuroplastic triggers or enhancers may be a very important event in the treatment of people with chronic brain damage, if we consider they are probably only available for a relatively short time after the trauma. Jones and Schallert report that the increase in dendritic branching is maximal at 2-3 weeks and thereafter there is a pruning back of dendrites. The pruning back may be due to behavioral recovery, but also could be due to the lack of these neuroplastic triggers. Moreover, it may be the case that the neuroplastic enhancer will also have a beneficial effect on neurodegenerative diseases like Alzheimer's or Parkinson's.

The final model we discussed was cortical reorganization. The malleability of cortical fields is undoubtedly dependent on behavior. In an attempt to integrate this model to the question of recovery after brain damage, we should ask the question, "What are the behavioral parameters that best produce the neuroplastic change? For example, do our current physical rehabilitation plans optimize the potential for change in cortical field physiology? Does the frequency and vigor of treatment lead to the best behavioral recovery, and is this correlated with changes in the cortex? Researchers can best answer these questions with animal models of brain damage and plasticity.

**Some Advice for Researchers in the 21**st**Century**

To answer the questions put forth in the preceding sections, neuroscience researchers must continue to receive interdisciplinary training represented as the four legs of neuroscience. However, unlike the past, the future will place much more emphasis on behavioral analysis. This shift in emphasis will mean that training in experimental design and statistics will become more important. The renewed interest in physiological psychology integrated with }cutting edge" technology may very well turn the steady pace of progress into a gallop.

**Conclusions**

The 21st century will be an exciting time for neuroscience and physiological psychology; there will be extensive examination of the dynamic brain and its relationship to changes in behavior. Researchers must continually challenge the correlations between the changes in brain structure, chemistry, physiology, and behavior because there will likely be numerous dynamic events to consider. An important topic for investigation will be how behavior drives neuroplastic events. Once this idea becomes more accepted in the neuroscience community, the true marriage between neuroscience and behavioral science will be realized. This realization will undoubtedly lead to a better understanding of brain function. The application of this new understanding will be new and more effective behavioral and pharmacological treatments for brain injury, stroke, and neurodegenerative disease. Thus, scientists will take another major step in achieving the goals set in the Decade of the Brain.

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[Flourish Line]

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# Chapter 5 ****Cross-Cultural Psychology in the 21st Century****

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If things continue as they have until now, cross-cultural psychology as we know it today will cease to exist in the 21st century. Instead, it will be integrated into mainstream psychology. Yet that integration should not be a total assimilation of cross-cultural psychology into mainstream psychology. There will be major accommodations as well, fundamentally changing the essence of the way we model and study human behavior. We are already witness to these changes, as we are in the middle of an evolution in psychology.

In this chapter, I would like to describe why I believe we are in the midst of this evolution. I will first describe compelling issues that have driven cross-cultural psychology until now. Then I will illustrate advances in knowledge about human behavior by describing current knowledge in my field of expertise, emotional expression and perception. I speculate about the future of research in this area, and describe challenges facing cross-cultural psychology as a whole for the next two decades. I end this chapter by offering some friendly advice to those who want to get into this exciting and wonderful area of psychology.  
  
**Compelling Research Issues in Cross-cultural Psychology**  
  
In the past, cross-cultural psychology was perceived as an "exotic" branch of psychology for those with esoteric interests in culture. Cross-cultural studies were generally viewed as an interesting aberrant of more serious research in mainstream psychology and were generally not assimilated into mainstream knowledge. Today, however, cross-cultural psychology is viewed as a serious endeavor. Studies reporting cultural differences are widespread and common and make fundamental challenges to mainstream knowledge. Throughout this history, a common thread ties much of this literature together, and that is its overwhelming concern with uncovering universal and culturally specific aspects of behavior.

Indeed, cross-cultural research has uncovered many psychological processes that appear to be universal. These include, for example, the perception and language of color; processes of language acquisition; principles of cognition, thinking, and learning; gender differences in mate selection and gender stereotypes; and recognition and expression of facial expressions of emotions. Not only do these findings provide important bases by which we can find commonality with fellow humans, they also allow us to speculate about their biological substrates, innateness, and evolutionary and adaptive significance.  
  
But cross-cultural research has also produced important cultural differences. These occur in temperament, attachment, and child-rearing; cognitive, moral, and socioemotional development; the structure and function of language; rules for displaying and perceiving emotions; psychopathology and physical health; and much more. Collectively, they tell us that culture plays an important role in shaping human experience and worldview as well.  
  
Uncovering cultural similarities and differences in psychological traits and behaviors is extremely important to the field for several reasons. First, it helps us refine and revise our theoretical understanding of human behavior. This activity is important if we want to have theories in psychology that are applicable to the widest audience possible. For example, cross-cultural research has helped to refine our understanding of child-rearing practices and attachment, modifying what the field considered to be optimal attachment and child-rearing based on research conducted solely in the U.S. to accommodate important differences in these practices around the world. Second, uncovering cross-cultural differences helps us deliver more effective psychologically-based services to the public. These activities occur through psychotherapy, counseling, business consulting, and the like, most of which are dependent on accurate information and knowledge about people derived from research. Cross-cultural research, for instance, has been instrumental in helping to develop culturally sensitive methods of psychological assessment and treatment, which is an important factor in psychotherapeutic effectiveness. Third, cross-cultural research is important because it provides important links and connections among people and psychologists all around the world, helping to forge new ways of international and intercultural cooperation among scholars and practitioners alike. New organizations that cross many borders involve psychologists and health-professionals, creating unions that would not be possible otherwise.  
  
Most current works in cross-cultural psychology document cultural difference through cross-cultural comparison. While these studies are found primarily in journals devoted to culture, such as the*Journal of Cross-cultural Psychology*, today they are found in many mainstream journals as well. Moreover, if culture is defined as a sociopsychological construct, as most writers do, then not only are people of different races, ethnicities, and nationalities members of different cultures; so are people of different genders, sexual orientations, and abilities. If you take this entire literature encompassing all these groups of people together as a whole, you will notice that cross-cultural research is widespread and commonplace in all areas of psycholog, and makes important contributions to knowledge. Cross-cultural comparison has become a staple in the academic diets of contemporary psychologists, and the existence of cultural differences and the importance of culture to mold our lives is now well accepted. This awareness is due, in part, to the overwhelming amount of cross-cultural research that has been conducted to date and the documentation of similarities and differences, which has been the compelling issue in cross-cultural psychology for years.  
 **Cultural Influences on Emotional Expression and Perception**  
  
Cross-cultural research in my own field of study - emotional expression and perception - exemplifies many of the developments and advances in cross-cultural psychology over the past twenty or thirty years, and I would like to review these developments here. I was first interested in this field as an undergraduate at the University of Michigan. For example, I wondered how infants, who did not speak or understand totally language that was spoken around them, could understand the emotional states of their mothers, fathers, and other caretakers around them. Under the supervision of Robert Zajonc, I designed a little study that tested the ability of young children to judge accurately emotions portrayed in nonverbal vocal cues. An opportunity followed that allowed me to conduct this study cross-culturally. Once into graduate school, I continued to delve into this area, immersing myself in the study of facial expressions under the tutelage of Paul Ekman at the University of California, San Francisco. Before I knew it, this area consumed my research endeavors during graduate school and helped to launch my career in this area.   
  
As in other areas, comparisons demonstrating both cultural similarity and difference have been extremely important in the area of emotional expression and perception. Knowing about similarities and differences in emotion across cultures helps us understand the possible innate, biological substrates of emotion that are universal across all peoples regardless of culture. It helps us to understand the role of emotion in our lives and the importance of emotion to thinking and behaving. Such comparisons help us to understand the role of emotion and nonverbal behaviors in social interactions with the goal of improving interactions among people from different cultural backgrounds. And, this research helps us to consider the common bases upon which humans develop, providing a backdrop for mutual understanding and cooperation across cultures.  
The last thirty years were witness to the "universality studies," which documented convincingly the universality of a set of six facial expressions of emotion, including anger, disgust, fear, happiness, sadness, and surprise. The emotions appear to be biologically innate, appearing in non-human primates and congenitally blind individuals (Charlesworth & Kreutzer, 1973; Ekman, 1973) and correspond to similarities in emotion taxonomies in different languages in the world (Romney, Boyd, Moore, Batchelder, & Brazill, 1996; Romney, Moore, & Rusch, 1997). We also know, however, that people modify their expressions on the basis of cultural display rules (Ekman, 1972; Ekman & Friesen, 1969; Friesen, 1972). These are culturally prescribed rules, learned early in life, that dictate the management and modification of the universal expressions depending on social circumstance. After the original universality studies in the late 1960s and early 1970s, many studies have replicated the universal recognition of these expressions (see reviews in Ekman, 1982). Today their universality, as well as the existence of display rules, are well accepted in mainstream psychology (see also Fridlund's (1997) view of display rules, which is different than that originally postulated by Ekman and Friesen).  
  
Recent research has extended the universality findings in important ways. Some studies have shown more ways in which cultures are similar, implicating consequences of expression universality. Other studies have produced differences, extending our knowledge about how cultures influence expression and perception. Collectively, they give us further insights to the biological and environmental processes that underlie facial expressions and emotion.   
  
More Cultural Similarities in Emotional Expression  
  
In contempt. In the last decade, a number of studies have reported the existence of a seventh universal facial expression of emotion: contempt. Initial evidence was collected from ten cultures including West Sumatra (Ekman & Friesen, 1986; Ekman & Heider, 1988). This finding was later replicated by Matsumoto (1992b) in four cultures, three of which were different from Ekman and Friesen's original ten. This finding received considerable attention and criticism (Russell, 1991a, b; Izard & Haynes, 1988). Russell (1991a, b), for example, suggested that the context in which the expression was shown influenced results in favor of universality. In his study, the contempt expression was more often labeled as either disgust or sadness when shown either alone or after showing a disgust or sad picture (Russell, 1991). Ekman, O'Sullivan, and Matsumoto (1991a, b), however, reanalyzed their data to address this criticism and found no effect of context. Biehl et al. (1997) also found no effects for other possible methodological confounds.   
  
In relative intensity. When comparing expressions, do people of different cultures agree on which is more strongly expressed? Cross-cultural research indicates that the answer to this question is yes. Ekman et al. (1987) compared these differences in paired expressions of the same emotion. Ninety-two percent of the time, the ten cultures in their study agreed on which of two expressions was more intense. Matsumoto and Ekman (1989) extended this finding by including comparisons across different poser types, including Caucasian and Japanese posers. Looking separately for each emotion, within culture and across gender and then within gender across culture, Americans and Japanese agreed on which photo was more intense in 24 out of 30 comparisons. These findings suggest that cultures judge emotions on a similar basis, despite differences in facial physiognomy, morphology, race, and sex of the posers, and culturally prescribed rules governing the expression and perception of faces. These findings are important because they suggest that people of different cultures use the same visual cues in judging others.   
  
In the association between perceived expression intensity and interpretation. Do people of different cultures agree on their assumptions about the relationship between expression and experience when judging others? Matsumoto, Kasri, and Kooken (1999) showed Japanese and American observers 56 expressions posed by Japanese and Caucasians. The observers judged what emotion the poser was expressing, and then the strength of both the external display and internal experience. Correlations between the two intensity ratings were conducted twice, first across observers separately for each expression, and second across expressions for each observer. Regardless of the computation, the correlations were high and positive for both cultures and for all expressions. Observers associated the strength of the external display with the presumed strength of the experience of that display, suggesting commonality in that linkage across culture. The link between the presence or absence of an expression with the underlying experience, and the intensity of both, is a topic of considerable importance in contemporary theories of emotion. Some authors have claimed that the linkage between expression and experience is unfounded (e.g., Russell, 1997; Fernandez-Dols, 1997). Others, however, have argued that expressions and experience are intimately linked with each other (but need not always be coupled) (Rosenberg & Ekman, 1994; see also the literature on the facial feedback hypothesis, reviewed by Matsumoto, 1987; Winton, 1986). The data from Matsumoto et al. (1997) clearly support notions of linkage.  
  
In secondary emotional recognition. Do people of different cultures agree on the secondary emotions portrayed in an expression? Research findings suggest the answer to this question is yes. Observers in Ekman et al.'s (1987) study judged not only which emotion was portrayed in the faces, but also the intensity of each of seven emotion categories. This task, therefore, allowed observers to report multiple emotions, or no emotion, instead of being forced to select an emotion to describe the face. While previous studies showed universality in the first mode of response, cultures may have differed in which emotion is next most prevalent. Analyses, however, supported cultural agreement. For every culture in Ekman et al.'s (1987) study, the secondary emotion for the disgust expressions was contempt, and for fear expressions surprise. For anger, the second mode varied depending on the photo, with disgust, surprise and contempt as the second responses. These findings were replicated by Matsumoto and Ekman (1989) and Biehl et al. (1997), suggesting pancultural agreement in the multiple meanings derived from universal faces. This agreement may exist because of overlap in the semantics of the emotion categories, antecedents and elicitors of emotion, or in the facial configurations themselves.   
  
In perceived expressivity. Do people of different cultures have similar stereotypes about the expressivity of other cultures? In one study (Pittam et al., 1995), Australian and Japanese subjects completed a questionnaire regarding overall level of expressivity of Australians and Japanese. Both Australian and Japanese subjects rated the Japanese as less expressive than the Australians. These findings indicated that people of different cultures believe that there are differences in intensity of emotion expression, and that they agree about who is more or less expressive.   
  
More Cultural Differences  
  
In emotion recognition. Are there ways in which cultures differ in their judgments of emotion? Actually, although the original universality research showed that subjects recognized emotions at well over chance rates, no study ever reported perfect cross-cultural agreement. Matsumoto (1992a), for example, compared Japanese and American judgments, and found that recognition rates ranged from 64% to 99%, which were consistent with earlier universality studies. Americans were better at recognizing anger, disgust, fear, and sadness than the Japanese, but accuracy rates did not differ for happiness or surprise.   
  
Cultural differences in recognition rates do not necessarily suggest non-universality, as has been suggested (Russell, 1994; see also critiques of Russell's thesis by Ekman, 1994, and Izard, 1994), and several studies have attempted to uncover possible explanations for these differences. Matsumoto (1992a) suggested that the differences in recognition rates are due to cultural differences in socially learned rules about how emotions could be recognized. Specifically, cultural differences between Japan and the US in the allowance for individuality or conformity may have contributed to their findings. In Japan, because of the emphasis on group harmony and conformity, emotions that threaten these would be discouraged. Therefore, a Japanese person would be careful to not show negative emotions, and have a tendency to not recognize these expressions in others. In contrast, the United States, a country that encourages individuality, would encourage both the expression and perception of negative emotions.  
  
Elsewhere (Matsumoto, 1996), I have suggested a mechanism similar to Ekman and Friesen's neurocultural theory of expression to describe how cultural similarities and differences in emotion perception or judgment can be obtained. This mechanism implies that judgments of emotion are affected by (1) a Facial Affect Recognition Program which is innate and universal (similar to Ekman and Friesen's Facial Affect Program), and (2) culture specific decoding rules that intensify, deintensify, mask, or qualify the perception (cf, Buck, 1984). I believe that this mechanism is as basic to emotion communication across cultures as Ekman and Friesen's original neurocultural theory, and we will revisit this issue several times below.  
  
Cultural differences in emotion recognition rates are related to stable and meaningful dimensions of cultural variability. Are cultural differences in emotion judgments related to interpretable dimensions of culture? To broaden the base of cultural dimensions that could explain cultural differences in agreement levels, Matsumoto (1989) selected recognition data from fifteen cultures reported in four studies, and ranked each culture on Hofstede's dimensions (1980). These included Power Distance (PD), the degree to which differences in power are maintained by culture; Uncertainty Avoidance (UA), the degree to which a culture develops institutions and rituals to deal with the anxiety created by uncertainty; Individualism (IN), the degree to which a culture encourages the sacrificing of individual goals for the goals of the group; and Masculinity (MA), the degree to which a culture emphasizes sex differences (Hofstede, 1980, 1983). The dimensions were then correlated with recognition accuracy levels. Individualism was positively correlated with the recognition of happiness and negatively with sadness, supporting the claim that Americans (individualistic culture) are better at recognizing negative emotions than Japanese (collectivistic culture).  
  
Differences in emotion perception as a function of culture were also found in a meta-analysis (Schimmack, 1996). Individualism was a better predictor of recognition of happiness than ethnicity (operationalized as Caucasian/non-Caucasian), supporting the notion that sociocultural dimensions account for differences in the perception of emotion. They also support the notion that people of different cultures learn ways of perception management via cultural decoding rules.   
  
Biehl et al. (1997) also reported cross-national differences in agreement (and in intensity ratings). These differences could not be adequately explained according to a Western/non-Western dichotomy, a division consistent with regional/country and racial/ethnic approaches to operationalizing culture. Rather, Biehl et al. discussed these differences in terms of possible underlying sociopsychological variables (i.e. those postulated by Hofstede 1980, 1983) and the dimensional approach to culture advanced by Matsumoto (1989, 1990). Theoretical explanations and further testing of the relationship between culture and recognition should define culture according to meaningful sociopsychological dimensions above and beyond country, region, race or ethnicity.  
  
In attributions of intensity. Are cultures similar or different in their judgments of the strength of an expression? Cross-cultural research has documented cultural differences in the intensity attributed to the facial expressions; Ekman et al.'s (1987) study of ten cultures was the first to do so. Although overall recognition data supported universality, Asians gave significantly lower intensity ratings on happiness, surprise, and fear. These data suggested that the judges were acting according to culturally learned rules about how to perceive expressions, especially given the fact that all posers were Caucasian. That is, it was possible that the Asians rated the Caucasian posers less intensely out of politeness or ignorance.  
  
To examine this notion, Matsumoto and Ekman developed a stimulus set comprised of Asian and Caucasian posers (Matsumoto & Ekman, 1988) and presented them to judges in the US and Japan (Matsumoto & Ekman, 1989). For all but one emotion, Americans rated the expressions more intensely than the Japanese, regardless of the race of the person being judged. Because the differences were not specific to the poser, Matsumoto and Ekman (1989) interpreted the differences as a function of cultural decoding rules.   
  
Matsumoto's (1989) study described earlier also investigated the relationship between Hofstede's (1980) dimensions of culture and emotion intensity ratings. Two important findings emerged. First, there was a negative correlation between PD and intensity ratings of anger, fear, and sadness, suggesting that cultures that emphasize status differences rate these emotions less intensely. Secondly, IN was positively correlated with intensity ratings of anger and fear; individualistic cultures gave higher ratings. These results suggest that understanding dimensions of culture could be the key to explaining cultural differences in the perception of negative emotions.  
  
In inferences about emotional experiences underlying facial expressions of emotion. Are people of different cultures similar or different in how strongly they believe a person is actually feeling an emotion when judging it in others? Although cultures differed in their judgments of external display, it was unclear as to whether cultures also differed in their inferences about underlying experience, and if so, whether these differences were similar to judgments of external display. Matsumoto, Kasri, and Kooken (1999) tested this notion by comparing American and Japanese judgments in which separate ratings were obtained for expression intensity and subjective experience. Americans rated external display more intensely than the Japanese, replicating previous findings. The Japanese, however, rated internal experience more intensely than the Americans. Within-culture analyses indicated no significant differences between the two ratings for the Japanese. Significant differences were found, however, for the Americans, who consistently rated external display more intensely than subjective experience. These findings were totally unexpected. Previously, we suggested that American-Japanese differences occurred because the Japanese suppressed their intensity ratings, as they do their expressions. However, it was the Americans who exaggerated their external display ratings relative to subjective experience, not the Japanese who suppressed. Not only are such findings wake-up calls to experienced cross-cultural researchers; they also force us to consider how culture produces these tendencies, and why.  
  
In recognition and intensity ratings  
  
Are the cultural differences obtained in previous cross-cultural research observable among different ethnic groups within the US? Matsumoto (1993) conducted a study that addressed this question, examining ethnic differences in affect intensity, emotion judgments, display rule attitudes, and self-reported emotional expression within the American culture. African-Americans perceived anger more intensely than Asian-Americans, and disgust more intensely than Caucasian- and Asian-Americans; Hispanic-Americans perceived Caucasian faces more intensely than did Caucasian-and Asian-Americans; and African-Americans perceived female expressions more intensely than did Asian-Americans. These findings compel us to reevaluate the way we conceptualize culture, and stress the importance of psychologically meaningful dimensions of culture that are independent of ethnicity or country. Most cross-cultural research assumes that a person living in a country is a member of its primary culture. Finding differences within an American sample (which is nearly always the comparison group in cross-cultural studies) clearly demonstrates otherwise and urges us to consider meaningful psychological dimensions (e.g., individualism-collectivism, status differentiation) to explain cultural and individual differences in emotion expression and perception.   
  
In attributions of personality based on smiles  
  
Do people of different cultures make different judgments of personality based on facial expressions? For example, the smile is a common signal for greeting, acknowledgment, or for showing acceptance. It is also employed to mask emotions, and cultures may differ in the use of smiles for this purpose. This appeared to be the case in Friesen's (1972) study in which Japanese and American men watched disgusting video clips with an experimenter in the room with them. The Japanese men used smiles to cover up their negative expressions much more often than the American men (Ekman, 1972, Friesen, 1972).  
  
To investigate further the meaning of those differences, Matsumoto and Kudoh (1993) obtained ratings from Japanese and Americans on smiling versus non-smiling (i.e., neutral) faces with regard to intelligence, attractiveness, and sociability. Americans rated smiling faces as more intelligent than neutral faces; the Japanese, however, did not. Americans and Japanese both found smiling faces more sociable than neutral faces, but for the Americans the difference was to a greater degree. These differences suggest that cultural display rules cause Japanese and Americans to attribute different meanings to the smile, and serve as a good explanation for perceived major differences in communication styles across cultures.  
  
**Speculations About Research on Culture and Emotion in the Next 15 Years**  
  
The next fifteen years will be exciting for research on culture and emotion. Interesting programs have sprung up not only in this country but around the world, and in all disciplines of psychology. New technologies for mapping culture as a psychological construct on the individual level are being developed, as well as ways to measure precisely moment-to-moment changes in our brains and bodies when we feel or judge emotion. All of these promise the most exciting decade or two of research in the history of studies on culture and emotion. Below, I review four areas that I believe research on this topic will challenge. These are not only my guesses; they are my hopes for where that research could and should go.  
  
The Integration of Culture, Psychology, and Biology  
  
New and interesting research on emotion is currently being conducted on the physiological, cerebral, and neuroendocrinological correlates of emotion processes. Although not directly related to culture per se, they are exciting because of the possibility of branching across the various sub-disciplines within emotion research to integrate methods and concepts, producing studies that link culture as a macro-social construct with underlying biological processes. I outline three such examples below.  
  
Culture and the physiology of emotion. In history, there has been some controversy about the relationship between physiology and emotion. Early writers (e.g., James, 1892) suggested that recognition and awareness of our bodily reactions is what we then label an emotion. Others suggested that some sort of physiological arousal is necessary for emotion, but the exact labeling of the emotion is dependent on the cues available to us in the environment (e.g., Schachter & Singer, 1962). Yet others have suggested that no physiology at all is necessary for emotion (e.g., Mandler, 1984).   
  
Despite these early controversies, new studies have shown that our physiological reactions are indeed specific to each of the emotions that are universal (Ekman, Levenson, & Friesen, 1983). These findings include responses of both the autonomic nervous system (ANS) and the central nervous system (CNS). We do not know, however, if these responses are universal. Research may uncover how and why culture influences physiology, hopefully linking physiology with culture as an individual-level as well as social-level construct, specifying the exact dimension of culture that influences physiology rather than relying on national or ethnic/racial methods of classifying participants. Also, these studies will hopefully incorporate neuroendocrine function, examining the universality of hormonal changes in relation to emotion. Some studies have already paved the way for this research, such as Scherer's work on self-reported physiological sensations (Scherer, Wallbott, & Summerfield, 1983), and Levenson's (Tsai & Levenson, 1997) work on Chinese v. European American participants.   
  
The representation of cultural display rules in the brain. Although the existence of cultural display rules is well accepted in contemporary psychology, surprisingly little is known about its exact nature, either psychologically or physiologically. As technology that allows moment-to-moment measurement of brain activity develops, we can examine how these rules are represented in the brain. While certain brain areas are sure to store the verbal rules of display semantically (e.g., big boys don't cry), it is unclear as to how these propositions are accessed during an actual emotion episode. My hunch is that there may be cross-cultural commonality in the brain sites that store display rule propositions, as well as sites in the limbic system that drive the biologically innate functions of arousal and expression. But, I suspect that there are cultural differences in how these areas are accessed and the degree of intercommunication across areas. The ability to test this hypothesis, however, requires that we are able to map brain functioning and intra-brain communication among multiple brain sites in less-than-a-second intervals, a technology currently unavailable.   
  
The representation of emotion perception in the brain. We also have little knowledge about how universal and culture specific aspects of emotion judgment are represented in the brain. Some brain areas are specific to face recognition and processing, but there is no research examining what areas of the brain are activated when emotions are judged. That facial expressions of emotion are universally recognized suggests that the brain areas involved in recognition processes are pancultural. Specific brain areas and intra-brain functioning, however, may be different for different emotions and judgment processes (e.g., judgments of display or experience intensity). Again, limitations in our ability to measure brain activity make this line of research impossible today, but a realization soon.  
  
Culture, Context, and Emotion  
  
One frontier facing emotion research concerns the effect of context on experiencing, expressing, and perceiving emotions, and the influence of culture on the relationship between context and emotion. To be sure, much of the emphasis in the field in the last 30 years was on the establishment of universality; research documenting differences has only appeared in the last 10 or 15 years. As these increase, they beg questions concerning the role of context in shaping emotion, and the influence of culture in this process. How does whom you are with, where you are, what is happening, when and why it is occurring, affect your emotional experiences, expressions, and judgments? If you are angry at your boss, does that affect how you display your emotions when you are at work, as opposed to when you are angry with your spouse? Do these parameters of context have the same meaning for each of the different emotions? And, do these context parameters have different effects, meanings, and influence on the process of emotion in different cultures? These are obviously important questions not only for theories of emotion and culture in psychology, but also for practical and applied purposes. Cross-cultural research, however, is yet to systematically explore these important questions. Below I outline two potential areas of study, of many, that challenge the field in the next two decades.  
  
Context effects on judgments of emotion. A number of studies has examined the effect of context on emotion judgment, some manipulating the context of the observer (e.g., Fernandez-Dols, Wallbott, & Sanchez, 1991; Munn, 1940), others manipulating the context of the poser (e.g., Carroll & Russell, 1996; Knudsen & Muzekari, 1983). While both areas are valid, studies of the latter are more worthwhile to the field. To my knowledge, however, there has been no study that has examined all the possible parameters of context - the who, what, when, where, and why of emotion - and their effects on elicitation, expression, or perception. Research needs to manipulate experimentally all of these simultaneously in a factorial design to investigate their effects on judgments. This research needs to include expressions of varying type and intensity, and multiple judgment options. What little research that exists in this area to date falls sorely short of these ideals. These studies also need to examine how the effects of context differ across cultures. Such research will have important implications to our understanding of intercultural communication and conflict.  
  
Folk psychology and display rules. As mentioned above, surprisingly little is known about the nature of display rules. Display rules can be theoretically understood via folk psychology - as a set of propositions and beliefs that are integrated to produce behavioral outcomes. Culture supposedly supplies the propositions and beliefs, and the nature of the integration. Future research can focus on uncovering the nature of these propositions and beliefs, and how the integration works. These propositions will need to account for the variety of contexts within which emotion can occur. Constructs distilled from these propositions in specific contexts that are generalizable across contexts may be considered cultural display rule values that guide our actions and behaviors. Much work already exists in terms of the appraisal processes involved in emotion arousal, and these need to be incorporated into folk psychological research on display rules; they comprise much of the semantic information necessary for action on the propositions to occur. Folk psychological theories that account for cultural display rules in one culture subsequently need to be studied across cultures. My hunch is that there is pancultural similarity in the structure of the semantic engine that drives display rules, and in much of the processes in which this engine engages to act upon propositions and beliefs to produce behaviors. Cultures will probably differ, however, in the nature of the propositions and beliefs.  
  
Culture and the Social Significance of Emotion  
  
Emotions have social as well as personal meaning, and we need to know what role emotion plays in creating, maintaining, or destroying interpersonal relationships, and how these processes are similar or different across cultures. Kemper (1978) suggested that emotions could be classified into two types - socially integrating emotions and socially differentiating emotions, the former helping people stay together, the latter breaking bonds among people. Kitayama, Markus, and Matsumoto (1995) proposed a similar distinction, differentiating between socially engaged and disengaged types, the former enhancing interdependence with others, the latter enhancing independence from others. Kitayama et al. (1995) demonstrated that such distinctions can be useful in describing cultural differences in the emotional lives of people of different cultural backgrounds. In their study, people in the individualistic American culture experienced socially disengaged emotions more frequently, while people of a more collectivistic Japanese culture experienced socially engaged emotions more frequently.   
  
Future research needs to explore these, and other, possible social roles of emotion. While previous approaches, however, have classified emotions into mutually exclusive dichotomies, I believe that emotions are complex enough that they can serve both integrating and differentiating, socially engaging as well as disengaging, roles depending on social context. For example, sadness felt at the death of a loved one may bond grieving parties together. Sadness that occurs because of a moral transgression of a friend, however, may serve to drive people apart. The same could be said of anger, happiness, and all other emotions in our affective spectrum. If this is true, future research must investigate not which emotions are integrating and which are differentiating, but instead the parameters and contexts that allow an emotion to be both integrating and differentiating, and why. I speculate that there would be cross-cultural similarities in the cultural rules regarding the social roles of emotion, but that there would be cultural differences in exactly which emotions played those roles. Cross-cultural research focusing entirely on emotions as the unit of analysis may not be as fruitful as focusing on the social functions they play.  
  
Culture and Emotion in Interaction  
  
As we learn more about the social and personal meanings of emotion, we gain valuable information about the role of emotion in intercultural and interpersonal communication episodes, and the influence of culture on this process. Many writers (e.g., Bennett, 1993; Gudykunst, Matsumoto, Ting-Toomey, Nishida, Kim, & Heyman, 1996) have suggested that emotion plays a key role in intercultural communication, focusing especially on anxiety attendant to the uncertainty in intercultural communication, and the fear, anger, and distress that often occurs in intercultural misunderstandings. Nonverbal aspects of communication far outweigh the verbal in communication, and much of the nonverbal information is emotional. Indeed, successful communication of emotions may be considered a necessary (and sometimes sufficient?) ingredient to successful intercultural communication. If true, future research on intercultural communication must focus more on nonverbal emotions. In particular, the regulation of emotional reactions to unintended gaffes may be a gateway to being able to think critically about events and harboring the openness and flexibility to accept rival hypotheses about the causes of these offenses. The relationship between emotions, values, and reinforcement of self also needs further exploration. I speculate that people of different cultures are similar in the processes underlying intercultural communication, but differ in the role of specific emotions within the process.  
  
**Speculations About Research in Cross-cultural Psychology in the Next 15 Years**  
  
Cultural differences challenge mainstream theoretical notions about the nature of people and force us to rethink our basic theories of personality, perception, cognition, emotion, development, social psychology, and the like, in fundamental and profound ways. We are on the verge of witnessing encyclopedic-type compendia of cultural differences in almost all subfields of psychology with ample evidence from many cultures of how truths of mainstream Americans are not necessarily applicable to the rest of the world. This overwhelming evidence brings with them an obligation for us to make some sense of it all. The biggest challenge facing cross-cultural psychology today and in the future is not in the continued compilation of cultural differences in various facets of psychology. Instead, it is in the development of theoretical models and conceptual frameworks that can explain how cultures are both similar and different, and why, and in the integration of these frameworks into mainstream academic psychology. In short, we need to stop and think about what it all means.  
  
The Development of Theoretical Models To Explain Cultural Similarities and Differences  
  
Fortunately, a small but growing number of cross-cultural psychologists has been interested in discovering how cultures come to create similarities and differences and why. Many have turned their efforts to studying the developmental processes underlying enculturation - the process of learning the rules, values, attitudes, beliefs, behaviors, and opinions of your first, original culture - and have made important inroads to understanding how we acquire culture and how it influences our lives (see reviews by Gardiner, Mutter, & Kosmitzki, 1998; Matsumoto, 1999a). Another important inroad concerns work on the relationship between culture and self-concept as a mediator of psychological differences across cultures (see Matsumoto, 1999b, for a review). A third avenue has been the use of meaningful dimensions of cultural variability such as Individualism-collectivism (IC) to predict and explain cultural similarities and differences observed in research and observation.  
  
In fact, much emphasis has been given recently to IC. Individualistic cultures foster a unique sense of self and autonomy, clearly delineating boundaries between oneself and others, encouraging the needs, wishes, desires of individuals over group or collective concerns. Collectivistic cultures, however, foster needs, wishes, and desires of ingroups over those of individuals, valuing harmony, cooperation, cohesion, and conformity.   
  
IC has been used by many to predict and explain cultural differences in a wide variety of psychological constructs (see review by Triandis, 1995). This construct is a major gain for cross-cultural research and thinking because it allows authors to go beyond nationality, race, or ethnicity in predicting and explaining differences, and instead focuses on functional psychological predictions and interpretations of data. Constructs like IC give researchers and theoreticians alike a basis by which they can understand the psychological impact of culture on both the macro-social as well as individual levels. The study reviewed earlier linking cultural differences in judgments of emotion with Hofstede's (1980) dimensions of cultural variability is an example of such research (Matsumoto, 1989).  
  
Recent advances in cross-cultural methods include the development of ways to measure IC tendencies on the individual level. Triandis (Triandis, Leung, Villareal, & Clack, 1985) refers to these tendencies as idiocentrism and allocentrism, and their measurement is a major plus for research. They allow researchers to empirically ascertain that their samples differ on this construct, providing an important methodological check and eliminating reliance on anecdotes, impressions, or stereotype when interpreting findings. They also allow researchers to assess numerically the degree of within-culture variability on this important construct. Using this index, researchers can determine how much of the difference between the groups are attributable to individual level differences in IC.   
  
Say, for example, that a researcher intends to compare two cultures where all participants completed an individual level measurement of IC. Group differences on the dependent variable could be tested through normal procedures (e.g., t-test, ANOVA, chi-square, etc.). In addition, the relationship between IC and the dependent variable could be assessed through correlational procedures. If correlations existed, their influence on the group differences obtained earlier could be tested using multiple regression or analysis of covariance (ANACOVA). The degree of contribution of IC to the group differences could be computed by comparing effect sizes of the group between the original and ANACOVA analyses.  
  
There are many choices today as to the method of IC measurement. The leading methods were developed by Triandis and his colleagues (see appendix in Triandis, 1995, for review). Recent approaches involve a multi-method approach assessing IC tendencies across attitudes, values, opinions, and beliefs. Singelis, Triandis, Bhawuk, and Gelfand (1995) have also developed measurement procedures to assess horizontal and vertical IC. Hui (1988) developed a context-specific method of measurement, while Yamaguchi (1994) has developed more specific measures of collectivism. We have also developed a measure of IC tendencies in specific contexts based on social interaction (Matsumoto et al., 1997).   
  
The field is embracing these measures in cross-cultural comparisons. These developments are a major plus, as they relegate culture to functional psychology, giving us a basis to understand how and why similarities and differences occur. They allow for valuable methodological checks in our research, and for statistical assessments of the contribution of measured culture to observed differences. The approach, therefore, is unique, promising, and innovative. However, I do want to mention the importance of another cultural dimension - power distance or status differentiation. The field has been almost too preoccupied with IC to the exclusion of other important dimensions. To be sure, no one dimension can capture "culture" as we know it. Yet, how a culture deals with power and status differences is just as important, if not more so, than IC. Future endeavors should include the development of individual level measures of this important cultural construct as well, and integrate it into cross-cultural research.   
  
The Integration of Cross-cultural Theories into Mainstream Academic Psychology  
  
Research on bilingualism has demonstrated that bilinguals seem to access two cultural frames of references, depending on which language they speak (see Matsumoto, 1999a for a review of this literature). Bilinguals have reported different personalities, judge emotions differently, appraise events and the environment around them differently, and attribute the causes of events differently depending on the language used when performing these tasks. Not only do multiple cultural frameworks exist in their minds, but bilinguals also have the added ability to monitor which cultural framework they should engage in depending on the social context. Thus, they have a meta-cognitive process that allows them to engage with their "multiple personalities" in a healthy and constructive way. This ability is related to the development of intercultural sensitivity (e.g., see Bennett, 1993).   
  
Most Americans are monolingual; yet, most of the rest of the world is multilingual. This suggests that the information obtained from research with Americans, and theories derived from Americans by Americans, may be based on a theory of mind that is fundamentally different than the rest of the world. We may not think twice about whether those theories make sense to us or not, because they are bounded within the same cultural framework as ourselves. It is only when we look outside of ourselves when we can experience, understand, and appreciate, those boundaries.  
  
Mainstream psychology, therefore, has a lot of catching up to do. The assimilation of cross-cultural findings and theories into mainstream psychology suggests a fundamental revision in ways of thinking of self and personality that have important consequences for all areas of psychology. No information or ideas that we have currently need to be thrown out. They just need to be placed within the proper context to be understood and applicable for the most appropriate people. Cross-cultural work needs to be assimilated into mainstream psychology, and mainstream psychology needs to accommodate to these ideas. The end product will be qualitatively different than the psychology we are currently accustomed.   
  
Where do we take up the challenge? The fight, if you will, is not in the laboratory or field. It is, instead, in ourselves. The greatest challenge facing cross-cultural psychology now is to think less about producing finding after finding of cultural differences, and to think more about ways of integrating them collectively into a cohesive, comprehensive theory incorporating mainstream as well as cross-cultural psychology. This is a challenge also for all the subfields of psychology, which are splintered fragments of a larger collective. While the need for specificity and fragmentation is understandable, so is the need for integration and synthesis. This requires that we look outside of psychology to "put the pieces back together;" otherwise, we never envision the whole, only parts of the whole. This integration may require us to consult with anthropology, sociology, business, medicine, and other disciplines. In developing theoretical models to integrate cultural similarities and differences, we need to go outside of psychology to know more about psychology. This new approach need not be forced, nor need the revisions be horrendously traumatic. Little steps will turn to big steps, and big steps will be a journey. In the end, it is the walking, not the destination, that is the desired end. Are cross-cultural psychologists up to the task? Are psychologists up to the task?  
  
**Advice for Those Breaking Into this Field**  
  
I have four suggestions for people wanting to break into psychology in general, and cross-cultural psychology in particular. Other writers will have many other excellent advices for those crazy enough to want to do so, but these are the kinds of things that have helped me along in my career.  
  
1. Get Grounded in Academic Psychology  
Get a solid grounding in the methods of contemporary academic psychology. Take as many classes on research methods and statistics as you can. Challenge instructors of your content courses about methods and statistics. Work in a research laboratory as an apprentice with someone who is will to take you under his or her wing and show you the ropes. Volunteer. Do a lot of research, make a lot of mistakes, and take time to think a lot on the way. Polish your skills at not only doing research, but learning how to think logically, rationally, and critically. Learn how to use a computer and analyze your own data. Be able to do everything in a study from start to finish, and do it well.  
  
2. Get Exposed to the Variety of Human Behavior  
Get a lot of life experience. Have friends. Take time for love and relationships. Work in a clinical setting. Experience people with psychopathology. Experience the range of human emotions - from the penultimate joys of accomplishment to the depths of anguish and despair of loss. As a psychologist, understand people from an emotional standpoint, not only from a cognitive/research standpoint. You can't learn about the taste of strawberries by reading about it in a book.  
  
3. Get Experience in an Unfamiliar Culture  
Travel, but not just as a tourist. Learn about the customs, ways, and lifestyles of different people. Learn how they think, experience emotions, and experience life. Learn another language, and get to the point where you are fluent in it. Learn to accept, appreciate, and respect cultural diversity. Become multicultural yourself. It is an entirely different plane of being.  
  
4. Put it all Together  
Finally, put it all together. Take your life experiences seeing the range of human behavior, your knowledge and appreciation of culture, and the academic skills you have learned, and integrate them into a meaningful career that teaches the rest of us something that we don't already know. Make the world a better place. The next frontier for psychology is the culture, and the next generation of psychologists armed with these skills will be those who are ready for that journey.   
  
Good luck in that journey.

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[Flourish Line]

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# Chapter 6 ****Dr. Jekyll Meets Mr. Hyde: Two Faces of Research on Intelligence and Cognition****

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In the Robert Louis Stevenson novel, Strange Case of Dr. Jekyll and Mr. Hyde, written over one hundred years ago in 1886, a basically well-meaning, well-mannered doctor, Dr. Jekyll, makes a discovery that enables him temporarily to transform himself into a hideous monster of a man, Mr. Hyde. At first, the discovery is merely a curiosity. But gradually the alter ego, Hyde, begins to dominate Dr. Jekyll, until, of course, tragedy strikes. Eventually, Mr. Hyde takes over. Early death puts an end simultaneously to both Jekyll and Hyde, as it must, because the two individuals share but a single body.

The field of intelligence has many of the characteristics of a Jekyll and Hyde relationship. It has been and continues to be, in many respects, well-meaning and well-mannered, offering the possibility of doing good for science and for the public. But the field also has an ugly side, which continually seems to be trying to dominate its good side. The question remains as to whether one side will ultimately dominate the other, or whether, as is more likely, the two sides will continue to live together in an uneasy truce as time passes by.

The field of intelligence has had its Jekyll and Hyde sides for me personally, which is why I entered the field in the first place. I became interested in intelligence when, as an elementary-school student, I did poorly on IQ tests. In fact, I did so poorly that in sixth grade I was sent back to a fifth-grade classroom to retake the fifth-grade intelligence test. In a sense, my professional career has been an attempt to understand and come to terms with my own early failures on these tests!

It is important to realize that this Jekyll-and-Hyde dualism is not limited to the field of intelligence. Consider physics: Is nuclear power good or bad? Potentially, it is either or both. Or try biology: Is gene splicing good or bad? It can be either, or both. In field after field, there is the potential for good or bad. What decides which way things go is not the knowledge base, but the people who use it for wise or unwise ends (Sternberg, 1998). How knowledge is used is always a choice. Thus, students need not only acquire knowledge, but the wisdom to use the knowledge for good ends.

**A Brief History Lesson**

Thinking in the field of intelligence dates back at least to ancient philosophers such as Plato and Aristotle. For example, in Book 5 of the Republic, Socrates asks Glaucon whether he is not in agreement that a gifted individual is one who easily acquires knowledge and tends to remember it, in contrast to the less gifted individual who acquires knowledge only with great difficulty, and then tends to forget it. Glaucon, of course, agrees. Who can disagree with Socrates, other than those of his contemporaries who put him to death? Aristotle, in *Posterior Analytics Book I*, conceives of intelligence in terms of "quick wit," which is the notion of hitting on ideas instantly. Such ancient thinking was rather harmless, but some more modern thinking has not been.

**What is Intelligence?**

The issue of the nature of intelligence was important in ancient Greece and continues to form today a fundamental issue in the psychology of intelligence. What makes the issue so important?

Importance of Issue

First, we use many different kinds of tests to measure intelligence. But before we measure intelligence, certainly we ought to seriously consider just what it is we are measuring. Otherwise, we run the risk of measuring the wrong thing. If we are going to use these tests to make high-stakes decisions, such as about tracking in schools or admission to colleges, universities, and professional schools, we especially should make sure we are measuring the right thing. This problem is not limited to intelligence. If we want, say, to sort children or adults on creativity, "good personality," or "good values," we also need a sense of just what we mean by these things before we blindly sort by them.

Second, when we start measuring something before we know what it is, we run the proverbial risk of putting the cart before the horse. Instead of ideas driving measurement, measurement ends up driving ideas. We may end up manipulating our theories to fit our measurements, rather than the other way around. Most likely, we will measure what is easiest to measure, and then end up creating theories that justify these measurements after the fact.

Modern thinking about intelligence is usually dated back to Sir Francis Galton (1883), who proposed that intelligence could be understood in terms of the qualities of energy and sensitivity. Galton had much that was positive to say about those who were well endowed with intelligence, but much that was negative to say about individuals and groups of individuals in what he believed to be the lower ranges of intelligence. Galton thus exhibited early the Mr. Hyde lurking in the background of work in intelligence. For example, Galton believed that

The discriminative facility of idiots is curiously low; they hardly distinguish between heat and cold, and their sense of pain is so obtuse that some of the more idiotic seem hardly to know what it is. In their dull lives, such pain as can be excited in them may literally be accepted with a welcome surprise. (p. 28)

Given that Galton believed that idiots were ones who did poorly on psychophysical tests of visual, auditory, haptic, and other forms of acuity and discrimination, one shudders to think of the implications of Galton's views for those who were on the lower end of what Gardner (1983) has more recently dubbed "bodily-kinesthetic intelligence." You want to do them a favor? Give them some pain as a gift that will excite in them a welcome surprise. In this and other writings, Galton made no effort to hide the Hyde side. Fortunately, at least for a time, his views more or less died.

Binet and Simon (1916) devised a test to measure intelligence that was based not on psychophysical acuity and discrimination, but on judgment. Their test had a distinctly Jekyll-like character to it. Their purpose was to determine which students would learn well in school. They also were trying to save children who were behavior problems in school from being relegated to special classes or schools for the mentally retarded. At the time, teachers did not clearly distinguish between behavioral and mental problems, and often the teachers would assume that bad behavior was tantamount to mental retardation. Such an assumption had the Hyde-like advantage of giving teachers a quick way to get rid of students they didn't want in their classes. Thus, the intelligence tests of Binet and Simon were designed to protect students, in Jekyll-like fashion, from Hyde-like decisions that could ruin their careers and their lives.

The problem is that the two faces of selection and retention are so easily reversed. Just as tests can be used to preserve talent, so can they be used to rid society or other groups of individuals who, for one reason or another, come to be viewed as undesirables. Indeed, some people believe that intelligence tests and related tests have come to be used in just such a way: They can provide a pseudo-scientific smoke screen for rejecting people from the mainstream of society whom the society wants to reject for nonscientific reasons (Gould, 1981). Instead of rejecting the people on the basis of their ethnic or national or other group, one creates a test that appears to give an objective reason for their exclusion.

Gould's (1981) recounting of events is sometimes in devoted service of his message, and so one needs to exert caution in accepting some of his conclusions. But there can be little doubt that, de facto, tests have tended to favor certain groups over others, for whatever reason (Sternberg, 1996). This fact illustrates an additional complexity in the study of intelligence as applied to society. When certain groups do more poorly on intelligence tests than others, there are those who believe that the difference reflects the Dr. Jekylls of psychology who create the kind of fair meritocracy that our country should be, and there are others who believe that the difference reflects the Dr. Hydes of psychology who legitimize institutional discrimination against the unfortunate. In other words, unlike in the novel, it is not always totally clear who is Jekyll and who is Hyde.

Although a major conflict regarding testing was between Galton and Binet, a main conflict regarding theory was between Charles Spearman (1904) and Louis Thurstone (1938). Spearman believed that performance of cognitive tasks requires two kinds of abilities, a general ability (g) common to all of the tasks, and specific abilities each relevant to just a single task. Thurstone, in contrast, believed that no single ability existed, but rather, that there are multiple primary mental abilities, such as verbal-comprehension ability, numerical ability, and spatial ability. The conflict between unitary and multiple conceptions of intelligence has carried down even to the present day.

**Contemporary Theories of Intelligence**

Today, the question of what intelligence is remains as hot as it was in the days of the differences between the views of Galton and Binet (Sternberg, 2000). Some investigators are actively attempting to expand our notions of intelligence. Two examples are the work of Howard Gardner and of myself.

Gardner (1983, 1993, 1999) has proposed a theory of multiple intelligences according to which intelligence comprises not just a single entity, but multiple ones, including linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist intelligences. For example, when you write a paper, you are using primarily linguistic intelligence. When you solve calculus or other mathematical problems, you are using primarily logical-mathematical intelligence. When you try to figure out why you procrastinate in your work, you are using intrapersonal intelligence. Gardner has also speculated as to the existence of existential and spiritual intelligences. According to Gardner, each of these multiple intelligences is more or less independent of the others. Conventional tests of intelligence measure primarily linguistic and logical-mathematical intelligences, and to some extent spatial intelligence, but ignore the other intelligences. Moreover, even the intelligences that are measured are assessed in ways that are very limited, such as through fairly trivial multiple-choice kinds of questions. Thus, these tests can at best give only a limited picture of what children and even adults can do.

I, too, believe that conventional tests give only a limited picture of what people can do, although my beliefs originate in a somewhat different way. In my own work (Sternberg, 1985a, 1988, 1996, 1999b), I have suggested a triarchic theory of intelligence, according to which there are three major aspects of intelligence: analytical, creative, and practical. Conventional tests of intelligence measure primarily analytical abilities, and all but ignore creative and practical abilities. The result is that people who might have very important contributions to make to society may be derailed early in their lives because they do not do well on conventional tests.

I sometimes refer to my own theory as the theory of }successful intelligence," because I place emphasis not just on predicting success in schoolwork, but also, predicting success in life. Intelligence tests were originally created to predict success in school, but there is much more to life than school, of course. The question then arises as to what, exactly, success is. According to my theory, success is what you believe it is, so long as you are defining it in a prosocial way. So it success could be life as a teacher for one person, as a carpenter for another. But being an axe-murderer does not count because it is antisocial rather than prosocial.

Gardner's and my own theories are sometimes presented as though they are "alternative" theories of intelligence. Indeed, in almost all of the introductory-psychology texts, they are presented in this way. But in fact, they deal with somewhat different aspects of intelligence. Gardner's theory deals with domains of intelligence, my own with processes within (or between) domains. Thus, one can think analytically, creatively, or practically, for example, in the linguistic (or any other) domain, as when one analyzes a work of literature (analytic), writes a poem (creative), or discusses the relevance of the travails of a literary character for one's own life (practical). It is thus important in psychology to realize that views that are presented as being in conflict with each other often only have the appearance of being in conflict. We must examine them rather carefully to determine whether the conflict is real or apparent.

Relation to General Issues in Cognitive Psychology

The issue of what intelligence is may seem remote from the concerns of cognitive psychology, in general, but nothing could be further from the case. There are several reasons why this is so.

First, many theorists view intelligence as the central set of abilities that organizes all cognitive functions (see, e.g., Anderson, 1983; Newell 1990; Schank, 1980; Sternberg, 1977, 1996, 1997). Thus, an understanding of what intelligence is would help us understand how all of cognition is organized and effectively brought to bear upon the tasks we face in our daily lives.

Second, the tension between Galton, on the one hand, and Binet, on the other, is a tension that has existed in cognitive psychology since its inception, and that shows no sign of abating. This tension is between those who emphasize the sensory and perceptual functioning characteristic of bottom-up processing (as did Galton), and those who emphasize the judgmental and comprehension characteristic of top-down processing, (as did Binet). In bottom-up processing, one starts information processing at the level of elementary sensory processes, and then builds up to more complex cognitive processes, such as reasoning. In top-down processing, one starts information processing at a complex level, and then works down to more basic processes. The tension between the two kinds of processes can be seen in many areas of cognition. In the field of visual perception, for example, some theorists emphasize bottom-up perceptual processes (e.g., Gibson, 1979) whereas others emphasize top-down perceptual processes (e.g., Rock, 1983). A similar issue arises in speech perception, where some theories are more bottom-up (Massaro, 1987) and others are more top-down (Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967; Liberman & Mattingly, 1985). Theories of reading can also emphasize bottom-up or top-down processing, although modern theories tend to seek a balance between the two emphases (e.g., McClelland & Rumelhart, 1981).

Third, the nature of intelligence raises questions about the extent to which the mind is modular, a key question in contemporary cognitive psychology. Modularity refers to the minds being divided into multiple systems of processing information that are largely independent of each other. For example, is the intelligence you use to do your schoolwork in a different module, or functional part of the brain, than is the intelligence you use to decide whether you like someone? In a much-cited book, Fodor (1983) argued that the mind is largely modular, except for higher intellectual processes. Gardner (1983), however, argued that even the higher intellectual processes are modular. The problem for a theory such as Gardner's, however, is adequately accounting for what Spearman (1904) called the positive manifold--the tendency for tests of higher level intellectual abilities all to intercorrelate positively with each other. At the very least, a hierarchical structure that somehow integrates the lower order modules seems to be necessary to account for these intercorrelations (Carroll, 1993). Gardners theory, proposed more than 15 years ago, still has not generated even a single empirical test. Until it does, the theory must be viewed as intriguing but, from a scientific viewpoint, as highly speculative. In particular, research is needed to know whether the intelligences Gardner has proposed actually exist, are truly independent, and are measurable in reliable and valid ways.

Finally, it is not clear that there even is any one answer to what intelligence is. A cognitive psychologist, Ulrich Neisser (1974), pointed out that intelligence may be best conceived of as a prototype (Rosch, 1978), or as a fuzzy concept. According to this view, we have conceptions of what characteristic features of intelligence might be but there are no necessary features that categorically distinguish intelligence from everything else. We have invented the concept to make sense of differences we see among people in everyday life. Different cultures may have different prototypes for intelligence (Sternberg & Kaufman, 1998).

Relation of the Nature of Intelligence to Everyday Life

The question of whether intelligence comprises a more general ability (Jensen, 1998), perhaps with subsidiary abilities embedded hierarchically beneath it (Carroll, 1993; Cattell, 1971) or instead is modular with no general factor (or at least none of importance; Gardner, 1983; Thurstone, 1938) is not one just of theoretical importance. It has implications for our everyday lives. If intelligence comprises primarily just one ability, then a single IQ (intelligence quotient) score can tell us pretty much what we need to know about a person's intellectual abilities. If intelligence comprises multiple abilities, however, any single number (or two numbers, such as verbal and mathematics scores) will leave us with an inadequate account of a person's profile of intellectual abilities. The fight among theorists, therefore, has implications for the practical realm. People who emphasize multiple abilities may well see people who emphasize just a single ability as reactionary Mr. Hydes who allow their right-wing sociopolitical ideology to corrupt their thinking because of their desire to suppress individuals--often members of minority groups--whose talents are not well captured by a single number. People who emphasize a single ability, however, may see the multiple-ability theorists as radical Mr. Hydes who allow their left-wing sociopolitical ideology to corrupt the integrity of their scientific thinking.

It is important to realize that the same general principle potentially applies to all thinking. Arguments about the ethical justifiability of abortion and capital punishment go on and on, for example, and do not get resolved on the basis of intellectual discourse. Ideology creeps into these arguments, as surely as it creeps into arguments about psychological issues. We all always need to be aware of how our ideology unconsciously shapes our thinking.

Of course, questions about what intelligence is are not the only ones at the forefront of modern psychological investigations. Another key question is how intelligence, whatever it is, should be investigated.

**How Should Intelligence be Investigated?**

It would seem as though how one would go about investigating something--say, intelligence--would depend on just what the thing is that one was investigating. Thus, the answer to the question of how intelligence should be investigated would seem to depend on what intelligence is, much as the question of how, say, a crime should be investigated would depend on what the crime is. One would not investigate a murder in quite the same way as one would investigate a land swindle. So how should intelligence be investigated?

Importance of Issue

Historically, the question of methods of investigation has, if anything, preceded rather than followed the question of what is being investigated in the field of intelligence. Methods have become available, and they have driven, to a large extent, how intelligence is conceived (see Sternberg, 1990). Although methods can certainly be helpful in driving substantive research (Gigerenzer, 1991), they can also lead to the situation where the methods, rather than the construct, drive research. In other words, the cart is placed before the horse.

To a large extent, how one investigates something can determine what one can find out about that something. For example, if one is investigating a murder, reliance on eyewitness testimony may suggest a suspect different from the suspect suggested by DNA analysis. Neither kind of testimony is infallible: Recall of eyewitnesses is often quite poor (Loftus, 1975; Loftus & Ketcham, 1991), and evidence with DNA in it may be planted at the scene of a crime to point the figure toward a targeted suspect. Similarly no one method for studying intelligence or anything else is infallible: Ideally, we want to use converging operations that help us understand a construct as a result of multiple kinds of analysis (Garner, Hake, & Eriksen, 1956). The importance of method, then, is that it may in large part determine the outcome; but the users of the method may not recognize the contribution of method to the determination of that outcome. This issue is not just hypothetical. Multiple-choice tests tend to correlate with each other, but they do not correlate as well with essay and other performance-based tests. Which kind of test is used has a major effect on how a person's intelligence is evaluated (Sternberg, 1996; Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996). Thus, who is identified as intelligent may depend in large part upon the method used to identify different levels of intelligence.

Contemporary Methods for Studying Intelligence

Many different methods have been used to investigate intelligence (Sternberg, 1982, 1990, 2000), but here I will concentrate on just two methodologies--factor analysis, which has its origins in differential psychology (Spearman, 1904), and cognitive analysis, which has its origins in experimental psychology (e.g., Donders, 1868).

The differential approach. Factor analysis is a technique that takes correlations--which represent patterns of individual differences shared across tests or other measurements--and attempts to find the latent mental (or other) structures that underlie, or give rise to these correlations. So, for example, if one were to give tests of vocabulary, verbal analogies, understanding of mathematical concepts, and mathematical problem solving, a factor analysis might plausibly reveal two factors, or latent sources of individual differences--verbal and mathematical abilities. The idea would be that underlying all the tests are just two fundamental abilitiestverbal and mathematical. You could be strong verbally but not mathematically, or vice versa. Or you could be strong or weak in both. Because the factors are separate, the abilities are largely independent.

Factor analysis has been widely used as a basis for understanding intelligence (see Carroll, 1982, 1993; Jensen, 1998), and continues to be a major source of information about abilities. Some psychologists, however, have been less than satisfied with this methodology as a sole or even primary basis for understanding mental abilities (e.g., Sternberg, 1977). Why?

First, the identification of abilities through factor analysis is dependent on there being individual differences in those abilities. If there are no individual differences, there can be no meaningful correlations between pairs of tests, and thus no factors can be revealed. But not all abilities yield salient individual differences. For example, the ability to use language is certainly a part of intelligence. One characteristic that separates human intelligence from that of most or even all other animals is the ability to use language. But virtually all humans have this ability, so the existence of linguistic ability is not susceptible to identification by factor analysis (although variations in levels of it usually will be).

Second, factor analysis may be useful as a structural model, but it typically tells us little or perhaps even nothing about the mental processes underlying intelligence. One can imagine factor analysis as revealing a map of the mind (Sternberg, 1990)--a representation of the terrain of how abilities are distributed. But factor analysis would not tell us how people navigate that terrain, or make effective use of it.

Third, conventional (so-called exploratory) factor analysis does not yield unique solutions. Imagine a map of the world. The locations of the sites on the map (cities, mountains, oceans, or whatever) are fixed, but the axes used to assign meaning to these locations are not. Typically, we use lines of longitude and latitude, so that we can make meaningful judgments about how far north or south, or east or west, a given site is. But there is no particular reason to use lines of longitude and latitude. We might use polar coordinates or some other system of coordinates. Similarly, in factor analysis, interpretation of results depends heavily on where factorial axes are drawn; but as with the map, there are an infinite number of axes we might draw that could be used uniquely to locate sites, in this case, in the factor space.

In sum, factor analysis is far from a perfect method for studying intelligence. Does cognitive analysis provide a more nearly perfect method of analysis, or at least, a better one?

The cognitive approach. The cognitive analysis of intelligence starts in a place quite different from that of the factor (differential) analysis of intelligence. The goal is to unpack variation in difficulties among tasks rather than variation in performance among people. In other words, the parameters that are isolated from the method of analysis are based upon stimulus rather than upon person properties.

For example, in some of my early work, I was interested in the role of inductive reasoning (a major part of what is called "fluid abilities" in the literature on differential psychology) in intelligence. I therefore had experimental participants solve fairly simple analogy, classification, and series-completion problems while they were timed by a machine (Sternberg, 1977; Sternberg, 1983; Sternberg & Gardner, 1983). Items were carefully selected for their stimulus properties so that they would vary in difficulty. For example, an analogy (such as DOCTOR : LAWYER :: PATIENT : a. CLIENT, b. JUDGE) might vary in the complexity of the relation between the first two terms of the analogy, or the first and third, and so forth. Ultimately, processes of inductive reasoning were identified such as inference--required to understand the relation between the first two terms of the analogy--andapplication--required to carry over the rule inferred in the first half of the analogy to solve the problem in the second half. These processes were identified on the basis of differential patterns of response times across items rather than across persons (as would be typical in factor analysis).

In the 1980s, the prospects for what at the time seemed to be a revolutionary approach to intelligence were rosy indeed. Those of us engaged in the cognitive analysis of intelligence (such as Carroll, 1976; Hunt, 1980; Pellegrino & Glaser, 1980; and Snow, 1980) thought that we had found the cure for the ills of the field of intelligence. Perhaps we were insensitive, though, to the dialectical nature of science, in general, and psychology, in particular (Sternberg, 1995, 1999a).

Relation to General Issues in Cognitive Psychology

In the dialectic, a given approach to a problem is offered--say, the psychometric one. In the terms of the dialectic, it is called a thesis. Proponents of it view themselves as the Jekylls of the field: They have an answer--one that will help enlighten and benefit all. But not everyone sees the thesis so positively. Skeptics come along, and view those promoting the thesis as the Hydes of the field. At best, they are unenlightened; at worst, they are reactionary enemies of progress. These skeptics pose an antithesis that is critical of the thesis on one and usually more than one dimension. Thus, the cognitivists viewed themselves as offering an antithesis to the differentialists--perhaps even the panacea intelligence research had been looking for.

As always happens, the supposed panacea proves to be nothing of the sort. Critics internal and external to the antithetical movement begin to see flaws. Thus, in my own work, I began to see cognitive psychologists as using pretty much the same kinds of test questions as had differentialists, with the main difference between the two groups in the way they were dividing up the same variance (Sternberg, 1985a). Moreover, information-processing analyses of intelligence were not working out the way they were supposed to. Often, the variation that best correlated with conventional psychometric tests was that in the regression constant--what was common to all of the test items being studied. It seemed almost as though general ability (g) had been rediscovered. Finally, just as some of the factor analysts had seemed to be mindlessly applying factor analysis to every data set in sight, so were cognitivists shown to be capable of applying cognitive analysis to every task in sight without asking whether the task was the right one to use. Cognitive analysis became just as task-based as had factor analysis (Sternberg, 1997).

Various attempts have been made to achieve some kind of synthesis between the differential and cognitive approaches, a call made over 50 years ago by Cronbach (1957). For example, my own triarchic approach represents one attempt at such a synthesis (Sternberg, 1985a). But there is no one right synthesis, and in any case, the whole idea of the dialectic is that the synthesis will eventually become a new thesis, itself to be criticized by those who will propose an antithesis, and so on.

This kind of dialectic is by no means limited to intelligence, cognitive psychology, or even psychology. It seems to be an aspect of reality in many and perhaps all fields of endeavor. It means, though, that we have to be careful in viewing our current paradigms or facts accumulated within these paradigms as in any sense final. Look at the textbooks of today and of ten, twenty, or thirty years ago, and you will see that general ways of thinking stay the same, but not paradigms and the facts accumulated within them. Most of those facts will never be shown to be wrong or other disproved. Rather, they will just come to seem uninteresting. The problems of interest to psychologists will change, and with them, the answers.

Truly, much of life has a dialectical property. At times, we tend to focus on one thing; then we realize we were focusing too much on that thing, so we try to focus on something different. Then we realize we need to integrate the two. For example, we may focus too much on our work at one point, and then rebel and focus too much on our personal life. Ultimately, we need to find an integration that incorporates both of these foci.

Relation to the Nature of Intelligence in Everyday Life

Methods used to study intelligence may seem to involve an issue quite distant from the concerns of everyday life. In fact, though, they are not so distant at all. If the assumptions underlying the psychometric analysis of intelligence are wrong, then the millions of ability tests given each year under different acronyms--for admission to private primary and secondary schools, or to colleges, graduate schools, or professional schools, not to mention for placement and diagnosis--are faulty and are possibly leading to questionable decisions. Where intelligence is most important is in its interface with everyday life (Sternberg et al., 2000).

Indeed, there is reason to believe that some of the assumptions underlying our use of tests are wrong. The factor structure of a test may be the same across cultures or subcultures, but it may be that the whole conception of intelligence differs from one culture or subculture to another, so that the test is not really measuring the same thing across cultures. For example, Okagaki and Sternberg (1993) found that different ethnic groups have different conceptions of intelligence, and that they socialize their children according to these conceptions. We found, for example, that Latinos tended to emphasize the social-competence aspect of intelligence more, whereas Anglos tended to emphasize the cognitive-competence aspect of intelligence more. These conceptions fit the school conception of intelligence to a greater or lesser degree. To the extent the fit is lesser, bright children may appear to be dull to their teachers. Even within the mainstream, different occupations have different conceptions of what it means to be intelligent in their field (Sternberg, 1985b). And in different countries, different views of intelligence may predominate (Yang & Sternberg, 1997). Indeed, many languages, such as Chinese or Hebrew, have no word in the languages that corresponds well to the word intelligence.

In sum, what might seem like arcane issues of methodology have a real impact on what happens from day to day in children's lives, and what opportunities are given to or taken away from them--on whether, as psychologists, we serve as Jekylls or Hydes. Psychologists and others consequently bear a major burden in ensuring that the tests of intelligence they are providing adequately represent the construct they are supposed to be assessing.

**The Future**

The battles over what intelligence is and what methods should be used to study it represent only two of the many issues that intelligence researchers will have to address during the years of the 21st century. Several other major issues loom on the horizon, and their answers are potentially high-stakes one. These are the issues that are being hotly researched today and are likely to be hotly investigated at least in the foreseeable future.

One of these major issues is the relation between intelligence, on the one hand, and heredity and environment, on the other. Although the issue is an old one, new research on it is proceeding at a rapid clip, and shows no sign of abating (see Sternberg & Grigorenko, 1997). Most researchers have passed the point where they merely wish to attach percentages to hereditary and environmental contributions to intelligence. They realize the important roles of covariance (forces that lead heredity and environment to have the same effects) and interaction. Various kinds of behavior-genetic designs have been proposed to tease out the various kinds of effects heredity and environment can have on intelligence, but all of them have their own idiosyncratic flaws. Almost certainly, converging operations are more informative than are single ones. But we need to remember that, regardless of the methodology used, the conclusion drawn can be as good only as the tests from which one draws those conclusions.

Recent findings are quite intriguing (see Plomin, 1997; Sternberg & Grigorenko, 1997). For example, we now know that heritability of intelligence, at least as measured by conventional tests of intelligence, increaseswith age. Most investigators previously had thought that it would decrease as environment had more and more of an effect. Instead, it appears that as time goes on, environment matters less and effects of genes matter more. Another interesting effect is that within-family rather than between-family differences appear to matter most for the development of intelligence. In other words, to the extent that differences in environment have an effect on the development of intelligence, it appears that the differences that matter most are those in the way different children within a given family are treated rather than differences in the way children are treated across families.

Some investigators, such as Plomin (1997), are attempting to go beyond quantitative-genetic studies to actual identification of the genes that are responsible for various aspects of intelligent behavior. Plomin believes that such research may eventually supplant the more conventional statistical studies. Perhaps, but at the moment, such studies yield little more than educated speculations. Links between genes and intelligence are so weak that it is unclear how much time it will take before we will be able to establish any strong and meaningful links. Certainly, such links would be important to establish, but they have yet to be discovered. Studies of the genotype of intelligence have the potential to bring us either into the land of Jekyll or that of Hyde. Will we use such knowledge to benefit humankind, or to justify the already questionable treatment of certain groups? Only time will tell.

A second major issue is group differences in intelligence. Although such differences are widely accepted as a fact of life (Sternberg, 1997), they depend on one's accepting the conventional notion of what intelligence is. And as the work of Herrnstein and Murray (1994) made clear, perhaps more important than the existence of such differences is their interpretation. The evidence in favor of a genetic interpretation for them is quite weak (Nisbett, 1995), but again, it is difficult to predict what the future will tell. At present, our best guess is that most differences between groups are better attributable to socialization than to genetic effects, or perhaps to covariance and interaction between socialization and genetics. But more research is needed to understand how socialization has its effects.

A third issue that I will mention is the modifiability of intelligence. Some investigators are utterly convinced that intelligence is modifiable (e.g., Feuerstein, 1980; Grotzer & Perkins, 2000; Nickerson, 1994; Ramey, 1994; Sternberg, 1996), at least in some degree, whereas other investigators are equally convinced that intelligence is minimally or not at all modifiable (e.g., Herrnstein & Murray, 1994; Jensen, 1969, 1998). It may be that we have not gone far in understanding the modifiability of intelligence because the kinds of tests we use do not give students much of an opportunity to learntthat is, to modify themselvestwhile they are being tested. Alternative testing techniques, called dynamic testing techniques, allow students to learn at the time they are tested (Grigorenko & Sternberg, 1998; Vygotsky, 1978). In such tests, individuals learn material while they are being tested, and then are tested on how much they have learned at the time of test. These techniques may give us a better understanding of peoples ability to modify their intelligence.

Whatever the answer, it is important to remember that heritability and modifiability are two completely independent issues. Something can be heritable and either modifiable or not. For example, height is highly heritable, and has also shown substantial modification in recent decades.

The distinction between modifiability and heritability, and yet its confusion not only in the mind of the public but even of specialists in the field, is noteworthy. To many people, it simply seems like a matter of logic that if something is inherited, then it is nonmodifiable. These people view genes as opposed to environment. Yet, this view is wrong. Even IQ, which appears to have a heritability of perhaps .5, has been shown to be modifiable if only because research shows that scores on tests that give rise to IQs have risen substantially over the past several generations (Flynn, 1987, 1994; Neisser, 1998). There is a lesson to be learned, and it is that we often make assumptions not because they are right, but because they are easy to make and sound so darn plausible.

The last issue I mention is the one that excites me the most: how to improve achievement in school and society by taking into account differences not only in amounts of intelligence, but in *profiles*of intelligence. Our research shows that if one teaches in a way that enables students to capitalize on their patterns of analytical, creative, and practical abilities, the achievement of the students increases (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999). Moreover, teaching all students in a way that enables them to use their analytical, creative, and practical thinking and learning skills appears to result in higher school achievement for all students (Sternberg, Torff, & Grigorenko, 1998). It may be possible in the future to help students improve their achievement by teaching in ways that expand upon the teaching repertoires that most teachers currently use.

**Joining In**

The field of intelligence is one of the most exciting to work in, because the stakes are so high, both theoretically and practically. But it is not a field for just anyone. Precisely because the stakes are so high, people who decide to join the fray need a thicker than average skin. There are so many different points of view that it is not a field in which there is any kind of work that is likely to please everyone; unless an investigator is prepared to take a certain amount of flack, he or she would do better finding another pursuit.

Working meaningfully in the field of intelligence also requires a broader background than might be the case in another field. Work in this field cross-cuts cognitive psychology, biological psychology, developmental psychology, differential psychology, educational psychology, personality psychology, cultural psychology, industrial-organizational psychology, and perhaps other areas of psychology as well. To keep up with the field and advance it, one must be able to understand and to integrate the contributions from these various aspects of the field.

Finally, I believe that the best work in this field, and perhaps any field, is that done by people who are willing to defy the crowd--to generate their own set of grounded beliefs and to fight for them (Sternberg & Lubart, 1995). Students like to believe that science is for the courageous, the willful, the strong of mind, and the towering intellect that will fight for truth. None of these stereotypes works awfully well, as Kuhn (1970) pointed out some years ago. For the most part, scientists follow the paradigms set by others, accept what they are told, and fill in the small gaps left to be filled by others. The result is that much and arguably most of the work that is done has little impact on a given field; the field would have changed little if at all had the work never been done.

We have no final truth in this or any other area of psychology. At best, we have good theories that will lead to new and hopefully better theories. It is the responsibility of the next generation of researchers to take up the dialectic where the previous generation left off--to build on these past theories, even if building on them means attacking them in the process. Perhaps curiously, even work that forms an antithesis to an existing thesis builds on the past work, because without the thesis, the antithesis could not exist--there would be nothing to attack. We need to encourage students to be scientific but bold, innovative but responsible--in other words, to show in their work the kinds of broader attributes of the intelligent people that the researchers themselves study.

Most of all, researchers in this field need to remember the Jekyll and Hyde character of work in their field. Work in the field of intelligence can do enormous good in providing opportunities for those who would not otherwise have them, or enormous harm in stealing opportunities from those who truly deserve them. Researchers need to think not only about the scientific contribution they have to make, but the contribution to science and society that they leave behind them.

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# Chapter 7 Social Psychology: Past, Present, and Some Predictions for the Future

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Social psychology has always been driven, to some extent, by the prevailing concerns of the day. Even when not explicitly directed by funding agencies and policy makers, social psychologists have drawn their impetus for research from newsworthy social phenomena, such as racism, altruism, and the AIDS crisis. This approach has not only led to a proliferation of applied research implementing established theory in a range of assessment and intervention programs, but it has also led to further theoretical developments. Some of the earliest advances in social psychology on topics, such as group dynamics and social influence, were supported by government funds, around the time of the World War II. Very practical issues, such as how to maintain group morale among the troops (Stouffer, Suchman, DeVinney, Star, & Williams, 1949) and how to persuade homemakers to serve cheaper cuts of meat (Hovland, Janis, & Kelley, 1953), reflected the social concerns of that period.

A balance between the basic and applied wings of the field will need to be maintained if social psychology is to remain healthy, and ongoing changes in society, such as increasing cultural diversity, are likely to influence the direction of such research. Social psychology offers a staggering array of topics that appeal to both seasoned and beginning researchers.

Our own research has been especially directed towards understanding the mechanisms underlying, and potential means of intervening in, socially relevant intergroup conflict situations. Before addressing what we see as useful directions for future work on this vexing problem, we briefly consider the present social context in which social psychology itself is embedded and how that is likely to influence its future research agenda.

The Current Context of Social Psychology

We expect that the current trend of funding research that focuses on the pressing issues of the day will continue. For example, as long as a medical cure for AIDS is far off, the importance of assessing and encouraging behavioral solutions to such health problems is likely to remain a research priority (see Snyder, 1993). That threats to health invite social psychological intervention is equally evident in other areas, such as smoking, drug abuse, and poor dietary habits, cases in which behavioral prevention is better than a medical cure of the ensuing problems. Therefore, social psychology has an important role to play. Societal problems of this sort cost taxpayers billions of dollars every year so investment in research designed to address their prevention may have far reaching economic as well as social consequences. Social psychology can provide insight into how social influences affect our behavior, and how we might intervene. The potential role of psychological shifts in self-definition and social contextual factors have yet to be fully explored, and we think this is a direction that social psychology should and will move. We predict that some of the most exciting research in these areas is yet come.

These examples of various behavioral problems suggest that some of the most serious issues facing humankind are "human-made." Social conflicts that arise from the need to share the planet with people of different creeds and colors seem to increase rather than diminish with the development of "civilization." Conflicts between and within nations are not just political issues; they invite social psychological analyses as a means of contributing to their solution. Social psychology cannot hope to provide all the answers to problems that have strong historical and economic roots, but it has a part to play in helping us understand and shape our world, especially where issues of self, identity, and social interaction play a major role. Obviously, the contributions that social psychologists can make in reducing tensions between and among groups underscores the value of creative research in this important area.

Social psychological research has been traditionally divided into three general topic areas, based on whether the emphasis is on the factors internal to the individual or broader social processes. At the most *intrapsychic* level, research topics that have been center stage have included self and attribution processes, impression formation, and attitudes. Research at the *interpersonal* level has focused on attraction and close relationships, prosocial behavior, and aggression. At the *intergroup* level, research has been aimed at understanding stereotyping and prejudice, social influence processes, and the impact of groups on the individual.

Within this tripartite taxonomy of social psychological research, specialization is both to be expected and functional: the sheer volume of empirical work makes it increasingly difficult to keep up with the latest developments in all parts of the field. This reality encourages young researchers to concentrate early in their careers in a specialized area of social psychology, but not without a cost. Such specialization produces fragmentation in the field; evidence of this can be found in all three areas of social psychology.

If the discipline is to make progress, the principles developed and evidence accumulated in one part of the field should be applicable to and overlap with those investigated in other areas. Because an increasing division into discrete topics thwarts theoretical integration, we consider here only those perspectives that have provided a broader view of the field as a whole. "Grand theories," aimed at explaining all of psychology in terms of a few mechanisms (e.g., behaviorism, Freudian theory), have been out of favor for some time. Mid-range theories that address phenomena within a fairly circumscribed area have been the norm. However, during the past decade, three fairly encompassing theoretical frameworks aimed at integrating a broad selection of social psychological findings have been developed. We briefly review these three different perspectives and point out how they differ from each other in terms of primary research topics and their level of analysis. Then, in the remainder of the chapter, we consider how the most social psychological of these three frameworkstthe social identity and self-categorization perspectivetcan be used further to unify the empirical findings obtained in the field as a whole. We close with a discussion of the processes that we see as requiring further research, and we consider several specific new topics that are increasingly likely to capture investigators' attention in the new millennium.

Unifying Theoretical Approaches to Social Psychology

The View From Below: Cognitive Psychology

One approach that is gaining momentum involves an explicit focus on the potential neural mechanisms underlying social behavior. To some extent, this movement towards an increasingly molecular level of analysis reflects a continuation of the borrowing of models and methods from cognitive psychology that has been ongoing for some time. As described by Fiske and Taylor (1991), the core of research in social cognition during the past two decades has focused on the mental structures and information processing principles employed by the individual perceiver engaged in social judgment tasks. Researchers have and continue to generate an impressive amount of research that describes the structures and processesunderlying the individual's conception of self and others (Higgins & Bargh, 1987; Linville, 1987; Markus, Smith, & Moreland, 1985; Smith & Branscombe, 1987; Wyer & Srull, 1986). They have also explored how people employ heuristics when reasoning about social events (Branscombe & Cohen, 1990; Fong, Krantz, & Nisbett, 1986; Kahneman, Slovic, & Tversky, 1982; Schwarz, 1990) as well as how biases in social judgment might arise as a result of cognitive capacity limitations (Fiske & Neuberg, 1990; Gilbert, Pelham, & Krull, 1988; Hamilton & Sherman, 1989). Research stemming from this tradition is increasingly employing connectionist and neural network models in order to develop a "machine code" for phenomena, such as impression formation and social stereotyping (see Smith, 1996). We see this tendency to conceptualize social judgment in terms of cognitive psychologys most recent "bottom up" model as likely to underestimate the social relational and motivational underpinnings of human behavior.

Within the social cognition tradition, researchers have conceptualized emotional and motivational factors primarily as moderators of normal cognitive processes. That is, emotion and motivation have been conceived of as "add-on" factors rather than ones that are integral to all social judgment and behavior. Thus, a variety of investigators have manipulated the mood state of participants by some means that is irrelevant to the task at hand (Bodenhausen, 1990; Fiedler, 1990; Forgas, 1995) in order to assess how social judgment and memory might be affected. For example, after being told that they will be participating in two unrelated studies and that the first study concerns responses to film stimuli, respondents may be shown a comedy, a sad film segment, or a neutral control. Introduced as a separate study on impression formation, the task involves manipulation of the features of the target persons or the conditions under which the judgments are rendered. This method assesses the role of different mood states that may be pre-existing when people are required to make judgments. Within this type of paradigm, moods may influence social processes by altering how the initial information about the target is encoded and what strategy is used to make the judgment. Thus, emotion is expected to limit the cognitive resources available to the individual, resulting in judgments that are more mood-driven and less individuated or responsive to variations in the specific target information provided. The mood state itself can create inaccuracy in person perception by eliciting heuristic means of assessing the likability of the target persons, with perceivers simply assessing their mood state and using that as a basis for judgment (Isen, 1987; Schwarz, 1990; Worth & Mackie, 1987). The relationship of the target persons to the self, or what kind of affect those persons might evoke in the respondent, has not been focused on in this research.

In contrast to mood states, motivation has been conceptualized as the means by which the accuracy of social perception can be enhanced. If motivational factors influence people's willingness to put forth the necessary effort to arrive at a more individuated and less stereotypic impression of others, judgment accuracy may increase (Fiske & Pavelchak, 1986; Showers & Cantor, 1985). The underlying assumption is that focusing on how members of groups are similar to each other is easier than focusing on how individuals differ from one another, with perceived similarity among group members being defined as the essence of social stereotyping. From this perspective, perceived similarity among individual group members is less accurate than perceived differences among members of a group. Social motivations might determine the level of categorization that is employed. For example, whether people are perceived as group members rather than as distinctive individuals can influence categorical judgments. In addition, their judgments might occur in ways that are consistent with the perceivers own position within the social hierarchy. These complications are neglected when motivation and emotion are conceptualized primarily as external moderators of basic social cognition processes rather than as integral to human social perception and evaluation.

The View From Our Past: Evolutionary Psychology

A second broad unifying direction that has come to the fore over the last decade involves attempts to explain social psychological phenomena in terms of evolutionary principles (Buss, 1995; Simpson & Kenrick, 1997). Although this approach can be also characterized as borrowed from biology, it has so far had its greatest impact on topics involving the nature of interpersonal relationships. Specifically, evolutionary psychologists have focused on gender differences in sexual behavior, helping, and aggression. Because men and women are assumed to have faced different adaptation problems because of their differing reproduction roles, residuals of this evolutionary history can be exhibited in ongoing human social behavior. Gender differences that have been central to this theoretical perspective and that have been empirically investigated include number of sexual partners (men report more than women); psychological investment in children (women report more than men); what aspect of infidelity is most distressing (women report greater upset about emotional disloyalty and men report greater concern about sexual disloyalty); who is more likely to behave in a physically aggressive fashion (men more so than women): and who is more likely to help and be helped by strangers versus relatives (men are more likely to display heroic helping of strangers but women take care of family members especially in private settings).

Of course, because any of these effects could be also explained in terms of gender differences in socialization and adult role requirements, any impact of our evolutionary history should be reflected primarily in cross-cultural constants. Some of the existing research has explored such possibilities. For example, Buss (1995) has argued that gender differences in terms of the attributes sought in sexual partners exhibit some cross-cultural generality (men report desiring physically attractive partners as an indicator of reproductive capability and women tend to rate variables related to status as especially desirable in mates). Nevertheless, there is more cross-cultural similarity in the attributes overall that are deemed desirable in a partner by both genders than there are differences. Evolutionary explanations that emphasize consistent differences by gender have difficulty with such similarities. These explanations also struggle with behaviors that are flexible in terms of when and how they are expressed (i.e., those that show considerable context-dependence). We argue that flexibility and sensitivity to context are perhaps the most important hallmarks of human social behavior. We also argue that a theory must be capable of accounting for these characteristics in terms of the psychological processes involved. Evolutionary psychology emphasizes what behaviors are likely to have worked in the context of our ancestors, although the actual nature of that context is much debated. As a result of their focus on the distant past, we are not provided with an explanation of how people adapt to and navigate in the complex and changing social environments that are found in present-day Western technological societies.

A Social Psychological Integrative Perspective

As we see it, the primary problem with attempts at grounding social psychology in neural networks or genetic history is that this neglects more "top down" influences stemming from the social context itself. As a result, a uniquely social psychological level of analysis located in the "here and now" is precluded. Although both of these borrowed frameworks represent theoretical attempts at ordering the proliferation of phenomena and paradigms within social psychology, there may be important limits on the degree to which we can or should rely on other disciplines for explanatory mechanisms. We believe that for a theoretical framework to be maximally useful it should contain uniquely social and psychological mechanisms (see Wicklund, 1990, for a discussion of this issue). For social psychology to make a distinctive contribution, it must acknowledge the fundamentally social nature of mental life and explore how psychological mediation occurs within the individual. Therefore, we turn our attention now to a social psychological perspective that attempts to integrate research within the three areas of social psychologytthe intrapsychic, interpersonal, and intergrouptby employing only social psychological mechanisms.

The theoretical perspective that meets our criteria can be found in an integration of social identity (Tajfel & Turner, 1986) and self-categorization theories (Turner, 1987). Together, they represent a "grand" theory of the interplay of social cognitive and emotional factors in the generation of behavior. Tajfel (1972, 1981) emphasized the importance of avoiding biological reductionism and strictly individualistic explanations for social psychological processes. He underscored the important role that the historical and social context plays. The social identity tradition offers a level of analysis that takes into account the nature of the social structure as well as how it is internalized by the individual. Because this theoretical tradition forms a guiding framework for our review of the different areas of social psychology, we now provide a brief summary of the general principles involved.

Social identity is conceptualized as that part of the person's self definition relating to their membership of a social group (or groups), along with the value and emotional significance that entails (Tajfel, 1978). The concept of self-categorization is closely related to social identity but broader in so far as it also comprises definitions at more unique levels (e.g., "personal identity") and more inclusive levels (e.g. "humankind"; see Turner, 1987). Social identity and self-categorization theories emphasize the links among social contextual factors, how the self is conceptualized, and whether interpersonal or intergroup behavior will be expressed. It does not assume that one level of categorization is more accurate, genuine, or real than another. For example, when interacting with a group of friends in one context, an individual may behave on the basis of his or her individual identity and perceive the self as different from the others present. At another point in time, the persons social identity may determine what actions are undertaken (e.g., as fans of a football team). In that case, even when in the company of the same group of friends at a football game, the individual may feel similar to those same people and typical of "our team." Therefore, all of these processes--perception, evaluation, and action--are solidly rooted in the contextually dependent process of self-definition. From this perspective, decontexualizing an individual will not reveal his or her "true" essence; rather, depending on the context, the person is *actually* an individual who is different from others and a group member who shares attributes with others.

Social identity theory tries to explain social behavior in terms of the processes of social categorization, social comparison, and social identification. Behavior can be explained as a function of the level at which they categorize themselves in any given context. The type of self-categorization operating in a given context will influence the nature of the comparisons drawn and the emotional significance of others' actions. The degree of emotional significance associated with particular identities will influence responses to others who may be perceived as threatening or supportive of one's social identity. One basic assumption of social identity theory is that people try to maintain a positive sense of themselves as individuals. This objective can be accomplished, theoretically, by either personally differentiating the self from other ingroup members at the individual level, or at the group level by positively differentiating the ingroup from other groups. Self-categorization theory (Turner, 1987) extends social identity theory to create a more encompassing perspective on social processes. In self-categorization theory, the self definition controlling behavior at different levels of inclusiveness ("me" versus "we") depends on the social context and the salience of different types of comparisons in the environment.

The importance of self-definition and subsequent comparisons drawn as a result were illustrated in a recent study majors (Spears, Doosje, & Ellemers, 1997). Psychology students characterized their ingroup as more intelligent when they compared themselves to fine arts students, but preferred to think of themselves in terms of their creativity when comparing themselves with physics. This example makes clear how the definition of self and its attributes is sensitive to the comparative context and the general tendency to view the self positively whenever possible. Our example is also consistent with the operation of some basic human "needs" that have been the focus of much social psychological theorizing of late. These include especially the need to be positively evaluated and the need for attachment or alignment with others (Baumeister & Leary, 1995; Branscombe & Ellemers, 1998; Doosje & Ellemers, 1997; Sedikides, 1993).

The social identity/self-categorization tradition provides us with a relatively simple but powerful theoretical framework for integrating and explaining a variety of social psychological phenomena across the three areas of research. Together they provide a non-reductionistic explanation of intrapsychic processes, interpersonal behavior, and intergroup relations and a theoretical means of integrating this tripartite division. Specifically, self-categorization theory has been used to explain social phenomena, such as self-esteem maintenance, attitude processes, group formation and cohesion, social influence, crowd behavior, and social stereotyping. To the extent that behavior is rooted in the perceivers definition of self, and self-definition is defined in relation to others in the context, we have a truly social psychological way of analyzing social behavior according to general principles that acknowledge diversity of behavioral outcomes across both time and persons. Employment of the central principles in this theoretical tradition allows us to integrate a whole host of empirical findings. We now examine a selection of research findings across all three areas of social psychology and illustrate their fundamentally social nature.

Impact of Self-Categorization and Social Context on Intrapsychic Processes

The social cognition approach has tended to explain social psychological phenomena in information processing terms. When making social judgments, people tend to use simplifying but potentially inaccurate strategies predominantly over systematically processing the information. From this perspective, the social dimension of social cognition simply refers to the fact that we process information about persons rather than implicate any distinctively social influence processes or explanatory principles. Accordingly, intergroup phenomena, such as stereotyping, have been seen as resulting from "normal" information processing biases (Hamilton, 1981). Researchers have conceptualized attitudes more generally in terms of the underlying information- processing mechanisms employed and the type of cognitive structures activated by a task. The main thrust of traditional models of attitudes (e.g., Eagly & Chaiken, 1995; Petty & Cacioppo, 1986) has been aimed at determining the conditions under which people will select one information processing route or another: focus on the "central" characteristics of the persuasive message (e.g., argument strength) or "peripheral" cues (e.g., nature of the source). However, recent research has begun to question the evidence for attitude structural stability and to consider seriously the possibility that attitudes are actually on-line judgments that are constructed differentially as a function of the context (Millar & Tesser, 1992; Schwarz & Sudman, 1996; Wilson & Hodges, 1992).

The tendency to focus on intrapsychic processes has begun to give way to an examination of more communicative and contextual factors implicated in attitude change. For example, researchers have started to examine how impression management concerns can influence message elaboration (e.g., Chen, Shechter, & Chaiken, 1996). The expectation of having to persuade a target on the attitude topic can influence how the contents of the message itself are processed (Nienhuis, 1998). Indeed, one important contextual influence on attitudes involves who the target audience is believed to be. Other people provide a reference point for social comparison and self-definition, and an audience's sensibilities has to be taken into account (Leary & Kowalski, 1992; Noel, Wann, & Branscombe, 1995; Reicher, Spears, & Postmes, 1995). Audiences can both constrain attitude expression and influence how they are constructed initially, especially when the audience is perceived as having the power to judge or affect the outcomes that will be received. For example, when people are motivated to make a good impression on others who have power over them, they are likely to express attitudes that they believe will positively impress their audience, even if that means derogating an outgroup that is not privately perceived as negative. If, however, participants believe that those in power will not learn what attitudes they expressed, then a quite different set of beliefs are reported (Noel et al., 1995). From a self-categorization perspective, both the nature of the self being presented (e.g., personal self versus a particular social identity), and the nature of the audience (e.g., an ingroup or outgroup) can be powerful influences on behavior. Research that fails to consider the purposes individuals may have in communicating a message in a given context will fail to anticipate how variable behavior can be in different contexts, or appreciate when such behavior will or will not reflect underlying attitudes and allegiances (Reicher et al., 1995; Turner, 1991).

Similarly, other basic cognitive processes thought to reflect purely information processing concerns appear to vary depending on how the self is contextually defined. For example, one influential tradition has concerned people's employment of heuristics--simplifying methods of dealing with complex information processing tasks (Kahneman et al., 1982). In the initial demonstration of the operation of the availability heuristic, fresher access to instances from memory is used to make a likelihood judgment. For example, Tversky and Kahneman (1973) showed that after reading a newspaper article about a car crash, participants were more likely to judge the frequency of motor vehicle accidents. They also judged their own chances of befalling one as higher than in a control condition where a neutral text was read. In other words, reading about this accident made available in memory instances of such events that influenced subsequent judgments of their likelihood. In a replication of this research, Stapel, Reicher, and Spears (1994) presented physics students with information about a car crash, but they also varied the link between that information and the participants' own social identities. For half the participants their identity as "physicist" was made salient, whereas for the other half the more inclusive identity as "scientist" was made salient. As a result, how the participants categorized the self varied differed across conditions with the relevance of the available or primed information. Thus, when their scientist identity was made salient, this includes not only physicists but also psychologists. Only when the reported crash was relevant to an ingroup identity (e.g., when the victims were either physicists or psychologists and the salient identity of the participants was as scientists) did respondents display an availability bias and overestimate the likelihood of crashes. When the crash story victims were defined as outgroup members (e.g., the victims were psychologists and the salient identity of the participants was as physicists), then subsequent likelihood judgments were unaffected. In other words, the operation of this seemingly basic cognitive bias stemming from use of the availability heuristic was dependent on the social relation of the relevant stimulus to the self.

The focus on cognitive processing mechanisms has also resulted in a neglect of the role of the communicative context. However, on further analysis, judgments that were once thought to be the due to the operation of heuristics appear to be products of how people interpret information in various social communication settings (e.g., Berndsen, Spears, McGarty, & van der Pligt, 1998; Bless, Strack, & Schwarz, 1993; Branscombe, N'gbala, Kobrynowicz, & Wann, 1997; Hilton & Slugoski, 1997; McGarty & de la Haye, 1997; Stapel, Reicher & Spears, 1995). Thus, what was once thought to be due to the operation of fundamental and unchanging cognitive processes, now appear to be the result of participants attempting to derive social meaning from the materials they are presented with. Recent research re-examining Kahneman and Tversky's (1982) classic demonstration of the simulation heuristic, where ease of imagining a better outcome for an event determines judgments about it, makes this point. In that work, the identical poor outcomes obtained by two individuals--one who puts forth effort in an attempt to make money and one who does nothing--are described in a single scenario to the participants. Consistently, the judge evaluates the acting target more negatively than the target person who did not do anything. This effect has been assumed to be due to the relatively greater ease of mentally simulating the acting target so that a better outcome could be imagined for him than for the non-acting target. Using Kahneman and Tversky's (1982) original materials, N'gbala and Branscombe (1997) showed, however, that differential ability to simulate the two targets was not why the targets were judged differently. Indeed, the two targets were actually equally likely to be mentally simulated. Rather, this judgment "bias" was found to arise out of participants' attempts to understand the situation they were presented with (i.e., two targets individuals who received the same outcome, regardless of their behavior). In order to make sense of the situation, participants directly compared the content of the two targets' behaviors. Given that the poor outcome appeared to be inevitable, participants appear to have concluded that the target who invested energy in what was clearly a losing proposition was a poorer decision-maker than the one who did not invest any energy. Again, the meaning gained and judgment arrived at by these participants in the experimental context they found themselves in did not stem from use of a general heuristic such as simulation; instead it resulted from a fairly simple context-driven comparison of the two targets behaviors.

Recent research using the Ebbinghaus optical illusion has demonstrated how seemingly simple perceptual phenomena, such as object size estimation, can be mediated by social meaning (Stapel & Koomen, 1997). In this classic illusion, a moderate-sized circle surrounded by smaller circles appears to be larger than a comparable moderate-sized circle surrounded by larger circles. This effect has been thought to arise from basic perceptual contrast processes where the context of the surrounding circles influences the subjectively perceived size of the central circle. Building on earlier research showing that the standard effect can be obtained with social stimuli (faces) as well as circles, Stapel and Koomen (1997) showed that the effect only occurred if the face stimuli were defined as emanating from a common social category (e.g., lawyers). When this common category relationship was absent (e.g., the identical stimuli were said to come from multiple social categories), the size-contrast illusion disappeared. In other words, the socially defined relationship of the stimuli to each other facilitated the ostensible "perceptual illusion;" eliminating that social relationship eliminated the illusion as well.

In sum, the assumption underlying much work on heuristics and social judgment is that their use reflects basic cognitive information processing mechanisms. At first sight, their operation would seem to be independent of more obviously social psychological issues of self-definition. However, as we have shown, the social context and the perceivers self definition affect even these }basic processes." When we turn to more obviously socially influenced judgment processes, such as attributions, the influence of culture and motivation are even more apparent. Indeed, a variety of findings that have been assumed to be universal cannot be generalized to more collectivist cultures which tend to be characterized by different forms of self-definition and social organization (Markus & Kityama, 1991).

One classic example of a phenomenons failure to generalize to collectivist cultures is the case of the "fundamental attribution error," in which people over-attribute the causes of actors' behavior to their internal dispositions compared to plausible situational causes or constraints (Ross, 1977). Although robust and widely replicated in Western cultures (Gilbert & Malone, 1995), this finding of greater personal than situational attributions does not extend to participants in the collectivist culture of India (Miller, 1984). Because people in individualistic cultures are more likely to see others as masters of their own destinies (potentially more than is warranted), they tend to neglect the power of the situation when making attributions for behavior. Moreover, the contents of a given culture are themselves not fixed or constant, but are historically specific (Gergen, 1973; Tajfel 1972; 1981). What it means to be a self, at both the personal and social identity levels, can shift over time. As a result, expectations and beliefs about how social relations are and should be structured must be historically situated. Because the treatment that is expected and is seen as legitimate for the self when categorized at the individual level and the self when categorized as a group member can differ, affective responses to the same events can be expected to vary depending on the social context.

The tendency to attribute positive or beneficial outcomes to some aspect of the self, and the consequences of doing so, depends on the meaning implied and the aspect of the self that is salient in a particular context. To illustrate, Branscombe (1998) asked male and female participants to think about either the positive or negative outcomes that they have received based on their gender group membership. Drawing on the basic social identity theory assumption that people attempt to maintain a positive view of themselves, men and women should be differentially motivated to conceptualize the effects of their group membership in particular ways. Those persons who are members of a powerful social group should be reluctant to, and are likely to find it psychologically uncomfortable to, think about themselves in terms of the benefits or privileges received as a function of that group membership, especially in individualistic cultures. In contrast, powerful group members should find it rewarding to think about the disadvantages that are associated with this group identity, especially if they are relatively localized. The results revealed that men did suffer self-esteem loss following thoughts of group-based privilege compared to thoughts of disadvantage. Thinking about privileges or disadvantages stemming from a subordinate group identity should have quite different effects, with thoughts of disadvantage tending to harm well-being in women compared to men. Focusing on group-based disadvantage in women reduces attributions of personal control and is correlated with depression (see also Kobrynowicz & Branscombe, 1997; Ruggiero & Taylor, 1997). However, among dominant group members, well-being reductions were associated with conceptualizing the self as a group member which, rather than the personal self, was implied to be the critical variable responsible for ones successes. As a result, for men, internal attributions for success appear to be undermined by thoughts about the privileges received based on group membership. In fact, for those who are low in identification with their gender group, thoughts that imply illegitimate receipt of benefits based on ones group membership may result in the experience of group-based guilt. Thus, this research points out how the effects of categorizing one's self in terms of gender depends on the nature of the power relations that exist between the groups and how those are framed in a given context.

Indeed, how people react to categorizing the self as a group member can depend on the nature of the group's history. Differential emotional reactions to an event may occur, depending on how the self is categorized and the degree of identification with the group. That is, although intense emotional responses to an event would not be expected when the self is categorized as a unique individual, elevated emotional responses to the same event may be exhibited when the self is categorized as a group member. Doosje, Branscombe, Spears and Manstead (1998) tested this hypothesis by inducing participants to categorize themselves as members of a group that had historically exploited another group or that had a history of fair treatment toward the other group. Participants also received feedback about whether they personally had or had not displayed prejudice towards members of the other group. Even when participants had nothing to feel guilty about at the personal level, because they believed they had not personally behaved in a prejudicial fashion, knowing their group's history was exploitive, resulted in the induction of feelings of collective guilt. In a second experiment using participants' Dutch national identity, Doosje et al. (1998) showed that the degree of collective guilt experienced mediated the impact of ambiguously presented information about their nation's history on behaviors reflecting a willingness to make reparations to members of their nation's former colony (Indonesia). These results show that people may experience emotional responses, such as guilt, but whether this reaction occurs or not depends on how the self is defined in a particular context. Furthermore, different kinds of emotional experiences can result, depending on whether the self is construed at the personal or the social identity level.

As our review has suggested, the social context and how the self is defined are important determinants of various social judgments and behaviors that are often assumed to be solely a function of information processing mechanisms. The social level influences on cognition that we have described appear to be considerable. Indeed, they may be even greater than those stemming from the impact of human cognitive capacity limitations per se. Social cognition seems to be structured by the definition of the self that is employed, with the context enabling socially meaningful perception rather than simply limiting information processing. As a result, intrapsychic processes can only be artificially separated from the other two areas of social psychology, the interpersonal and the intergroup. We now turn to the role of self-definitional and contextual factors in interpersonal processes.

Interpersonal Processes and the Impact of Differing Self-Definitions

Attraction between individuals has long been assumed to vary as a function of perceived personal similarity (Byrne, Clore, & Smeaton, 1986; Griffin & Sparks, 1990), familiarity (Bornstein, Leone, & Galley, 1987; Moreland & Beach, 1992), and physical attractiveness (Hatfield & Sprecher, 1986). We maintain close relationships when they are perceived to be equitable, instrumentally rewarding, and emotionally satisfying (Hatfield, Traupmann, Sprecher, Utne, & Hay, 1985). These same factors encourage helping others: attributions of deservingness, ability to obtain a variety of rewards (Piliavin, Dovidio, Gaertner, & Clark, 1981), and identification with or empathy for the person in need (Batson, 1987; Smith & Henry, 1996). For the most part, the lack of these factors or the presence of their opposites has been shown to influence the expression of aggression. Specifically, frustration, anger, perceived unfairness, and an inferred intention to bring about an undesirable outcome have all been linked with aggression (Geen, 1990).

Once again, we will not attempt to review all of the research available on interpersonal processes exhaustively. Rather, we will show how some of the themes from social identity and self-categorization can be used to illuminate the underlying processes responsible for some of the major effects that have been observed. Much of the existing social psychological research on interpersonal relations has been rather individualistic in the sense that it conceptualizes social interaction exclusively in terms of what occurs between individuals when they categorize themselves strictly in terms of their individual identity. We will attempt to illustrate, however, that the self-definition of the participant in a given context (e.g., the personal versus social level) can moderate interpersonal process effects.

Research on attraction has primarily emphasized the bonds between individuals that result from factors, such as interpersonal similarity, mutual interdependence, and the like. Yet, from a self-categorization perspective, attraction to others can also occur at the social level. Furthermore, such social attraction is both conceptually and phenomenologically distinct from interpersonal attraction or the attraction between individuals as individuals (Turner, 1987). Perhaps the most obvious example of this distinction comes from research employing "the minimal group paradigm," where people reward ingroup members and discriminate against outgroup members without any personal knowledge of or relationship with the individuals in either group except for group membership per se (Tajfel & Turner, 1986). In fact, in many minimal group studies, the participants' personal friends may be actually categorized as members of the outgroup. Hoggs (1992) research has explicitly examined the distinction between personal and social attraction and their differing consequences. In that research, participants were first categorized into groups with others who, based on bogus pre-testing, were said to dislike some members of their ingroup and prefer individual outgroup members. In other words, group bonds per se were not strong in this condition and evaluation was made on the basis of each individuals personal features. Measures of liking of one form (interpersonal) reflected the features of the individual personalities involved, but favoritism in terms of reward allocations was based on another form of liking (social attraction). As a result, ingroup members who were seen as }interpersonally dislikable" because of their personal characteristics were given greater rewards than were "interpersonally likable outgroup members" when participants were acting on the basis of their social identity. Thus, feelings about and the treatment delivered to others depends on how the self and the target are defined: as individuals or as ingroup and outgroup members.

In a field study of netball players, Hogg and Hains (1997) provided evidence concerning the relative independence of these two forms of attraction. They showed that social attraction (which was related to how prototypical of the group the individual felt and degree of identification with the group) was distinct from personal attraction (which was related to perceived similarity and other interpersonal variables). Indeed we would argue that, in some circumstances, social attraction even may outweigh the impact of interpersonal similarity in evaluation of others. For example, Schmitt and Branscombe (1998) found that men who valued their gender group identity evaluated another man more positively when he matched the group's prototype compared to when he was like themselves personally and was not prototypical of the group. Specifically, men who identified highly with their gender group and whose masculinity was threatened by the experimenter telling them that they were less masculine than the norm of their group, actually derogated someone else who was like themselves and was described as low in masculinity. In contrast, when the target was described as highly masculine (and was therefore personally dissimilar to the participant) but matched the prototype of the group, evaluations were more positive among the high identifiers. Attraction here was driven more by group level protection concerns rather than by interpersonal similarity, which has been heretofore regarded as the main basis of attraction.

Likewise, how people occupying leadership roles are evaluated can depend on how the perceiver defines the self in a given social context. In a series of studies, Platow, Hoar, Reid, Harley and Morrison (1997) showed that in interpersonal contexts people have a preference for fair leaders rather than unfair leaders, as one might expect. However, in intergroup contexts people exhibit a preference for leaders who are unfair (i.e., who are biased against the outgroup). Indeed, leadership endorsement and social influence in both contexts was mediated by the participants level of self-categorization and the extent to which they perceived themselves as members of that group. Such a divergent pattern of findings depending on the judgmental context, reflects the fact that those contexts cue different levels of identity (personal versus group), which evoke their own norms and agendas. In an interpersonal context we are keen to know whether a leader will treat everyone equally and fairly (particularly ourselves). In an intergroup context, however, the person who best supports our own group's interests (against those of the outgroup) may be the one who is seen as best for the group (and oneself). In short, evaluation of leaders, and attraction more generally, is not governed by a fixed set of rules. Who we evaluate positively or negatively depends on the social context the judgment takes place in as well as the identities that these contexts make salient.

The notion that attraction can be socially structured by our group memberships also helps explain some important aspects of helping behavior. There has been a long-standing debate in this literature as to whether "true" altruism exists, or whether the effects that have been obtained can be explained by more self-interested motives. Evidence in favor of altruism has been based on a set of studies illustrating the role of empathy or identification with the person in need. Empathizing with the plight of the person in need, according to Batson (1987), evokes a need to benefit the other rather than helping merely as a means of eliminating ones personal distress in the situation. This research closely parallels the self-categorization notion that only when the other is in some sense categorized as part of an inclusive self-category (e.g., an ingroup) is that person likely to be the beneficiary of helping that is altruistic. Indeed, we would expect that those who are highly identified with a particular group would be more likely to empathize with the plight of another ingroup member or the group as a whole and as a result they should be the most prepared to lend assistance. In our own research (Branscombe, Spears, Ellemers, & Doosje, 1998) we have found that people who feel highly respected by other ingroup members (e.g., they believe the ingroup values them as good group members), choose to invest more of their time helping the group compared to themselves personally. We found that this effect was most prominent when the group itself was a socially devalued one, where the perceived need of the group for the valued member's assistance is especially likely to be high.

As with helping behavior, anger and aggression can depend on how the self and the other are categorized. As Smith (1994) discussed in his critique of the hostility and prejudice literatures, responses to members of devalued social categories are not uniformly negative. In fact, people frequently exhibit distinctly positive responses to outgroup members who stay within circumscribed social roles, particularly when the relationship is defined as interpersonal (see Eagly & Mladinic, 1994; Jackman, 1994). Considerable evidence now exists that women, when categorized by men at the interpersonal level can be very positively evaluated, but when categorized as a member of a competing outgroup they can be treated quite negatively. Similarly, White Americans can express fondness towards Black Americans who occupy domestic or subordinate roles, while at the same time displaying hostility towards those individuals who seek equality for their group. In both of these cases, hostility emerges only at the intergroup level of categorization and when expectancies at that level are violated. Categorization at the interpersonal level in both instances can result in positive evaluations.

Conversely, hostility can be experienced when an individual is categorized at the personal level (e.g., as a function of the individual's dislikable personal attributes). Yet, when the same individual is categorized as a fellow ingroup member, positive evaluations can emerge. Wann and Branscombe (1993) demonstrated that evaluation of an attribute or behavior must be considered in context, according to the interpretation it evokes. An aggressive behavior on the part of a person categorized as a member of one's ingroup (e.g., another University of Kansas basketball fan) was rated positively. The same behavior was displayed by a person categorized as a member of an important competing outgroup (e.g., a University of Missouri team fan) and was evaluated negatively. Thus, shifts in the level of self- and other-categorization can rapidly alter whether aggression occurs as well its intensity. Hostile responses can be based on either an interpersonal or an intergroup categorization of the target.

Contextual and Self-Definitional Processes in Intergroup Relations

The domain of intergroup relations has long been concerned with explaining the all too frequent evidence of intergroup conflict. Early approaches to understanding prejudice tended to be quite individualistic, such as the analysis provided by authoritarian personality researchers (Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950). As others have noted (see Billig, 1976), personality-based explanations are ill-equipped for explaining the collective dynamics of intergroup conflict. Indeed, Pettigrew (1958) argued that prejudice was more strongly related to the content of social norms than to individual psychodynamics. More recently, Altemeyer (1987) has reformulated the original analysis of authoritarianism in largely normative terms.

The arrival of the cognitive revolution in social psychology meant, however, that such early attempts to explain prejudice and stereotyping in motivational and normative terms were superseded by accounts that emphasized their emergence as products of everyday information processing biases (Hamilton, 1981). Stereotypes came to be conceptualized as schemas or acquired sets of beliefs about social groups that are stored in an associative memory network (Stangor & Lange, 1994). Like attitudes, they were seen as being fairly fixed mental structures that were resistant to change and that should be relatively immune to contextual factors. Hence, much research energy was invested in describing the content of various prominent social stereotypes (Brigham, 1971; Deaux & Lewis, 1984), as well as in whom and when they are likely to be activated in memory (Devine, 1989). Even when prejudice was considered to be a genuine reflection of socialization in a prejudiced cultural milieu, rather than being due to information processing factors alone, it was regarded as something that we all acquire more or less automatically (Devine, 1989). The view that people are automatically prejudiced, and only override this prejudice by conscious resistance has been recently challenged. In fact, evidence suggests that prejudice itself is not universal and that there are important individual differences (Lepore & Brown, 1997; Wittenbrink, Judd, & Park, 1997). Not only do our identities make a difference to the expression of prejudice, but the observed variability in stereotyping and prejudice means that these phenomena cannot be solely located in cognitive processing universals. Social contextual factors can have an impact on the very meaning assigned to an event and its participants, thereby influencing social behavior.

The metaphor of the "cognitive miser" that has dominated social cognition research in the last two decades was well placed to provide a powerful explanation of social stereotyping. The use of social categories and the stereotypes associated with them were assumed to be a "default setting" in social perception. Therefore, their greatest impact should be observable when people do not have sufficient time or motivation to see people as individuals (Brewer, 1988; Fiske & Taylor, 1991). For this reason, stereotypes might even be seen as "energy saving devices." In support of this conception, Macrae, Milne, and Bodenhausen (1994) found that the processing of stereotype-congruent information was indeed facilitated when the stereotype had been previously primed with an explicit category label. Moreover, compared to a control condition where the stereotype was not primed, additional cognitive resources were freed up as a result of stereotype use, resulting in enhancement of performance on a concurrent task. Thus, from this perspective, although stereotypes might be viewed as dysfunctional at one level, because of the biases that result from their employment, at another level they could be seen as serving a complexity reduction function that facilitates information processing. Stereotype use, according to this perspective, is therefore both understandable and to some extent inevitable.

The view that stereotyping results from the ongoing operation of "normal" cognitive processes implies that the social perceptions underlying group behavior should be stable and relatively insensitive to the social context. However, work within social cognition has begun to question the privileged status of social categories in information processing, and query whether stereotype influences are necessarily automatic (Bargh, 1994; Gilbert & Hixon, 1991) or if their operation are so different from more individuated levels of processing (Kunda & Thagard, 1996). If the meaning of a behavior shifts with the social context and the meaning of a behavior depends on how the person exhibiting it is categorized, then failure to consider both of these aspects will result in an inaccurate portrait of stereotyping processes. Focusing on the architecture and limits of information processing neglects the existing power relations between social groups, which forms an important aspect of the social context, as well as socio-motivational factors that influence how the self is categorized.

New evidence is beginning to emerge that suggests stereotypes may not be fixed cognitive structures (Oakes, Haslam & Turner, 1994; Spears, Oakes, Ellemers, & Haslam, 1997). Rather their content appears to vary as if they are constructed "on-line" according to ongoing social needs (see also Kahneman & Miller, 1986). For example, Haslam, Turner, Oakes, McGarty, and Hayes (1992) showed that the content of a stereotype depends on the comparative frame of reference and the current relations that exist between social groups. When researchers asked Australian participants to characterize Americans, the content of their descriptions (e.g., whether Americans were said to be aggressive or not) varied predictably depending on whether the question was asked before the Gulf War or afterwards. Their answers were also influenced by the inclusion of other countries, which were included in the comparative frame of reference. As the War escalated, Americans were more likely to be stereotyped as aggressive than they had been previously, and this reaction reflected changes in the relationship between the participants own nation and the U.S. In addition, when the comparative context drew attention to the conflict with Iraq, Americans were perceived more negatively than when the frame of reference did not remind participants of the Persian Gulf situation. Such work illustrates that stereotypes may be more akin to communicative devices whose operation varies depending on the relationship between the stereotyper and the target rather than on fixed mental structures.

Researchers have increasingly begun to stress the importance of people's desire to make sense of their world actively rather than simply managing cognitive load as important determinants of stereotyping (Spears & Haslam, 1997; Yzerbyt, Rocher, & Schadron, 1997). To examine the potential role of peoples desire to understand information for stereotyping processes, Yzerbyt et al., (1997) replicated Macrae et al.'s (1994) basic experiment that we described earlier. However, they also added a condition where the person information that was presented for participants to judge was inconsistent with the stereotype prime. In this case, they found that priming a stereotype actually consumed cognitive resources (rather than conserving them) as perceivers tried to make sense of and resolve the inconsistency. In a complex social world then, stereotype use may require interpretative effort and, as a result, it may be more cognitively costly than has been previously supposed. If so, conserving cognitive resources cannot be the primary underlying factor in stereotyping. Based on these data it would appear that either economy or inefficiency in information processing can occur as a result of stereotype use, and both appear to be by-products of meaning-making in a given context (Spears & Haslam, 1997).

An important social dimension to stereotyping neglected by an exclusively cognitive focus is the fact that stereotypic images are shared and communicated. If stereotypes were not socially shared, they would be of little social consequence. However, as a result of their socially consensual nature, the process by which they come to be promulgated is of central concern (Tajfel, 1981, 1982). The knowledge that other group members share one's views may be an important means by which stereotypic views are validated. Social influence processes appear to play a critical role in stereotype acquisition (Hardin & Higgins, 1996; Haslam, 1997). Therefore, attachment to a social group and the sharing of the groups perspective may be important inputs in the structuring of social cognition itself. Analysis of social relations operating in a particular context therefore seems to be essential to understanding both the stability and variability of intergroup perceptions. This consideration necessitates an examination of the role of self-definition and social context for intergroup perception.

In contrast to the cognitive miser approach to stereotyping, social identity theory provides a socio-motivational explanation of prejudice and discrimination (Tajfel & Turner, 1986). Research that has tested the various tenets of social identity theory (see Ellemers, 1993, for a review) has delineated important variables that moderate people's intergroup responses. Specifically, prejudice is more likely to be exhibited when a salient social identity is threatened by either negative social comparisons or by a threat to group distinctiveness, and by persons who are highly identified with the specific group that is threatened (Branscombe & Wann, 1994; Doosje & Ellemers, 1997). In fact, some degree of group identification is necessary for group-based behavior to occur. Research shows that high identifiers react in fundamentally different ways than low identifiers. For example, Wann and Branscombe (1990) showed that fans who identified strongly with their team (the "die-hard" fans) were more likely to stick with their team even when it was threatened by defeat or a poor record compared to low identifiers (the "fair-weather" fans). Furthermore, when an important social identity is threatened, high identifiers are consistently more likely than low identifiers to see both groups as more homogeneous (Doosje, Ellemers, & Spears, 1995), perceive themselves as more prototypical of the ingroup (Spears et al., 1997), and reject deviant ingroup members (Branscombe, Wann, Noel, & Coleman, 1993). High identifiers are thus more likely to embrace their group, particularly when it needs their support, whereas low identifiers adopt a more instrumental and individualistic stance, distancing themselves from the group when it suits their personal interests or when it might represent a threat to their personal identity. The correspondence between such cognitive effects as self-stereotyping and perceived group homogeneity which are used to preserve the ingroups distinctiveness with indicators of group behavior such as intergroup reward allocations as we have outlined, once again emphasizes the close link between social cognition and intergroup processes. Such cognitive changes facilitate ingroup cohesiveness among those who are highly identified. These changes also encourage the use of group-level strategies, such as collective action, to change the intergroup relational status quo.

More often than not, social psychologists have been tempted to reduce other aspects of group behavior to individualistic processes that fail to capture the social nature of the phenomenon under study. Perhaps the classic case of this involves the explanation of crowd behavior in terms of deindividuation theory (Festinger, Pepitone, & Newcomb, 1952; Zimbardo, 1969; Diener, 1980; Prentice-Dunn & Rogers, 1989). This theoretical tradition draws directly on the earlier writings of Le Bon (1895/1995) who described the individual in the group or crowd as being reduced to an "inferior form of evolution" where all normative restraints on behavior were stripped away. Although deindividuation theory has been repeatedly reformulated, this basic anti-social view of the individual in the crowd has remained a central feature. According to the most contemporary account, deindividuation is a state of diminished private self-awareness coupled with arousal caused by immersion in the group (Prentice-Dunn & Rogers, 1989). This state has been assumed to lead to disinhibited behavior and violations of social norms.

In a critique of the deindividuation explanation of crowd behavior, Reicher et al. (1995) provided an alternative account based on social identity theory (the social identity model of deindividuation effects or the "SIDE" model). According to this view, anonymity and immersion in the group do not result in a loss of the self (as argued by classical deindividuation theory), but serve to enhance the salience of social identity at the expense of personal identity. As a result of such an identity shift, conformity to group norms is enhanced rather than diminished. However, this approach makes a distinction between sensitivity to the local social norms that are active in a given research context and more generic societal norms (which define aggressiveness as generally antisocial). This distinction between what was normatively appropriate in the experimental contexts employed in the original deindividuation research and broader social norms was not taken into account.

Consider the classic deindividuation paradigm, where participants were dressed in hoods to make them feel anonymous. They were then required by the experimenter to administer electric shocks to another participant who was actually a confederate (Zimbardo, 1969). It was assumed that administering shocks is characteristic of aggression and is, therefore, anti-normative. However, this interpretation fails to take into account the meaning from the participants viewpoint, given the contextual demands that required them to administer shocks to another person. Indeed, an equally well-known line of research on obedience to authority, where participants were also required to administer shocks to another person, has been used as proof of compliance to an authority figure (Milgram, 1974) and *not* as evidence of socially unregulated behavior. The local normative demands that were operative in deindividuation studies appear to be rather different than those that might be found in other social contexts. To explore this possibility, in a meta-analysis of the all the relevant deindividuation studies, independent raters rated both the local norms governing the experimental setting as well as more general societal norms that might apply (Postmes & Spears, 1998). The evidence obtained overwhelmingly supported the normative analysis based on the SIDE model: conformity to the specific social norms operating in prior deindividuation studies best accounted for the outcomes that had been obtained. Thus, people's interpretation of the situation they are faced with is guided by contextually derived social norms.

Group norms have been postulated to play an important role in moderating intergroup behavior such as ingroup favoritism (Turner, 1987). There is a close link between social identification and conformity to group norms. In a series of studies, Jetten, Spears, and Manstead (1996) manipulated ingroup and outgroup norms orthogonally to create a discrimination or fairness norm. Results showed that group members conformed to the ingroup norm, even when it dictated fairness to the outgroup. This finding suggests that group norms have the power to moderate the extent to which ingroup bias occurs. Indeed, people who identified highly with their group were particularly likely to conform to their group's norm, whether it was one of discrimination or fairness (Jetten, Spears, & Manstead, 1997). A major question that might profitably be pursued in future research is how "fairness" social norms can be more broadly created. According to this analysis, such norms may well be critical if we hope to reduce social discrimination.

In existing models of persuasion and attitude change, intrapsychic processes have been emphasized more strongly than has the communicative context. In the dual process models of persuasion that we described earlier, the group membership of the source was conceptualized as a peripheral cue that can lead to weak and ephemeral social influence. By contrast, cognitive elaboration was expected to operate on the central arguments of the message. Likewise, classical perspectives on social influence subscribe to the view of the group as exerting an external pressure to comply ("normative influence"), which does not necessarily lead to internalized or "true" influence (Deutsch & Gerard, 1955). However, the self-categorization approach to social influence accords the group a more central and influential role because its norms can be central to how we define ourselves. Therefore, knowing what groups people identify with can help us understand what norms people are likely to have internalized (Turner, 1991). In this sense, the group is not peripheral but is central to our understanding of when and how social groups exert an influence on the individual.

As our selective summary of research on intergroup relations has illustrated, the operation of the same social principles can be observed as when interpersonal and intrapsychic processes are examined. Our overview emphasized the importance of the social context, how the self is categorized, and the implications for social behavior that follow from conformity to various types of social group norms. Social psychology has become sufficiently mature to generate its own theoretical explanations that are uniquely *social*, and the integrative framework provided by social identity and self-categorization theories offers a useful set of principles for understanding seemingly widely disparate social phenomena. Indeed, rather than social psychological phenomena originating in basic cognitive processes or capacity limitations, the research on intrapsychic processes that we discussed suggests that many apparently basic cognitive and perceptual processes may themselves be socially mediated by level of self-definition and social contextual factors. Research in all three of the major research areas of social psychology has provided evidence for the operation of these fundamentally social influences. Using the principles stemming from social identity and self-categorization theories allowed us to survey social psychology in a fairly integrated and interrelated fashion, as a distinctive and unitary discipline. Although there have been other candidates for integration and unification, either "from below" (neuroscience, connectionism) or from "our past" (evolutionary psychology), by their very nature they fail to do full justice to the social psychological nature of the phenomena investigated.

Into the New Millennium

All three of the different unifying theoretical approaches to social psychology that we discussed (connectionism and information processing, evolutionary theory, social identity and self-categorization) are likely to receive increasing research attention as we move into the new millennium, in part because of their ability to order seemingly disparate findings. As the methods and models within cognitive psychology become more sophisticated and plausible neural pathways are developed, some social psychologists will increasingly pursue this route. Similarly, although evolutionary approaches to social psychology are as yet in their infancy, the indications are that their influence will grow as advocates try to push the limits of this level of explanation as far as possible and provide further links to the biological sciences. Because we believe that the richness of social behavior is inherently influenced by people's social identities and the agendas dictated by those groups' norms, we expect that research illustrating how behavior is shaped by a host of economic, cultural, and historical conditions will increase as well. Such effects, as they emerge, are unlikely to be reducible to the micro-mechanisms of the neural network or the macro-mechanisms of evolutionary selection pressures.

The challenges of social psychology in the new millenium should be especially attractive to scientists who have the capacity to synthesize findings from diverse theoretical approaches. Graduate students looking for an academic home in social psychology will need to be able to use theory in a fluid and integrative manner to bring the best elements of relevant theories to bear on the social puzzles before us.

We have chosen to focus on one important representative of a social psychological level of analysis, but there are also other equally "social" candidates that we have neglected and that may gain in influence in the future. In particular, social psychological approaches, such as the discursive and social constructionist traditions which have hitherto been somewhat separated from mainstream experimental research, should continue to thrive (e.g.,Gergen, 1991; Potter & Wetherell, 1987). These research traditions have diverse roots, notably in ethnomethodology within sociology, and speech act theory and semiotics within linguistics and philosophy. There are also close connections between constructionism and the more "sociological" branch of social psychology, the "symbolic interactionist" tradition. Social constructionistapproaches tend to focus on how social reality is constructed through linguisitic and discourse processes. In its more radical form, this view questions whether there is indeed a reality "beyond the text" or outside of linguistic constructions (postmodernist philosophy has been very influential here). In methodological terms, this tradition has been critical of experimental means of imposing a particular construction of reality on participants, and for assuming that it can access some underlying truth beyond the understandings and discourses of the participants involved. In response, mainstream social psychologists have criticized those in the social constructionist and discourse camps for the relativism and indeterminacy of its position and for questioning the value of quantitative methods of assessing underlying causal relations (Spears, 1997). These criticisms of the experimental method have doubtless contributed to their current lack of impact on mainstream social psychological research.

The issue of how meaning is socially constructed has, for the most part, been neglected in mainstream social psychology and it may well become an important problem around which integrative progress can occur. Some attempts are already evident. Research within the social cognition tradition has begun to reveal the value of incorporating constructionist principles in ways that use rather than oppose standard scientific paradigms. Research on "construal" processes (Griffin & Ross, 1991) has shown that the objects of perception and judgment should not be taken as givens. Indeed, the way in which we construe (or "construct") an object, has important consequences for judgment and behavior. For example Asch (1952) showed that interpretation of and agreement with the statement "a little rebellion now and then is a good thing" was dramatically affected by whether its source was cited as Thomas Jefferson or V.I. Lenin. Such differential interpretations are socially shared and socially constructed as well as cognitively construed. In this sense, social constructionism has the capacity to add an even more social dimension to social psychology. Similarly, recent research examining communication principles and "conversational norms" has highlighted their importance for intrapsychic processes such as attribution (Hilton & Slugoski, in press). Thus, many of our existing experimental results may be the product of how people make sense of the experimental context according to the pragmatic rules of communication, rather than reflecting the direct and unmediated products of cognition. Sensitivity to such processes will help us not only better distinguish artifact from reality, but also to understand better the communicative dimensions of social reality.

In terms of the social identity and self-categorization traditions that have formed our main thematic focus, there is also scope for integration with a more constructionist perspective. There is a tendency for these theoretical traditions to take the definition of self and social contexts as "givens" whereas these too are to some extent negotiated and contested in social discourse. For example, whether we view a rioting crowd as a "mad mob" or as a group victimized by police, is a matter of how we construct this event. These differing constructions are influenced by self definition and social context (Reicher, 1995). How we see the event is dependent on whether we define ourselves as peaceful demonstrators who are being attacked by the police, or as neutral bystanders who are witnessing an intergroup conflict. In fact, such bystanders may construct the event differently than those who merely read about it in newspapers which present it through the eyes of journalists who use certain discourses to define the crowd in terms akin to those used by Le Bon. In short, there may be multiple possible constructions of the same event, with each capable of influencing our evaluation of it. Greater recognition of the constructed nature of social categories and situations may provide one of the missing links in self-categorization research in particular, and in mainstream social psychology in general.

Developments That Will Further Link the Three Social Psychological Research Areas

As we described already, degree of identification with one's group is an important predictor of group behavior when the relevant identity is salient. We argued that participants in minimal groups studies were attempting to achieve a positively distinct social identity. However, research has increasingly begun to look at the role of intragroup dynamics as contributors to intergroup behavior. Factors that can moderate the occurrence of intergroup behavior include the individual's personal status or ability (McFarland & Buehler, 1995; Seta & Seta, 1996), the personal self-esteem level of the individual (Long & Spears, 1997), and the degree of perceived respect received from other ingroup members (Smith & Tyler, 1997; Tyler, Degoey, & Smith, 1996). Research linking intragroup dynamics and intergroup behavior reveals that depending on one's position within a group (be it peripheral or central), behavior can reflect either intragroup concerns or more group-level purposes (Branscombe et al., 1998; Noel et al., 1995). An outwardly appearing identical behavior (discrimination against an outgroup) can be either personally instrumental--engaged in as a means of currying favor for the self with other ingroup members, or it can be enacted in the service of the group's needs out of genuine commitment to the group and its goals. Although these studies illustrate that intergroup behavior can be quite complex and can derive from intragroup as well as intergroup agendas, additional research examining how contextual factors alter their relative weight is needed.

We also perceive a need for additional research linking traditonal intrapsychic topics, such as attribution with interpersonal and intergroup processes. Attribution theory has focused primarily on how individuals themselves, as isolated agents, construct explanations for events. However, others may exert important influences on the nature of the explanation for an outcome that is ultimately deemed to be the most plausible one. Research concerning normative influences on acceptance of group-based explanations for events (i.e., discrimination), and how they come to be socially validated or not, could greatly expand our understanding of the development and promulgation of social ideologies. Furthermore, because individuals can and do categorize themselves at different identity levels depending on the nature of the social context, the explanations that they are willing to accept for the same outcome might vary accordingly. Consider the attributional dilemma of a job candidate who applies for a position but is not selected. Are there normative supports available for this person to consider the possibility that group-based discrimination may have played a role in producing this outcome, or is such an explanation seen as a socially undesirable one to voice? Does the degree of social influence on such explanatory processes depend on whether an ingroup member or an outgroup member suggests that discrimination may have played a causal role in producing the outcome? Does the explanation that is suggested by others encourage consideration of how "people like us" have been historically treated by "people like them," or does it discourage such possibilities by pointing to more individualistic factors (Smith & Spears, 1996)? Because quite different behaviors may be dictated depending on who suggests what type of explanation best accounts for a given outcome, the potential impact of such normative factors deserves additional research attention in the future.

Applied or Social Issue Topics That Will be Increasingly Pursued

Opportunities to contribute in meaningful ways to understanding group phenomena linking these three approaches are plentiful. We will suggest many important areas that could serve as dissertation topics for graduate students or the start of important research streams for beginning researchers.

In the foregoing sections we have tried to show how intergroup conflict and discrimination are not necessarily inevitable. We believe that appropriate group norms, ideologies, and values may ultimately help to keep the peace. With the changing structure of the American population in terms of increasing cultural diversity and increasingly global interactions, the possibilities for interacting with different sorts of people have soared (Gergen, 1991). Such interactions mean that wider and more diverse types of social contacts and influences can be expected, providing for both the possibility of greater integration based on diversity and acceptance of cultural differences, although it also raises the potential for increased intergroup tension.

The social identity tradition in social psychology is one perspective that has encouraged the discipline to take a new look at more macro-level social concerns such as cultural diversity, multiculturalism, and the nature of power. Research has already begun to examine how cultural factors can influence social perception and behavior. The roles that power and status play via memberships in dominant and devalued social groups is also likely to become an increasingly important research topic (Branscombe & Ellemers, 1998; Fiske, 1993). We are seeing a new interest in the psychological experience and perspective of members of devalued social groups (Crocker & Major, 1989; Steele, 1997) and the response strategies available to them when they face social discriminatory treatment. Thus, we predict that research will increasingly employ members of devalued groups as participants. The tenability of the existing assumption that all people, regardless of their place in the social structure, respond similarly to the social conditions they find themselves in is beginning to be questioned. To take one recent example, Branscombe, Schmitt, and Harvey (in press) distinguished between the psychological responses of African-Americans who differ in terms of how pervasive they perceive prejudice to be, and how those are likely to differ from dominant group members who perceive themselves to be victims of discrimination. Historically disenfranchised group members are more likely to perceive the outgroups discrimination as stable and pervasive, and this perception encourages such persons to turn toward their minority group as a means of protecting their well-being. Because the US is becoming an increasingly ethnically diverse society, such variations in willingness to define the self in terms of a minority group membership and the social interactional consequences of that choice should receive greater attention in future research.

The face of the population is changing in other important ways that are likely to have consequences for social psychological research in the future. As a consequence, creative students will have ample problems to study in this area. One demographic change that is likely to exert a widespread social impact concerns the age profile of the population. As a result of increases in life expectancy, an increasing proportion of the population is elderly, with those over 85 being the fastest growing group (Hansson, 1989). As the number of older Americans grows, stereotyping and intergroup conflict research based on age groups will also come increasingly to the fore. In fact, the National Science Foundation has recently announced a new grant initiative aimed at integrating existing social psychological research with aging issues. Although age group membership is a particularly interesting example of a group conflict situation because it is the only one where we rotate through the different categories (see Snyder & Miene, 1994), the possibility of intergenerational conflict is nevertheless quite real. Increased dependence by this growing segment of the population on public funds from social security and Medicare, combined with political organizations that present the elderly as taking resources from the young reflects the need for research that can assist in the management of this social change. Furthermore, a focus on aging could act as an impetus for work on multiple category memberships. As Hansson (1989) has noted, the aging experience is fundamentally dependent on other social group memberships. It is primarily White Americans, rather than minority group members, who constitute the bulk of the elderly population, especially those who are relatively well-off financially. Likewise, the number of elderly women is growing at a much faster rate than the number of men. Thus, existing group conflicts based on ethnicity and gender may be played out in terms of stereotyping and prejudice against the elderly. Therefore, solutions will require a more solid understanding of how one kind of social category membership can influence the ongoing impact of another.

More generally, we see an important need for research in the future on the role of multiple group memberships. We currently have only a minimal understanding of what influences when people will perceive others in terms of one or another of their group identities, or if the processes differ for intersecting category memberships. Furthermore, identities are rarely experienced as a constant across time, and how some come to gain importance while others decrease has received little attention. As people navigate their way through life, they may encounter circumstances in which desirable new identities can be added (Ethier & Deaux, 1990), and the loss of others must be coped with. As Breakwell's (1986) pioneering work on people facing unemployment, divorce, and immigration illustrates, the psychological impact of such profound identity changes depends on the degree to which they are voluntary or externally imposed. In addition, the degree to which people anticipate being accepted into and receiving positive treatment based on their new group membership is likely to be critical for adjustment.

Perhaps because social psychology has been historically wedded to the undergraduate as research participant (see Sears, 1987), we have not as yet fully appreciated how group commitments may shift across the lifespan. Addressing additional questions such as why people might choose to exhibit negatively evaluated identities with visible markers (e.g., tattoos, body piercings) deserves attention. When such markers of group membership will come to be widely accepted throughout the culture and when they will remain indicators of "fringe" status could be used to investigate broader questions concerning the processes of social diffusion and social change. Similarly, gaining an understanding of what circumstances and why people might attempt to hide their group membership (e.g., homosexuals, signs of aging) will require us to seek research participants outside the academy. As a starting place, we suggest that some people may choose to align themselves with social groups that are negatively evaluated because they reject the standards of the "mainstream" (potentially as a result of feeling rejected by it), and they wish to convey that they are not "one of them." Other people may move toward an alternative group identity because they do identify with that group's norms and values, and they wish to publicly express their alignment with it.The possibility that differing social motivations may be crucial for joining different social groups or in different members of the same group cannot be assessed without research on actual members of such groups.

Just as important as the social and demographic changes that are ongoing in society are the technological changes that accompany them. These changes will provide countless research ideas for enterprising students. For example, increasing automation of production and so forth makes possible alternative ways of organizing work and leisure, as well as altering the structure of the relations between people. Perhaps the most significant change in this area in the last 10 years, and one that will continue to develop, concerns the new communications technologies such as e-mail and widespread access to the internet. Increasing numbers of people are interacting with one another by means of text-based computer-mediated communication and standard on-line video links are not far off. Once again social psychological research can make a contribution to our understanding of the effects that these new technologies can exert on social interaction and organization.

The proliferation of communications media means that we are potentially inundated with information on a scale not before known, leading to what one author has referred to as the "saturated self" (Gergen, 1991). Many people may experience the infinite choices provided by these media as overwhelming and find the shifting skills required to manage these technologies as psychologically stressful. More positively, the range of choices provided by these media, and the Internet in particular, means that people can channel and tailor them to their own work, consumer, and entertainment needs. The day when the mass media are as varied as the groups and individuals that they address is not too far around the corner. The "agenda setting" influence of the mass media may increasingly disappear if individuals can set their *own* agendas to suit their existing political preferences and tastes. Such flexibility may, however, come at the cost of social fragmentation if individuals increasingly withdraw from the real social world into their virtual ones.

However, these virtual worlds do offer new ways of being and relating to others. In cyberspace, there are new possibilities afforded for identity construction when freed from the constraints of time, distance, and personal appearance. The Internet provides a new medium for interpersonal contact that is no less intimate than face-to-face communication and sometimes is more so (Lea & Spears, 1995). Indeed, these new communications media may be experienced by some as personally liberating in so far as they allow for increasing control of our information consumption and our interpersonal relations.

Nevertheless, there is also no guarantee that access to these technologies will be equally distributed and that existing power and status gaps may be reproduced in terms of differential access, with the opportunities provided by them exacerbating the gap between the haves and the have nots. Moreover, even for those persons who do have access, there is some evidence that features of the Internet (anonymity and isolation) can paradoxically reinforce social boundaries rather than break them down. Although some researchers have argued that the relative absence of social cues can undermine status differences and lead to more equalized and democratic participation (e.g., Kiesler, Siegel, & McGuire, 1984), this view is not universally shared. Research in the tradition of the social identity model of deindividuation effects that we discussed earlier suggests that such interaction may be more bounded by social context and relational factors than previously thought. Thus, according to this model, the visual anonymity associated with such media can reinforce the impact of social identities, social norms, and the operation of existing power relations, compared to more face-to-face communication where individual differences are more salient (Spears & Lea, 1994). Simply because people interact with each other less directly than in face-to-face communication, does not render an analysis in terms of social psychological principles any less relevant or applicable.

Although predicting the future of any human endeavor can be a risky business, we have pointed to what we believe will be important directions for social psychological research in the future. By first examining important existing threads of research, within an integrative framework, we were able to project those strands forward to provide a peek at what the social psychological quilt might look like in the future. What can be confidently predicted is increasing theoretical integration across the three traditional areas of social psychology in terms of common mechanisms and a continuing concern with addressing applied social problems as they emerge. As such, students capable of sophisticated theory skills will not only have a variety of opportunities from which to choose, but also may be able to make a substantial impact on the serious social problems that we will face in the next century.

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# Chapter 8 Psychology of Women and Gender in the 21st Century

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Introduction

Psychology of women has come a long way from Helene Deutsch's (1944) psychoanalytic writing and the century-long tradition of gender differences research in psychology. Today it has a vibrant foundation of three decades of contemporary research and a promising future built on this foundation, yet with many questions unanswered. Psychology of women today interweaves three strands: (a) psychological research focused specifically on women, their psychological functioning, and women-associated issues such as rape; (b) the psychology of gender, incorporating traditional research on gender differences but expanding beyond that to examine gender as a stimulus variable; and (c) feminist psychology, rooted in feminist theory and an articulated set of values that emphasizes equality of opportunity for women. We incorporate all three of these strands in our review.

Here we will consider four major areas that represent the current status of the psychology of women and, we believe, will chart the future of psychology of women: theories in the psychology of women; the intersection of gender with race/ethnicity, sexual orientation, and disability; research methods in the psychology of women; and applications of research on the psychology of women in the areas of public policy, forensic practice, and the practice of psychotherapy and counseling.

Theories in the Psychology of Women

Few "grand theories" have been proposed in the field of psychology of women; one of the few is gender schema theory (Bem, 1981), reviewed below. This is not to say that the field is atheoretical. Rather than building grand theories, researchers have concentrated on rewriting and redefining the androcentric theories upon which psychology was established and building models to deal with more circumscribed problems. Feminist theory, often borrowing from the humanities, has been a rich source as well. Here we review each of these approaches, with examples.

Gender Schema Theory

Bem's (1981) gender schema theory reflects the cognitive revolution in psychology over the last several decades and applies this approach to understanding the development of gender stereotyping. In cognitive psychology, "schema" generally refers to a cognitive structure, developed from prior learning, that is used when filtering and interpreting new information. For Bem, a gender schema is a person's general knowledge framework about gender, with which information is processed and organized based on gender-linked associations. Children gradually form a gender schema as they learn their culture's network of associations with gender. Moreover, the gender schema becomes linked to self-concept so that children, as part of their motivation to become "good" girls or boys, engage in the gender-appropriate behavior specified by the gender schema.

Many studies support gender schema theory. In testing the theory, Bem categorized participants into *gender-schematic* persons (masculine males and feminine females, as determined by Bem's test of androgyny [1974]) and *gender-aschematic* people (androgynous males and androgynous females). She argued that gender-schematic people are more likely to engage in gender-schematic processing of information, whereas gender-aschematic people engage in it less. In a free-recall test of a list of words, gender-schematic people were more likely to cluster the words by gender (e.g., gorilla, bull, trousers), than gender-aschematic people were. Reaction-time data indicated that gender-schematic people, when responding "me" or "not me," processed schema-consistent attributes faster than they processed schema-inconsistent attributes. Martin and Halverson (1983) found that, if five- and six-year-old children were shown pictures of children engaging in stereotype-consistent or stereotype-inconsistent activities, a week later the children made errors in recall of the stereotype-inconsistent pictures, recalling them as stereotype-consistent. That is, if they had seen a picture of two girls boxing, they remembered that they had seen two boys boxing.

Gender schema theory is compelling for a number of reasons, one being that it explains why gender stereotypes are so resistant to change -- our gender schema simply filters out stereotype-inconsistent information. The theory has also been criticized but the reasons are too technical to go into here (e.g., Spence & Helmreich, 1981). From our point of view, the main limitation of the theory is that it is exclusively cognitive.

Emotion is reemerging as a prominent construct within psychology in general, and in the 21st century we look toward theories of gender that integrate cognition (thought) and affect (emotion). For example, the expanding literature on self-concepts and self-strategies (see review by Wood, 1989) is just waiting to be incorporated into research on gender. As we noted, gender schema theory provides a cognitive explanation for why gender stereotypes are so difficult to change. However, another plausible, and very exciting explanation might suggest that some people are motivated to maintain their gender stereotypes. For instance, there may be times when people accentuate or draw attention to their own gender-stereotyped traits, if doing so makes them feel good about themselves. People may feel more positively about themselves and their own gender when they degrade the other gender.

On the other hand, some people do indeed work on reducing their stereotyped attitudes about gender, but what motivates them to work so hard at this? Maybe there are situations in which gender stereotypes become so personally limiting and/or defeating that people want to reject them? How do they do this? Integrating self-concept research into research about gender presents the opportunity to determine motivational factors underlying why gender is such a salient interpersonal characteristic for both women and men, and why its importance is so immutable.

Specific Models

Here we will provide two examples of research building specific theoretical models to deal with specific questions.

Stereotypes and power. Susan Fiske (1993) has proposed a model of the ways in which power and stereotypes influence each other. Two processes are involved: (a) Stereotyping exerts control or power over people, pressuring them to conform; therefore, stereotyping maintains the status quo. (b) Powerful people tend to stereotype less powerful people far more than the reverse. Given that gender is an important status or power variable, you can read "men" for "powerful people" and "women" for "less powerful people." The theory is even broader than that, though, and extends to other categories such as ethnic groups.

Let's consider the first process, in which gender stereotyping exerts control of males and females. Stereotypes can be prescriptive -- that is, they say how people of a certain group should behave. Adolescent boys should excel at athletics. Girls should not be aggressive. If one fails to meet the demands of such stereotypes, the penalties can be severe, such as social rejection by the peer group. Stereotypes, therefore, exert control over people.

Turning to the second process, the powerful group (men) tends to stereotype the less powerful group (women) more than the reverse. Less powerful people generally are motivated to pay attention to the idiosyncrasies of powerful people because those powerful people control outcomes for the less powerful. Servants know a great many details about their employers and their preferences, for example, but the reverse is unlikely. Powerful people pay less attention to others and consequently rely on simple stereotypes. Powerful people pay less attention to the less powerful in part because the less powerful have little control over them.

Fiske (1993) has conducted many clever experiments to test various aspects of her theory. In one study, undergraduates were given the power to evaluate the summer job applications of high school students. Some undergraduates were given more power in the final decision and others were given less power. The students who were given more power actually paid less attention to the applicants, consistent with Fiske's model.

Fiske's model and research were influential in an important Supreme Court case, *Price Waterhouse v. Hopkins*. Ann Hopkins was denied partnership in the prestigious accounting firm of Price Waterhouse. Compared with her male colleagues who were also being considered for partnership, she worked more billable hours, was well liked by clients, and brought in millions of dollars in accounts. She was denied partnership not because her performance was inadequate (it was in fact superb by objective standards), but rather because she was not considered feminine. Stereotype violation, in short, was used as grounds for the denial of promotion.

Based on Fiske's model, we can understand how stereotypes operated at several levels in this case. Men were in power at Price Waterhouse and women were outnumbered. Therefore, the powerful men were likely to hold stereotyped expectations about the women and to pay less attention to their individual details, such as their qualifications. Hopkins, by being a successful woman in a male-dominated profession was a stereotype violator and received punishment for it.

The Supreme Court ruled in favor of Hopkins, and the brief filed by the American Psychological Association, reporting Susan Fiske's research, was highly influential in the decision.

Men who sexually aggress against women. Some theorists argue that too much rape research has focused on women who have been raped, when the real emphasis should be on the aggressors. Only by gaining a scientific understanding of them will we be able to reduce the occurrence of rape. Neil Malamuth and colleagues (1991) developed a model of the factors that predispose a man to engage in sexual coercion with women and then tested it against data obtained from a large, national sample of male college students. According to their model -- and the data supported it -- four factors predispose a man to engage in sexual coercion: (a) Hostile home environment -- Violence between parents or battering or sexually abusing the child increase the chances that the boy will engage in sexual coercion. (b) Delinquency -- Being involved in delinquency leads a boy to associate with delinquent peers who, for example, encourage hostile attitudes and rationalizations for committing crimes and reward a tough, aggressive image. (c) Sexual promiscuity -- Often in the context of the delinquent group, the young man comes to believe that sexual conquests bring him status within the peer group, and coercion may seem to be a reasonable way to achieve his goals. (d) A hostile masculine personality -- This personality constellation involves deep hostility toward women together with negatively defined, exaggerated masculinity--masculinity characterized as rejecting anything feminine, such as nurturance, and emphasizing power, control, and macho characteristics.

Understanding the factors that make some men rape-prone will be crucial for intervention programs. What other factors might be related to men sexually aggressing against women, and might these and other factors interact or lead to one another in a causal sequence? How could such models be tested?

Feminist Theory

Research and theory about the psychology of women has been heavily influenced by feminist theory (e.g., Jaggar & Rothenberg, 1993; Tong, 1989), much of which has originated in the humanities. An early example was Bem's (1974) theorizing and research on androgyny, which was preceded by earlier writings in the humanities (Heilbrun, 1973). We have no doubt that this pattern will continue into the 21st century, as developments in feminist theory are made in the humanities, and then translated by psychologists into theory that is testable with empirical data. Here we offer one recent example.

Nita McKinley and Janet Hyde (1996) developed the Objectified Body Conscious (OBC) Scale to measure women's experience of their own bodies. The research began with the writings of feminist theorists, who argue that the female body is constructed as an object of male desire and exists to receive the gaze of the male (Spitzack, 1990). The result is that women experience objectified body consciousness (McKinley, 1995). OBC consists of three components: (a) body surveillance, in which the woman or girl views her own body as if an external onlooker and constantly evaluates it; (b) internalization of cultural standards that specify the ideal female body and the ideal for beauty; because these standards are internalized, conformity seems to be a matter of personal choice rather than external pressure, and shame results when one fails to control one's weight or appearance; and (c) beliefs that one can control one's appearance and weight, which can lead to unhealthy behaviors and eating disorders. Based on this feminist theorizing, McKinley and Hyde (1996) developed the OBC scale to measure these three components. Their data showed that high scores on these scales were associated with disordered eating. Now the scales are available to those doing further research on this important topic.

One of the most exciting aspects of the psychology of women is that it is part of the interdisciplinary field of women's studies. As such, there are rich opportunities to learn from developments in other disciplines and in turn to use psychology to build on those developments.

Gender and Its Intersection with Race/Ethnicity, Disability, and Sexual Orientation

One of the key tenets of feminist theory is that gender does not act alone, but rather acts jointly with race/ethnicity, disability, and sexual orientation, in influencing an individual's life experience. Here we provide examples of some of this work that looks at the conjoint influence of gender and these other status characteristics.

Gender and Race/Ethnicity

We can see the intersection of gender with race/ethnicity most directly if we examine variations in gender roles across ethnic groups in the United States. For example, the evidence shows that some North American Indian tribes had a system of egalitarian gender roles, in which separate but equally valued tasks were assigned to women and men and women had a strong role in government (Blackwood, 1984). The very work that is considered acceptable for women or men can be determined by one's ethnic group.

Among Asian Americans, educational attainment is highly valued and both males and females are expected to meet high standards. Asian American women graduate from college at a higher rate than white men do (Hyde, 1996). There is no view that women are less worthy of education. In this case, one's gendered aspirations are defined by one's ethnic group.

As these two examples indicate, we cannot begin to understand the impact of gender roles on girls and women unless we consider ethnicity simultaneously.

Gender and Disability

Few individual characteristics rival gender in their salience or impact in social situations, but disability is one of them. It is surprising that only a small body of research exists on the interaction of gender and disability; we believe that this literature will continue to expand in the next decade. Michelle Fine and Adrienne Asch (1988) have edited an interdisciplinary volume on this topic. They commented on the discrepancy between feminists strivings for independence and disabled womens assumed dependence. This misconception may be one reason why disability and gender have not been extensively researched within the psychology of women.

Despite the scarcity of research, some areas have been explored. For example, an analysis of autobiographies written by blind people revealed that blind women were more likely than blind men to seek jobs within the blind community, teaching and counseling other blind people (Asch & Sacks, 1983). Furthermore, blind women were less likely than blind men to refer to intimate relationships, but more likely to show concern about the visible features of their disabilities.

Another line of research on women and disability has focussed attention on womens experiences of sexuality and mothering. Asrael (1982) articulated the discouragement and difficulty that disabled women face when deciding to have children, and then offered a useful model within which disabled women are described as working with a team of professionals to plan their pregnancies and deliveries. This compelling idea highlights one of this areas complexities. For example, would this approach be appropriate for all women with disabilities? Embedded within this research topic is a challenge to recognize differences and commonalities among peoples experiences who have different disabilities.

Most of what we know in this area is descriptive in nature and is based on interviews with disabled women. Although these studies are rich with detail and are an important place to start, the underlying social and psychological processes related to womens experiences will be identified only when researchers apply psychological theory to this domain.

Disabled women (and men) have been described as members of an }invisible" population. Although this description is true in general, some disabilities are more invisible than others and have escaped the attention of researchers to an even greater extent. Examples of these invisible disabilities are learning disabilities, mental illness, and some physical or sensory disabilities. These individuals who can }pass" as not disabled at first glance may have unique experiences and frustrations that are not socially recognized or validated. Researchers may gain insight into the nature of gender and stigma associated with disability by focussing attention on how these women choose to navigate through life labelled as disabled or not.

Another area that is rich with research possibility concerns public attitudes about women with disabilities. Are women with disabilities evaluated more negatively than disabled men when they need to advocate for themselves? What attributions are made of their emotional behavior? In what ways do physical atypicalities influence interpersonal behaviors among women with disabilities, and how do these women deal with extreme standards of beauty and femininity that may seem contradictory to their disabilities? Approaching the topic from a more positive stance, are women with disabilities more capable of challenging gender stereotypes or expectations because of their often marginalized position? The answers to these questions are unknown, and the questions continue to emerge. Psychology of women has its work cut out for itself in the arena of understanding the complex relationships between gender and disability.

Sexual Orientation

Issues of sexual orientation have personally touched the lives of many within the field of psychology of women and part of the research attention afforded this topic can be traced to this interest. However, perhaps more powerfully, psychology of women has a strong tradition of documenting and validating the diversity in human experience. It is from this stance that psychology of women has tackled the very complex issues related to sexual orientation.

Like no other area of academe, psychology of women has sought to describe and validate the experiences of lesbians (Boston Lesbian Psychologies Collective, 1987; Greene & Herek, 1994; Davis, Cole, & Rothblum, 1996; Weinstock & Rothblum, 1996). Some stereotypes have been shattered, but perhaps more importantly, it has become clear that there is no single lesbian experience. One important part of past research is that psychologists have recognized and documented the challenges facing lesbians who are building and maintaining relationships without the support of family, friends, and/or social institutions.

Research has also focussed on the qualities of lesbian relationships themselves. More specifically, these relationships offer one of the only opportunities to witness the dynamics of intimate relationships without the inherent inequalities introduced by pairing women and men. Although most lesbian relationships are more egalitarian than heterosexual relationships (Peplau, Cochran, Rock, & Padesky, 1978), one finding that was surprising to some was the existence of violence within some lesbian relationships (Brand & Kidd, 1986). This finding is particularly relevant to future research in this area, in that investigators will continue to disentangle the network of status and power that exists between people even in relationships where gender is equalized.

Issues of sexual orientation are not limited to lesbianism. Future research will focus on bisexual women. Bisexuality has often been brushed aside, without having an identity of its own, but gradually it is becoming less marginalized. Bisexuality offers a unique situation in which women have the flexibility to alternate between }heterosexual" and }homosexual" experiences depending on whom theyre currently dating. The psychological and social complexities that accompany this situation, and the nature of a bisexual identity or identities, will be illuminated in future research (Ault, 1996; Weinberg, Williams, & Pryor, 1994).

Finally, research on sexual orientation will continue to address issues related to social policy. For example, one line of research shows that children are not disadvantaged as a result of being raised by lesbian rather than heterosexual couples (Flaks, Ficher, Masterpasqua, & Joseph, 1995; Patterson, 1992). This type of research may be influential in adoption cases where concern is raised regarding whether lesbian couples are fit to be parents. Furthermore, through research, lifestyles that may seem marginal to some people, become more normalized and acceptable. There is great power in showing that women who are lesbian or bisexual are not necessarily different from heterosexual women on variables other than sexual orientation.

Research Methods in the Psychology of Women

Researchers within psychology of women have adopted, adapted, and cultivated a wide variety of research methods. Part of this diversity has grown out of the challenges feminist researchers encounter as they search for methods that will effectively answer their research questions without contradicting their feminist ideals. The selection and application of research methods is a series of tradeoffs because each has its strengths and weaknesses, and none is a methodological panacea. The tradeoffs typically center around two fundamental characteristics of any research endeavor: (a) whether qualitative or quantitative data are collected, and (b) the context in which the data were collected. For clarity, we will discuss these issues separately although they are intertwined.

Quantitative and Qualitative Research

Regarding the first issue, data can be either qualitative or quantitative. Qualitative data come in the form of verbal description and are usually summarized in text, whereas quantitative data are in the form of numbers and are analyzed via statistical procedures. One of the most well-known studies of the qualitative type was conducted on womens moral reasoning by Carol Gilligan (1982). Gilligan conducted a series of elaborate interviews with women who were making the decision of whether or not to have an abortion. She designed her research in response to the androcentric theory of moral reasoning advanced by Kohlberg (1969) in which he pronounced women to be less mature in their moral reasoning than men. In contrast, Gilligan concluded that women were not deficient in their abilities to reason morally, but rather, reasoned from different premises than did men. According to Gilligan, men mainly use considerations of justice in their moral reasoning, whereas women attend more to relationships and the imperative to care for others. It is easy to understand how Gilligan's interview-based methodology is congruent with the feminist goal of documenting and validating the lived experiences of women. This approach can uncover detailed information about individuals' experiences by taking into account the contexts in which they live and the intricacies of their lives.

Qualitative methods such as these can definitely contribute a great deal to the field. However, due to the elaborate processes by which qualitative data are collected and synthesized, these accounts typically represent the experiences of only a small number of people; thus, the virtue of this method is also its vice. Because of the rich detail and concern for individuals unique experiences, it is often difficult to draw general conclusions.

Investigators using quantitative methods, in contrast, frame and seek to answer research questions using statistical techniques. For example, participants may be asked to report their attitudes on a scale from say, 1 to 7, and by doing this they are quantifying their attitudes rather than describing them in their own words. Although there is considerable utility (for example, one can collect data on a large, random sample) in being able to summarize people's attitudes in this manner, this benefit comes at a cost. It is likely, if not inevitable, that part of individuals richness and depth are lost when they are asked to report information in this way. In summarizing the distinction between qualitative and quantitative methods then, we might say that whereas the benefit of qualitative data is depth, the benefit of quantitative data is breadth.

Contextual and Design Factors in Research

Another important methodological distinction is between naturalistic and laboratory studies. Naturalistic investigations are conducted in the environments where people live, work, and play, rather than in laboratories. Because feminists stress the importance of context, many would suggest that it is not optimal to strip these important factors away from the setting in which research is conducted, as in laboratory studies. However, there is also much to be gained from laboratory research. Superfluous contextual factors that may muddle a researchers understanding of a particular phenomenon can be removed from studies in laboratories.

Psychological experiments, more specifically, introduce their own costs and benefits. In an experiment, the researcher seeks to demonstrate the causal effects of one entity (the independent variable) on another (the dependent variable). When this is done in the laboratory, contextual factors except for the causal entity need to be minimized or controlled. Thus, the "all powerful" experimenter attempts to strip away contextual factors that might add "noise" to the data. Then, typically unbeknownst to the participants, the experimental environment is manipulated or altered in some way and then the participants are asked to respond. This manipulation (and sometimes deception) produces a situation in which a hierarchical relationship is constructed between the experimenter and the participants. The experimenter has considerable power over the situation and control over the participants. This power differential has the potential of leading the participants to feel exploited or demoralized, which is the antithesis of the outcome that feminist researchers seek.

Integrating Research Approaches

Although quantitative methods and laboratory experimentation have their flaws from a feminist point of view, we contend that the discipline has nonetheless benefited a great deal from these approaches. Powerful feminist arguments have been substantiated from their use. For example, only by quantitative methods is it possible to document the widespread violence against women on college campuses (e.g., Koss, 1987) and only with experimental methods can one investigate the direct causal effects of gender-biased language (Hyde, 1984). To illustrate, one of us (JH) conducted an experiment to determine whether childrens perceptions of a fictitious occupation (wudgemaking) were influenced by the pronouns used to describe people who did this for a living (Hyde, 1984). She found that participants rated women as only moderately competent at the task when the pronoun was masculine, but their ratings rose when either a gender-fair or feminine pronoun was used. The use of the experimental method allowed the researcher to determine the influence of masculine, feminine, or gender-fair pronouns on childrens perceptions of this fictitious occupation. It is also noteworthy that although the children in this study were in an experiment, they most likely were not led to feel manipulated or controlled.

Issues concerning hierarchy and control can emerge in almost any research setting. For example, personal and professional responsibilities may be blurred in an ongoing interview study, where intimate information is passed from participant to investigator. Thus, even qualitative, non-laboratory researchers face ethical challenges in navigating the path between data collection and interpersonal exploitation or invasion of privacy. Laboratory experimentation, however, has been most highly criticized by feminists. First, to provide a balanced view, it is notable that participants are at minimal risk in most laboratory experimental research. Furthermore, the ethics of research procedures are monitored by a designated board of people who review all proposed research with human participants, so long as the research is conducted within a university context (a practice that also is followed with research that is not experimental). In addition, recognizing the usefulness of laboratory studies, feminists have made strides in improving the situations into which research participants enter. Landrine, Klonoff, and Brown-Collins (1992) have made several suggestions of how feminist psychologists can alter their methods to coincide more with feminist ideals. For example, they suggested that researchers provide monetary compensation for participants service and never coerce participation as part of a course requirement. Moreover, in an ideal world, research would be designed so that the people under investigation actually benefited from participation.

We suggest that the methods just discussed have different strengths and weaknesses and compliment each other well. Used in tandem, these methods may prove to be extremely useful in terms of leading to our greater understanding of gender and its intersection with other social and cultural phenomena. For example, an area of research may at first be investigated qualitatively to determine what topics are important to participants lives. Then, once these more specific aspects are identified, they can be investigated via quantitative methods. Qualitative and quantitative methods might also be used iteratively. That is, the first study on a question might be qualitative, followed by a quantitative study, followed by a qualitative study designed to clarify the findings of the quantitative research, and so on.

Deborah Tolman and Laura Szalacha (in press) provided an excellent example of multiple-method research on adolescent girls experiences of sexual desire. Narrative data from 30 girls were collected, and then the data were summarized both qualitatively and quantitatively. The researchers were able to summarize the data at multiple levels of specificity. They reported overall patterns using statistical analysis and then returned to the original narrative data to capture the richness of individual girls experiences and to explore the nature of the overall patterns. This type of research should inspire researchers within psychology of women to liberate their research questions and paradigms from the constraints of rigid boundaries between methodologies.

As psychology in general continues to progress away from a positivist perspective (Hare-Mustin & Marecek, 1988), peoples varied experiences within a given situation will be recognized as important. In this way, the psychological meaning of a situation, as constructed by participants, will become more central and thus press the empirical methods used in psychology to be more diverse and flexible. A challenge to researchers in psychology of women is to lead the way in this use of multiple methods. This approach may be more difficult than it seems at first glance. One area in which attention can be focussed in order to bring this about concerns the training of scholars in these diverse methods. Typically, one is trained to be either a quantitative or qualitative researcher. This boundary needs to be broken and open dialogue should occur between researchers using both approaches. A second area in which gains need to be made is in the evaluative criteria for qualitative methods. There is general consensus in psychology about what methods are acceptable among quantitative approaches (e.g., appropriateness of statistical tests, adequacy of comparison groups), but this is less true of qualitative methods. Guidelines have begun to be defined (e.g., Guba & Lincoln, 1989; Olesen, 1994) and these should continue to be developed so that adopting qualitative methods from other backgrounds will feel more confident in this methodology.

Finally, given that we embark on our research with a clear feminist perspective, it is important for the psychology of women that we make every attempt to communicate to others our message and our research in a way that others will }listen" to and respond to affirmatively. It is imperative for feminist psychologists to conduct careful, well-planned research so that our results will be respected and taken seriously. Only by conveying our research in a way that is compelling to psychology as a whole will we be successful in accomplishing our goals and improving the lives of women.

Applications of Psychology of Women in the Real World

Public Policy

One of the most neglected public policy issues in the United States is parental leave, which refers to the leave from work that a mother or father takes at the time of the birth (or adoption) of a baby (Hyde, Essex, Clark, Klein, & Byrd, 1996). We offer this issue as an example of the ways in which psychological research can have an impact in the policy arena. In 1985, the United States was the only developed nation to have no national policy providing parental leave for new parents. In 1993, the federal Family and Medical Leave Act (FMLA) became law. It provides for a minimum leave of 12 weeks for new mothers or fathers. The leave must be job-guaranteed -- that is, the employee has the right to return to the same job or a comparable one. The minimum requirement is for unpaid leave, but employers may be more generous and provide paid leave. These requirements hold only for persons employed by a company that has 50 or more employees; small businesses are not required to comply. This policy is considerably less generous than policies in European nations.

When Congress was considering whether to pass the FMLA, it called on psychologists to provide expert testimony. The research of experts -- most of whom were developmental psychologists and testified that infants need 4 to 6 months with their mother, father, or other stable caregiver in order to form a secure attachment, which is crucial for later adjustment -- was instrumental in passing the bill.

Our research team, examining the expert testimony, noticed that it focused exclusively on infants and their well-being, and that the well-being of mothers had been ignored. We launched a project, the Wisconsin Maternity Leave and Health Project, to provide data on this crucial issue and, we hoped, to inform future public policy decisions (Hyde et al., 1996; Hyde, Klein, Essex, & Clark, 1995). We found, for example, that a short leave (6 weeks or less) acts as a risk factor, when combined with other risk factors such as a troubled marriage, for elevated levels of depressive symptoms in women. We also found that 66% of the women took a shorter leave than they would have preferred (Hyde et al., 1996). The reason? Finances. Most could not afford to stay away from work any longer, when the leave was unpaid. The results from this project should help to inform decisions about parental leave policy in the future. They build a strong case for strengthening the current legislation to provide for paid leave.

Efficacy of Therapy

One of the hot questions in psychology today is whether various forms of psychotherapy "work" -- an issue variously known as the efficacy of therapy or empirically supported therapies (Chambless & Hollon, 1998; Compas, Haaga, Keefe, Leitenberg, & Williams, 1998). This question has been asked of feminist therapy and of therapies used to treat disorders in which a preponderance of the affected people are women, e.g., eating disorders (e.g., Compas et al., 1998).

Is feminist therapy effective? The bottom line is that we do not have enough good research to be able to answer the question. Ideally, an evaluation study should randomly assign clients to feminist therapy or no therapy (the latter group receives therapy later, after the research is completed), and then evaluates the clients at the end of therapy compared with the no-treatment controls. We know of no study that has used such a design. One of the few relevant studies compared women in feminist therapy with women in traditional therapy (Marecek, Kravetz, & Finn, 1979). Unfortunately, the women had selected the therapy themselves rather than being randomly assigned, so we cannot be certain whether differences between the groups were a result of the different therapies or pre-existing differences.

Evaluating the effectiveness of feminist therapy will surely be an important research topic in the next decade. Two distinct questions can be asked: (a) Is feminist therapy effective compared with no therapy? and (b) Is feminist therapy as effective or more effective than traditional therapies? Beyond that, we can ask more complex questions, such as whether feminist therapy is particularly effective in treating certain problems. The first question is important and feasible to answer. The second question probably will not lend itself easily to research because most feminist therapists incorporate elements of traditional therapies into their treatment, as appropriate to the particular problem (Enns, 1993). It would therefore be difficult to separate out the effect of the particular feminist components.

Forensic Psychology of Women

A substantial number of feminist psychologists -- some of them academic researchers, some of them feminist therapists -- work in the area of forensic psychology. This area may include analysis of psychological harm arising from trauma (e.g., domestic violence, sexual harassment), evaluation of parents in child custody cases, or preparing an attorney to cross-examine an accused rapist (for a review, see Brown, in press). Feminist forensic psychologists develop their expert opinions based on a combination of basic research in the psychology of women and accumulated clinical experience of themselves and others in treating women who have experienced such traumas. In this role, they strongly influence legal outcomes. Examples include judgments about whether a mother loses custody of her children following a divorce, whether a woman can sue an employer for damages on account of psychological trauma she suffered as a result of sexual harassment on the job, and whether an accused rapist is convicted.

As one specific example, feminist forensic psychologists gradually accumulated an argument that was upheld in many legal cases. Specifically, they argued that a battered woman might well be in constant fear for her life, even if a knife was not held to her throat at a particular moment; therefore, if she killed her batterer, it could reasonably be regarded as self-defense (Brown, in press). Feminist forensic psychology is an exciting area that doubtless will expand in the future.

Advice to Aspiring Feminist Researchers

One of the most important goals of feminist psychologists is the improvement of the lives of girls and women and a commitment to that goal will surely extend into the 21st century. If we are to improve the lives of girls and women, so many areas desperately need more research and more talented researchers. We have only begun to glimpse the complex behavioral and cultural mechanisms that will help us unravel the puzzles before us in feminist topics, such as sexual assault, sexual harassment, eating disorders, homophobia, the double whammy of racism and sexism. Without basic research to give us an understanding of these issues, we cannot hope to be effective in treating those affected by these problems, much less in preventing them.

If you want to pursue a graduate degree specializing in feminist psychology, you will need to be especially careful in accepting the appropriate graduate program. For example, not every department is supportive of feminist approaches. Some may actively discourage research related to women and gender. If possible, select a university that is strong in both psychology and womens studies. Ideally, you should take graduate courses in womens studies as well as psychology.

Mentorship is also a significant factor in establishing a successful research program as a feminist psychologist. Interview faculty members in the department who express an interest in feminist psychology. Find out which feminist psychologists have graduate student positions available. Then find out if those individuals would be willing to work with you specifically. Chances are that feminist mentors may be especially supportive in helping you survive the rigors of graduate training.

Many entire textbooks have been written about the psychology of women and gender (e.g., Hyde, 1996). Our coverage here has been necessarily brief and has omitted much. As we think forward to the 21st century, we have a solid foundation of three decades of research and theory on which to build. It is exciting to be part of this effort. Feminist researchers especially welcome new researchers into the fold who can continue to work energetically for causes important to girls and women. We think that it is exciting to be part of this effort.

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# Chapter 9 Sensation and Perception

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## Introduction

Studies of sensation and perception have historically been the starting points for the scientific study of the mind. An interest in the structure of sensory systems and the nature of human perception predates psychology. In fact, research in this area in the early and middle 1800ís was instrumental in creating the academic climate that gave rise to psychology as a distinct scientific field.

The year 1879 is often cited as the date of the founding of psychology, marked by the establishment of Wundtís experimental laboratory. The year 1860 is probably a better choice, however. This is the year that Fechner published his book Elements of Psychophysics (Boring, 1950). Fechner (below) described a set of methods for studying and quantifying the relationship between sensory stimuli and perceptual experiences. The realization that the relationships between stimulus events and mental events might be reducible to simple laws apparently occurred to Fechner while lying in bed on the morning of October 22nd, 1850 (Schultz & Schultz, 1996). This early work on the relationship between sensation and perception and the accuracy of the perceptual representations of sensory stimuli made up a substantial portion of the bedrock of early experimental psychology. Now, scientists celebrate Fechner Day (October 22nd) each year with scientific meetings and other events in remembrance of this contribution to our field.

Gustav Fechner (1801-1887)  
[Image from the International Society for Psychophysics](http://www.psychology.adelaide.edu.au/psychophysics)

The intervening 150 years of research on sensation and perception has led to technological advances in experimental apparatus, the discovery of new research methods for gathering observations, and the addition of advanced quantitative methods for describing and analyzing psychophysical data.

In the very early days, researchers in sensation and perception had fairly similar training and interests. Quite rapidly, however, work in the area diverged to include a broad set of research areas and scientific approaches. Today, the general area of sensation and perception is composed of researchers with vastly different training, and psychologists make up only a small percentage of these individuals. As sensory psychologists approach the millennium, they are re-examining their theoretical approaches to the traditional problems in the field, their selection of problems to investigate is heavily influenced by work in related fields (e.g. neuroscience), and they have become more applied.

Depth perception is a good example of the diversity of training and theoretical approach of todayís researchers in sensation and perception. Some sensory psychologists study how we use depth cues to help perform object recognition (de Vries, Kappers, & Koenderink, 1993) or to perform a visual search (OíToole & Walker, 1997). Others study how we recover 3-D shapes from motion cues (Lappin, Doner, & Kotas, 1980; Todd & Norman, 1991) or how we use depth cues to move through natural environments (Palmisano, 1996) or virtual ones (Cutting, 1997). In addition, neuroscientists study disparity sensitive cortical cells (Chino, Smith, Hatta & Cheng, 1997), optometrists study binocular function in the presence of strabismus or amblyopia (Yu & Levi, 1997), and biologists study depth perception in animals (Pettigrew & Konishi, 1976; Collett & Harkness; 1982).

Although scientific heterogeneity defines our field today, advances in the neurosciences heavily influence research in sensation and perception. This impact is understandable; we have made great strides in our understanding of the brain and we have developed exciting new research methods for investigating it. Only a handful of sensory psychologists would classify themselves as behavioral neuroscientists. However, most psychologists today are unlikely to investigate perceptual phenomena without at some point considering how their psychophysical data relate to the underlying sensory physiology or to brain organization.

## Sensation and Perception Today

In the late 1990's sensation and perception consists of many exciting research areas. These areas represent an expansive continuum from studies directed at the earliest, ìlow-levelî stages of sensory processing to those directed at later ìhigh-levelî perceptual mechanisms.

In this chapter we consider examples of what we feel are exciting areas of research in sensation and perception from both ends of this continuum, with an emphasis on the current state of the discipline. These examples, then, are primarily from the areas of vision and visual perception and represent both basic and applied science. We conclude with a brief discussion of possible future directions for the discipline, using as an example research in the area of virtual reality. Because it currently drives a great deal of the research and thinking in sensation and perception, we begin with current explorations in the area of visual neuroscience.

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### Visual Neuroscience

The study of the biological basis of sensation and perception is a fascinating areas of study for two reasons. The first reason is that the pace of discovery is breathtaking. It seems that every few weeks a new set of findings challenges our conceptions of how the brain processes sensory information. The second reason is interrelated with the first. In many ways, the understanding of how the brain processes sensory and perceptual information is used as a basis for understanding how the cerebral cortex, as a whole, operates. The cerebral cortex is where it is believed that our most advanced functions reside. The most extreme version of this approach is seen in Zeki's (1993) Vision of the Brain. Zeki unapologetically uses the knowledge of the architecture and function of the visual areas of the cortex to develop some general ideas about cerebral cortex. While most researchers will not go quite so far, it is certain that some general insights about cerebral cortex will come out of the study of the sensory cortices. A brief review of the current knowledge of the visual system and how it has changed in the last 30 years will illustrate these points.

The idea that the brain operates with many parallel elements is the major emerging theme in our present understanding of the neural bases of the sensory systems; different pathways and different modules of the sensory systems operate to extract unique features of the information in the sensory stimulus. Throughout the sensory systems, there is evidence of parallel (that is simultaneous) operations, both with parallel pathways and parallel targets for sensory information.

Sensory information processing was first viewed as predominantly serial (that is sequential), based upon the groundbreaking work of Hubel and Wiesel (1962, 1968). However, even in these early studies researchers began to find evidence of parallel processing.For example, Hubel and Wiesel uncovered the existence of cortical columns. In a cortical column, all cells process the same feature of the environment from the same location on the retina. For example, one column processes oriented stimuli of a certain width from a certain location on the retina; the next column processes stimuli with a slightly different orientation. Each column is organized in a parallel fashion processing information simultaneously.

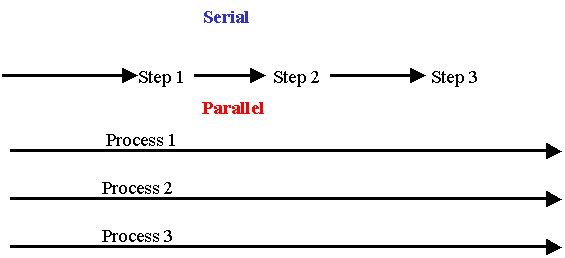


Figure 1. An illustration of the difference between serial and parallel processing. Serial processing is in stages and parallel processing is different processes proceeding at the same time. [[Figure 1 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig01)]

Another important early finding that foreshadowed todayís emphasis on parallel processing was the study of cat retinal ganglion cells by Christina Enroth-Cugell and John Robson (1966). Enroth-Cugell and Robson identified two types of cells in the feline retina, named X and Y cells, that responded very differently to specific features of light stimuli. X cells tend to respond consistently throughout the time that the stimulus was presented, had relatively small receptive fields, and required fairly high contrast. Y cells, in contrast, tend to respond primarily to stimulus onsets and offsets and do not respond well to a stimulus that does not change over time (see Figure 2). Also, the receptive fields of y cells tend to be larger and require less contrast. These findings, which have been replicated and extended to primates, clearly indicate that there is something fundamentally parallel in the processing of visual information. Studies by Hubel and Wiesel (1968) found a similar functional segregation in the cortex between their simple and complex cells although at the time they interpreted these cells as sequentially linked.

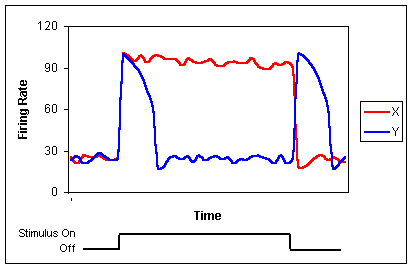


Figure 2. The response patterns of X versus Y cells. [[Figure 2 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig02)]

At the lateral geniculate nucleus (LGN) in the thalamus, for example, the visual system is still divided into two main pathways. The LGN is a composed of six layers in the primate. Two of the layers have relatively large cell bodies and are called magnocellar layers while the other four layers have relatively small cell bodies and are called parvocellular layers (Lennie, Trevarthen, Van Essen and Waessle, 1990). The -cellular suffix is often dropped and the two types of cells are called magno and parvo or even M and P. The magno and parvo cells show very different response patterns. In fact, the response patterns are very similar to the X and Y ganglion cells seen in the cat retina. In addition, the parvo pathways carry color information. There is a tendency to apply these distinctions, based initially upon anatomy of the LGN, to the retinal ganglion cells. There is a lot of functional similarity between the magno and Y systems and the parvo and X systems. For example, the magno and Y systems have larger receptive fields and have transient response patterns. Similarly both the parvo and X systems have smaller receptive fields and more sustained response patterns. The Y cells even have relatively large cell bodies just like the Magno cells of the LGN and X cells have relatively small cell bodies like the Parvo cells of the LGN. The overlap of functions and anatomy of the retinal and LGN systems allows this distinction to be nicely applied. See Table 1 for a summary of the distinction between x/parvo and y/magno systems.

Table 1  
A Summary of the X/Parvo and Y/Magno systems of the retina, LGN  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Feature X/Parvo Y/Magno

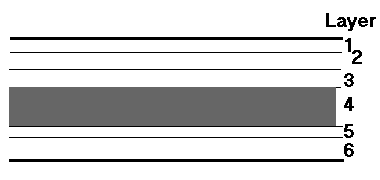
Response pattern Sustained Transient

Receptive Field Size Smaller Larger

Contrast Sensitivity Relatively Low Relatively High

Color Sensitivity Yes No

The first stop for visual information in the cortex is the striate cortex (V1) in the occipital lobe at the very back of the brain. A little geometry of the cortex is helpful. First, all parts of the neocortex are composed of six layers and each of these layers are involved in the same type of function regardless of where that layer is on the cortex. For example, the fourth layer from the surface of the brain, Layer 4, always receives input from sensory systems (see [Kolb and Whishaw, 1996](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/references.htm#Kolb, B., & Wishaw, I. Q. (1996).), for a more detailed review of the organization of the cortex). In the sensory areas of the brain, such as the Visual cortex, this layer is very thick. This layer stains very darkly, which gives this first part of the visual cortex its name of striate cortex (See Figure 3).

Brain Surface  


Inside of the Brain

Figure 3. An illustration of the layers of the cortex as might be see in V1. Layer 4 is where the input from the LGN occurs and is the thickest layer here. It stains darkly giving this region one of its names, the striate cortext. [[Figure 3 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig03)]

Within the striate cortex (V1) the parvo and magno pathways are now segregated into three separate units that function independently: blobs, interblobs, and Layer 4b (Wong-Riley, 1979). Blobs receive inputs from both the magno and parvo system and seem to play an important role in the processing of color. Interblobs receive inputs from only the parvo system and seem to process fine patterns in the stimulus. Layer 4b is a subpart of one of the six layers of the neocortex. Its input is solely from the magno system and these cells seem to respond to motion and very low contrast. Thus, the two parallel pathways have divided now into three pathways. These pathways from the LGN to the striate cortex are summarized in Figure 4 .

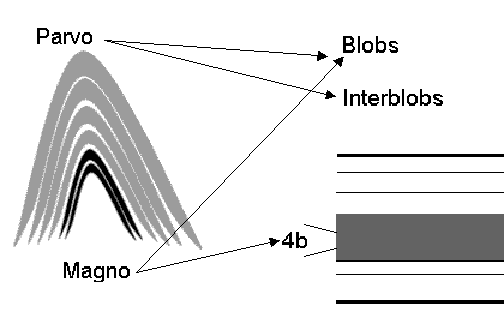


Figure 4. The relationship of the layers in the LGN to the different functional parts of V1, the striate cortex. [[Figure 4 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig04)]

In the primate, five visual areas have been identified and given the clever names of V1, V2, V3, V4 and V5. Each section is anatomically distinct and is thought to perform different functions relevant to our perception of the world. A simplified view of how these regions are connected is shown in Figure 5. The current evidence suggests that V3 is involved with the processing of form, V4 with color constancy, and V5 complex motion processing. Some of these findings have been supported by the study of lesions in the occipital cortex. For example, a person with a lesion of the human region analogous to primate V4 on the left side of the brain, would report having no color vision in the right half of their visual world (Zeki, 1993).

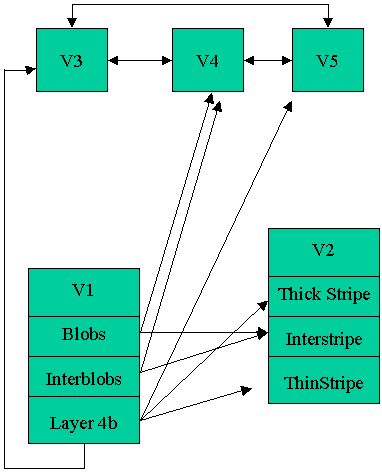


Figure 5. A simplified diagram of the interconnections between different regions of the cortex. [[Figure 5 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig05)]

In addition to all of the connections from V1 and V2 to V3, V4 and V5, each of these regions connects back to V1 and V2. These seemingly backward or reentrant connections are not well understood but one possible role for them is to index the processing in V3, V4 and V5 to the more precise visual maps found in V1 and V2. Although each of the visual regions has a map of the visual world, they are not nearly as precise and detailed as those found in V1 and V2. In other words, their receptive fields are much larger which allows for poorer localization of a stimulus or object. For example, although V4 locates a color region in space, the receptive field is rather large and might not indicate whether this color belongs to the cup or the book on the table in front of you. These reentrant connections, feeding back to the precise maps of V1 and V2 may provide a mechanism that allows the visual system to assign the color precisely to the appropriate location and object, say a part of the cover of the book in front of you.

Our present understanding of the visual system is very different from the serial model Hubel and Wiesel initially proposed. There are separate functional modules that operate relatively independently; information, instead of flowing in one direction, now flows both directions. Thus, later levels do not simply receive information and send it forward, but are in an intimate two-way communication with other modules.

This emerging and modular and parallel view of the visual cortex has helped us better understand some terrible but fortunately rare disorders of the visual system. They are achromatopsia and akinetopsia. Achromatopsia refers to a selective loss of color vision, usually as a result of stroke (Zeki, 1990). It is important to note that the loss seems to be selective to color vision. These patients can read, recognize patterns, and respond to motion. In fact, current research indicates that little if any other visual function is lost, with the exception of occasional but temporary loss of form vision immediately following the injury (Sacks & Wasserman, 1987). These patients describe the world as being very drab and gray. It might be like permanently viewing the world on an old black and white TV set. Apparently this is not a very bright TV set either. With this modular view of the brain, it is possible to understand how a patient might lose color vision only. Loss of the human equivalent of V4 would take out color vision selectively. PET scans on these human patients that allow doctors to examine the living functioning brain, find hat the lesions in achromatopsia is found in V4 (Sacks & Wasserman, 1987).

Akinetopsia is basically the same type of syndrome, only the person looses the perception of motion (Zihl, von Cramon, & Mai, 1983). The patient can only see objects as stationary. They might be perceived in different places at different times but they are not perceived to be moving. At each place they are perceived to be still. Imagine the danger of crossing the street with this condition. This syndrome is associated with damage to visual cortex V5, mentioned above. A with achromatopsia, other visual functions are spared. The person sees in color and can read, for example. Again, our developing modular view of the brain allows these syndromes to be clearly understood.

Where does the study of the biological basis of the brain go from here? Probably in two or three directions. One direction certainly will be the further breaking down of the different sensory regions. Subregions for each of the primary visual areas will be discovered for each of the visual areas discovered so far and new regions will probably be discovered. Some have already been found. For example, while we have a sense for the processing of form, color, and motion, we do not yet know clearly how the brain functions to process depth and texture. A second direction for future research will be how information from these regions is used by the rest of the brain. The neural pathways to the parietal and temporal lobes have been described but little is known about how sensory information is integrated with more cognitive functions. A third possible path would be to better understand how these separate modules lead to unified perceptions. While color can be selectively lost, color is not usually perceived separately from the object.Somehow, that fact, and other integrative perceptual experiences, needs to be a part of our understanding of the brain.

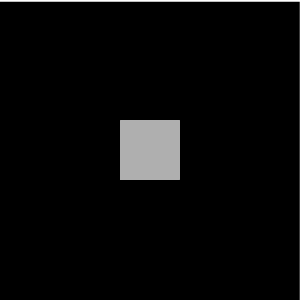
The discovery of the extent of parallel processing in sensory systems has greatly changed how we conceptualize sensory information processing. This work has been coupled with a grown in the use of the computer to understand the operation of the visual system.

### Computational Approaches to Sensation and Perception

Along with the rapid development of visual neuroscience, there has been an equally rapid development of computational approaches to understanding perception. These approaches ranges from models of large scale like that of Marr (1985) effort at a unified computational theory to more limited efforts such as Krantz, Silverstein, & Yeh's (1992) model of visibility of displays underdynamic lighting. In this section a brief presentation on one computational model being developed by one of the authors will be presented to illustrate some of the power of these models (Krantz, 2000).

The motivations for this effort comes largely from teaching some of the concepts in the last section on Visual Neuroscience. Basically the effort is to try to examine the impact and function of the receptive fields from the retinal ganglion cells, particularly the x cells.

Take a look at the figure here. [[Description of visual display](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#grey-fig)]



The center does not change in any way. Does it look that way. The same is true for the two center squares below - they are identical.

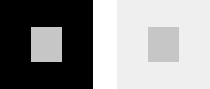


Figure 6. Simultaneous Contrast [[Figure 6 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig06)]

This effect is called simultaneous contrast. The model that has been developed will plot the output of many of these cells in a regular array - like an x and y grid. Figure 7 shows the output of this model for using the same simultaneous contrast image as in Figure 6. The receptive fields illustrated are small and would be very good at resolving fine details. The intersections of lines on the figure show where the center of a receptive field was located. So the x and y axes, defining the horizontal plane, represent a set of cells. The height of the surface in the figure represents how fast that cell would respond according to the model. The higher the point on the graph the faster the cell responds.

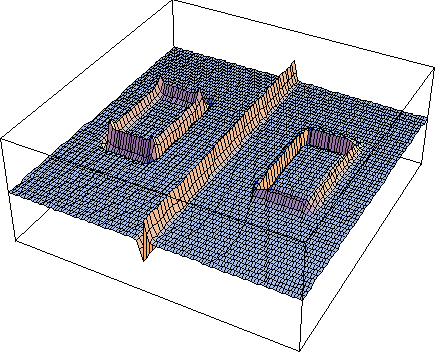


Figure 7. The model output for a simultaneous contrast image. [[Figure 7 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig07)]

There are several interesting and important features of this figure. The most noticeable thing in the output of the model is the edges. If the receptive field does not have an edge in it, then the cell has about the same output whether the input is bright (white), moderately bright (gray) or dark (black). Light filling the entire receptive field is not an effective stimulus for the cell (Kuffler, 1953). So edges are excellent stimuli for cells and that shows up in model in Figure 7 (Troy & Enroth-Cugell, 1993). This finding that only the edges are sent back to the brain for processing agrees with the general finding about vision and it's filling-in of areas. This same process seems to play a role in why we do not see our blind spots.

Now, look at the edges a little more closely. Notice that the hills are next to brighter regions and valleys are next to darker regions. In particular, look at the big hills and valleys where the back background meets the light background (Figures 6 and 7). The square on the left has a hill next to it suggesting it is light and the square on the left has a valley right next to it suggesting a dark regions. This is exactly the illusion. I offer a more complete description of this model, its development, and how it helps us to understand how we see in Krantz (2000).

This model is barely at the beginning of its development. There are many ways to expand this model in the future. So far only X cell responses in the fovea have really been examined. Some of the possible extensions are to model Y cells, add color responses (DeValois & DeValois, 1975), and make the modeled eye jiggle just a little bit all the time like it does in real life (Carpenter, 1977).

While visual neuroscience and computational approaches seem to play a role in revealing new phenomena, reexamination of what are thought to be well established findings can also yield new insights. A recent advance in studies of the earliest stages of sensory information processing was the stunning discovery that the human eye contains a greater variety of cone photoreceptors than previously thought.

### Human color vision and the cone photoreceptors

Color is a fundamental visual feature that imparts a richness to the man-made or natural world. Color vision has long fascinated those with an interest in sensation and perception. Isaac Newton (1730/1979), in his famous experiments using prisms to produce and mix colored lights, deduced that ìcolorî is not a property of light wavelengths per se, but rather a property of the eye. This raises an interesting question: Do all eyes perceive colors similarly? The answer is no.

Many of the interesting research questions in this area have been directed at individual differences among humans and inter-species differences. The rationale for this is straightforward: An understanding of "how" and "why" these differences exist will tell us a great deal about how color vision is achieved by the eye and brain.

One of the most fascinating features of color vision is the fact that, more than any other aspect of perception, color vision shows large individual differences both across and within species. Not all animals, in fact not even all humans, share the same color experiences. For many species, including humans, there are even differences between males and females. Oddly enough, there are species of monkey where most of the females have normal color vision but all the males are color-deficient (Jacobs, 1998). We consider below some exciting recent advances in our understanding of human color vision.

A long-standing and fundamental property of human vision is trichromacy. The trichromatic theory explains our color perceptions and color discriminations. The anatomical basis of trichromacy begins with the complement of cone photoreceptors in the retina. For over one hundred years researchers thought that the color-normal eye contained three cone types whose photopigments were later psychophysically estimated to have peak spectral sensitivities near 440, 540, and 560 nanometers. A Figure showing the spectral sensitivities of these pigments, across the visible spectrum, is shown below:

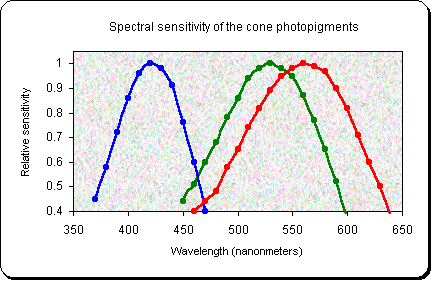


Figure 9. The relative sensitivity to different light wavelengths is shown for each cone photopigment.   
Note the overlap in sensitivity of the middle wavelength sensitive and long wavelength sensitive cone types. [[Figure 9 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig09)]

Over the years, however, psychologists questioned whether subtle variations may exist in normal color vision based on small individual differences in the spectral sensitivities of the photopigments (Alpern & Wake, 1977; Neitz & Jacobs, 1986). The findings of the early studies were viewed with some skepticism, however, because of the difficulty in ruling out measurement error and confounding factors. As the psychophysical evidence grew, researchers began to investigate this possibility from many angles.

Today, psychophysical (Neitz & Jacobs, 1990; Mollon, 1992), microspectrophotometric (Dartnall, Bowmaker, & Mollon, 1983), and molecular genetic studies (Nathans, Piantanida, Eddy, Shows, & Hogness, 1986; Winderickx et al., 1992) provide evidence of substantial variation in the number and spectral sensitivity of the cone types in the color-normal eye (also see Mollon, Cavonius, and Zrenner, 1998). The evidence now suggests the presence of three families of normally occurring cone photopigments. There is thought to be only one photopigment with a peak spectral sensitivity in the shortwavelengths (blue), but there is now evidence that there are multiple middlewavelength (green) photopigments and multiple longwavelength (red) photopigments. The difference in spectral sensitivity among he middlewavelength pigments or among the longwavelength pigments has been estimated to be approximately 5-7nm(Neitz, Neitz, & Jacobs, 1995). A representation of all these pigments is shown in the figure below:

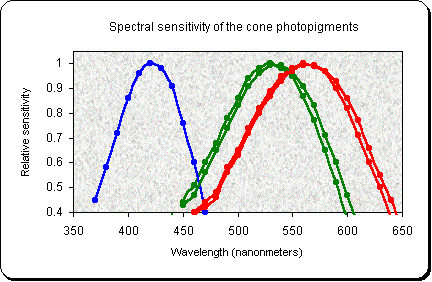


Figure 10. A representation of all the identified cone photopigments.   
It is easy to see how two avoided detection for so long--they are nearly identical to two others. [[Figure 10 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig10)]

Molecular genetic analyses show that individuals may inherit a surprisingly large number of different X-linked, recessive genes that encode the production of these photopigments (Neitz, Neitz, & Grishok, 1995). A representation of different gene arrangements is shown below. An obvious question is why do we have so many color vision genes? The genes that encode the middle and longwavelength sensitive pigments reside near the end of one of the arms of the X chromosome and they have very similar DNA sequences. In fact, the substitution of one amino acid in the DNA of a photopigment gene is sufficient to cause a change in the spectral sensitivity of that photopigment and in our color perceptions. The location and similarity of these genes makes them susceptible to the kinds of genetic errors that produce multiple gene copies, as well as hybrid genes that are genetic composites of the original ones (Nathans, et al., 1986).

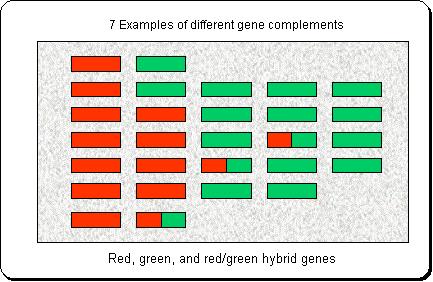


Figure 11. Each rectangle represents a single color vision gene; each row of genes represents an observed gene arrangement. The half red / half green genes represent hybrid genes; linked to "unusual" spectral sensitivity. [[Figure 11 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig11)]

At present, it appears that normal color vision results from inheriting at least one cone type from each cone ìclassî (short, middle, and long). It is unclear, however, which complement of genes and cone types result in specific types of color vision deficiency.There is a great deal of genetic variation among individuals with the same type of color defect, making this work difficult. However, it appears that both the type and severity of a color vision defect can be linked to the complement of different cone types in the retina.Hybrid genes, which have been associated with small differences in the spectral sensitivity of the photopigments, are thought to be involved.

These findings lead to an interesting question: if humans possess more than three cone types in their retina, do they still have trichromatic vision? The answer appears to be yes, presumably because the outputs of the different middle or longwavelength cone photoreceptors are summed together before leaving the retina. The resulting signals differ to a small but significant degree across individuals, though, because they affect color perception in some situations. Individuals with different complements of cone pigments will not accept each othersí color matches in the longwavelength end of the spectrum and they will disagree on color names for certain wavelengths of light (Neitz, Neitz, & Jacobs, 1993). For example, a particular mixture of red and green light might appear a perfect yellow to your eye, but appear a greenish-yellow or slightly orange to someone else. This type of color vision assessment, called the Rayleigh Match, is the most accurate method for measuring color discrimination and diagnosing the congenital color vision defects. Some Rayleigh match data is shown below.

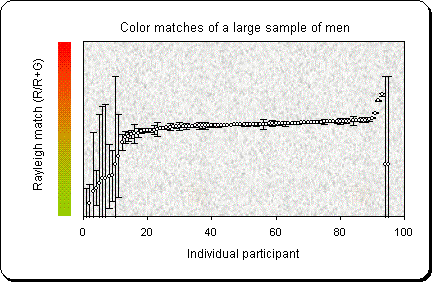


Figure 12. The Rayleigh matches of 94 men. The length of the "error bars" represent all the different ratios of red to green light that can be mixed to make an acceptable match to a comparison yellow. Longer bars, therefore, represent poorer color discrimination. The individuals on each end of the figure have color vision deficiencies. [[Figure 12 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig12)]

Whereas most of the research to date has examined the color vision of men, the situation for women, especially women who have a color vision deficiency or who have a family history of color deficiency, is even more interesting. Women, by virtue of having two X-chromosomes, inherit two sets of color vision genes. The traditional view proposed that inheriting the normal complement on one or both X-chromosomes led to normal color vision while failing to inherit a normal complement of genes on at least one X-chromosome led to defective color vision (see Mollon, 1992).

However, we now know that early in development women may alternatively express genes from one or the other X-chromosome and that later in development one of the X-chromosomes is inactivated. Consequently, a womanís retina may have regions where the cones reflect the expression of genes on one X-chromosome and other areas where the cones reflect the expression of genes on the other chromosome. A representation of a normal distribution of cone type is shown below:

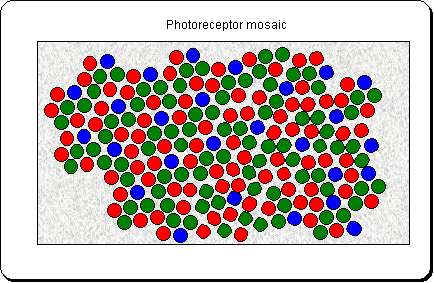


Figure 13. A representation of the distribution of photoreceptors in the retina. The ratio of R / G / B cone types varies, but the long wavelength cones are the most prevalent; short wavelength cones the least prevalent in the retina. [[Figure 13 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig13)]

Women who are heterozygous for the normal complement of color vision genes, therefore, may have a ìmosaicî retina: a patchwork of color-normal and color-deficient regions (Cohn, Emmerich, & Carlson, 1989). The nature of this mosaic depends on the inherited complement of color vision genes and on the point in development that X-chromosome inactivation occurred. That is, some women heterozygous for these genes may develop a color vision deficiency while others may develop normal color vision (Miyahara, Pokorny, Smith, Baron, & Baron, 1998). And, in fact, there are reports in the literature of identical (monozygotic) twins where one twin has normal color vision and the second is color-deficient (Jorgenson, et al., 1992).

In light of these current findings, sensory psychologists and other perception researchers are probably designing psychophysical tasks to try to tease apart the nature of color processing in the eyes of individuals with different complements of cone photoreceptors. The challenge will then fall to neuroscientists, molecular biologists, and others to support or refute our findings at the cellular level.

Future work for sensory psychologists will also involve investigating the extent to which these individual differences in color vision affect our interactions with our world. This knowledge is important because our society uses color to code information in a variety of settings, including education and transportation. In many occupations color discrimination is critical, for example, in discriminating electrical wiring and colored signal lights. While these individual differences are small, they may prove to be problematic in some settings.

In contrast to the exciting research directed at the earliest stages of sensory processing, today there is also substantial research interest at the other end of the S&P continuum: Research directed at higher level perceptual processes and phenomena in the gray area where perception and cognition meld. One area of intense research effort today is the study of visual search: The ability to scan our visual world, quickly distinguish among a variety of objects or forms, and locate and identify a specific target.

### Visual Search

Studies of visual search investigate the process of looking for and identifying the presence or absence of a specific visual stimulus (a target) embedded among other items (distracters). To date, most of the research questions that have been asked in this area have been related to the very interesting finding that visual searches for some features are much easier and faster than searches for other features. Two natural questions emerge from these findings: Which visual features are found quickly and easily and which visual features are not? And, of course, why are some visual searches easier than others? The answers to both questions and an understanding of the mechanisms involved in visual search will contribute to our understanding of the active nature of visual information processing and to the perceptual organization of our visual world.

How does this perceptual mechanism work? Although low-level stimulus features such as color or size play a major role in determining the efficiency (speed) of a visual search (Geisler & Chou, 1995), other factors like familiarity also play a role (Lubow & Kaplan, 1997;Wang, Cavanagh, & Green, 1994).

As mentioned above, one fascinating aspect of our ability to perform a visual search is that some physical characteristics of stimuli allow for easy and efficient searches, whereas other stimuli result in difficult and time-consuming searches. This property is often referred to as salience, and objects that have high salience are perceived to "pop-out from their surroundings. It appears that visual scenes can be processed in parallel, that is, simultaneously, and pre-attentively for these items. Low salience objects, on the other hand, require lengthy searches. A search for low salience objects seems to take place in a serial format where item-by-item processing is required. Sometimes simply changing which stimulus is the target and which stimuli are the distracters changes the quality of the search from one mode to another. For example, Triesman & Souther (1985) found that searching for an "Q among "O,s was an easy (parallel) task but that searching for a "O among "Q,s was a more difficult (serial) task and we demonstrate this with the demonstrations below.

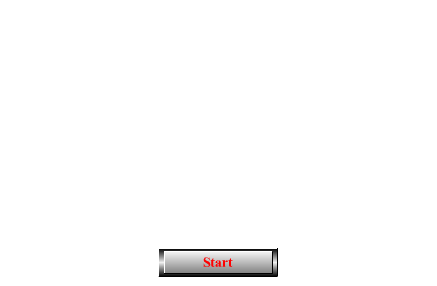


Figure 14. This is an example of searching for a "Q" among a small array of "O's". Clicking on the button labeled "Start" will present the stimulus array for a brief 100msec. This is an example of a parallel search: the "Q" pops out and you have no difficulty seeing it despite the very short duration of the display. Now try the demonstration below: [[Figure 14 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig14)]

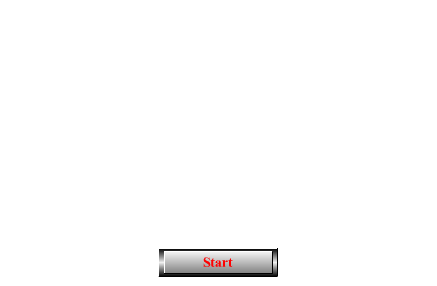


Figure 15. Same as above, but now you are searching for a "Q" in an array of 36 other items. Again, click on "Start" to flash the array. Here, despite the fact that there is a 9-fold increase in the number of search items, you find the "Q" quickly. There is little if any influence of the number of items. O.k., now try the demonstrations below. In the first example you will be searching for a "O" among "Q's" in an array of 4 items. [[Figure 15 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig15)]

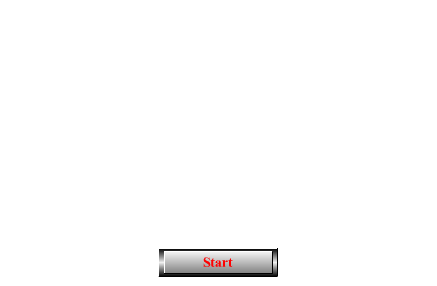


Figure 16. Again, you have no difficulty identifying the presence of the target, an "O" in this case, when the array size is small. [[Figure 16 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig16)] Now try the following:

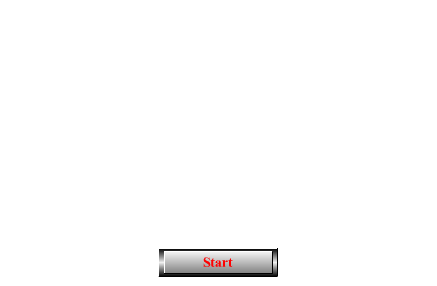


Figure 17. Ouch! Were you lucky enough to see it? Not likely. In an array of items such as this the length of presentation must be considerably longer in order to allow people enough time to identify the presence or absence of a target "O". It does not pop-out. [[Figure 17 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig17)]

Some of the additional visual features that pop-out are brightness (Gilchrist, Humphreys, Riddock, & Neumann, 1997), color (D,Zmura, 1991), and motion (Nothdurft, 1993). Quite often, though, we are searching for objects that can only be identified by the simultaneous presence of two or more stimulus features. These so-called conjunction searches have been studied for color and form (D,Zmura, Lennie, & Tiana, 1997), motion and form (Muller & Found, 1996), color and orientation (Friedman-Hill & Wolfe, 1995), and for the conjunction of two colors or two sizes (Wolfe, 1992). Some conjunction searches are very difficult and require serial processing. A good example is the children,s game "Where,s Waldo. In this popular game, children search drawings of crowded social events for one particular individual (Waldo) who is characteristically dressed in a red and white-stripped sweater and cap, glasses, and dark hair. Waldo must be distinguished from a crowd of "distractor individuals who possess some but not all of these features.

Although there has been extensive research on the topic of visual search over the last decade, it is evident that there is still much to be learned about the basic processes involved. The results of dozens of visual search experiments (studying many different types of visual features and feature conjunctions) has shown us that a sharp distinction between serial and parallel processing may be too simplistic (Wolfe, 1998). The allocation of attention in visual search probably lies along a continuum, where stimulus features and context determine search efficiency. This raises interesting questions for future research. For example, what situations result in optimal search efficiency? How could the search context for a specific target be manipulated to maximize search efficiency?

The answers to these questions have a very practical value in applied settings. That is, outside the laboratory in the real world. What we have learned about visual search has quickly been applied to many real world situations such as air traffic control (Vortac, Edwards, Fuller, & Manning, 1993), driving (Lajunen, Hakkarainen, & Summala, 1996; Summala, Pasanen, Rasanen, & Sievanen, 1996), visual display design (Fisher & Tanner, 1992) and how visual displays are monitored in the workplace (Liu, 1996). Today, questions regarding sensation and perception are increasingly being applied to problems outside the laboratory.

## Applications of Research in Sensation and Perception

Over the years, the applications of sensation and perception have grown considerably. Today, some of the areas where knowledge of sensation and perception is applied include human factors, ecological psychology, industrial/organizational psychology, and neuropsychology.We consider the role of sensation and perception in two of these fields: human factors and neuropsychology.

### Human Factors

One of the fundamentally important outcomes of sensory research is the development of an important set of applications based upon a functional knowledge of the operation of our sensory systems. Human Factors is one applied field that has made great use of diverse areas of psychology including sensation and perception. Human Factors refers to the application of scientific knowledge of human capabilities to the development of equipment (Proctor & Van Zandt, 1994). Basically, the idea behind human factors is to make the equipment fit the human user instead of the other way around. In other words, human factors is where we make basic psychology work in the real world, which is a very exciting task.

One vital area of application of visual knowledge in human factors has been the development of displays such as televisions and computer monitors. Historically, the development of color televisions and monitors owes much to the trichromatic theory of color vision. Beginning in 1931, the Commission Internationale de líEclairage (CIE) had formalized human color matching behavior using a quantitative model of the trichromatic theory, with major updates in 1960 and 1976. See Figure 18 for a depiction of the 1931 CIE diagram. Even in the years prior to the measurement of the responses of the cones, engineers were able to make a precise prediction of the human color response. Engineers need only to give a coordinate for a color in this space and, depending on the reliability of the equipment, the color will be precisely duplicated on any television and monitor or even printer.



Figure 18. The 1931 CIE color system. Colors are specified by their chormaticity coordinates (x, y). The spectrum is on the outside with example wavelengths given. The triangle represents the range of colors that can be reproduced on a typical television (Silverstein and Merrifield, 1985). [[Figure 18 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig18)]

Because the visual system has a functionally trichromatic receptor layer, there are other important engineering simplifications in developing color television and monitors that have been made possible. In essence the trichromatic theory specifies that three primaries should be sufficient for reproducing most colors we see. Thus, all modern color monitors and televisions use three color elements for color reproduction. These three elements are placed close enough together so that the colors are blended by the spatial summation mechanisms of the eye. To show how this is a real engineering blessing, consider what might happen if we had more than three color systems in our visual system. For each additional color mechanism, the engineer would need another color element in the system to be able to match the color of the scene being caught on film or tape. If we had even octachromatic vision (eight color mechanisms or cones), then there would need to be eight guns on our color television and not three. It might be very hard to fit all eight dots inside the limits of human spatial summation, that is, close enough together so that they are blended together by the visual system.

More recent efforts in display development have been in two primary areas. The first area is in assisting the development of new display technologies so that they have the same visual excellence as the CRT (cathode ray tube, the technology behind the standard monitor). The second area is in developing displays for harsh visual environments such as the airplane cockpit.

When the electron gun of a CRT strikes the surface of the display it stimulates several elements. The elements in the middle are bright and the ones at the edge are dim. This pattern of stimulation can be described as bell shaped or gaussian. Think of the lines on the CRT as being drawn with a bright center and dim slightly fuzzy edges. Thus the dots in the middle of the line are brightest and the dots on the edge are much dimmer. Since the jagged edges of the lines are made by dim dots, they are not as noticeable. If the lines are drawn directly like a pencil on paper as they are on some CRTs, then the jagged edges are all but unnoticeable (Silverstein & Merrifield, 1985). Liquid Crystal Displays (LCDís) and other technologies do not have these bell shaped beams but access each element directly in a digital fashion. Thus, the jagged edges of lines are easily noticeable. Thus, research efforts have determined how to take advantage of the way the visual system operates to most effectively and efficiently minimize the visibility of these jagged edges (Silverstein, Krantz, Gomer, Yeh, & Monty, 1990).

The airplane cockpit is a harsh environment in which to place an electronic display such as a CRT or LCD. If the sun is in front of the pilot, then it might take the pilot a relatively long time to be able to see the much dimmer display (i.e., dark adaptation). In some flight situations even a few seconds might be critical. If the sun enters the cockpit from the side window onto the display, the surface is washed out making it difficult or impossible to read and distinguish the colors of the elements. In the evening, it is important that the display not be too bright that the pilot can not see important but possibly dim targets in the sky or on the land. Visually oriented human factors research has focused on the stimulus intensity needed on these displays so that pilots can read them accurately and quickly under the wide range of conditions. An important goal of these efforts is to develop an automatic control mechanism that senses the ambient light visible out the front cockpit windows and the light falling on the display surface and automatically adjusts the intensity of the display for the pilot (Silverstein & Merrifield, 1985; Krantz, Silverstein, & Yeh, 1992).

One important future direction for sensation and perception's application to human factors will be developing a good general model of visual system-display interaction. With a single TV at home, this was not a big issue, but with scanners and digital cameras, printers, computer monitors, and TVs all at home the difference in color from one display to the next can be very great and disappointing. Obviously the model that is developed should not be tied to any single display type. There are also a plethora of new display technologies coming out. The venerable CRT will still be around for many years, the LCD is found on laptop computers and may be on our walls if HDTV takes off, color printers are coming into the home, and there are many other new display technologies besides.Two difficulties arise with these new technologies. First, the research effort to develop good images on CRTs and LCDs were very expensive and it would be nice if what has been learned from one technology could be applied to another. Secondly, the image reproduced on different displays can look very different, especially the colors. Colors will change and some times so dramatically that we would describe it as a different color on different displays. A good general model of visual system display interaction would allow new technologies to benefit from previous research and to develop images that have the same color from screen to screen and screen to printer.

Whereas studies of sensation and perception comprise a substantial portion of the field of human factors, studies of sensory and perceptual function have also recently made important contributions to the field of neuropsychology. This work has helped us to better understand and characterize a diverse group of neuropathologies and neurodegenerative disorders.

### Neuropsychology

The field of neuropsychology examines the relationship between central nervous system function and behavior, often in cases of pathology. Scientists have long speculated on the links between cortical function and impaired behavior, and in the past have relied on studies of gross brain abnormality (e.g., the case of Phineas Gage) in order to gain insight into this relationship. Studies of specific visual and auditory processes now contribute considerably to our understanding of diseases and disorders that involve central nervous system pathology. These disorders include dyslexia, mental retardation, schizophrenia, and autism, as well as progressive neurodegenerative disorders such as Alzheimerís disease, Parkinsonís disease, and multiple sclerosis.

One challenge confronting researchers in these areas is that many disorders show multiple behavioral impairments. Most neurological disorders have a characteristic profile of spared and impaired behavioral abilities: some behaviors are relatively unaffected; others may be profoundly affected. For many syndromes, scientists still seek to identify the range of different behaviors that show impairments, the relative magnitude of these impairments, and the cortical and subcortical areas of the brain that may be affected.

Without the answers to the questions above science cannot begin to understand and explain these disabilities. Obviously there is a great interest to society, as well. If we know how and to what extent different behaviors are affected there may be ways to help compensate or reduce the impact of an impairment. Perhaps much the same way large-print books help the visually impaired. Also, we may discover that specialized training may be able to reduce or eliminate some perceptual impairments. There is evidence that suggests that this may be true with dyslexia (Merzenich et al., 1996).

Sensory psychologists have contributed greatly to our understanding of these disorders. Because such a large proportion of cerebral cortex is devoted to processing sensory information, studies of sensation and perception offer a ìwindowî into the brain. The information gathered from these studies helps identify specific sensory or perceptual impairments, helps infer the cortical locations of the impairments, and helps move us towards thorough causal explanations. As examples, we consider the cases of developmental dyslexia and Alzheimerís disease.

Dyslexia. Dyslexia refers to a broad family of impairments. Generally speaking, dyslexia is a term used to define a severe learning problem that is unrelated to intellectual ability, emotional disturbance, gross sensory or physical handicaps, sociocultural status, or insufficient schooling. The most common type of dyslexa, specific reading disability (SRD) involves difficulties in learning to read and write. At present we lack clear agreement about the nature of dyslexia, including its causes and symptomology. In fact, a minority of investigators even propose that dyslexia simply represents the lowest portion of the normal distribution of these abilities in the general population, rather than a distinctive disorder (Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992).

However, most researchers agree that dyslexia probably results from abnormal neurodevelopment. Psychophysical studies suggest problems that are neural in origin as do anatomical studies of brain structure and physiological studies of neural activity. Stein and Walsh (1997) provide a succinct and recent review.

SRD is a reading impairment and children diagnosed with SRD are impaired in their abilities to auditorially distinguish the small differences among phonemes, the smallest units of speech (Brunswick & Rippon, 1994; Merzenich et al., 1996). Other verbal skills such as the rapid naming of objects and the ability to break words down into smaller segments (i.e., cowboy to ìcowî and ìboyî) are also impaired (Eden, Stein, Wood, & Wood; 1995).

A recent, systematic study of the nature of phonological processing in dyslexia was conducted by Shaywitz et al. (1998). Shaywitz et al. (1998) required dyslexic readers and control participants to perform a series of tasks, some of which required extensive phonological processing and others that required very little. While the participants engaged in these tasks, Shaywitz et al. used a brain imaging technique called fMRI (functional magnetic resonance imaging) to measure and map the pattern of neural activity in cerebral cortex. Shaywitz et al. observed what they refer to as a ìneural signatureî of dyslexia: A pattern of neural overactivation in some areas of cortex and underactivation in others. Some of the affected areas include traditional language areas and traditional visual ones. The authors interpret their findings as evidence that dyslexia is primarily a phonological impairment, and one that may involve a functional disruption of the mapping of the visual image (the printed words) to phonology during reading. These findings and this theory of dyslexia explain a large set of the research findings in this area and may describe the most proximal cause of SRD.

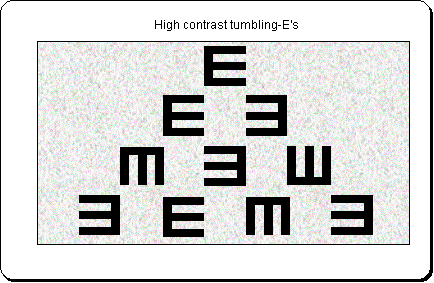
There is considerable evidence that children with SRD exhibit a set of visual perceptual problems that precede this stage, however, and researchers are working to characterize their relationship to SRD. Lovegrove, Garzia, & Nicholson (1990) provide a good discussion of the early work in this area. A large literature now documents impairments in motion perception (Cornelissen, Richardson, Mason, Fowler, & Stein, 1995; Eden et al., 1996) contrast sensitivity (Borsting et al., 1996; Cornelissen et al., 1995; Evans, Drasdo, & Richards, 1994), flicker sensitivity (Evans et al., 1994), as well as other tasks that preferentially involve the magnocellular pathway (Edwards, Hogben, Clark, & Pratt, 1996). Further support for visual perceptual correlates of SRD comes from a recent study revealing a correlation between motion detection thresholds and word reading performance in children without SRD (Cornelissen, Hansen, Hutton, Evangelinou, & Stein, 1998).

Anatomical and physiological abnormalities in the brain are associated with these behavioral abnormalities. In individuals with dyslexia the magnocellular layers of the LGN have been reported to be disordered and the cells themselves much smaller than normal (Livingston, Rosen, Drislane, & Galaburda, 1991). Eden et al. (1996) used fMRI to reveal abnormal neural activity during visual motion processing in adults with dyslexia.

In an attempt to explain the range of perceptual and anatomical impairments that are associated with SRD, investigators have recently suggested that dyslexia may be linked to a general sensory temporal processing impairment (Farmer & Klein, 1995; Stein & Walsh, 1997). That is, individuals with SRD have difficulty in processing sensory information that is brief or that changes rapidly over time. Studies of visual perceptual abilities of children with SRD would be consistent with this explanation, as well as studies that show that children with SRD have difficulties with some non-verbal auditory perceptual tasks as well as verbal ones (Tallal, 1980).

Again, the role that psychological research will play in understanding SRD will be large. Psychological research will help identify the cause(s) of SRD by helping to detail all the behaviors that are affected. A thorough description of SRD is very helpful because it permits researchers to eliminate alternative explanations of dyslexia that cannot explain the profile of impairments. Psychological research may also help find ways to compensate of help minimize the affect of the impairment, for example, with specialized training.Merzenich et al. (1996) report that children with learning disability can improve their abilities to perceive speech and nonspeech auditory stimuli with relatively little (8 to 16 hours) training.

Sensory psychologists have typically investigated these impairments in contrast sensitivity using specialized stimuli (e.g. sine wave gratings). Several undergraduate students working in one of our laboratories decided to investigate how well children with SRD would perform with more real-world stimuli, for example a visual acuity chart made up of high and low contrast letters. These students used a computer program designed in-house to test a group of children with and without dyslexia on their abilities to read low and high contrast Tumbling-E's. The Figures below show representations of the stimuli used.



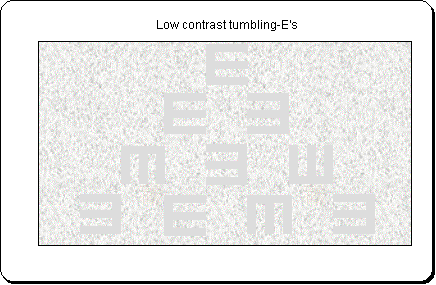
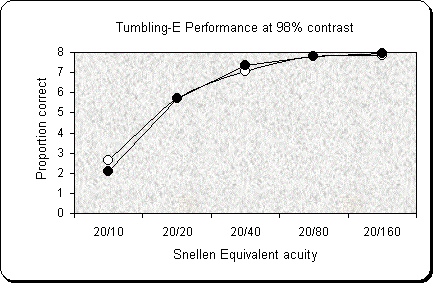


Figure 19. The panel on the left shows E's that are black on a white background-they have high luminance contrast. The panel on the right shows E's that are gray on a white background-they have low luminance contrast. [[Figure 19 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig19)]

The student's hypothesis, based on reports in the literature, was that the children with SRD would perform no differently than the children without SRD on the high-contrast E's but have difficulty in correctly identifying the low-contrast E's. The data collected are shown in the Figures below.



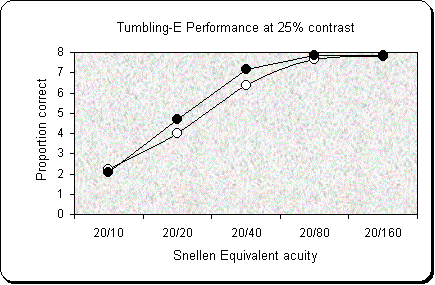


Figure 20. Each graph shows proportion correct for the different size E's, shown as the Snellen acuity equivalent (the way your optometrist describes the size of the letters). The panel on the left shows the data for both groups of children when the E's were high contrast; the right panel for the low contrast stimuli. [[Figure 20 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#fig20)]

Notice that there was no difference in performance between groups when the letter contrast was high. Both groups of children could see the large to small E's equally well. In the right panel, however, you can see that when the contrast between the letters and the background was reduced the performance for the children with dyslexia was affected to a much larger extent. Our students had demonstrated that the effects of reduced contrast apply to the critical stimuli present in reading: individual letters (Ballew, Brooks, & Annacelli, 2001). More importantly, special stimuli and conditions were not required to observe the effects (see also Woods & Oross, 1998).

Studies of sensation and perception have also contributed to our understanding of progressive neurodegenerative disorders, such as Alzheimerís disease.

Alzheimerís Disease. Alzheimerís disease is characterized by neuropathology (neurofibrillary tangles and amyloid plaques in cerebral cortex) and behavioral impairment, primarily progressive cognitive decline. To the general public, Alzheimerís disease is a ìmemory disorder.î Alzheimerís disease involves memory impairments, but it involves other behavioral deficits as well. In fact, according to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association DSM-IV, 1994) a diagnosis of Alzheimerís disease (Dementia of the Alzheimerís type) requires the presence of other non-memory related symptoms.

Early work suggested that the sensory systems and general perceptual abilities were spared in Alzheimerís disease. The initial observation that primary visual cortex was relatively free of the plaques and tangles that are characteristic of the disease and because visual acuity in Alzheimerís patients was not significantly different from that typically observed in normal aging supported this conclusion. Science, in its thoroughness, continued to investigate and assess other cognitive and noncognitive behaviors. As research in the area continued and specific perceptual skills were assessed, however, several visual and perceptual changes associated with Alzheimerís disease were revealed.

In addition to visual changes that are a consequence of normal aging, Alzheimerís disease is now associated with ganglion cell death in the retina (Blanks, Hinton, Sadun, & Miller; 1989), a substantial degeneration of optic nerve fibers (Hinton, Sadun, Blanks, & Miller, 1986), and cell loss in primary visual cortex (Hof & Morrison, 1990).

The association of visual perceptual problems with Alzheimerís disease is now well documented. Relative to age-matched controls, individuals with Alzheimerís disease have been reported to have impairments in contrast sensitivity (Bassi, Solomon, & Young, 1993; Gilmore & Whitehouse, 1995), blue-yellow color discrimination (Cronin-Golomb, Suguira, Corkin, & Growdon, 1993), depth perception (Mittenburg, Malloy, Petrick, & Knee, 1993) and motion perception (Gilmore, Wenk, Naylor, & Koss, 1994). The extent of the visual problems in Alzheimerís disease has led many investigators to consider the visual sequelae one of the hallmarks of the disease. In fact, some investigators have reported that Alzheimerís disease may have its origin in the visual sensory pathways (Gilmore & Whitehouse, 1995).

Importantly, research in visual perception may have helped identify a set of new diagnostic tools. There is evidence that in Alzheimerís disease the perceptual impairments may present before many of the cognitive impairments. Some individuals with Alzheimerís disease report consulting their optometrist or ophthalmologist concerning a vision problem before memory or cognitive impairments became evident ([Kiyosawa et al., 1989](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/references.htm#Kiyosawa, M., Bosley, T., Chawluk, J., Jamieson, D., Schatz, N., Savino, P., Sergott, R., Reivich, M., & Alavi, A. (1989).)). Researchers are currently investigating the extent to which visual perceptual tests may be used clinically to help identify Alzheimerís disease and other progressive neuropathologies in their earliest stages.

## Future Directions in Sensation and Perception

As discussed early in this chapter, recent discoveries in the behavioral neurosciences have greatly affected research in sensation and perception. An appreciation of the extent to which sensory systems process information in parallel required us to reconceptualize how sensory systems build our perceptual experiences. The advances in the behavioral neurosciences have led a substantial number of researchers to direct the focus of their research to explaining perception at this level of analysis. Today, research in sensation and perception often involves using psychophysical data to make inferences regarding the underlying neuroanatomy and neurophysiology. This theoretical approach to understanding sensation and perception, called neuroreductionism, has enjoyed great success. Many of the simpler perceptual phenomena can be explained by (or related to) the structure or function of underlying neural structures.

We have every reason to believe that this trend will continue and that other equally stunning discoveries are just around the corner. However, we need to recognize that in the future the neuroreductionist approach may result in diminished returns. Many of the perceptual phenomena that are amenable to simpler neuroreductionistic explanations have been described. Also, the extent to which this approach can provide similar and satisfactory explanations of higher-level perceptual phenomena remains to be demonstrated.

Additionally, as a theoretical approach to understanding perception, neuroreductionism has its share of detractors. William Uttal (1998), in his book Toward a new behaviorism: The case against perceptual reductionism, argues that researchers in sensation and perception should resist the very seductive enterprise of trying to link psychophysical data to specific underlying neural mechanisms. One of the theoretical problems associated with this approach, according to Uttal, is that neural events are not identical to mental events. Uttal calls this ìpsychoneural equivalence,î and he argues that it will always be difficult, if not impossible, to satisfactorily relate the two. He further adds that psychologists should not feel compelled to attempt it. Additionally, Uttal argues that ìÖif perceptual psychology is to survive, and not be inappropriately absorbed into the neural or computational sciences in the next millennium, it will have to return to its behaviorist, positivist rootsî (p. xii).

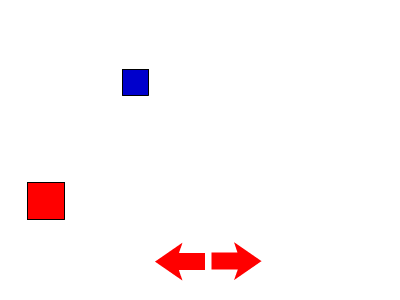
Although Uttalís (1998) argument is a compelling one, this large a shift in theoretical approach is unlikely. First, the neuroreductionist approach continues to provide us with valuable insights into sensory mechanisms. Second, the advent of superior brain imaging techniques, like the fMRI, have opened new avenues for researchers to visualize perceptionís neurological substrates in the awake, behaving human.

However, despite todayís neuroreductionist leanings, we still recognize that our individual perceptions are best described as gestalts, where the whole is far more than the sum of the anatomical or physiological parts. Also, many psychologists would agree that an understanding of these higher-order, emergent properties will do more to enhance our understanding of human sensation and perception than will neuroreductionist explanations involving the activity in small groups of neurons. Psychophysics, the set of methodological tools that sensory psychologists possess, is ideally suited to investigate perception at this level of analysis. Perhaps the unique promise of sensory psychology, relative to the other perceptual sciences, is that it does provide explanations of behavior at the molar rather than the molecular level. In a sense, this may be our ìscientific niche.î

We believe, then, that some of the most dramatic and important contributions that psychology will make in the near future will be in our understanding of higher-level perceptual mechanisms. We will see more studies of phenomenology, perception and action, and sensory integration. A good example of one of the intriguing research techniques and issues on the horizon for perceptual psychology is virtual reality (VR).

### Virtual Reality

VR is the development of artificial environments that can be navigated directly. They can be the relatively simple or very complex. They fall into two general categories: window on the world and immersion. In window on the world, the user views the environment as from a window into the world. The monitor screen is the window and the information on the screen provides the visual information about this world. This is the type of VR involved in most video games and a very primitive version of this type of VR is illustrated in Figure 21. The more compelling and interesting type of VR occurs when the person is immersed in the environment. This type of VR uses helmet-mounted displays to generate the visual information, often has an integrated sound system, and occasionally provides tactile feedback. It is this latter type of VR that holds the most interest, but research and study is proceeding on both types of VR.

  
Figure 21. Here is a very primitive virtual environment of the window on the world type. Use the arrows to navigate to the right and the left and observe the movement of the two objects in the display. [[Figure 21 description](http://teachpsych.org/ebooks/faces/text/Ch09_HTM/figuredescriptions.html#21)]

VR is both a research technique, because of its ability to provide sensory input from multiple sensory systems in a controlled manner, and a research area because it is also an application where sensory knowledge will be fundamental for success. Some examples of the application of VR that are relevant to psychology have been in clinical psychology (Huang, Himle, & Alessi, 2000; Jang, Ku, Shin, Choi, & Kim , 2000; Roessier, Mueller-Spahn, Baehrer, & Bullinger, 2000), neuropsychological evaluation (Kesztyues et al., 2000), memory research (Gamberini, 2000), and education and training (Cromby, Standen, & Brown, 1996; Mohler, 2000).

One of the research advantages of the most advanced VR systems is that it can provide controlled inputs to the visual, auditory and tactile systems. To date, the vast majority of studies in sensation and perception have primarily investigated the senses separately.However, many experiences are based upon inputs from multiple sensory systems. For example, hearing and seeing a bat hit a ball. Consider how jarring it is to sit so far away that the sound and the sight are not integrated.

The study of body orientation, for example, focuses on a fundamentally integrated sensory system. A series of recent studies suggest that visual information alone may be sufficient for determining whole-body translation and linear movement in the virtual environment. However, feedback from the tactile systems may be needed for accurate determination of rotation (Chance & Loomis, 1987; Richardson, Hegarty, & Montello, 1997).

Richardson et al. (1997) found that going around a staircase in a virtual building leads to larger errors in determining their location relative to their starting point than either learning the environment from maps or actually moving through the real version of the environment. Chance and Loomis (1987) studied perception of direction in individuals moving in virtual environments, with or without tactile feedback. Chance and Loomis found that if a person actually rotates but translates via the virtual environment, thus receiving the tactile input from the rotation, they kept their sense of direction far better. We know that visual input is suppressed during saccadic eye movements, which accompany body rotations. Perhaps the orienting system, not expecting good visual input during physical rotation, has developed a tendency to rely more on tactile input (Krantz & White, 1989; Volkmann, 1986) . The need to rely on tactile input may result from the fact that during the illusion of rotation in a VR environment, the vestibular system is not activated, an illustration of the importance of understanding the integration of different sensory systems (Cohn, Dizio, & Lackner, 2000). The VR environment is especially suited to studying multi-sensory and sensory-motor integration.

Sensory research is also proving to be helpful to engineers working on VR systems. In a recent paper, Cutting (1997) gives a review of the visual information needed for VR applications, including how space perception and the use of depth cues can assist VR engineers in developing appropriate visual inputs. An important feature of Cuttingís work is his quantitative approach to VR. Just as it was necessary to develop equations for color matching to be used in monitors and printing, so it will be necessary to provide quantitative functions for other visual functions before they can be applied to VR. Thus, research in sensation and perception may well take the form of taking well-understood phenomena and developing quantitative models for application. This research may also indicate new visual functions that need to be explored. One possible issue is the location of the center of projection relative to the persons eye height. Dixon, Wraga, Proffitt, & Williams (2000) found that the relationship between a subjects eye height and the center of projection profoundly affected the perception of size.

Another interesting question related to VR that is both a research question and an application issue is the difference between the two forms of VR. The experience of VR in the immersion techniques is far more immediate than the window on the world. What are the features that makes this so? One difference is that the field of view tends to be far more restricted in the window on the world (Dichgans & Brandt, 1978) though Dixon et al. (2000) found that an immersion technique with a restricted field of view had as strong a relationship between eye height and perceived size as did a full immersion technique. The window on the world condition in the same paper showed now effect of the relationship between eye height and center of projects. These results suggest that the difference between the two forms of VR is more than just a difference between the size of the field of view. All in all, VR is a fruitful field for psychological research into sensation and perception and vice versa. In fact it appears that the development of VR and the use of VR as a research tool in sensation and perception may be tightly intertwined.

## Summary

Today, research in sensation and perception continues to identify interesting and important perceptual phenomena that contribute to our understanding of sensory system structure and function, the nature of perceptual processes, and the human mind. The discovery of additional cone photoreceptor types in the retina is one recent example of a contribution to our fundamental understanding of the visual system. Studies of sensation and perception have also made important contributions to applied fields such as human factors and neuropsychology. In the case of human factors, research in sensation and perception helped in the design of machines that better fit human capabilities. In the case of neuropsychology, this research contributed to our understanding of a variety of neuropathological disorders and has shown promise as a tool for early identification. The future research in sensation and perception will continue to involve studies of fundamental sensory processes as well as complex perceptual mechanisms. One future area of research that shows particular promise is the study of integrated perceptual experiences such as VR.

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These are descriptions to accompany the figures found in Chapter 9, Sensation and Perception

**Visual Neuroscience Section**

Figure 1 is an illustration of the differences between serial and parallel processing. The top part of the figure illustrates serial processing using arrows to go from step one to step two, etc. The bottom part of the figure illustrates parallel processing by three lines going horizontally the length of the figure. None of the processes require any of the other processes to complete before it can start. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 2 illustrated the response pattern of x and y cells. The figure is a plot with time on the horizontal x axis and how fast the neurons are firing on the vertical y axis. Below the x axis is a plot showing when the stimulus is on. The stimulus is on for the middle 3/4th's for the figure. The plot of the x cell rises when the stimulus comes on and while it varies moment by moment it stays high until the stimulus goes off when it returns to its baseline firing rate. The plot for the y cell rise when the stimulus goes on, stays high for a brief period of time and then falls back to the baseline firing rate. The firing rate for the y cell goes up briefly again when the stimulus goes off. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 3 graphically represents a cross section of the cortex as it is in the striate cortex. There are 6 horizontal layers parallel to the surface of the cortex. The 4 layer is the thickest here and is stained darker to show the stripe that give this region its name of striate cortex. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 4 graphically represents the connections between the Lateral Genuculate Nucleus and the striate cortex. On the left portion of the figure is a schematic LGN, with the bottom two layers in black representing the magnocellular layers of the LGN. The top four layers are gray representing the parvocellular layers. Both types of layers are labeled. On the right are the words blobs and interblobs, and the same representation of the cortex as in Figure 3 with a portion of Layer 4 indicated, layer 4b. Lines go from the parvocellular label to both the blobs and interblobs label. Lines go from the magnocellular label to both the blobs and the Layer 4b labels. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 5 indicates the upward connections from V1 to the other regions of the cortex. V1 is broken into three sections (blobs, interblobs, and layers 4b). V2 is broken into sections called Thick stripes, interstripes and thin stripes. The other sections indicated are V3, V4, and V5. The blobs show arrows connecting to the interstripe and v4 regions. The interblobs also connect to the interstripe and v4 regions. Layer 4b connects to thin stripes, thick stripes, v5 and v3. V3 is interconnected to v4 and v5. V4 is interconnected to v3 and v5. V5, likewise is interconnected with v3 and v4. [End of description; Use your browser's BACK button to return to section you were reading.]

Take a look at the figure below  
There is a central medium gray square that does not change. Surrounding that is a larger square that goes from black to white. As it does, the brightness of the central square changes. When the larger square is light, the central square looks darker. When the larger square is dark, the central square looks lighter. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 6 is a traditional representation of the simultaneous contrast. On the left is a gray square surrounded by a larger black square. On the right the same gray square is now surrounded by a larger white square. The gray square on the right looks brighter on the left. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 7 shows a plot of model of the output of center-surround receptive fields of ganglion cells to Figure 6. Only the edges of the two inner squares show up all other cells respond the same as the background level. For the square on the left, the edge next to the square are higher than the center of the square and the edge next to the black surround square are lower than the rest of the black region. For the square on the right, the edge next to the square is lower than the center of the square and the edge next to the white is higher than the rest of the white region. [End of description; Use your browser's BACK button to return to section you were reading.]

[There is no Figure 8. It was removed late in the editorial process and, for convenience sake, the numbers of the following figures were retained.]

**Human Color Vision section.**

Figure 9 shows the traditional spectral sensitivity of a three cone photopigment system. Wavelength is on the X-axis (horizontal) and sensitivity is on the Y-axis (vertical). Each curve resembles an upside down "U". One curve has its peak in the short wavelength part of the spectrum, one in the middle wavelength part of the spectrum, and one in the longwavelength end of the spectrum. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 10, like Figure 9, shows the spectral sensitivity of cone photopigments. This Figure contains 5 curves, however, representing the newly discovered cone types. Shown is an additional curve in the middle wavelengths and an additional curve in the long wavelength end of the spectrum. The two added spectral sensitivity curves are very nearly identical in shape and placement to the two original middle wavelength and longwavelength cone photopigments. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 11 shows several rows of colored rectangles. Each rectangle represents a single color vision gene; red rectangles symbolizing genes encoding the long wavelength cone type, green rectangles symbolizing the middle wavelength cone type; and half red / half green rectangles representing hybrid genes which are linked to "unusual" spectral sensitivity. Different rows, representing different individuals, often contain multiple copies of the different gene types indicating diverse gene arrangements. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 12 shows a graph of the color matches of 94 different men. Shown on the X-axis (horizontal) are the individuals, numbered 1 to 94, and on the Y-axis (vertical) is their color match. This color match, called the Rayleigh match, is one where red and green light must be mixed in some proportion to make yellow. The Y-axis (vertical) shows this proportion. Each individual is represented by a vertical bar that shows all the proportions of red and green that would make an acceptable match to yellow. Longer bars, therefore, represent poorer color discrimination. The Figure shows many individuals with good color discrimination and several with poor color discrimination. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 13 shows a representation of the distribution of photoreceptors in the retina. Red, green, and blue filled circles represent the different cone types. The ratio of R / G / B cone types varies: The long wavelength cones are the most prevalent; short wavelength cones the least prevalent in the retina. [End of description; Use your browser's BACK button to return to section you were reading.]

**Visual Search section.**

Figures 14 to 17 are animated demonstrations of visual search tasks. These figures demonstrate that the ability to search a visual display for a single target item among a group of distracter items depends on certain factors. Some targets are quickly found regardless of the number of distracters present in the display. Other targets, however, are not as easily found and increasing the number of distracter items increases the length of time required to successfully find the target. [End of description; Use your browser's BACK button to return to section you were reading.]

**Human Factors Section.**

Figure 18 shows the CIE chromaticity diagram. The x value of the color is on the x axis (horizontal) and the y value is on the y axis (vertical). Inside the axes is a figure that represents all colors that it is possible to see. Around the curved portion of the outside are the labels for the wavelengths in the spectrum of visible light (from 380 to 750 nanometers). This is a straight line connecting from the 380 nm to the 750 nm point to indicate the mixtures of these two extreme colors in the spectrum. Inside the range of possible colors is a triangle. The three points represent typical primaries on a color CRT and the region inside the triangle are all of the colors a CRT can reproduce. Much of all possible colors falls outside this triangle. [End of description; Use your browser's BACK button to return to section you were reading.]

**Neuropsychology section.**

Figure 19 shows a representation of the stimuli used to test low-contrast visual acuity. The panel on the left shows rows of high contrast black "E" stimuli on a white background. The "E" can be pointing up, down, left, or right and the size of the "E" gets progressively smaller from top to bottom in the panel. The panel on the right is similar except the "E" stimuli are low contrast: a very light gray on a white background and are much more difficult to see. [End of description; Use your browser's BACK button to return to section you were reading.]

Figure 20 shows the data collected on children with and without dyslexia with visual stimuli similar to those in Figure 19. Each panel shows Snellen acuity on the X-axis (20/20, etc) and proportion correct identification on the Y-axis. The panel on the left shows the data when children with and without dyslexia are tested with high contrast "E" stimuli. Both groups show similar visual acuity. The panel on the right shows the data when these same children are tested with low contrast "E" stimuli. When tested with these stimuli the children with dyslexia perform more poorly than children without dyslexia. [End of description; Use your browser's BACK button to return to section you were reading.]

**Virtual Reality Section.**

Figure 21 is a very simple virtual reality illustration. It has a blue square about 3/4th the way to the top, a larger red square about 1/3rd the way to the top and two arrows at the bottom. One arrow points to the left and the other to the right. When you press on these arrows, the two squares will move in that direction. The red square moves much more. When in movement, the red square gives the impression of being closer to you. [End of description; Use your browser's BACK button to return to section you were reading.]

# Chapter 10 Trends in Human Development

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During moments of reflection about our own lives and those of people we know well, virtually all of us ponder questions that are of great interest to researchers of human development. Perhaps you have wondered about one or more of the following:

* What determines the attributes we share with our parents and siblings and those that make each of us unique--in physical traits, mental capacities, interests, and behaviors?
* What is the infant and young child's understanding of the world like, and how does it change over time?
* Why do some of us retain the temperamental styles that characterized us as children (such as shyness, sociability, excitability, or high activity), whereas others change in essential ways?
* How do homes, schools, neighborhoods, and contemporary realities--employed mothers, day care, divorce, smaller families, and new technologies--contribute to our characteristics and skills?

Human development is a field of study devoted to understanding constancy and change throughout the lifespan. Its scientific roots date back to fledgling observational and interview studies of children and adolescents in the early part of the twentieth century. In the beginning, description--charting age-related milestones, such as when a child first walked, spoke in sentences, formed a best friendship, and reached puberty--was the principal activity of American developmentalists (see, for example, Murchison, 1933). Little attention was accorded to process--the how and why of human change.

Following World War II, the field came into its own. Although always a melting pot of interdisciplinary contributions, by the 1960s human development achieved the status of a distinct subdivision within psychology. Empirical work flourished, becoming more sophisticated in methodology and focusing more directly on explanation. Grand theories (behaviorist views of learning, the psychoanalytic approach to personality development, and Piaget's theory of cognitive development) held sway (Cairns, 1983, 1998). Each was closely tied to a specific domain, or aspect, of human functioning. Together, the grand theories brought tension and debate to the field, offering powerfully opposing perspectives on the course and processes of change. A passive child continuously shaped by environmental inputs was pitted against an active, sense-making being undergoing a series of stagewise shifts rooted in human biology.

Investigators of the mid-century phase had become increasingly sensitive to social and applied issues. Besides traditional topics of enduring interest, such as perception, intelligence, language, personality, and morality, they turned to questions of burning practical concern, such as the impact of poverty, child abuse and neglect, the rising divorce rate, maternal employment and day care, and learning problems in school. In addition to theoretical advances, the field had aligned itself more closely with the goal of improving children's conditions of life.

This broad brush-stroke image of the emergence of developmental psychology is chronicled in detail in the*Handbook of Child Psychology,*a compendium of the field that has been published in successive editions at 9- to 16-year intervals since the 1930s. The *Handbook's* fourth edition appeared in 1983; the fifth in 1998. A comparison of these most recent volumes with the preceding, 1970 edition reveals a period of unprecedented expansion and change. The most obvious shift is that by the early 1980s, the grand theories that had dominated mid-century research were being seriously questioned. In their place had sprouted a variety of alternative perspectives, including ethology, information processing, social cognition, behavioral genetics, and cultural approaches. These views were no longer as one-sided in focusing on a single domain of functioning (e.g., social behavior, personality, or cognition). They were also less polarized in their view of the roles of biology and environment (Dixon & Lerner, 1992; Lerner, 1998). The concerns of researchers had also broadened considerably, generating much more research on such topics as play, peer relations, the self-system, aggression, developmental psychopathology, and the school as a context for development (Mussen, 1983).

The Field Today

The 1980s have been characterized as a transitional phase in developmental psychologytone in which "[no theoretical perspective] was on center stage" (Damon, 1998, p. xv). As the most recent *Handbook* reveals, a fragmented field is giving way to new, more powerful theoretical models involving multiple interacting variables at several levels of influence--biological, psychological, proximal environmental (family, child-care center, school, neighborhood), and distal environmental (community, society, culture, historical) (Bronfenbrenner & Morris, 1998; Fischer & Bidell, 1998; Lerner, 1998). Although greater in number than they once were, a core of theories is again leading contemporary research. These include ecological-systems, lifespan, and transactional (person/context) approaches; behavioral genetics views addressing the joint operation of nature and nurture; neo-Piagetian models encompassing neurological, information-processing, and task-specific influences on cognitive change; and Vygotskian sociocultural views focusing on social interaction and culture as major forces in psychological development (Damon, 1998).

Moreover, research summarized in the 1998 *Handbook*attests to growing interest in both basic psychological dimensions, such as temperament and emotion, and in higher-order, metacognitive processes, including children's knowledge of their own and others' thoughts, feelings, and beliefs and capacity to monitor and regulate their own cognitive and social behavior. The 1998 *Handbook*is also the first to devote an entire volume to child psychology in practice--a clear indication of burgeoning efforts to use research as the basis for successful caregiving, educational, and clinical interventions (Sigel & Renninger, 1998).

Although it is impossible to portray comprehensively all current forces in the field, the following are vital dominating and interrelated trends:

* Strengthening connections with other subfields of psychology and other disciplines. The contemporary move toward a systems perspective on development--one in which thinking, feeling, and acting are viewed as an integrated whole and affected by a wide array of factors in biology, context, and culture--has motivated developmental researchers to strengthen their links with other fields of psychology and with other disciplines. Currently, neuropsychology, social psychology, educational psychology, health psychology, clinical psychology, biology, pediatrics, sociology, anthropology, and other fields contribute to and benefit from research agendas in developmental psychology. The lessons gleaned have been a major impetus for the three trends that follow.
* An emphasis on multiple pathways of change. Today, the field of developmental psychology recognizes that because children have similar brains and bodies and live in stimulating environments, certain broad outlines of development apply to many youngsters. At the same time, biological makeup, everyday tasks, the people who support children in mastery of those tasks, and the quality of children's experiences vary greatly, leading to wide individual differences in specific skills. Even when children master the same skills, such as walking, talking, or adding and subtracting, they often do so in unique ways. Consequently, an increasing number of investigators are choosing ecological, dynamic systems, and sociocultural perspectives through which to frame their research in hopes of accounting for the enormous diversity in development (Bronfenbrenner, 1995, 1998; Rogoff, 1990, 1998; Thelen & Smith, 1994, 1998; Van der Veer & Valsiner, 1991).   
    
  A recent revival of longitudinal research has been a powerful force in raising the field's consciousness of diversity in development. Although few in number, longitudinal studies occurred early in the history of the field--in the 1920s and 1930s. The most notable began with a focus on child and adolescent development but were extended over participants' lifetimes (Jones, 1971; Kagan & Moss, 1962; Terman & Oden, 1959). Tracking of individual trajectories of change revealed unique routes to maturity and both stability and instability in physical health, intelligence, and social and personality functioning.   
    
  For example, researchers discovered that the majority of children show substantial IQ fluctuations over childhood and adolescence--in most cases, 10 to 20 points, and sometimes much more (McCall, 1993). Gainers tended to be independent and competitive about doing well in school and had parents who were highly interested in their intellectual accomplishments, applied greater pressure to succeed, and used rational, democratic discipline. Decliners tended to have parents who made little effort to stimulate them and who showed extremes in child rearing, using either very severe or very lax discipline (McCall, Appelbaum, & Hogarty, 1973; Sontag, Baker, & Nelson, 1958). From the start, longitudinal work challenged genetic determinism and illuminated complex biological and environmental contributions to development (Caspi, Elder, & Herbener, 1990; Friedman, Tucker, et al., 1995). It also provided part of the foundation for the contemporary emphasis on studying development throughout the lifespan.  
    
  Inherent in the current burst of longitudinal studies--both short-term and spanning many years--is the recognition that development can only be fully understood by directly examining its temporal context. As the only method that focuses on relationships between early and later events and behaviors, the longitudinal approach is particularly suited to highlighting processes of change. Furthermore, cohort effects (the impact of cultural-historical conditions on development), previously regarded as a contaminant in longitudinal research, are now a target of investigation in their own right. For example, the Great Depression of the early 1930s had a profound impact on development. It introduced stresses into parent-child relations, affected children's emotional adjustment and school performance, modified adolescents' educational aspirations and occupational choices, and prompted an earlier age of marriage in young adulthood (Elder, 1974; Elder, Caspi, & Van Nguyen, 1986; Elder, Liker, & Cross, 1984). The field has become more conscious that the environment is not restricted to events in the immediate situation. Instead, cultural and historical systems at more distal levels affect immediate contexts, the person's interpretation of those contexts, and therefore person-environment interaction (Magnusson & Stattin, 1998; Shweder et al., 1998).
* More sophisticated conceptions of the joint influence of biology and environment. Contemporary work on biology and development is based on complex frameworks that posit interconnected roles for hereditary/constitutional and environmental factors. The current literature is replete with references to range of reaction; genetic-environmental correlation; shared and nonshared environmental influences; experientially-induced synaptic growth; dynamic systems in which biology and environment join forces to induce development; co-construction of psychological structures by child and expert partner; and evolutionary perspectives on attachment, cognition, and social behavior. As these ideas reveal, the field has turned away from biological determinism, a flawed perspective with devastating psychological, social, and policy consequences (Eisenberg, 1998). In its place is the realization that biological and environmental factors interact in intricate ways and cannot be separated in a simple manner.   
    
  At present, biological dispositions are viewed as emerging in and modified by diverse social contexts. Even in domains where biological evidence is rapidly accumulatingtfor example, the growing literature on neurological and hormonal correlates of temperament--research findings repeatedly underscore that biology always shares power with experience (Kagan, 1998). To cite just two examples, when an extremely shy, inhibited baby is exposed to appropriately supportive caregiving, the physiological correlates of inhibition are reduced (Gunnar et al., 1996). Similarly, among adopted children at genetic risk for antisocial behavior (it was prevalent in their biological families), the quality of adoptive parents' support predicts whether or not they actually develop aggressive, antisocial personalities (Cadoret et al., 1995).   
    
  As these illustrations reveal, contemporary research is no longer as heavily concerned with whether and to what extent heredity is involved in a variety of human attributes. Instead, investigators have turned their energies toward uncovering the biological mechanisms that bridge the gap between genes and behavior and the types of parenting and teaching strategies that might modify those factors and, thereby, help children with specific temperaments, personalities, and intellectual strengths and weaknesses develop at their best. Consider the following research questions: What are the physiological correlates of shyness, in terms of heart rate patterns, blood hormone concentrations, and brain-wave activity? Can child-rearing practices modify these responses and the chances that a shy baby will become a fearful, inhibited child? (See Kagan, 1998; Park et al., 1997; Rubin et al., 1997). How effective is educational, nutritional, and health intervention for children exposed to biological and social risks, such as poor prenatal care, birth complications, and poverty-stricken home environments? How early must such intervention begin, how long must it be sustained, and how intensive must it be to have a long-term impact on development? (See, for example, Ramey & Ramey, 1998.)
* A stronger interface between theory-driven research and pressing practical concerns. The field of developmental psychology has intensified its interest in generating research findings that can be applied to real-life issues in real-life situations--homes, schools, mental health clinics, hospitals, juvenile courts, workplaces, and any other setting that affects the health and welfare of the developing person. Blending scientific research with practice has been, and continues to be, a formidable challenge. Because research done in the traditional way--in laboratories and under highly controlled conditions--fails to mirror conditions of everyday life, it cannot offer prescriptions for what practitioners should do; it can only be suggestive. Moreover, the majority of developmental research is not written to be accessible or useful to practitioners--in large measure because most researchers are not engaged in practice and have little direct involvement with practitioners.   
    
  Nevertheless, the field is gradually doing a better job of bridging the gap between science and application. In some instances, researchers have created collaborative partnerships with practitioners in designing and carrying out research. These efforts have not only yielded information of greater usefulness, but have uncovered obstacles that must be surmounted for knowledge to be applied in real life. In pediatrics, for example, making childhood immunizations free and accessible is not sufficient to ensure that every child will be fully vaccinated. Daily stressors that prevent parents from taking their child to a clinic along with parental misconceptions--that an immunization itself might lead to illness--need to be overcome (Abbotts & Osborne, 1993). In education, teachers cognizant of research on the importance of play in young children's development face difficulties in applying their insights because of external pressures for curriculum coverage. In addition, many adhere to the belief that they should not intervene in play, despite their own observations that children often encounter cognitive and social challenges while playing that can only be resolved with adult support (Bennett, Wood, & Rogers, 1997).  
    
  Efforts to integrate research with practice have led to a breed of professionals called "scientist practitioners"--educators, practicing psychologists, and physicians trained to engage in both endeavors. In addition, new interdisciplinary fields have arisen during the past two decades, each of which aims to reduce the sharp division that formerly existed between basic and applied research. The most influential of these fields is developmental psychopathology, which addresses the relationship between normal development and disturbances in psychological functioning (see Bearison, 1998, for another exampletpediatric psychology).  
    
  In bridging developmental and clinical psychology, the field of developmental psychopathology is demonstrating that we can learn much about normal development by studying pathology, since investigations of brain damage, mental disorder, and stress-ridden environments enable scientists to isolate factors that foster adaptation not readily apparent in well-functioning individuals (Cicchetti & Cohen, 1995; Overton & Horowitz, 1991). Similarly, much can be learned about pathology by examining normal development. In this vein, researchers have been especially interested in individuals who are *resilient,* or functioning well despite biological or environmental risks. Comparisons of their life courses with those of individuals displaying psychological dysfunction have uncovered personal and social factors that protect against adversity, for example, an easy going, sociable disposition; a warm parental relationship; high intellectual ability, which increases that chances of rewarding experiences in school; and social supports outside the immediate family (Cicchetti, 1993; Cicchetti & Toth, 1998). To achieve these understandings, longitudinal research has become the hallmark of developmental psychopathology (see, for example, Garmezy, 1993; Rutter, 1987; Moffitt et al., 1996; Werner & Smith, 1992).  
    
  Researcher-practitioner alliances have done much to strengthen the trends mentioned earlier in this chapter. Practitioners cannot make use of narrowly focused research; they require an understanding of the whole individual--the way physical, cognitive, emotional, and social development are interwoven. Moreover, the interdisciplinary perspective of developmental psychopathology has enhanced our appreciation of diversity in development--that maintenance and breakdown of functioning can occur in a great many ways. Finally, conceptions of development emerging from this new field acknowledge human development in its full subtlety, as due to complex transactions between biological and environmental forces.  
    
  As developmental researchers reach out to applied fields that touch their own, they are making research more accessible, drawing together formerly fragmented topics of study, conducting more investigations in real-life settings and, thereby, expanding their appreciation of contextual influences on development. They realize more firmly that "understanding can come from many sources: research in the laboratory, research in the field, practice in the consulting room, watching children in the classroom, and taking a step back and reflecting on all [they] see" (Sigel, 1998, p. 1131). The synergy arising between developmental researchers and consumers of their work is yielding dual benefitstfor developmental theory and for interventions and services directed at preventing maladaptive outcomes and improving conditions of life.

Vygotsky's Sociocultural Theory and Contemporary Developmental Research

Several themes addressed in the preceding section--the complex interconnection between biology and environment, multiple pathways of change, and the interface between theory and practice--have permeated my own research and that of others working within the same theoretical tradition. For the past decade and a half, my research group has addressed the origins, development, and functional significance of a fascinating but puzzling phenomenon: children's private speech, or speech to themselves as they engage in problem solving, play, and other activities.

I became captivated by private speech while carrying out classroom-observational research on the effects of school environments on children's cognitive and social development. Although at the time my research goals were focused on other phenomena, I could not help but notice that children talked to themselves a great deal as they went about their daily activities. After spending several weeks in a special elementary school for children with severe learning and behavior problems, I came away with the impression that certain children used private speech almost constantly while engaged in academic work. My first investigations, along with the work of others, confirmed that depending on the situation, private speech accounts for 20 to 60 percent of the spoken language of preschool and school-age children (Berk, 1992). Its high rate of occurrence led me to ask: If children talk to themselves so often, what role does such language play in their psychological development?

The work of my research group has been guided by Vygotsky's sociocultural theory, a leading perspective in contemporary developmental psychology that regards uniquely human, higher forms of mental activity as originating in social and cultural experiences. Our studies have also been spurred by applied concerns. We are intensely interested in the role that private speech plays in learningtfor normally developing children and children with serious difficulties with attention and regulation of behavior. Our work is part of a much larger Vygotsky-inspired literature that is revolutionizing the field's view of the importance of social and cultural contexts for cognitive development, offering new insights into the development of children with serious learning problems, and energizing a plethora of innovative educational interventions and programs.

Essentials of Vygotsky's Theory

A major tenet of Vygotsky's theory is that people are products of their social and cultural worlds and that to understand children's thinking, one must understand the social and cultural contexts in which children develop. Although Vygotsky's innovative sociocultural ideas date back to the 1920s and early 1930s, they did not take hold in Western developmental psychology until recently for several reasons. First, Vygotsky's untimely death in 1934, at the age of 37, meant that he had little opportunity to integrate his formulations into a tightly organized, well structured theory. In this sense, it is best to think of his work as a series of minitheories that embody a general approach that has since been extended and refined by many scholars. Second, in the mid-1930s, Vygotsky's writings were condemned in the Soviet Union due to Stalinist repression. Consequently, for almost 30 years they remained virtually unknown to Western scholars. Finally, when the first English translations of significant works by Vygotsky were released in the 1960s and 1970s, interest had to wait for growing dissatisfaction with Piaget's theory, which dominated mid-twentieth century research on cognitive development.

A Socially Formed Mind. Although Piaget and Vygotsky are often placed in opposition, they have important points of contact and compatibility (Cobb, 1994; Glassman, 1994; Tudge & Winteroff, 1993). Each derived theories with both natural (biological) and social dimensions. Piaget, however, stressed the natural line of development--factors within the organism that lead to cognitive change. His view of the social line was considerably more restricted than that of Vygotsky. Interaction with adults, Piaget (1923/1926; 1928/1977) believed, is often ineffective in prompting cognitive change; he thought children tended to bend to adult authority without truly examining the adult's perspective. Instead, Piaget underscored the power of arguments with agemates, or coequals, in jarring children into realizing that others hold viewpoints different from their own. Yet even though Piaget regarded peer disagreements as a significant motivator of revisions in cognitive structures, social experience never became a major focus in his theory or research (Berk & Winsler, 1995; Rogoff, 1998). Nor did Piaget, in positing a universal sequence of stages, address the role of culture in cognitive development.

By the 1980s, increasing evidence of wide variability in children's developmental paths and progress led American psychologists and educators to greet Vygotsky's emphasis on the social and cultural side of children's experiences with enthusiasm. For Vygotsky, the locus of development is not within the individual brain or mind. Instead, it is*socially situated*--between people (Bakhtin, 1981; Wertsch, 1985; Wertsch, Tulviste, & Hagstrom, 1993). Through social interaction, each society passes on to the next generation a set of higher mental functions--for example, attention, memory, and problem-solving strategies--specially suited to carrying out that culture's practical activities. As more expert members of society (both adults and peers) assist children in mastering challenging tasks, their collaboration alters the natural line of development, transforming basic mental capacities into culturally adaptive competencies (Vygotsky, 1930-1935/1978). Then new generations collectively transform these mental functions and practices, contributing to cultural-historical change (Scribner, 1985; Wertsch, 1985).

Role of Language. According to Vygotsky, transfer of cognitive processes from the social to the individual plane of functioning is enabled by "tools of the mind," or signs, that mediate relations between people. Although Vygotsky (1960/1980) noted a wide variety of culturally generated, symbolic tools, the tool of the mind of preeminent importance in his theory is language, since it is our primary avenue of communicating with others and serves as the major means by which social experience is represented psychologically. Gradually, the child turns social speech toward the self and uses it to organize, transform, and regulate his or her own thinking and behavior.

Vygotsky regarded private speech as the crucial bridge between the social and psychological worlds. These self-directed utterances originate in and differentiate from social speech; they signify that the process of internalizing social experience is underway. As the child gains mastery over behavior, private speech abbreviates and becomes less audible. Once cognitive operations become well practiced, children start to "think words" rather than saying them. Gradually private speech becomes silent, inner speech--the conscious dialogues we hold with ourselves while thinking and acting in everyday situations. Nevertheless, the need to engage in private speech never disappears. As people encounter unfamiliar or demanding activities throughout the lifespan, private speech resurfaces as a tool for overcoming obstacles and acquiring new skills. Moreover, it continues to display the communicative properties and mark of the sociocultural settings in which it originated.

Although Vygotsky viewed higher mental functions as internalized social processes, they are not the result of children simply mimicking features of social interaction (Wertsch, 1985). Vygotsky's vision is very different from traditional social learning views, which regard development as copied from external sources. Rather than a social-influence approach, Vygotsky's theory embodies a social-participation perspective in which children are active agents in their own development (Rogoff, 1998). Through shared endeavors, they join with others to create mental functions and alter those functions to fit their momentary goals and circumstances. Because the term internalization has the unfortunate connotation of simple transmission of knowledge and skills, some Vygotskian scholars have suggested that other words, such as "appropriation" or "constructive transformation," be used to reflect Vygotsky's vision (Lawrence & Valsiner, 1993; Rogoff, Mistry, Göncü, & Mosier, 1993; Stone, 1993).

The Zone of Proximal Development. Vygotsky (1978) termed the region of social to psychological transfer of culturally adaptive competencies the *zone of proximal development;* it is probably his most well-known idea. The zone of proximal development refers to a range of tasks that the child cannot yet master independently but can do with the guidance of adults or more skilled peers. It is the dynamic, ever-changing locus of collaboration where learning and development take place.

Through the zone of proximal development, Vygotsky posited that development results from children's participation in activities slightly beyond their competence. To maintain the zone, interaction continuously recalibrates to fit the child's changing competencies, interests, and goals and the expert partner's insights into what can best help the child move beyond the immediate task and situation to become a more competent member of his or her cultural community. In essence, the zone of proximal development is the "crucible" of sociocultural development (Cole, 1985).

The concept of the zone of proximal development has far-reaching implications. As we will see later, it has sparked a growing body of research on qualities of adult-child and child-child interaction that promote cognitive development. It also suggests a revised approach to assessment. Indeed, Vygotsky first envisioned the zone of proximal development as an alternative to traditional intelligence and achievement testing and the view of development and education that emerges from use of such tests. Instead of measuring "static," previously acquired abilities (what the child already knows or can do independently), he suggested that what we should be measuring is the dynamic, future-oriented side of human cognition--what the child can do with the assistance of others and therefore has the potential to learn.

On a larger scale, the zone of proximal development highlights the vital role of education in Vygotsky's theory. Earlier I noted that for Piaget, development is largely internally controlled; what comes from within the child is most important for directing cognitive change. Education refines those capacities that emerge spontaneously from children's explorations of their surroundings. Vygotsky (1956), in contrast, argued that education leads, or elicits, development. It does so by involving children in activities suited to their potential development, thereby advancing their actual development.

Furthermore, Vygotsky (1934/1986) noted that as education leads to new capacities, it helps children move to a new level of understanding in which they become increasingly aware of their own mental life. That is, as children integrate into their private speech the strategies gleaned through dialogues with experts, they begin to engage in "verbalized self-observation" in which they think about those strategies and apply them in a more deliberate fashion. In sum, Vygotsky viewed education as a major contributor to children's metacognitionttheir growing consciousness and regulation of their own thought processes. Education prompts a shift to a higher, more reflective level of cognitive activity.

Vygotsky-Inspired Research: Social Origins of Cognitive Development

Research stemming from the sociocultural perspective addresses a wide range of social contexts for cognitive development. Since teachers, parents, peers, and other significant individuals--and the learning environments they create--are seen as the primary means of fostering development, sociocultural research is infused with educational meaning. Attention to culture is also threaded through much of the empirical literature. The following sections present a sampling of research endeavors, theoretical issues, and related educational topics.

Adult-Child Collaboration. In sociocultural theory, collaboration with teachers, parents, and other adults is a major way that children develop new competencies. The role of this joint activity is to provide children with experiences in their zone of proximal developmenttones that challenge them and that can be accomplished with adult guidance. Several metaphors that describe the quality of this expert-novice collaborative relationship have emerged in the research literature. Among the most important are scaffolding and intersubjectivity.

*Scaffolding*. The concept of scaffolding designates a changing quality of intervention over a teaching session in which the adult offers a "scaffold," or support system, by adjusting the help he or she provides to the child's current level of performance (Wood, Bruner, & Ross, 1976; Wood, 1989). As the child displays increasing competence, effective scaffolders gradually and sensitively withdraw assistance, relinquishing responsibility for the task to the child.

Scaffolding is typically measured by coding the degree to which the adult shifts to less directive support after the child succeeds on an element of the task and to more directive support after the child fails. Findings indicate that parents who are more effective "contingent shifters" have children who master tasks more readily (Pratt, Green, MacVicar, & Bountrogianni, 1992; Pratt, Kerig, Cowan, & Cowan, 1988). Furthermore, in two studies, a global rating of scaffolding resembling the well-known authoritative parenting construct (a combination of responsiveness to the child's needs and reasonable demands for mature behavior) predicted children's task-relevant private speech (efforts to regulate their own behavior) and problem-solving success (Behrend et al., 1992; Berk & Spuhl, 1995).

Whereas substantial support exists for the benefits of scaffolding, several Vygotskian scholars have argued that the typical image of an effective scaffolder who adjusts his or her tutoring to suit the child's needs risks reducing the child to a passive recipient of the adult's teaching efforts (Packer, 1993; Rogoff, 1998; Stone, 1993). According to Stone (1993), besides instruction, other behaviors are also important, including the quality of adult support, the interpersonal relationship between adult and child, and the value both partners attach to the situation, the task, and its associated behaviors. These mutual contributions to learning have not been sufficiently emphasized in scaffolding research. However, investigations of such shared involvement are present in other literaturestfor example, in studies of early language development that emphasize the importance of joint attention and mutuality in communication (Dunham, Dunham, & Curwin, 1993; Carpenter, Nagell, & Tomasello, 1998) and in studies of make-believe play, which I treat in a later section.

Furthermore, as Rogoff and her collaborators emphasize, the "pedagogic" mode of communication inherent in the scaffolding metaphor may be especially suited to child-oriented, academic tasks that are common in Western cultures. For example, Guatemalan Mayan caregivers are far less likely than American caregivers to structure young children's learning situations. Instead, they expect children to take greater responsibility through observation and participation in adult (rather than child-oriented) activities. Consistent with these values, Guatemalan Mayan parents are less verbal in their teaching interactions; they rely more on demonstration, unobtrusive directing, and monitoring while adjusting the assistance they provide to the child's current competence (Greenfield, 1984; Rogoff, Mistry, et al., 1993; Rogoff, Mosier, et al., 1993). These findings, and other similar ones, suggest that effective "scaffolding" varies from culture to culture and is best understood in terms of the values and requirements of the child's society as a whole.

To account for children's diverse opportunities to learn through involvement with others, Rogoff (1990, 1994) has suggested the term *guided participation,*a broader concept than scaffolding. Without portraying a particular model of interaction (thereby allowing for cultural variation), guided participation calls attention to both the novice's and the expert's contributions. It also includes both deliberately instructional (school and school-like) and everyday settings in which children acquire culturally adaptive knowledge and skills. Clearly, research on shared expert-novice participation is beginning to encompass a wider range of personal and contextual factors.

*Intersubjectivity.* Perhaps the most effective concept to date in underscoring the quality of communication that, from a sociocultural perspective, fosters development is intersubjectivity (Newson & Newson, 1975). It refers to a process whereby two participants who begin a task with different understandings arrive at a shared understanding. To achieve true collaboration and to communicate effectively, each partner must adjust to the perspective of the other. As partners negotiate and compromise, their "fusion of reference . . . creates a platform for subsequent joint action" and further development (Rogoff, 1998, p. 686; Wertsch, 1984).

The concept of intersubjectivity is applicable to many contexts--parent-child and teacher-child interaction, family discussions, and peer collaboration. Some theorists argue that the capacity for intersubjectivity is present early in life--in the young baby's mutual gaze, exchange of emotional signals, and early imitation of the caregiver (Meltzoff & Moore, 1992; Tronick & Cohn, 1989). Regardless of when intersubjectivity first emerges, it changes substantially with development. For Vygotsky, the acquisition of gestural communication and (shortly thereafter) language, permitting greater clarity of communication, should facilitate it.

By the second year of life, children often strive for intersubjectivity. Toddlers attend to adults' and peers' activities and use of objects, actively trying to take another's perspective and perform similar actions. As they do so, they acquire new skills (Eckerman & Didow, 1996; Rogoff, 1990; Ross, Conant, Cheyne, & Alevizos, 1992). Young children are also active in soliciting others' help and in directing that assistance to ensure that it is beneficial (Azmitia & Hesser, 1993; Nelson-LeGall, 1992). In sum, the concept of intersubjectivity reminds us that children and adults *jointly*manage shared endeavorstand that the contributions of both create the zone of proximal development.

Peer Collaboration. In Vygotsky's view, assistance in the zone of proximal development can also occur with more capable peers (Vygotsky, 1930c1935/1978). Earlier I noted that whereas Piaget emphasized the value of conflict with peers who are coequals, Vygotsky stressed the facilitating impact of interacting with peers who vary in expertise. Moreover, according to Vygotsky, peer conflict can contribute to heightened understanding, but only insofar as partners resolve their disagreements and move toward a joint, intersubjective view of the situation.

Consistent with Vygotsky's view, researchers observing the dynamics of peer collaboration have found that conflict and disagreement are not as crucial for development as the extent to which peers resolve differences of opinion, engage in joint decision making, and work toward common goals (Kobayashi, 1994; Kruger, 1993; Tudge, 1992; Tudge & Rogoff, 1987). When cooperation and sharing of ideas do not occur, then cognitive gains are typically not observed (Gauvain & Rogoff, 1989; Tudge, 1989). For example, in a study of fifth graders solving math problems cooperatively, partners were more likely to move toward correct strategies if they clearly explained and considered each other's ideas. A child could propose a correct strategy, but without partner acceptance it tended to be abandoned (Ellis, Klahr, & Siegler, 1994).

A wealth of applied research in classrooms is enriching our understanding of contextual factors that foster peer collaboration and gains in development. For example, studies of mixed-age grouping reveal that when academic performance differs between mixed- and single-age classrooms, it favors the mixed-age arrangement. Self-esteem and attitudes toward school are also more positive, perhaps because mixed-age grouping decreases competition and increases harmony in the classroom (Jensen & Green, 1993; Pratt, 1986). The opportunity that mixed-age groups afford for peer tutoring may also contribute to their favorable outcomes. When older or more expert pupils teach younger or less expert pupils, both tutors and tutees benefit in academic achievement and self-esteem (Hooper, Temiyakarn, & Williams, 1993; Johnson, Johnson, & Taylor, 1993).

However, simply putting peers together does not guarantee that they will engage with one another in ways that lead to a higher level of understanding. The capacity of children to collaborate, like other competencies, is a developmental attainment that must be scaffolded by adults. An impressive example of peer collaboration under the guidance of adult experts is*reciprocal teaching,* a method designed to improve reading comprehension in children who are at risk for academic difficulties (Brown & Palincsar, 1989; Palincsar, 1992). A teacher supports a group of two to four pupils, who take turns leading dialogues on the content of a text passage. Gradually, the teacher releases responsibility for learning to the children. Through group discussion, participants ask questions, clarify ideas, and achieve consensus on meaningta process that helps ensure they will grapple deeply with concepts and restructure their knowledge, supported by the diversity of skills within the group. Evaluations reveal that participants show substantial gains in reading comprehension compared to controls exposed to alternative instructional strategies with the same reading materials (Lysynchuk, Pressley, & Vye, 1990; Palincsar, Brown, & Campione, 1993).

The values and practices of the larger community influence the ability of pupils to engage in and sustain collaboration in classrooms. If adults do not collaborate in their own lives, then collaboration is harder to induce in children. Joint engagement in learning groups seems to come more easily to children with collectivist rather than individualist cultural backgrounds. For example, Navajo children achieve this mutuality more readily than do European-American children (Ellis & Gauvain, 1992). Japanese classroom practices, in which children solve problems by building on one another's ideas, are situated in a larger cultural context that values interdependence in family and work life (Hatano, 1994). In contrast, cultural-majority children in the United States typically consider competitive and individualistic approaches to learning to be natural--a perspective that interferes with their ability to attain intersubjectivity in cooperative work groups (Foreman & McPhail, 1993).

School reform experiments reveal that peer collaboration in classrooms works best when it is supported by similar ideals throughout the educational institution. The most extensive and well-known school restructuring effort inspired by Vygotsky's theory is the Kamahameha Elementary Education Program (KEEP) (Tharp, 1993). Begun as an innovative educational system for academically at-risk ethnic minority children, KEEP classrooms are organized into activity settings, defined as "contexts in which collaborative interaction, intersubjectivity, and assisted performance occur" (Tharp & Gallimore, 1988, p. 72). Small groups of children rotate through the settings over a week's time (except for a focal literacy setting, which they enter everyday), providing multiple opportunities for peers to work collaboratively. In KEEP, each level of the school system is based on principles of assisted performance. Supervisors, principals, consultants, and other teachers jointly create activity settings for teachers to further their competence in assisting children's learning. This culture of cooperation is believed to have contributed greatly to KEEP's success in augmenting the literacy skills and academic achievement of first to third graders who typically do poorly in school.

In a related Vygotsky-inspired curricular approach, the classroom is transformed into a community of learners in which the distinction between adult and peer contributions is relinquished; all collaborate and develop through sociocultural activities. This community-of-learners model is based on the assumption that different people have different expertises that can be helpful to other members of the community, depending on the task at hand. Projects, not lessons, are the focus of classroom activitiestcomplex real-world problems requiring many steps in which children and adults draw on one another's expertise to move toward joint solution (for examples, see Brown & Campione, 1994; Cognition and Technology Group at Vanderbilt, 1994; Moll & Whitmore, 1993).

In the efforts just described, peer collaboration itself becomes socially situated, embedded in a sociocultural system created from within by teachers and children and supported from without by its surrounding cultural context. In this respect, some scholars have argued that Vygotsky's concept of the zone of proximal development needs to be broadened, from a view of a single child in collaboration with a more expert partner (adult or peer) to a vision of multiple, interrelated zones (Moll & Whitmore, 1993).

Private Speech. Vygotsky's claim that the most significant moment in cognitive development occurs when young children use language not only for communication with others but also as a tool for regulating thought and action has inspired a steady stream of research on private speech. Our findings join with those of other investigators to provide substantial confirmation of Vygotskian predictions on the social origins and self-regulating role of children's speech to themselves.

*Social Origins.* Diverse findings support Vygotsky's assumption that private speech originates in early social experience. For example, moderate to strong positive correlations between children's social and private remarks have emerged in several investigations, suggesting that the two forms of language have common roots (Berk & Garvin, 1984; Kirby, 1997; Kohlberg et al., 1968). In addition, socially rich contexts appear to foster private speech, since children talk to themselves more freely when they have access to social partnersteither peers or adults (Goudena, 1987; Ramirez, 1992). Moreover, a comparison of elementary school children's private speech while working on academic tasks in their classrooms and in a solitary laboratory setting revealed a precipitous drop in private speech in the laboratory (Berk & Landau, 1993). Isolating children from their sociocultural world and the opportunities it affords for dialogues with others dramatically affects the extent to which they engage in dialogues with themselves.

*Developmental Course.* The Vygotsky-predicted developmental course of private speech--from externalized to internalized forms--has also amassed clear support. In both cross-sectional and longitudinal investigations, audible task-relevant private speech declines with age while signs of inner speech (inaudible muttering and lip and tongue movements) increase (Berk, 1986; Berk & Garvin, 1984; Berk & Potts, 1991; Berk & Landau, 1993; Bivens & Berk, 1990; Frauenglass & Diaz, 1985; Kirby, 1997).

These trends are evident among preschool and elementary school children, whether studied cross-sectionally or longitudinally. They are also apparent in microgenetic research, a type of longitudinal investigation in which children are followed as they engage in moment-by-moment learning of a challenging task (Berk & Spuhl, 1995; Duncan & Pratt, 1997). Similar movement toward private speech internalization at diverse ages and within a variety of task contexts suggests that rather than following a single overarching path of development (as Vygotsky predicted), private speech may re-emerge and abbreviate each time children tackle a new area of cognitive skill.

Consistent with this idea, comparisons across studies using the same classroom observational methodology indicate that private speech is particularly prevalent during the early grade-school years--about twice as high as it is during the preschool period (Berk, 1986; Bivens & Berk, 1990; Krafft & Berk, in press). Literacy activities appear to be an especially rich context for verbal self-regulation as children first become immersed in consciously manipulating and controlling the symbolic systems of their culture. In support of Vygotsky's supposition that education fosters a self-reflective, metacognitive approach to thinking, recent research reveals that 6- and 7-year-olds, but not 4-year-olds, are aware of their inner speech (that "a person can tell himself things and talk to himself up in his head") and that people are constantly engaged in thought (Flavell, Green, & Flavell, 1993, 1995; Flavell, Green, Flavell, & Grossman, 1995). The investigators speculated that increased consciousness of mental activity may result from intensively experiencing one's own inner speech while engaged in reading, writing, and solving math problems.

*Self-Regulating Function.* Studies consistently confirm the role of private speech in the development of self-regulation. For example, private speech increases with task difficulty, suggesting that children call on it to overcome obstacles (Berk, 1992). More definitive support for its regulating role comes from research examining the relationship of private speech to task-related behavior and performance. While engaged in language arts and mathematics assignments, first- through fifth-grade children who frequently use task-relevant utterances display fewer self-stimulating and distracting behaviors and are more attentive (Berk, 1986; Berk & Landau, 1993, 1997). Moreover, in a longitudinal study in which children were followed from first to third grade as they worked on mathematics tasks, gradual internalization of private speech went hand-in-hand with more effective channeling of behavior. That is, children who progressed more rapidly from audible, self-directed utterances to inner speech were also advanced in their ability to focus attention and inhibit self-stimulating motor activity (Bivens & Berk, 1990).

Evidence for the self-regulating function of private speech also extends to children's task performance. In previous research, private speech showed inconsistent relationships with concurrent performance (how well children did on a task at the time they manifested private speech). This apparent challenge to the facilitating effects of private speech has been traced to two factors. First, many tasks typically given to children in the laboratory are either too easy or too difficult (not within the zone of proximal development) and therefore not suitable for evoking self-guiding private speech in all children (Berk, 1992, 1994). Second, since private speech increases when children encounter obstacles to success, it often co-occurs with task failure (Diaz, 1992). In carefully designed, longitudinal investigations in which tasks were selected to be within children's zones of proximal development, private speech was consistently associated with future performance, or gains in problem-solving competence assessed from 2 days to 1 year after the original observation (Azmitia, 1992; Behrend, Rosengren, & Perlmutter, 1989, 1992; Berk & Landau, 1997; Bivens & Berk, 1990; Gaskill & Diaz, 1991).

In sum, substantial empirical support has accumulated for Vygotsky's central premises on private speech. There is convincing evidence that private speech originates in social experience, is progressively internalized with age, and serves a self-regulating function.

Make-Believe Play. Until recently, most researchers were guided by Piaget's (1945/1951) belief that toddlers discover make-believe play independently, as soon as they are capable of representation. Consequently, the emergence of pretense was studied in isolation from the social and cultural contexts in which it usually occurs.

Vygotsky (1933/1978) in contrast, regarded make-believe play, like other higher mental functions, as socially constructed. He believed that societies provide children with opportunities to represent culturally meaningful activities in play. Moreover, Vygotsky emphasized that the enactment of imaginary situations and social rules during play (for example, children focusing on the roles and rules of the classroom as they play school) strengthens understanding of social norms; the ability to think before acting; and, consequently, self-regulation. Finally, Vygotsky stated that make-believe play "creates a zone of proximal development in the child. In play, the child always behaves beyond his average age, above his daily behavior; in play it is as though he were a head taller than himself" (p. 102). In sum, Vygotsky regarded play as the leading educational activity of early childhood. (For a fuller discussion of Vygotsky's ideas on make-believe play, see Berk, 1994; Nicolopoulou, 1993).

Vygotsky's theory has led to a spate of research on the development of pretense. A longitudinal study in which children were followed from 1 to 4 years of age while playing at home suggested that make-believe has social origins; the majority of pretense until age 3 involved mother-child interaction, even when children had ready access to child playmates (Haight & Miller, 1993). Findings of this investigation and others indicate that toddlers' make-believe with caregivers is more sustained and complex than is their solitary make-believe (Slade, 1987; Fiese, 1990; O'Reilly & Bornstein, 1993; Tamis-LeMonda & Bornstein, 1991). In line with the zone of proximal development, very young children, for whom make-believe is just emerging, act more competently when playing with a mature partner than they otherwise would.

Play with caregivers appears to prepare the child for playful cooperation with agemates. In Haight and Miller's (1993) study, mother-child pretense gradually gave way to child-child pretense, and children whose mothers ranked high in pretending when their children were 1 year old ranked high in peer play at age 4. Play with agemates requires joint, responsive engagement to support development. Intersubjectivity among peer playmates, in the form of extensions and affirmations of one another's messages, increases substantially during the preschool years (Göncü, 1993). Interestingly, preschoolers have greater difficulty establishing a cooperative, shared framework in nonplay problem solving (Azmitia & Perlmutter, 1989; Gauvain & Rogoff, 1989). As in the adult-child context, the child engaged in play with peers is, in Vygotsky's words, "a head taller than himself"--advanced in comparison to other contexts. By middle childhood, the social skills mastered during joint make-believe generalize to nonplay activities.

In many cultures, adults do not play with children. Instead, older siblings take over this function, serving as caregivers for younger brothers and sisters in mixed-age play groups. For example, research in Indonesia and Mexico reveals that make-believe is more frequent and complex with siblings than with mothers. As early as 3 to 4 years of age, older siblings draw younger children into play activities and frequently make comments and suggestions for more elaborate pretending. The fantasy play of toddlers in these cultures is just as well developed as that of their American counterparts (Farver, 1993; Farver & Wimbarti, 1995; Gaskins, 1994). Moreover, older children granted opportunities to fill responsible roles with younger children undoubtedly gain in perspective taking and sensitivity to others' needs.

Researchers have begun to pay increasing attention to the impact of cultural values on the style and organization of children's play. In collectivist societies that stress group harmony, play takes different forms than it does in individualistic cultures like the United States. Children in India, for example, generally play in large groups that require high levels of cooperation. Much of their behavior during make-believe and early games is imitative, occurs in unison, and involves close physical contact (Roopnarine et al., 1994). Similarly, Marquesan preschoolers of Polynesia gather in groups of as many as ten children. Familiar, highly scripted activities reduce opportunities for disagreement. Older children help keep younger children orient toward group goals through persuasion and, sometimes, shaming when they drift off into self-centered play (Martini, 1994).

Finally, my research group has begun to examine Vygotsky's assertion that make-believe play contributes to the development of self-regulation. Observing 3- to 5-year-olds during free-choice periods at preschool, we found that the incidence of private speech was much higher in fantasy play and play involving engagement with peers than in nonfantasy and solitary play contexts. Moreover, in a preschool that de-emphasized make-believe play and peer collaboration, children displayed far less private speech than they did in a play-oriented preschool (Krafft & Berk, in press). These results provide suggestive evidence that make-believe activities are vital contexts in which children learn to bring action under the control of thought. To test this assertion more definitively, we have examined relationships between preschoolers' developing play competence and cognitive and social skills that depend on emerging verbal self-regulation. Our findings reveal positive associations (Bach & Berk, 1999; Elias & Berk, 1999).

In sum, a growing literature is addressing diverse sociocultural facets of children's play. Findings are consistent with Vygotsky's view of make-believe as a vital zone of proximal development in which preschoolers subordinate their behavior to rules in socially constructed play scenes imbued with the values, expectations, and practices of their culture.

Children with Attention and Impulse Control Problems. Vygotsky's sociocultural approach has also been extended to the study of children with learning and behavior problems, thereby contributing to our understanding of developmental psychopathology. According to Vygotsky (1993), the path of development is altered because of compensatory behaviors that emerge due to the child's disability and because of the restrictive impact that the disability has on access to positive interactions with adults and peers.

For example, in the literature on children with sensory deficits, several studies reveal that due to greater access to supportive parent-child interaction, deaf children with deaf parents (who communicate through sign language) develop more favorably than do deaf children with hearing parents (who either do not use sign language or need time to learn to do so). Deaf children with deaf parents resemble hearing children in quality of parent-child interaction, development of private speech (manual signing to themselves), and self-regulation. In contrast, deaf children of hearing parents, who experience less positive, sensitive, and stimulating exchanges with parents, display diminished use of task-relevant private speech and serious self-regulatory difficulties in academic and social development (Chess & Fernandez, 1980; Jamieson, 1994, 1997; Jamieson & Pedersen, 1993). These findings suggest a clear, sociocultural basis of intervention for preventing learning and social-skills problems in deaf children with hearing parents.

My research group has focused on the private speech of children with attention-deficit hyperactivity disorder (ADHD), whose symptoms of inattention and impulsivity also interfere with school learning and social relations. Recently, interest in the self-regulating function of private speech has increased among clinicians and researchers concerned with ADHD. In a prominent new theory, Barkley (1997) argues that children with this disorder suffer from a biologically-based deficit in response inhibition--that is, an impaired ability to delay responding, cease ongoing behavior, and resist distraction from the surrounding environment. This basic deficiency is believed to lead to secondary deficits in metacognitive processing, including impaired use of and internalization of private speech. Barkley's theory expands Vygotsky's emphasis on the sociocultural origins of private speech by stressing the role of an intact neurological system for self-directed language to gain control over behavior.

Our investigations offer strong support for Barkley's theory. We studied children clinically diagnosed with ADHD and children with poor impulse control, the symptom presumed by Barkley to be the defining deficit of ADHD. Both ADHD and impulsive children talked out loud to themselves more during academic problem solving than did normal controls. When we examined age-related trends, we found that children with ADHD and impulsivity were delayed in internalization of private speech; that is, they used audible, externalized self-talk over a longer developmental period than is typical among school-age children (Berk & Potts, 1991; Berk & Landau, 1993, 1997).

Several additional findings suggested that this developmental lag was the result of an impairment that prevents ADHD children's private speech from gaining efficient mastery over behavior. First, when we increased the difficulty of academic work, the private speech of impulsive children became disorganized; rather than increasing (like that of normal controls), it decreased and consisted of more irrelevant remarks (Berk & Landau, 1997). Second, private speech failed to predict improved attention and academic performance for ADHD and impulsive children, whereas clear prediction of these indicators of self-regulation emerged for normal controls (Berk & Landau, 1993, 1997; Berk & Potts, 1991). Finally, when we observed ADHD children while they were both taking and not taking stimulant drug medication (known to augment neurological functioning), medication sharply increased the maturity of private speech and its association with focused attention and control of motor activity (sitting quietly rather than fidgeting) during academic problem solving (Berk & Potts, 1991).

Taken together, findings on deaf children and children with ADHD underscore diverse paths to deficits in self-regulation. In the case of deaf children, whose basic neurological system is intact but whose hearing parents lack the "mental tools" (fluent sign language) to promote language development in their child, social experience accounts entirely for self-regulatory difficulties. In the case of children with ADHD, a biologically based deficit in response inhibition seems to interfere both with access to adult supportive interaction (see Landau, 1999, for a review) and with the ability of private speech to realize its self-regulating function. Our results suggest a need for intervention research that focuses on the complementary goals of reducing ADHD children's impulsivity and assisting them in making more strategic use of the high rates of private speech they do display.

The work I have described on children with attention and impulse-control difficulties illustrates productive links being forged between developmental and clinical theory and research. The fruits are new insights into the multiple origins of serious learning and behavior problems and hope of improved treatments.

Future Directions

Research emanating from the sociocultural perspective has contributed significantly to current revisions in our understanding of human development, especially to recent conceptions of diversity in developmental pathways. The sociocultural perspective has been a major force in reminding the field that unique combinations of biological and environment forces at multiple levels lead to both similarities and differences in trajectories of change.

The most significant contribution of the sociocultural perspective is a more sophisticated and detailed conception of the environment--specifically, the social and cultural environment at the very seam of organism-environment interaction. In its fine-grained examination of social collaboration within the zone of proximal development, Vygotsky-inspired research has given us a much deeper understanding of the everyday processes by which children become enculturated into their communities. This evidence is among current sources that have profoundly challenged researchers' and practitioners' tendency to think in terms of broad, homogeneous classifications of individuals, such as "socioeconomic status," "ethnic minority," or (in the case of individuals with deficits and disabilities) undifferentiated labels such as "low achiever" or "children with attention deficits." A careful look inside such groups--at life histories, current experiences, and cultural and subcultural values and practices--uncovers wide individual variation.

Understanding and predicting change is the sine qua non of the field of human development, which assumes in all its activities that the past and present can inform us about the future. This principle is just as applicable to the sociocultural framework and the field of development as a whole as it is to the developing person. I forecast a strengthening of the following ongoing directions within sociocultural research:

* Stronger links with other research traditions in the domain of cognitive development. The sociocultural perspective has largely forged a body of evidence distinct from other contemporary literatures in cognitive development, including neo-Piagetian and information-processing work and research on such capacities as perception, memory, representation, and problem solving. In current reviews of the status of research on these topics, sociocultural forces are now acknowledged, but they are granted far less attention than such intraindividual forces as practice of task-relevant skills, expansion of the knowledge base, and biological maturation (see Kuhn & Siegler, 1998).  
    
  In a recent review, Rogoff (1998) predicted that the future would bring greater attention to sociocultural aspects of the cognitive phenomena just mentioned. Yet to attain this goal, sociocultural research must reach out to embrace and build on other methods and findings as much as it encourages other researchers to attend to the sociocultural perspective. The result is likely to soften the strong Vygotskian claim that *all*higher cognitive processes develop through social interaction. Indeed, several research programs within other traditions stress the role of mechanisms within the person--experimentation with the physical world, quiet-time reflection, logical reasoning, and multiple opportunities to test the efficacy of cognitive operations--for capacities as diverse as children's understanding of their mental worlds; strategy use in memorizing and in acquiring basic academic skills; and scientific problem solving (Flavell, Green, & Flavell, 1995; Kuhn, Garcia-Mila, Zohar, & Andersen, 1995; Siegler, 1996).   
    
  Assessing the status of research on cognitive development at the end of the twentieth century, Flavell (1992) expressed pessimism about the lasting value of "contextualist approaches" (p. 1003). This pessimism, which he left unexplained, might have stemmed from the observation that the sociocultural tradition has proceeded largely in its own direction, without much attention to others. The message of history is that any explanation emerging within a single tradition has limits; a complete account of human change must ultimately attend to evidence and ideas in other traditions as well. As sociocultural investigators apply their belief in an intersubjective meeting of minds to their own research endeavors, we are likely to see the processes of social appropriation and individual discovery melded into a more comprehensive theoretical systemtone that clarifies when each is most beneficial and how each supports the other.
* Stronger integration of cognition with other domains of functioning. The sociocultural perspective has largely been applied to research on cognitive development. Yet its emphasis on collaboration with expert partners as a source of development is applicable to other domains of functioning. Self-regulation is not solely the province of cognition; a growing literature on the development of emotional self-regulation reveals the importance of a diverse array of social experiences, including sensitive face-to-face communication in infancy, parental modeling of effective strategies, conversations about emotions, and language-based techniques for gaining control over emotional arousal (Saarni, 1997; Thompson, 1990). In the domain of social skills, research shows that parents of socially competent preschoolers arrange informal peer play activities and offer advice, guidance, and examples of how to act toward others (Ladd, LeSieur, & Profilet, 1993). Such parents also gradually grant the older child and adolescent autonomy in accord with their readiness to assume itta support system akin to scaffolding (Collins, Harris, & Susman, 1995; Holmbeck, Paikoff, & Brooks-Gunn, 1995). In the realm of morality, parental warmth, sensitivity, and explanations; peer discussions of moral issues; and the child's efforts to make sense of social conflicts in which others' rights have been violated foster moral understanding (Turiel, 1998; Walker & Taylor, 1991).  
    
  Although the parallels are striking, these literatures and Vygotsky-inspired cognitive research have hardly touched shoulders. Efforts to integrate them promise to help us discern which social experiences promote development broadly and which ones are unique to specific domains of functioning. Moreover, emotional and social skills are vital for children to collaborate in the zone of proximal development, and cognitive development supports many emotional and social skills. Consequently, bringing the sociocultural perspective to bear on the emotional and social domains should greatly enrich these strands of inquiry while extending and refining the sociocultural approach.
* Greater attention to the natural, or biological, line of development. Vygotsky stated that the natural and social lines of development join, forming a single developmental pathway. Yet in focusing on the social line, he said little about the natural (biological line). Investigators in the sociocultural tradition continue to pay less attention to the biological substrate of development than do researchers of other theoretical persuasions. (An exception is the literature reviewed earlier on the private speech of children with attention and impulse-control problems.) Yet current evidence suggests that neurological changes--from brain growth spurts to lateralization of the cerebral cortex--are profoundly influenced by experience (Fisher & Bidell, 1998; Greenough et al., 1993; Neville, 1991). In addition, accumulating research shows that children's competence is best promoted when parenting and teaching strategies are in tune with children's biologically based dispositions (Kagan, 1998; Pellegrini & Horvat, 1995).  
    
  As they attend to the biological side through contact and collaboration with investigators specializing in psychophysiological methods and brain-behavior relationships, sociocultural researchers will have much to contribute to our understanding of the interface between biology and environment. A particularly valuable contribution is likely to be a stronger cultural perspective in the study of temperament, behavior disorders, sensory deficits, and learning disabilities. Already we know that parents and teachers view shyness, sociability, and difficultness quite differently, depending on cultural context--attitudes that affect children's adjustment (see, for example, Chen, Rubin, & Li, 1995; Weisz et al., 1995). The sociocultural perspective is well suited for building on these understandings. We may soon see, as a result, that many biology-environment interactions are culture-specific.
* Expansion of longitudinal research to include microgenetic investigations. To fully understand person-environment interactions that lead to development, researchers will need more than the snapshots of change offered by the widely spaced observations of traditional longitudinal research. More studies are likely to be microgenetic--moving in close to track change as individuals master a novel or everyday task (see Kuhn, 1995; Siegler & Crowley, 1991, for analyses of the strengths and limitations of this method).   
    
  Within the sociocultural tradition, the microgenetic method has offered valuable glimpses into the flow of interaction between experts and novices and into children's internalization of private speech. Adherents of other cognitive perspectives have used the method even more vigorously, greatly enriching our understanding of how children participate in their own development by experimenting with strategies as they acquire new skills (see, for example, Schauble, 1996; Siegler, 1996). As microgenetic evidence expands, researchers may be in a more favorable position to tackle the formidable problem of how to meld this microcosmic view of change with the macrocosmic view provided by other longitudinal studies. These efforts should also inform us about an issue raised earlierthow socially and personally based mechanisms of change work together.
* Increased influence on practice. Sociocultural theory has already had a profound impact on practice, and it will undoubtedly continue in that vein. Its core assumptions, that higher mental functions first emerge socially, within the zone of proximal development, and only later psychologically, are likely to inspire many new teaching experiments and educational reforms. These include refinements in collaborative learning; grouping arrangements that bring novices and experts into closer proximity; and contextual modifications--activity centers, small class sizes, and culturally sensitive teaching strategies that foster the dialogues so vital, in the sociocultural view, for spurring development. At the institutional level, alternatives to grade or age placements may arise, in response to the realization that not all classmates and agemates function within the same zone of proximal development. Within school administrative structures, cultures of cooperation may become more widespread, in recognition that creating zones of proximal development at higher levels helps ensure that they will emerge within classrooms.  
    
  In early childhood education, where tensions persist between child-centered and teacher-directed philosophies, the sociocultural perspective offers a potential resolution, in advocating adult responsiveness to children's capacities in ways that lead development forward. Within this debate, play continues to struggle for legitimacy as teacher-controlled goals threaten to dominate it, justified by the need to prepare young children for academic learning (Hart et al., in press; Stipek & Byler, 1997). Sociocultural research grants renewed validity to play as the supreme educational activity of the early years, and it should spark new play-based curricula.   
    
  In the field of developmental psychopathology, the sociocultural approach may inspire innovative therapies for children with self-regulatory difficulties. Play therapy, at one time a major psychoanalytic tool, may return in new forms, as a promising approach in which impulsive and ADHD children can transcend their present level of development and become better able to manage their own behavior. Perhaps therapeutic procedures will also capitalize on adult-child and child-child dialogues within the zone of proximal development, drawing on such interventions as reciprocal teaching to ameliorate academic and social difficulties (Diaz & Berk, 1995).   
    
  As Vygotsky-based educational and therapeutic practices gain wider acceptance, assessment procedures are likely to change, from traditional tests that emphasize already attained competencies to dynamic assessments that uncover what the developing person can acquire with the assistance of a more knowledgeable partner. Although a variety of dynamic assessment systems currently exist (see Lidz, 1991; Luther, Cole, & Gamlin, 1996), they have not yet caught hold broadly. Yet education and therapy grounded in Vygotsky's zone of proximal development will require philosophically compatible assessments aimed at identifying potential to learntthe ripening capacities of today or tomorrow rather than those of yesterday.
* Enhanced knowledge of culture, collaboration, and development. Sociocultural theory is responsible for a greatly expanded knowledge base on cultural variations in expert-novice interaction. As this work continues, it is likely to encompass a wider range of cultures (especially non-Western) and situations, including everyday (nonschool) activities, about which we have relatively little information (Rogoff, 1998). Furthermore, sociocultural research has largely focused on dyads--a teacher, a parent, or a peer interacting with a child--in part because of the greater prevalence of dyadic interchanges in U.S. middle-class than in other cultures (Rogoff et al., 1993). In many homes, neighborhoods, and classrooms, communication often takes place in groups, the dynamics of which have rarely been examined from a sociocultural perspective.   
    
  Cultural variations in collaboration extend to people with whom we communicate at a distance, including the internalized voices of influential texts, former teachers, and members of previous generations. These communicative partners have been addressed in a small literature extending into adulthood (see, for example, John-Steiner, 1992; Wertsch, 1991). They merit considerably more research for a full appreciation of human shared endeavors. Furthermore, innovation in technological societies has yielded a wide range of tools for bridging time and space in communicationtamong them, telephones, fax machines, electronic e-mail, and the internet. Studies of how people of different ages and within different settings use these devices, along with their impact on face-to-face interaction, are underway and likely to increase (Crook, 1994; Windschitl, 1998). This avenue of research is expanding our definition of community and our understanding of the impact of culture on social participation and development.

What do the next 15 years hold for developmental psychology as a whole? The trends identified at the beginning of this chapter will undoubtedly proceed apace. Interconnections with other subfields of psychology and other disciplines will become increasingly important for understanding biology-environment interactions and developmental processes at the psychological, immediate social-setting, community, and cultural levels. More research groups will need to combine expertise in genetics and neurology with in-depth knowledge of the contexts in which human beings move through life to grant greater clarity to a theme threaded throughout this chaptertpluralism of developmental pathways. Consequently, the study of development is likely to become less localized in an identifiable assembly of experts and increasingly distributed among various disciplines.

In his day, Vygotsky regarded fragmentation in the field as a crisis. He argued that there was a need to work toward a theoretical framework that would unify diverse observations (Wertsch, 1985). It is doubtful that the field will soon reach consensus on a single theoretical perspective. At the same time, it seems to be moving toward broader agreement that the various systems views (e.g., ecological systems theory, dynamic systems theory, family systems theory, the lifespan perspective) carry important lessons for a wide range of phenomena. These approaches have in common an emphasis on the dynamic relation between the individual and multilevel contexts as necessary to explain development. They also recognize that a synthesis of perspectives is needed to advance knowledge.

A vital message that Vygotsky's sociocultural theory offers--to itself and to the larger field of development--is the power that collaborative endeavors hold for creating zones of proximal development that move theory and research forward. As more interdisciplinary and researcher-practitioner partnerships form, longitudinal research will be enriched by the methodologies of diverse disciplines. As a result, developmental inquiry is likely to include not just traditional quantitative procedures, but qualitative approaches that better reflect the developing organism in context as a complex, functioning whole. Because of their longer tradition of conducting research within the ecology of people's lives, education and sociology are ahead of developmental psychology in enlarging their arsenals of methods (Walsh, Tobin, & Grau, 1993; Peshkin, 1993). As the field of development follows suit, the returns will be great for both scientific and practical knowledge.

How individuals just beginning their careers best prepare themselves to participate in the endeavors just described? More than ever before, developmental researchers of the twenty-first century will need interdisciplinary preparation. They will also benefit from immersion in the world of practice for at least a period of their careerstas teachers, clinicians, nurses, physicians, practicing psychologists, social workers or, if not practitioners, participant observers who become thoroughly familiar with the proximal and distal environments of the organism they wish to study.

Researchers of the future will also need collaborative skills, and nurturing those skills will need to be far more central to their education than it is today. New trends in the field may prompt substantial changes in way developmentalists are trained. Instead of research being performed by a solitary student under the supervision of a single mentor, the master's and doctoral dissertations of the twenty-first century may involve peer collaborations with interdisciplinary teams of mentorstlearning environments that mirror the research environments that the next generation of scholars must create to advance the field.

In conclusion, like the persons and contexts they study, great diversity is likely to characterize the development of future developmental researchers, who will access the field from a much wider range of backgrounds and perspectives. If their endeavors truly become, in the sociocultural sense, a collaborative processtthe work of communities of scholarstthen exciting gains await us in knowledge of development and in interventions that enhance well-being throughout life.

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[Flourish Line]

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# Chapter 11 ****Psychology and Law, Now and in the Next Century****: ****The Promise of an Emerging Area of Psychology****

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Aspiring psychology students are often drawn to psychology and law by exciting media portrayals of violent crimes, expert testimony in a publicized case such as the O. J. Simpson trial, or sensational movie depictions of criminal profilers "catching the bad guys." Although the study of criminal behavior and theories of crime may have provided a significant contribution and even historical impetus for the field (Grisso, 1991; Hess, 1996; Loh, 1981), the intersection of psychology and the law has grown into a broad and increasingly sophisticated subdiscipline of psychology (Melton, Huss, & Tomkins, 1998; Wiener, 1997). This chapter's examination of the full expanse of this emerging field is not meant to discourage the student initially drawn to the more sensational aspects of psychology and law. In fact, it is intended to encourage students to explore all that is exciting about this budding area. Though psychology and law is comparatively young, it is in a position to make a unique contribution to society and science both because of its interdisciplinary nature and its ability to answer applied question

This chapter first describes what is meant by terms like psychology and law and forensic psychology. Because of the relative youth of the field, I will briefly discuss earlier research efforts in two broad areas (i.e., general psychology and law and forensic psychology) and some of the hottest topics in these areas. Furthermore, a specific topic in forensic psychology that is of the most interest to me, risk assessment, will be examined in more depth both by examining the current state of the area and the future directions researchers are likely to pursue. I will then examine the future of the general field of psychology and law. Finally, I will offer some advice for students interested in pursuing a career in psychology and law.  
  
What is Psychology and Law?Simply put, anything that falls within the intersection of psychology and the legal system can be considered within the scope of psychology and the law. The imprecision of this definition allows for a very broad and ever expanding field that is only limited by the imagination and the continually evolving legal system (Bartol & Bartol, 1994). Because research in psychology and law is shaped by the legal system, the basic and applied nature of psycholegal scholarship are equally important. Traditional psychological research often seeks to address basic principles of human behavior. Legal and forensic psychologists are forced to bridge the gap between the laboratory and the courtroom by the very nature of the applied topic they study. This statement is not meant to minimize the contribution of basic psychological research to psychology and law. There are numerous tenants of cognitive, developmental, social, and clinical psychology at work in psycholegal research. However, psychology and law offers a somewhat special and direct application of its principles to a real world laboratory, the legal system, that few other areas of psychology are able to do.   
  
The real world application of psychology and the law has been identified at least since Hugo Munsterberg (1908) made grand claims regarding the promise that psychology held for the legal system nearly a century ago in his pioneering book *On the Witness Stand*. Some of the early research was inspired by the real world events like the kidnaping of Charles Lindbergh's young child and subsequent trial of the alleged perpetrators (McGehee, 1937). Early psycholegal research also was used before the United States Supreme Court's finding that public school segregation was unconstitutional (*Brown v. Board of Education*, 1954). One of the more publicized cases involving the use of psychological expertise in the courtroom occurred during the Harrisburg Seven trial in the early 70's. In this politically charged case, Phillip Berrigan and seven other men were on trial for a number of antiwar activities. A group of social scientists joined the defense team to offer their expertise to select a jury favorable to the defendants. The team of experts sought to identify a number of demographic characteristics (e.g., religion, age, gender, education) that were be related to a bias for convicting the defendants (Schulman, Shaver, Colman Emrich, & Christie, 1973).   
  
From these early ventures into the courtroom, psychology and the law has experienced tremendous and rapid growth during the past 20 years (Ogloff, Tomkins, & Bersoff, 1996; Melton, 1992). The growth of the field is marked by the establishment of specialized journals (e.g., *Behavioral Sciences and the Law*, *Criminal Justice and Behavior*, *Law and Human Behavior*, and *Psychology, Public Policy, and the Law*), increasing use of psychological testimony and the examination of psycholegal research in court cases (e.g., *Lockhart v. McCree*, 1986), the establishment of professional organizations (e.g., American Association for Correctional Psychology; American Board of Forensic Psychologists; American Psychology-Law Society), and the creation of graduate training programs specifically in psychology and law (see generally, Bersoff, Goodman-Delahunty, Grisso, Hans, Poythress, & Roesch, 1997; Hess, 1996; Melton et al., 1998; Ogloff et al., 1996; Otto, Heilbrun, & Grisso, 1990, Tomkins & Ogloff, 1990). The expansion of psycholegal research and the field's increasing promise to society as a whole is remarkable (Melton, 1992).   
  
The subdiscipline of psychology concerned with the legal system has been referred to as psychology and law, forensic psychology, psycholegal studies, correctional psychology, etc., and its identity has been debated almost since it inception (Hess, 1996; Grisso, 1991). The diverse focus of the field has fueled much of the debate.  
  
Traditionally, *psychology and law* is divided into a few discrete, but related areas (Bersoff et al., 1997). The more clinical aspects of psychology and law, *forensic psychology*, tend to cover areas such as psychological assessment, prediction and reduction of future dangerousness, and interventions designed to rehabilitate criminal offenders. More experimental topics in psychology and law are most often based in the social, personality, cognitive, or developmental, areas of psychology. Examples of these areas include jury decision making, eyewitness identification, the impact of expert witnesses, and the role of children in the courtroom. Another area of psychology and law that is achieving prominence examines the impact of court decisions, legislative action, and administrative conclusions on the beliefs and behavior of society. Many individuals believe these *policy* issues may hold the greatest promise for psychology and law to make a meaningful contribution to society (Melton, 1992). However, policy aspects of the field are often reflected in the forensic or general psychology and law research and will not be described separately.

The diverse nature of psychology and law is apparent in the articles published in *Law and Human Behavior*, the official journal of the American Psychology-Law Society/Division 41 of the American Psychological Association, in one calendar year (i.e., 2000). The journal included a range of topics: the nature of coerced confessions, polygraph procedures, alternative trial procedures, the impact of pretrial publicity, the influence of appointed and retained counsel on capital cases, and recidivism rates among sex offenders to name but a few. Though the journal focused on experimental or psycholegal topics in the past (Wiener, 1997), of a total of 37 topical articles or research notes in the past year, 12 (32%) were forensic in focus, 19 (51%) focused on the more experimental areas of psychology and law, and 6 (16%) were policy oriented. Of course, these categories are not mutually exclusive and this crude comparison is only meant to be descriptive of the field. Other psychology and law journals such as *Behavioral Sciences and the Law*, *Criminal Justice and Behavior*, and *Legal and Criminological Psychology*, *Psychology, Crime and Law*, *Psychology, Public Policy, and the Law* have their own orientations toward psychology and law. These journals all reflect the diverse and broadening nature of psychology and law.   
  
The breadth of psychology and law makes it impossible to identify and summarize all of the compelling research issues in the area. However, a cursory examination of several major topics in psychology and law provide a good starting point for students interested in the field as well as established professionals unfamiliar with the literature. This examination of general psychology and law research will focus primarily on jury selection and decision making, and eyewitness identification. Discussion of forensic research will deal with traditional clinical concepts of treatment and assessment within the legal context. It should become evident that psychology and law is distinctive in its direct application. Research can assist in the imprisonment of individuals, in putting them to death, in suggesting when some should be released, and in setting some free. The effects can be very real and very profound.   
  
Jury Selection and Juror Decision Making Methodologies Employed by Legal Psychologists  
  
A predominant methodology in psychology and law research has been the use of *mock jurors* to represent the functioning of actual jury members as they behave during the trial process (i.e., *jury simulations)*. Jury simulations usually consist of participants being exposed to the facts of a case either in the form of a brief scenario, a lengthy trial transcript, or a videotaped reenactment. These mock jurors are then asked to render a verdict and/or sentence as if they were actual jurors in the case. Jury simulations may be conducted with individual mock jurors or in groups ranging anywhere from 6-12. Individuals may discuss or deliberate as jurors normally do in criminal and civil cases or simply come to individual decisions.

Researchers in the field have long been critical of this methodology for its lack of generalizability to actual jurors (Vidmar, 1979; Weiten & Diamond, 1979). Jury simulations are criticized because of their use of college students as the majority of participants, brief trial summaries to represent hours of actual trial testimony, the lack of deliberation among jury members, and inappropriate dependent measures (e.g., confidence, degree of responsibility etc.) that are not options in real trials where jurors simply vote guilty or not guilty (Weiten & Diamond, 1979). Diamond (1997) revisited the methodological concerns she and Weiten raised almost 20 years ago and concluded that some have been addressed whereas others have largely been ignored. Diamond (1997) and others have called for researchers to continue to improve jury simulations to address the concerns raised by the courts when evaluating the applicability and usefulness of the research.   
  
The body of literature focusing on jury decision making has fallen into identifiable areas (Penrod & Cutler, 1987). Much of the initial research focused on individual characteristics including demographic, attitudinal, and personality factors. More recent research examined jury decision making from evidentiary and procedural perspectives.   
  
Predictors of Mock Juror Verdicts and Scientific Jury Selection  
  
The focus on individual differences in juror decision making was primarily an outgrowth of psychological interest in scientific jury selection (Schulman, et al., 1973). Scientific jury selection held that individual differences among jurors would influence the final verdict. Individual differences included demographic differences (e.g., sex or age) or attitudinal and personality differences (e.g., pro-death penalty or authoritarianism). For example, psychologists and legal actors wanted to know whether a white, middle-aged man would be more prone to decide a particular case in one direction compared to a elderly, Hispanic woman. They were also interested whether a female attorney would be more persuasive in a particular case or an African-American judge would impact the outcome. It should become apparent how valuable such information could be to parties on either side of an issue. However, reviews of the juror literature found largely inconsistent results and concluded that most individual differences are not strong predictors of final verdict choices (Penrod & Cutler, 1987; Penrod & Fulero, 1990). More recent research may provide better contextual answers to the earlier conclusions (e.g., Narby, Cutler, & Moran, 1993) and suggest greater promise for the predictive power of these variables.   
  
Demographic variables such as sex, age, income, education, religion, and race have shown minimal predictive power in regard to ultimate verdict decisions (Goodman, Loftus, & Greene, 1990; Updike & Shaw, 1995). Race and sex have produced more robust outcomes when the case facts are specifically focused on issues seemingly more relevant, as in cases of sexual assault, domestic violence, or a minority group defendant (Crowley, O'Callaghan, & Ball, 1994; Gowan & Zimmerman, 1996; Greenwald, Tomkins, Kenning, & Zavodny, 1990; Pfeifer & Ogloff, 1991). Though some inconsistency still exists in regard to the juror demographics, increasing evidence is suggests that sex and racial characteristics of the important legal actors (judge, attorney, and defendant) may also play a prominent role in juror decision making (Goodman, Loftus, Miller, & Greene, 1991; Gordon, 1990).   
  
Studies assessing attitudes and personality also report mixed results. Researchers have not found a consistent relationship between aspects of personality such as belief in a just world, locus of control, socialization, and conviction-proneness (Mills & Bohannon, 1980; Moran & Comfort, 1982, 1986). Two exceptions appear to be attitudes toward the death penalty and authoritarianism. Though the Supreme Court has refused to recognize the conclusions in regard to juror attitudes toward the death penalty (*Lockhart v. McCree*, 1986), results of a number of studies suggest a tendency to convict by those who are pro-death penalty (e.g., Cowan, Thompson, & Ellsworth, 1984; Fitzerald & Ellsworth, 1984; Ellsworth, Bukaty, Cowan, & Thompson, 1984). Authoritarianism also has demonstrated greater consistency than the other attitudinal and personality characteristics while a review suggests that authoritarianism, especially legal authoritarianism, correlates strongly with the verdict decision (Narby et al., 1993). Legal authoritarianism is the specific belief in the authority and just power of the legal system and its actors.   
  
Effects of Courtroom Procedure on Mock Juror Verdicts  
  
Although individual differences, primarily among jurors but also the other legal actors, have resulted in modest relationships with trial outcome, the juror literature focusing on evidentiary and procedural aspects of the legal system appear to have resulted in greater insights (Penrod & Cutler, 1987). Procedural aspects of psychology and law research, focus on the methods and processes by which individuals (e.g., defendants, victims, judges, jurors, attorneys) move through the legal system, primarily those procedures occurring during criminal and civil trials. A number of Supreme Court decisions have resulted in important procedural changes that spurred psychologists into new areas of investigation (e.g., *Batson v. Kentucky*, 1986; *Wainright v. Witt*, 1985). Our legal system is constantly striving for justice and psycholegal research often is able to offer answers into procedural changes that the courts are contemplating or have already taken action upon. Investigations of trial procedures have focused on the size of the jury, the specific instructions given to the jury prior to deliberation, the unanimity of jury decision rules, and pre-trial publicity, juror note taking among others.

Several Supreme Court decisions during the 1970s concluded that juries smaller than the standard 12 person jury did not violate constitutional due process requirements (*Ballew v. Georgia*, 1978; *Colgrove v. Battin*, 1973, *Williams v. Florida*, 1970). However, concern was expressed that a reduction in the actual size of the jury could impact the quality of the deliberation, the reliability of the jury's fact-finding, the ratio of non-guilty to guilty verdicts, individual ability to resist majority pressure, and community representation of the jury (see *Williams v. Florida*, 1970). A recent quantitative review (i.e., meta-analysis) of the literature revealed larger juries are more likely to contain minority group members, deliberate longer, become deadlocked more often, and demonstrate greater accuracy in recall of the trial testimony (Saks & Marti, 1997). Saks and Marti (1997) concluded the results suggest that the courts should re-examine their prior rulings in regard to the appropriateness of juries of less than 12 members.   
  
Jurors' comprehension of the instructions they receive from the court prior to beginning their deliberation has been thoroughly investigated. Studies have examined juror comprehension of death penalty instructions (Haney & Lynch, 1997), insanity instruction (Ogloff, 1991), and cases involving battered women who kill (Terrance, Matheson, & Spanos, 2000). This research generally reveals that jurors have difficulty understanding and applying judicial instructions. Though efforts have been undertaken to suggest modifications of jury instructions (Lind & Patridge, 1982), few alterations have been successful in improving juror comprehension (e.g., Haney & Lynch, 1997).   
  
Studies have shown that other legal and extra-legal procedural factors can also impact verdict outcome. For example, U. S. Supreme Court decisions allowing trial courts to use less than unanimous verdicts have prompted researchers to find that simple majority opinions may provide less opportunity for members to dissent but that these juries may demonstrate better recall of the trial testimony (Saks, 1977). Several studies also revealed that pretrial publicity has a tremendous impact upon verdict outcome and suggested that extensive steps should be taken to reduce or eliminate any resulting bias (e.g., Moran & Cutler, 1997; Ogloff & Vidmar, 1994; Studebaker & Penrod, 1997; Studebaker, Robbennolt, Pathal-Sharma, & Penrod, 2000). Other studies have revealed the advantages and disadvantages of jurors taking notes during testimony (Heuer & Penrod, 1989, 1994), allowing jurors to ask questions (Heuer & Penrod, 1988), judicial instructions to deadlocked juries (Smith & Kassin, 1993), privately retained versus court appointed attorneys (Beck & Shumsky, 1997), and improvement in the pretrial questioning of perspective jurors (Middendorf & Luginbuhl, 1995).   
  
The Impact of Evidentiary Psycholegal Research  
  
A number of researchers have also investigated evidentiary aspects of the legal process. Many times the presentation of a piece of evidence in a particular manner or at a particular point in the trial may have profound impact upon the ultimate decision of the jurors. Researchers have examined the impact of expert witnesses across a broad range of case specific facts, the impact of out of court statements regarding a fact in question (i.e., hearsay), the presentation of information on coerced confessions, evidence on statistical probabilities, and a number of mediums for the presentation of evidence (e.g., computer animation). Attorneys want to know how they can best persuade a jury to believe in their client's innocence in a criminal trial or that their client has been wronged civilly. Psycholegal research is often able to lend some assistance with regard to the persuasiveness or impact of particular types of evidence.   
  
The largest body of evidentiary psycholegal research has focused on the use of expert witnesses. These research efforts are largely the result of the increasing demand for psychologists to testify on issues ranging from battered women syndrome to eyewitness memory. The presentation of expert testimony can be an opportunity to reeducate the jurors about particular psychological phenomena that are beyond the everyday knowledge of the juror (Blackman & Brickman, 1984).   
  
Much of the initial research centered on the impact of expert testimony to explain the relevant factors that influence eyewitness identification such as the relationship between eyewitness confidence and recall accuracy, the suggestibility of their memory, the presence of a weapon, and the impact of different police line-up procedures (see Cutler & Penrod, 1995). Additional efforts have examined the impact of expert testimony evidence focusing on battered woman syndrome (Schuller, Smith, & Olson, 1994), a defendant's insanity plea (Rogers, Bagby, Crouch, & Cutler, 1990), child sexual abuse (Crowley et al., 1994), rape trauma syndrome (Frazier & Borgida, 1992), and possible age discrimination (Raitz, Greene, Goodman, & Loftus, 1990). Though some studies appear to suggest that the introduction of expert testimony is not always effective in specific cases (compare Kasian, Spanos, Terrance, & Peebles, 1993, with Schuller & Hastings, 1996), studies have largely concluded that expert testimony can have a significant impact on the manner which jurors process the trial related information and their ultimate verdicts (e.g., Penrod & Cutler, 1987).   
  
The literature has continued to develop by not simply focusing on the impact of the introduction expert testimony in a variety of cases but by also examining more contextual issues (e.g., Kovera, Gresham, Borgida, & Gray, 1997). Studies have examined the impact that the strength of the expert's credentials have upon juror decision making (Cooper & Neuhaus, 2000), judicial limiting instructions (Schuller, 1995), complex presentations of expert evidence (Diamond & Casper, 1992), and the extent to which experts are allowed to issue testify (Fulero & Finkel, 1991). This research further identified the circumstances under which expert testimony is most likely to have an impact on the decision making process and when it is likely to inform the jury (Kovera et al., 1997). Given that expert testimony is increasingly being used in our court systems and that the courts have been increasing the scrutiny with which they examine such evidence (Landsman, 1995), it would appear that being able to identify those factors that make an expert's testimony more meaningful to judges and juries would hold real promise for making a difference in the judicial process.   
  
The examination of evidentiary factors in psychology and law research extended beyond expert testimony to a number of legally relevant and innovative issues. For example, Kassin and Neumann (1997) examined the impact of admission of the defendant's confession at trial compared to eyewitness identification, character testimony, or none of these. Results suggest that confessions are significantly more powerful than other types of evidence (Kassin & Neumann, 1997). Kassin and Sukel (1997) demonstrated that coerced confessions increased conviction rates even when jurors see them as less voluntary and believe they have less impact on the decision than a more voluntary confession. Studies also found that hearsay testimony, testimony given by a victim witness out of court, has a powerful impact upon juror decision making (Golding, Sanchez, & Sego, 1997; Schuller, 1995). The impact of statistical or probability evidence (e.g., evidence in DNA cases) has a significant impact on jurors' decisions, even though jurors do not use it in a perfectly appropriate manner (Smith, Penrod, Otto, & Park, 1996). Studies have examined the mediums by which we display evidence such as graphic photographs (Douglas, Lyon, & Ogloff, 1997) and computer-animated displays (Kassin & Dunn, 1997). They generally find that the more elaborate displays of evidence have greater impact on verdict decisions and that jurors may even deny that they had a greater impact on their decision making (see Douglas et al., 1997).   
  
It should be understood from this brief review of the literature that psycholegal research is not simply conducted within a vacuum. This research is used in arguments before the United States Supreme Court, by attorneys in specific trials and even conducted in anticipation of a particular trial in order for one side to better prepare their case. Alterations in the types of people serving on a jury, the size of the jury, the type of expert testimony that is offered, or whether a confession is coerced out of a defendant can have a profound impact on real people. Innocent people can go to prison and guilty people can be acquitted because of a failure to pay attention to psycholegal research or even on the basis of it.   
  
Eyewitness Identification and Recall  
  
One of the most substantial bodies of research in psychology and law focuses on eyewitness memory or eyewitness identification. The scientific study of eyewitness memory has largely remained within the domain of psychology and the general study of memory has been integral to the development of psychology as a science (Wells, 1995). Eyewitness research primarily has focused on the victims of crime (i.e., eyewitnesses) and the factors that influence eyewitness performance. However, the issues important to eyewitness researchers have not strictly focused on memory constructs but also on other cognitive as well as social processes (Ross, Read, & Toglia, 1994; Wells, 1995). Many psycholegal researchers argue that the quantity of research focusing on eyewitness identification is a direct result of the magnitude of the problem of wrongful convictions based on false eyewitness reports (Loftus, 1993). Cutler and Penrod (1995) further conclude in their extensive examination of the literature that the accuracy of eyewitness identification is clearly impacted by a host of variables and that identification errors are not infrequent, though their frequency can not be conclusively determined by the psychological literature at this time.   
  
Variables Influencing Eyewitness Identification  
  
One area of eyewitness research has focused on variables specific to the witness that influence later identification. Static or stable characteristics include sex, race, intelligence, age, and general facial recognition ability. Studies have found that such stable variables are not especially predictive of identification accuracy (Cutler & Penrod, 1995). Results focusing on dynamic or more malleable witness factors are mixed. For example, store cashiers are often told to pay special attention to a would be robber's face so that they can accurately identify them. Shapiro and Penrod (1986) made a quantitative examination (i.e., meta analysis) of several studies looking at differences among participants who either expected future identification or did not. Their results suggest that future expectations do not improve later identification accuracy (Shapiro & Penrod, 1986). Shapiro and Penrod (1986) also found that training participants in facial recognition to better remember perpetrator faces did not significantly improve their identification accuracy. However, they did find that training programs focusing on elaboration techniques where the participant is trained to make inferential personality judgments based on facial characteristics improve later identification accuracy (Shapiro & Penrod, 1986). These results seem to suggest that there may be particular witness variables that are beneficial in improving eyewitness identification accuracy.   
  
The effect of a number of variables concerning the *target* characteristics of the witnesses identification have also been investigated. Shapiro and Penrod's (1986) meta-analysis once again only found significant predictive relationships between the distinctiveness of the target's appearance and later accuracy. Target sex and race alone were not found to consistently impact the accuracy of the witnesses identification across the entire literature (Shapiro & Penrod, 1986). Studies have found that changes in facial characteristics (e.g., hair style, eye glasses, facial hair) and the use of disguises significantly alter participants' in later identification of the witness (e.g., Cutler, Penrod, & Martens, 1987a, 1987b; Patterson & Baddeley, 1977). The literature thereby indicates that specific target characteristics may hold some promise in regard to their influence on the accuracy of witness identification.   
The environment in which both the original event occurred and the post event information/setting took place are very often also significant factors in the accuracy of witness identification. Important research questions in this area include: What are the situational factors associated with eyewitness accuracy? Duration of the target exposure? Presence of a weapon? The seriousness of the crime? The general level of arousal experienced by the eyewitness? Cross-race identification and cross-gender identification of the witness and the target. All of these factors have been linked to the later accuracy of witness identification to varying degrees (Cutler & Penrod, 1995). For example, though witness and target race do not impact witness accuracy independently, when examined together own race recognitions are more accurate than other race recognitions (Anthony, Cooper, and Mullen, 1992). Post event factors such as the interval between the original witnessing of the event and the later identification, the manner in which the target is displayed (e.g., mugshots, lineup characteristics), and the recreation of the original witness context have all been found to alter accuracy of later identification (Cutler & Penrod, 1995).   
  
Eyewitness research primarily has focused on the influence of visual cues, mainly facial recognition, to the exclusion of the recollection of auditory information (Melara, DeWitt-Rickards, & O'Brien, 1989). However, auditory information may be the only evidence in some cases and a less developed line of research has centered around *earwitness identification*. Situations may occur in which a witness needs to identify a voice on the telephone, the direction of a gun shot, or source of a scream. Clifford (1980) reports that many of the basic flaws and assumptions of eyewitness identification have counterparts in earwitness identification. Earwitness researchers focus on many of the same questions. What effect does stress or arousal have upon the accuracy of recall? Does the gender or age of the speaker or the listener impact the accuracy of the witness? Are their certain interviewing and lineup procedures that can be used to better assist the witness in their identification or even bias them in one direction? Early efforts at testing this claim have found similar parallels between the eyewitness and earwitness literatures (e.g., Huss & Weaver, 1996; McAllister, Dale, & Keay, 1993; Yarmey, 1995).  
  
Related Eyewitness Areas  
  
Separate from the issues of eyewitness identification, researchers have also attempted to improve eyewitness reporting by investigating techniques designed to more fully and more accurately elicit information from eyewitnesses (Fisher, 1995). An approach that has led to a number of encouraging results is the use of the Cognitive Interview (see Fisher & Geiselman, 1992). This technique focuses on cognitive, social, and communication factors underlying eyewitness recall; it improves eyewitness recollection (Fisher, 1995). Research also has been conducted on the impact of the construction and conduct of police lineups. A review of this literature points to four criteria that could reduce the number of false convictions: (a) inform the eyewitness that the defendant may not be in the lineup, (b) construct the lineup so the suspect does not stand out, (c) the person administering the lineup should be blind as to the identity of the suspect, and (d) the certainty of the witness should be assessed before it can be contaminated by future interactions with the suspect (Wells & Seelau, 1995).   
  
A controversial topic in the eyewitness literature becoming increasingly important because of recent court cases is that of repressed or recovered memories (Lindsay & Read, 1995). The debate over repressed memories focuses on the scientific existence of childhood memories remaining hidden or out of the conscious awareness of an individual, only to return years later. Many researchers have expressed concern over the prevalence of child abuse and its damaging effects on the victims but have questioned the existence and prevalence of so called repressed memories (e.g., Loftus, 1997; Loftus & Ketcham, 1994). However, others have been equally vehement in their beliefs that millions of child sexual abuse victims carry hidden memories of these events into adulthood (e.g., Bass & Davis, 1994). Cases in which adult victims of child sexual abuse pursue legal action against their abusers 10, 20, or even 30 years later pose special problems for the legal system on a number of different levels (e.g., statute of limitation in criminal cases, admissibility of repressed memory testimony, legal need for additional substantiated testimony) and therefore hold great promise for psycholegal research to offer important information on the possible formation and prevalence of repressed memories (Lindsay & Read, 1995). In addition, the issues of childhood memory/witnessing go well beyond the arguments regarding the existence, prevalence, or possible induction of recovered memories. There is a large body of literature focusing on specific problems with questioning child witnesses and how to address those problems effectively whether the issue is childhood abuse or not (Perry & Wrightsman, 1991).   
  
Research in the Treatment of Forensic and Correctional Offenders  
  
Research in forensic psychology is often separate and distinct from the broad field of psychology and law. The American Board of Forensic Psychology and the American Psychology-Law Society (1995) define forensic psychology as:   
the professional practice by psychologists within the areas of clinical psychology, counseling psychology, neuropsychology, and school psychology, when they are engaged regularly as experts and represents themselves as such, in an activity primarily intended to provide professional psychological expertise to the judicial system (p. 6).  
  
Such a definition focuses the field on the mental health aspects of psychology and the law and away from the more experimental areas of jury selection and eyewitness identification. Issues in forensic psychology typically include appropriate interventions for criminal offenders, prediction of future dangerousness, issues surrounding competency and insanity, the feigning of mental illness (i.e., malingering), civil commitment, juvenile delinquency, child abuse, and neglect among others. Due to space limitations there are a number of issues relevant to clinical psychology that will not be examined under the framework of forensic psychology. In general most forensic research, as is true in most research in clinical psychology, can be divided into that focusing on treatment and assessment.   
  
The criminal justice system attempts to balance its treatment of offenders between two primary objectives: punishment for prior bad acts and prevention of future bad acts (Harvard Law Review, 1996). Concern over increasing crime rates has polarized policy makers with some individuals proposing to reduce criminal recidivism through harsher criminal sanctions (e.g., McCorkle, 1993) and other persons calling for the use of mental health interventions to decrease criminal behavior (e.g., Gendreau & Ross, 1987). Researcher want to be able to answer a number of questions. Is it possible to effectively treat criminal offenders? If so, what treatments are most likely to be effective? Are these treatments equally effective for all criminals?

The early theories of criminal behavior that were spawned by a belief in rehabilitative efforts offered a preliminary foundation from which later interventions and treatment approaches were derived for criminal offenders (e.g., Yochelson & Samenow, 1976). As evaluations of offender treatment were produced (e.g., Kassenbaum, Ward, & Wilner, 1971), pessimism grew that the psychological interventions were not effective in rehabilitating criminal offenders (Martinson, 1974). However, more recent qualitative and quantitative reviews of the vast body of offender treatment literature are more optimistic and specific about what interventions are effective (Andrews, et al., 1990; Gendreau, 1996).   
  
Mental health interventions have often meet with mixed success among offender and antisocial populations (Stone, 1993); however, increasing attention is being focused on the cognitive correlates of criminal behavior and related treatment strategies (Andrews & Bonta, 1994). For example, one of the key elements in the treatment of sex offenders has been a focus on their cognitive distortions (Murphy, 1990). Some of the interest on cognitive correlates of criminal behavior can be traced back to the work of Yochelson and Samenow (1976) whose cognitive interpretation of criminal behavior identified a number of cognitive distortions that are characteristic of the criminal personality. Several researchers have since suggested that programs focusing on cognitive functioning are most likely to produce positive treatment outcomes (Izzo & Ross, 1990; Ross, Fabrino & Ewles, 1988).   
A number of researchers have identified and described a special segment of the offender population that appears to be the most dangerous, most resistant to intervention, and more likely to drop out of treatment (Hare, 1996). These individuals are often referred to as psychopaths and pose a special problems for forensic psychologists. Cleckley (1976) originally identified a number of traits associated with the psychopath including: (a) superficial charm and "good" intelligence, (b) absence of delusions and other signs of irrational thinking, (c) absence of nervousness" or psychoneurotic manifestations, (d) unreliability, (e) untruthfulness and insincerity, (f) lack of remorse or shame, (g) inadequately motivated antisocial behavior, (h) poor judgment and failure to learn by experience, (i) general poverty in major affective reactions, (j) specific loss of insight, (k) unresponsiveness in general interpersonal relations, (l) fantastic and uninviting behavior with drink and sometimes without, (m) sex life, impersonal, trivial, and poorly integrated, and (n) failure to follow any life plan.   
  
Psychopaths are estimated to be 15-30% of the total correctional population and differ from other criminal offenders along a number of important dimensions (Harris, Rice, & Cormier, 1991). These offenders are more likely to commit violent crimes and exhibit higher rates of violent recidivism than non psychopaths (Harris et al., 1991; Williamson, Hare, & Wong, 1987). Psychopaths also are more likely to victimize strangers than non psychopaths (Hare, McPherson, & Forth, 1988). In addition, research indicates that insight-oriented therapies are not highly successful with psychopaths and may even result in greater recidivism rates among treated psychopaths (Rice, Harris, & Cormier, 1992). Newman and Wallace (1993) have further proposed a response modulation hypothesis that focuses on the cognitive deficits of the psychopath that may provide additional implications for the treatment of even these most serious criminal offenders.   
  
Areas of Special Interest in Forensic Assessment  
  
A second major area of research interest in forensic psychology has been forensic assessment. The courts often call on clinical psychologists to provide their psychological expertise in a matter before the court (e.g., insanity, competency to stand trial, likelihood of future dangerousness at the time of sentencing). Though there has been much debate among legal and psychological commentators as to the appropriate role of clinical psychologists in these matters, research and practice continue to focus on the area (see Melton, Petrila, Poythress, & Slobogin, 1997).  
  
Competency  
  
One of the assessment issues most often faced by forensic psychologists is that of competency (Melton et al., 1997). The general premise of the law is that a individual defendant must demonstrate particular minimum requirements in regard to their understanding of legal procedures and the possible consequences of any legal decision (see *Dusky v. United States*, 1960) if the interests of the individual and society are to be appropriately served by the law (Reisner & Slobogin, 1990). Much of the research on competency asks whether we are consistent and valid in our assessments and what measures are the most helpful. Furthermore, what variables are likely to be associated with competency? Competency may arise throughout the legal system in regard to standing trial, entering a plea, entering into a contract, and ability to consent to medical treatment (Melton et al., 1997). Though there are separate and distinct areas of competency, courts have ruled that defendants are required to exhibit similar abilities across different issues of competency (*Godinez v. Moran,*1993).   
  
Though competency is a very broad legal term that takes on a number of different forms both in civil and criminal cases, competency to stand trial is by far the most prevalent issue a forensic psychologist must face and occurs in 10-15% of criminal cases (Poythress, Bonnie, Hoge, Monahan, & Oberlander, 1994). Of those individuals actually referred for competency evaluations, an average of 30% are initially found incompetent (Roesch & Golding, 1980). Early studies suggested that most of those individuals found incompetent to stand trial have marginal education, few ties to the community, have never been married, and have long histories of criminal justice and mental health involvement (Steadman, 1979). However, more recent research has found no differences between incompetent defendants and control groups in terms of education and mean number of arrests (Hoge, et al., 1997). Hoge et al. (1997) found that incompetent defendants differ from other defendants in regard to their history of hospitalization and outpatient mental health treatment, IQ, psychoticism, and depression.   
  
Though studies have found competency evaluations to be consistent across clinicians, examinations of the validity of these assessments have found that clinicians who are well trained can also achieve high validity (Nicholson & Kugler, 1991). Attainment of high reliability and validity figures have at least been due in part to the development of structured evaluations formats such as the Competency Screening Test, the Competency Screening Instrument, the Interdisciplinary Fitness Interview, and the Georgia Court Competency Test. Nonetheless, these instruments have been criticized for their limited focus on the issue of competency and lack of standardized administration (Grisso, 1986; Roesch & Golding, 1987; Roesch, Ogloff, & Golding, 1993). Recent development of the MacArthur Competence Research Instruments was intended to eliminate many of these criticisms (Appelbaum & Grisso, 1995; Hoge et al., 1997).  
  
Insanity  
  
A number of misconceptions surround another area of forensic psychology, the defendant's mental state at the time of the offense or insanity. Although the general public believes a large number of criminal defendants use the insanity defense, an eight-state study conducted by Callahan, Steadman, McGreevy, and Robbins (1991) found the insanity defense was used in only 1% of all felony cases. The public also believes that most defendants who use the insanity defense are acquitted. Again, in the Callahan et al. (1991) study, they found that defendants were successful in only one-quarter of those cases in which it was used. A later study by Silver, Cirincione and Steadman (1995) confirms these findings. People also express concern that defendants found not guilty by reason of insanity are released back to society shortly after their trials. Steadman and Braff (1983) found that the average hospital stay was three and one-half years and the length appeared to be increasing over time. They also found longer stays for criminals who committed more serious crimes. Studies also show no difference in recidivism rates or slightly lower recidivism rates for defendants found not guilty by reason of insanity compared to guilty defendants (Cohen, Spodak, Silver, & Williams, 1988).

Researchers focusing on insanity attempt to address many of the same questions as those focusing on incompetency do. What characteristics are associated with someone being insane? How can I reliably assess insanity and what psychological tools will be the most effective? However, research on the reliability and validity of insanity assessment is largely absent and those that have been conducted employ a number of dissimilar methodologies (Melton et al., 1997). Studies assessing the validity of insanity evaluations also are rare and suffer from the same methodological shortcomings from which competency studies suffer (Melton et al., 1997). Formal assessments of insanity are rare compared to competency evaluations. In fact, only the Rogers Criminal Responsibility Assessment Scale has been developed to assess insanity in a systematic manner; it has demonstrated acceptable preliminary psychometric properties (Rogers, Dolmetsch, & Cavanaugh, 1981).   
  
Though insanity standards vary from jurisdiction to jurisdiction and have changed over time, all standards require the presence of a mental illness. Research suggests that defendants exhibiting psychotic characteristics are most likely to be found not guilty by reason of insanity (Melton et al., 1997). Because the presence of a mental illness is necessary for the insanity defense, there is an obvious incentive to feign mental illness. As a result, feigning mental illness or malingering is a concern in insanity evaluations as well as most forensic evaluations.   
  
Malingering  
  
Though it is difficult to determine conclusively whether an individual is feigning mental illness, there are a number of mechanisms by which forensic psychologists can assess the probability of malingering. The MMPI has been used to determine malingering and has shown some ability to differentiate between honest responders and malingerers (Rogers, Sewell, & Salekin, 1994). Responses on psychological measures that even the most severely impaired person would be likely to succeed on, failure to take into account the difficulty of items where one would assume that "normals" do better on the easier items and poorer on the more difficult items, making approximate answers (i.e., near misses), scores below chance, inconsistent or atypical presentation, and especially marked variations in performance on several similar tests are all characteristic of malingering (Binder, 1992; Rogers, Harrell, & Liff, 1993). Moreover, Rogers and colleagues have developed a structured interview, the Structured Interview of Reported Symptoms (SIRS), as method to detect malingering and found it has the ability to detect malingering (Rogers et al., 1991; Rogers, Gillis, Dickens, & Bagby, 1991; Rogers, Kropp, Bagby, Dickens, 1992).  
  
Risk Assessment  
  
My own interests lie primarily in one of the most pervasive and increasingly important areas of forensic research both in terms of clinical practice and the law, risk assessment. I remember beginning my studies of psychology and wondering how one person could commit such horrific violence while other people could perform completely altruistic and self sacrificing acts. This led me to become interested in the scientific prediction of violence or risk. I wanted to be able to predict with some accuracy who the "bad boys" were going to be and what they were going to do. What were the situations that were more likely for them to become violent? What types of factors were likely to reduce their risk? Today risk assessment or risk management is one of the hottest topics in forensic psychology.   
  
Forensic psychologists are routinely called on to make assessments of an individual's risk to commit dangerous acts in sentencing, civil commitment, juvenile transfer, and insanity decisions (Heilbrun, 1997). Assessments in these matters may have far reaching impact and at least in part determine whether a person receives jail time, if they are institutionalized in a mental hospital, the length of their criminal sentence, if they are to be released from a mental hospital or prison, and even whether they are to be executed. Early efforts at risk assessment and dangerousness prediction, often referred to as *first generation studies*, were criticized because of clinicians' marked inability to accurately predict future violence with any certainty at above chance levels (Monahan, 1981). It was often said that one could flip a coin and predict as well as the "experts" at the time. These efforts were criticized because most of the high risk offenders used as participants were never released from the institution, predictions were not based on clinical assessments but administrative decisions, and researchers' use of poor outcome measures of violence (Monahan, 1981). However, recent reviews have been much more optimistic about the scientific basis for making risk assessments (see Grisso & Tomkins, 1996; Monahan & Steadman, 1994).   
  
Second and third generation studies have demonstrated that forensic psychologists are able to predict violence at higher than chance levels in at least some circumstances (e.g., Harris, Rice, & Quinsey, 1993; Lidz, Mulvey, & Gardner, 1993; Mossman, 1994). Researchers have begun to focus on both male and female participants, short-term hospitalizations and predictions, and multiple criterion measures (Monahan, 1996). The improvements in risk assessment can be largely attributed to constructive efforts at critiquing the body of research (e.g., Monahan, 1981, Otto, 1992) and the move away from clinical decision making and toward actuarial or empirically based decision making (e.g., Hare, 1991; Webster, Harris, Rice, Cormier, & Quinsey, 1994). Moreover, continued legal use of dangerousness predictions, despite their scientific shortcomings (e.g., *Barefoot v. Estelle*, 1983), provides an impetus for forensic psychologists to improve their reliability and validity.   
  
The use of actuarial or structured approaches, scales or psychological batteries mark a significant step forward for the practice and research of forensic psychology. Though the specific names of these techniques may not be of great importance to you, the identification of a growing list of measures attempting to quantity or objectively measure particularly subjective constructs in forensic psychology is of great importance. These structured approaches provide evidence of significant improvement in the forensic decision making process over simple clinical judgment.

One of the earliest measures used for risk assessment is the Psychopathy Checklist (PCL; Hare, 1980). The revised version of the PCL, the PCL-R, consists of 20 items that are scored on a 0-2 point scale and assessed via both a semi-structured clinical interview and collateral review of psychiatric and correctional records (Hare, 1991). Though the PCL was not intended to be a measure of risk assessment, psychopathy has been identified as the single best predictor in the assessment of future violence (Rice & Harris, 1995; Serin, 1996). Moreover, the PCL and PCL-R have demonstrated acceptable reliability and validity (e.g., Harpur, Hare, & Hakstian, 1989; Kosson, Smith, & Newman, 1990; Newman & Kosson, 1986; Smith & Newman, 1990).

Measures intended solely for the prediction of dangerousness have also been developed, many of which have incorporated psychopathy as a factor (e.g., Violence Risk Assessment Guide and the HCR-20). The Violence Risk Assessment Guide (VRAG) is a 12-item measure that was empirically derived from a sample of patients at a maximum security hospital (Harris et al., 1993). The items include scores on the PCL-R, elementary school maladjustment, marital status, age at index offense, victim injury index, male victim index offense, history of alcohol abuse, diagnosis of personality disorders and schizophrenia, separation from parents under the age of 16, failure on a conditional release, and history of property offenses. Further studies have shown that the VRAG performs equally well on forensic and prison populations, at shorter and longer intervals, and for different operationalizations of violence (see Rice, 1997). The HCR-20 is a 20-item measure to assess risk for future violence in offender and psychiatric populations with a scoring system similar to that of the PCL. The HCR-20 focuses on the historical, clinical, and risk variables believed to be the most relevant to predictions of future violence (Webster & Polvi, 1995). Though the evidence is limited at this time, independent raters appear to be able to code the HCR-20 reliably while it also demonstrates acceptable validity (Douglas & Webster, 1999). In addition, preliminary evidence indicates that the HCR-20 may be a better predictor than the PCL, largely due to the PCL:SV being an item within the HCR-20 (Douglas, Ogloff, Nicholls, & Grant, 1999).   
  
One of the major difficulties with earlier efforts at risk assessment was the use of solely forensic and offender populations. However, research has begun to focus on additional populations such as sex offenders, psychiatric inpatients, and community samples (Borum, 1996). Quinsey, Rice, and Harris (1995) developed an instrument for use on sex offenders and studies found that identification as a psychopath is associated with sex offending (e.g., Barbaree, Seto, Serin, Amos, & Preston, 1994). McNiel and Binder (1991) conducted research on the risk factors for inpatient violence. They developed an actuarial instrument for inpatient populations that outperformed most studies of clinical judgment and includes history of attacks, absence of suicidal behavior, a diagnosis of schizophrenia or mania, gender, and marital status as important variables (McNiel & Binder, 1994). Research was conducted on community samples (e.g., Gardner, Lidz, Mulvey, & Shaw, 1996). Gardner et al. (1996) compared their actuarial procedure with clinician's predictions of community violence for a sample of patients with mental illnesses. The actuarial methods were more accurate than the clinical predictions (Gardner et al., 1996).   
  
The Future of Risk Assessment and Dangerousness Prediction Research  
  
Not only am I excited about how far the risk assessment literature has come but the future for my area of specialization appears even brighter. Though research on the prediction of dangerousness has been severely criticized over the last 20 years (e.g., Monahan, 1981), current efforts reflect tremendous improvement over the early attempts at risk assessment (e.g., Mossman, 1994). However, there are a number of ways in which future research could advance (e.g., Monahan & Steadman, 1994). Such advances will be in terms of methodology, policy considerations, and front-line use by practitioners.

The most important trend that must continue is the use of actuarial or structured methods of violence prediction. Much of the improvement in our ability to predict dangerousness can be traced to our improvement in actuarial methods such as the PCL, VRAG, or methodologies employed by McNiel and Binder (1994) and Gardner et al., (1996). The next generation of research will extend these measures into specific subsamples as described before. The Spousal Risk Assessment Guide (Kropp, Hart, Webster, & Eaves, 1994), which focuses on perpetrators of domestic violence, is a structured approach in the early stages of development. The next generation of actuarial tools will be designed for similar specific populations. Although a measure such as the PCL-R may well be useful beyond the general offender populations, preliminary research on risk factors in specific areas such as domestic violence already suggests deviations from the predictive models associated with the first generation of actuarial tools (Saunders, 1995).   
Although broad-based actuarial methods may offer a significant advancement, they fail to account for the specific context in which the violence occurs (see Monahan & Steadman, 1994 for the importance of context). A particular personality disorder or age of the victim may well predict the probability of violence within a serious offender population, however, these variables are unlikely to generalize to perpetrators of domestic violence in the same manner. Moreover, context should not be viewed as a static variable but a dynamic one that is continually reassessed (Steadman et al., 1993). Currently, risk assessment is usually a one time event used to predict a single future event. The idea of an ongoing risk assessment naturally lends itself to the continuing management of risk assessment (Heilbrun, 1997).   
  
The issue of context should not only apply to the context in which the violence occurs but also the legal context in which the assessment is taken (Heilbrun, 1997). Many clinicians assume that the dangerousness they attempt to communicate in a civil commitment is parallel to dangerousness in the sentencing phase of a murder trial. However, it has been argued that clinicians need to take into account this legal context in their communication of dangerousness predictions (Schopp, 1996). It seems intuitive that a forensic psychologist also needs to take the legal context into account when formulating the actuarial tools used in the risk assessment. Future research will likely focus on the legal context as well as the context in which the dangerous behavior takes place.   
  
The statistical analysis used to communicate risk is methodological issue of great relevance to future research. Much of the dangerousness research has presented the results in terms 2 x 2 contingency tables in which yes/no decisions are easily communicated and depend on violence base rates (Hart, Webster, & Menzies, 1993). However, the use of receiver operating characteristics (ROC) is a technique independent of base rates that may more accurately describe and communicate the true probability of risk (Gardner et al., 1996; Mossman, 1994; Rice & Harris, 1995). ROC techniques have been borrowed from the psychophysiological literature examining signal detection theory. ROC techniques allow the decision maker to identify the point on a curve at which the most accurate decision can be made while being aware of the possibility of a false alarm. Mossman (1994) reports that in reanalyzing data from 44 prior risk assessment studies that ROC results strongly suggest predictions stronger than chance. Though a description of the intricacies of ROC is beyond the purpose of the current chapter, results of the above studies as well as its theoretical advantages over prior methods of analyses suggest that it offers a very useful tool for future violence research, especially those populations in which base rates are far lower than criminal populations.   
  
The clinical utility of these methods of risk assessment to individual practitioners or community agencies is another issue of potential relevance. Though many of the most recent actuarial methods provide for greater predictive accuracy, they have limitations for small scale assessments. A forensic psychologist performing an evaluation assessing the dangerousness of an individual acquitted of murder may find a lengthy interview and review of defendant's records too time consuming (e.g., PCL-R). A psychologist on a forensic unit may not have the resources to administer a lengthy measure or review records that are not immediately available. Although it may also be the duty of the staff psychologist to design a system in which such information is available, researchers should also keep in mind that the usefulness of a measure can vary tremendously given the resources available (Elbogen, Calkins, Tomkins, & Scalora, in press).   
  
Being able to predict and control human behavior is basic tenant of the discipline of psychology. Risk assessment attempts to do exactly that. I am personally very encouraged about the future of risk assessment. Forensic psychologists have come a long way in the last twenty years and have a fairly clear ideas of where they need to be in the next twenty years. However, it is not an easy task to predict human behavior with so many external factors at work all interacting to increase and decrease the probability of a particular individual acting out violently. The promise of this field and the willingness of researchers to learn from their past efforts excite and motivate me to be a part of it all.   
  
Future of Psychology and Law Research  
  
Many of the issues likely to be important in regard to risk assessment are not unique to forensic psychology but also apply to the broader field of psychology and the law. For example, the importance of context also extends to much of the jury simulation research. Early efforts examined the impact of juror sex or personality differences but future research will continue to emphasize legally relevant evidentiary and procedural aspects. Psychology and law topics have long been criticized for being psychologically interesting while failing to exploit the legal relevance to its utmost. It may be psychologically fruitful to examine the effect of a particular procedural manipulation on the legal outcome; however, if the law is unlikely to adopt such a change because of legal precedent or legal utility, it is unlikely that this research will be legally meaningful. Research in psychology and law must strive to not only be interesting to the psychological researcher but also the legal community.   
  
As investigators in psychology and law attempt to improve the legal relevance of their research, they will need to pay greater attention to the court cases that shape their laboratory. For example, a United States Supreme Court case (*Daubert v. Merrill Dow Pharmaceuticals Inc.*, 1993) clarified the previous standard for the admission of scientific evidence, the *Frye* Standard. Many individuals argue this case had real world implications concerning the type of evidence psychologists may testify to in court (see Faigman, 1995). The implications may also extend to the rigorousness of the research, the particular methodology employed, and to the types of evidence that are generally allowed (Faigman, 1995; Faigman, Porter & Saks, 1994; Penrod, Fulero, & Cutler, 1995). Though *Daubert* may be especially significant in terms of its broad impact, case law increasingly drives the research psychology (e.g., *Neil v. Biggers*, 1972). Future researchers will have to pay increasing attention to the developing case law to assure the legal relevance of their labors.

Much of the psychology research focuses on issues of significance to criminal law. Perhaps researchers find these issues personally appealing, however, there are other areas of the law which also hold promise for psychology and law researchers. For example, a study by Stolle and Slain (1997) represents one of the few studies designed to examine the impact of contract law on our daily lives. We enter into such contracts whenever we purchase a movie ticket, check our coat, sign for repairs on a home appliance, and so on. Stolle and Slain (1997) found that individuals rarely understand the legal significance of these documents. Examination of the psychological principles at work in less popular areas of the law such as administrative law, estate law, and tax law also are under represented. An appropriate metaphor might be found between psychology's avoidance of most areas of the law and frontier wilderness of early 19th century United States. To realize the full impact of psychology, these unexamined areas of the law must be explored.

The absence of overarching theoretical frameworks of paradigms to offer cohesion and direction to the field also have attracted criticism. However, there are some examples of paradigmatic efforts to organize the field. Monahan and Walker (1993) have categorized social science research in order to better assist legal decision makers. They propose that research which attempts to change the law be identified as social authority, research specific to a particular case be termed social fact, and research used in combination of these two be identified as social framework. They further argue some of this research should be treated as legal precedents, not as facts before the court (Monahan & Walker, 1988). The result would allow for greater access to psychology and law research and greater impact within the legal system (Monahan & Walker, 1993).   
  
Therapeutic jurisprudence has also been offered as a paradigm for psychology and the law research (see Wexler & Winick, 1996). Therapeutic jurisprudence examines the role of the law as a therapeutic agent and intends to produce research that is more relevant to legal reform. The intent is to uncover how psychology can shape the development of the law or the degree to which the law encourages the psychological and physical well being of individuals with which it comes into contact (Slobogin, 1996). Topics may include how the legal system influences the treatment of perpetrators of domestic violence (Simon, 1995), how the legal limitation of client-patient privilege impacts the therapeutic potential (Klotz, 1991), how fault-based compensation improves the recovery from personal injuries (Shuman, 1994), the impact of a normative focus on sexual predators (Schopp, 1995), and improvement in legal counseling (Patry, Wexler, Stolle, & Tomkins, 1998). The intent is to bring together social science research that may be seemingly unrelated and promote programs of research that focus on the therapeutic impact of the law (Wexler & Winick, 1996).

Researchers in psychology and law have also called for an increase in comparative scholarship examining the discipline from an international perspective (Carson & Tomkins, 1997). They point to the dearth of research initiated by those outside of the United States (examples of international scholarship include Allan & Louw, 1997; Freckleton, 1997; Fulero & Turner, 1997) especially compared to other fields such as medicine (see Carson & Tomkins, 1997). A heightened awareness of research in other countries is especially relevant to psychology and law because the impetus for many of our research agendas are derived from the legal system; a system that is far from universal. Outside of the "Commonwealth" countries (e.g., Australia, Britain, Canada, New Zealand, United States) adversarial legal systems are replaced by the European notion of truth seeking. The fundamentally different systems of justice may render comparative examinations of psychology and the law difficult; however, the infusion of new ideas, methodologies, and alternative approaches to address psychological aspects of the law are likely to open the discipline to a host of ideas and greatly enhance the field for future investigators (Carson & Tomkins, 1997).   
  
Beginning Research in Psychology and the Law  
  
The comparative youth and development of the field and its relevance to real world problems make psychology and the law increasingly attractive to students. This popularity lead to a national conference intended to evaluate the training that students at the undergraduate, graduate, and postgraduate levels receive and to propose more effective models (see Bersoff et al., 1997). Conference participants generally endorsed five areas they found to be integral to training in psychology and law: they identified a core knowledge in the basic areas of psychology, firm knowledge of research design and statistics, legal knowledge, foundational courses in legal psychology, and participating in original research and scholarship as fundamental to sound training in law and psychology (Bersoff et al., 1997). These basic areas provide a useful framework for beginning researchers in law and psychology. It is clear that a basic knowledge in psychological principles and methodology is imperative. Moreover, knowledge in psychology and law along with the law specifically is critical. However, the conference did not specify the method by which such training should take place.   
  
The most obvious manner in which one can receive training in psychology and the law is through specifically designed programs. Such opportunities include psychology programs that offer the opportunity to specialize in psychology and law as well as specifically designed joint-degree programs offering degrees in both psychology and the law. There are a number of universities that offer specialty training in psychology and law culminating solely in the PhD (e.g., University of Alabama, University of British Columbia, Florida International University, University of Illinois at Chicago, University of Kansas, University of Nevada-Reno, Queen's University, Simon Fraser University, St. Louis University, University of Texas at El Paso, and the University of Virginia). There are also programs that offer a terminal Master's degree (e.g., Castleton State College, John Jay College, University of Denver). In addition, there are several universities that formally offer joint JD/PhD training (e.g., Allegheny University of the Health Sciences-Villanova University, University of Arizona, and University of Nebraska); one PsyD/JD Program (Widener University) (Bersoff et al., 1997; Ogloff et al., 1996). The University of Nebraska and Stanford University also offer abbreviated legal training culminating in the Masters' in Legal Studies (MLS) and a PhD.

Both the specialty options and the joint-degree programs offer advantages and disadvantages. A joint degree offers a broader exposure to areas of the law that are under-represented, the special credentials may assist a student in obtaining certain employment opportunities, and many individuals argue there is something special about the simultaneous exposure to training in the law and psychology (Hafemeister, Ogloff, & Small, 1990). The joint-degree programs usually take longer because of the additional degree and require additional motivation from the student, increase the cost to the student, and particular career opportunities may eliminated by obtaining the joint degree (see Melton et al., 1998, for a fuller explanation).

Whatever reasons a student pursues either joint-degree training or specialized training, it is clear that a solid foundation in basic methodology, statistics, and courses in psychology are important before pursuing graduate training and while pursing graduate training in law and psychology (Bersoff et al., 1997). Many undergraduate institutions offers specific courses on psychology and law. Students should be encouraged to enroll in these courses but not feel that they are at a distinct disadvantage if their university does not offer a course in psychology and law or forensic psychology. If such a course is not offered at your particular institution, students should approach a professor and request a special readings course in psychology and law. In addition, undergraduate students should be encouraged to get involved in psycholegal research with a faculty sponsor. Though any research experience is invaluable for admission to graduate school, exposure to a particular area of the literature that may have only been briefly summarized here can be important for a number of reasons. It gives the student exposure to the most current research in a particular psycholegal area, allows him/her to evaluate where their psycholegal interests actually may lie, and gives them first hand exposure to the methodologies that may be specific to psycholegal research and their implementation in a particular project. Student should also be encouraged to join professional organization such as the American Psychology-Law Society (AP-LS) where they can receive a subscription to *Law and Human Behavior* with their membership. AP-LS has established at web page (http:www.unl.edu/ap-ls) that contains membership information and additional details on law and psychology. AP-LS holds a biennial conference offers any interested students a broad exposure to the field that can be invaluable in terms of sparking interest or focusing it.

**Conclusion**

It was my intent to touch on some of the important topics of research in psychology and law as well as identify important issues for researchers in the next century. The breadth and richness of the questions that remain unexamined in this area of psychology are remarkable. Students intent on pursuing a career in the more experimentally focused areas of research or the more applied areas of the field such as forensic assessment are likely to have a rewarding future ahead of them. Now is a time both when psychology is beginning to realize the impact it can have on the law and society; and the law is beginning to realize that psychology may have something to offer it.

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[Flourish Line]

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# Chapter 12 ****Psychopathology****

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At a social gathering of fellow graduate students in the early 1970's a heated debate erupted about the cause of mental illness. On one side of the argument were my antagonists who insisted that all behavior results from learning, and that it is reasonable to conclude that psychiatric disturbances result from unfortunate life experiences. With an air of disbelief, I challenged my colleagues with pointed questions. Do people learn the symptoms of schizophrenia? If so, how and why? Are the euphoric episodes of mania conditioned responses? It just didn't make sense to me to view all mental disorders in terms of behavior theory. Although I didn't realize it at the time, this friendly disagreement would serve as a foundation block upon which I would build a career devoted to understanding the causes of mental disorder and the treatment of people with various forms of disturbance. During this past quarter century I believe that I have expanded my knowledge about mental disorders and treatments. Yet, as I prepare to venture into the new century I realize that I still have so much more to learn. I also realize that many of the seemingly brilliant research findings of earlier decades now seem unsophisticated and at times erroneous. I wonder where the fields of psychopathology and intervention will be twenty five years from now.

As any good soothsayer will attest, predicting the future is not an easy task. People who are proficient at speculation are usually those who have a good grasp of the present and an astute understanding of the past. In this chapter, I will attempt to venture some educated guesses about the future of psychopathology by considering the current state of the field, while also being sensitive to theories and hypotheses that were viewed as tenable in the recent past. I find it helpful to take a critical look at beliefs that once seemed reasonable but are now regarded as facetious. For example, psychopathologists of the 1970s delineated psychotic mental disorders as either 'functional' or 'organic.' In DSM-II (American Psychiatric Association, 1968), schizophrenia was listed in a section entitled 'Psychoses Not Attributed to Physical Conditions.' Although the authors of DSM-II did not offer etiological hypotheses regarding the cause of disorders such as schizophrenia, the notion was widely held at the time that people could develop this disorder from being raised by a 'schizophrenogenic mother.' In fact, in the debate with my friend, he pointed to this notion in support of his premise that life experiences are sufficient for explaining the development of even the most severe forms of disturbance. I wish that I could revisit that debate now that thousands of research studies have led psychopathologists to replace such ill-founded theories with hypotheses that give biology a central role in many etiological explanations.

**Theoretical Perspectives**

Psychopathology research is presently at an interesting turning point, with the emergence of biology as one of the defining factors in the etiology of many disorders. However, as we will see, biology rarely tells the whole story; rather, most disorders arise from a complex set of factors. Integrative approaches that bring together biological, psychological, and social influences are emerging as the tools with which psychopathologists are constructing tenable theories and clinicians are developing effective treatments for the new millennium. The term 'biopsychosocial' aptly captures the essence of this integrative perspective.

The diathesis-stress model is an important foundation block upon which biopsychosocial approaches are built. This model proposes that people have a predisposition, or diathesis, that places them at risk for developing a mental disorder. Presumably this vulnerability is genetic, although some theorists have proposed that the vulnerability may also be acquired very early in life as the result of certain life events, such as traumas, diseases, or birth complications (Zubin & Spring, 1977).

In order to appreciate the complexity of this integrative perspective, it is helpful to take a look at the multifaceted state of the contributing subfields. In the following sections, I will discuss the current views of biologists, psychologists, and other social scientists regarding the causes and treatments of mental disorders.

**The Biological Perspective**

Students in psychopathology courses are usually able to understand the connection between aberrant bodily and emotional functioning by considering the connection in their own experience between certain psychological phenomena and physical events in the body. For example, they know that going without food or sleep for extended periods can cause emotional havoc; a high fever can evoke hallucinations; ingested substances can provoke psychotic-like symptoms. During the past decade advances in biological psychiatry have opened many doors to understanding the ways in which psychological functioning is affected by the nervous system, the endocrine system, and genetics.

In the realm of nervous system research, promising clues to understanding mental disorders have emerged from studies of neurotransmitters, such as acetylcholine, gamma-aminobutyric acid, dopamine, norepinephrine, enkephalins, and serotonin. For example, during the past decade, special attention has been given to serotonin, which researchers now realize is involved in a variety of disorders including obsessive-compulsive disorder, mood disorders, and eating disorders. In the decade to come, researchers will certainly intensify their efforts to understand some of the ways in which neurotransmitters cause people to act, think, and feel in ways that others regard as abnormal.

Researchers will also expand their inquiry into the role of the endocrine system in causing mental disorders. In what ways do hormones cause people to act and feel abnormally? Astute clinicians recognize the importance of conducting assessments that are sensitive to this question. For example, researchers have proposed that certain 'stress' hormones become activated in cases involving melancholic depression, leading to the experience of anxiety and fearfulness (Schulkin, 1994). Experts also know that many people with mood disorders have abnormal levels of thyroid hormones, leading them to speculate about the relationship between rate of metabolism and the occurrence of manic or depressive symptoms (Sokolov, Kutcher, & Joffe, 1994). As we venture toward the next century, an increasing number of disorders will be explained in terms of endocrinological dysfunction. It is conceivable that clinicians will be able to use hormonal testing to predict the onset of some psychological problems months or years before the emergence of symptoms.

Genetic make-up is yet another biological determinant of mental disorder. Polygenic models of genetic inheritance have been proposed to explain the ways in which many genes participate in the process of determining behavioral characteristics. Scientists have developed sophisticated procedures for estimating heritability in their efforts to assess the extent of genetic influence on various characteristics. Even though genetic influences have been shown to play a prominent role in the determination of several disorders, such as schizophrenia and mood disorder, experts realize that these genetics do not tell the entire etiological story. Using a diathesis-stress approach, researchers have begun to make quantitative estimates of the relative contributions of genes and the environment to the development of a mental disorder (Buchsbaum, 1994). As genetic research becomes more sophisticated in the years to come, clinicians may be able to make predictions, perhaps prenatally, about the statistical likelihood of an individual becoming psychologically disordered.

As biological research continues to advance, and more precise modes of predicting the development of mental disorders emerge, experts in the fields of psychopathology and intervention will face many profound ethical and social dilemmas. Should we tell the 18-year-old young woman that she is destined to develop major depressive disorder twenty years from now? Should we inform the 50-year-old man that a decade hence he will be suffering from Alzheimer's Disease? Moving beyond the issues of predicting and informing, researchers in the field will be driven to formulate preventive measures so that the 18-year-old woman and the 50-year-old man can go through their lives unburdened by the frightening scenarios that would otherwise be portrayed. Perhaps medications or psychosurgical procedures will be developed that can change the course of bodily development for people carrying biological predispositions for mental disorders.

**The Psychological Perspective**

In recent decades psychopathologists have moved away from reliance on narrow theories to explain the etiology and treatment of psychological disorders, and have moved toward integrative models that tap the empirically validated contributions of divergent schools of thought. Tapping various models, including psychodynamic, behavioral, humanistic, and family systems, astute clinicians develop formulations and treatment plans from a multitheoretical perspective (Halgin, 1989).

A few decades ago there were many psychotherapists who spoke ardently about the effectiveness of particular clinical techniques, while discrediting the benefits of other approaches. Behaviorists and psychoanalysts commonly demeaned the efforts of each other, and humanistic therapists ridiculed the techniques of both these models. During the second half of the20th century, thousands of research studies have failed to demonstrate conclusively the superiority of any single model. In fact, in a meta-analysis of outcome psychotherapy studies, Wampold and his colleagues (1997) concluded that the efficacy of bona fide treatments is roughly equivalent. Perhaps this growing realization has been influential in the choice of increasing numbers of therapists to explain and treat mental disorders by turning to the tenets and techniques of more than one model. As Norcross (1997) noted, 'informed pluralism and psychotherapy integration are the Zeitgeist of the new millennium' (p. 86).

In order to understand the psychological aspects of mental illness, we turn to the major theoretical models that have been influential during the past several decades including psychodynamic, behavioral, and family systems. Although relatively less influential in the recent past, humanistic approaches have added a valuable dimension as well.

Psychodynamic Contributions

Psychoanalysis has been broadened and reformulated in recent decades to such an extent that adherents are more likely to use the label psychodynamic and to include a wide range of concepts to explain and treat mental disorders. Particularly prominent among the contributions of psychodynamic adherents is the emergence of object relations theory and technique. Object relations theorists have proposed that various mental disorders arise from an individual's failure to form an integrated self early in life because of disturbed or inadequate relations with a primary caregiver. Researchers adapted the concept of infant attachment style to understand the ways that individuals relate as adults to significant others in their lives (Bartholomew & Horowitz, 1991; Hazan & Shaver, 1994). Such investigations opened doors to understanding emotional problems that involve pathological interpersonal styles in adulthood (Sable, 1997). Experts also applied attachment theory to psychotherapy by incorporating the tenets of this approach into clinical interventions with various kinds of clients suchas disturbed families, bereaved individuals, and distressed children (Biringen, 1994). When working with an especially hostile client, for example, an object relations clinician would give particular attention to the client's early experiences with caregivers in an effort to understand how the individual developed such a distancing interpersonal style.

Recognizing that the traditional techniques of long-term psychoanalysis are not viable in the contemporary clinical world, clinicians have adapted some psychodynamic tenets in the development of short-term models of intervention. Binder, Strupp and Henry (1995) formulated time-limited dynamic psychotherapy (TLDP) in which the psychotherapeutic process is viewed as a set of interpersonal transactions in which 'the therapist uses the relationship with the patient as the primary medium for bringing about change' (p. 53). In TLDP change comes about through the 'recognition of patterns of interactions with others that continuously reinforce maladaptive attitudes and feelings about oneself and others' (p. 54).

Behavioral and Cognitive Contributions

Behaviorally based models of understanding and treating mental disorders generated considerable excitement as theorists moved beyond the narrow behaviorism of the first half of the 20th century and formulated innovative approaches, such as social learning, cognitive-behaviorism, and behavioral medicine, during the latter decades of the century. Social learning theorists demonstrated the ways in which maladaptive behaviors are learned through observing other people being reinforced for engaging in those behaviors. For example, children raised by violent parents are likely to model violent behavior when they are frustrated. Social learning principles, such as those pertaining to modeling, can be applied in situations in which the observation of healthy and appropriate behavior is particularly important. For example, children can be taught to manage stressful situations by observing others dealing effectively with potentially upsetting circumstances.

Within cognitively based approaches, theorists emphasized the central role that thought processes play in the acquisition and treatment of various disorders. During the 1980s and 1990s many behaviorists redefined their approach as cognitive-behavioral or simply 'cognitive' (Craighead, Craighead, Kazdin, & Mahoney, 1994), thereby emphasizing the thoughts and unobservable processes that determine behavior. The cognitive approach developed most comprehensively with efforts to understand and treat depression (e.g., Beck, 1991; Ellis, 1998), but impressive advances were also achieved in the realm of anxiety disorders (Barlow & Brown, 1998; Steketee, 1998). What is particularly exciting about the work of cognitive-behaviorists is the notion that many symptoms, previously viewed as uncontrollable by the patient, have been brought under control by teaching individuals ways to change their thoughts and thereby change maladaptive emotions. As a result of the efforts of cognitive behaviorists, clinicians can look beyond antianxiety and antidepressant medications in formulating treatments for various conditions. For example, Barlow and Brown (1998) comment that the psychosocial treatment of panic disorder is one of our profession's success stories. The refinement of cognitively based approaches in the years ahead should add to the excitement generated by those professionals who have demonstrated ways of using the powers of the mind to resolve emotional and behavioral dysfunction.

Behavioral medicine is an approach in which clinicians combine behavioral, cognitive, and physiological techniques in the treatment of many medical conditions. As the line that divides medical and psychological intervention becomes increasingly blurred, the benefits of behavioral medicine will become even more evident. For example, experts recognize the fact that many physical conditions, such as heart problems, respiratory difficulties, pain conditions, and even cancer can be exacerbated by stress and alleviated by behavioral and cognitive-behavioral methods. The emerging field of psychoneuroimmunology has focused attention on the connections among psychological stress, nervous system functioning, and the immune system. Although it is a common response to turn to medication for the relief of medical problems, in the years ahead investigators will strive to tap the inner curative powers that play such an important role in personal health.

Family Systems Contributions

The family perspective developed in the late 1960s within the emerging framework of systems theory (Haley, 1976). The underlying premise of this perspective is that the individual's personality is inseparable from the pattern of interactions and relationships within the family. Within this view, disturbance may arise from disturbed communication patterns in the family, problematic family structure, or dysfunction in the family system. For example, a man's alcoholism may be understood, not just as his problem, but rather as a problem in which all the family members play a role in maintaining (Rohrbaugh, Shoham, Spungen, & Steinglass, 1995). Adherents of this approach support interventions that involve all those in the system; so rather than treating just the individual, they involve all the members of the family.

Particularly challenging for family systems theorists is the changing definition of the American family. As we approach the next millennium, clinicians will be confronted with challenges of understanding and treating problems within the contexts of families that differ from previous family structures involving two biological parents. Single-parent households are becoming more common, especially among some groups such as African Americans (Heaton & Jacobson, 1994). It is also more common to find children being raised by gay couples, grandparents, or others with the responsibilities once held almost exclusively by two biological parents. Divorce has become so common in American society that the blended family comprised of children from two or more marital relationships is becoming commonplace. Family researchers and clinicians will devote increasing attention to the impact of new family structures on psychological development as they strive to develop interventions that are responsive to a changing American family.

Humanistic Contributions

Although few psychopathologists would suggest that humanistic psychology plays a central role in contemporary approaches to understanding and treating psychological disorders, the client-centered techniques of Rogers and the self-actualization theory of Maslow have had a lasting impact on the work of many clinicians. For example, Hans Strupp (1997), one of the most prominent psychotherapy researchers of the century notes that 'irrespective of its theoretical underpinnings, psychotherapy is anchored in, and fundamentally inseparable from, a human relationship' (p. 92). Effective clinicians recognize that techniques per se are meaningless unless there is a working alliance between the helper and the client.

As I think about the ways in which psychological theorists have contributed to the understanding and treatment of people with mental disorders, I am reminded of why I chose to pursue a career in clinical psychology rather than medicine. I have always been drawn to the curative powers of the human relationship. As I noted above, I recognize that biological contributions play an important roles in helping clinicians understand and treat mental disorders; at the same time, it is my belief that the most powerful medications in the world are limited in efficacy unless accompanied by a therapeutic relationship. In the years to come, I hope to continue to investigate the curative powers of the working alliance between client and clinician, with more focused attention to the specific aspects of a clinician's interpersonal style that are most important in helping clients derive therapeutic benefit.

The Sociocultural Perspective

The racial demographics of American society have changed drastically over the past several decades, and psychopathologists are recognizing the importance of viewing mental disorder through lenses that are sensitive to cultural differences. As the fabric of society changes, so also must definitions of mental disorder and interventions that are culturally sensitive. In a diverse society, experienced clinicians know that they must be broad in their understanding of ethnic and cultural contributions to mental disorder. There is considerable potential for bias in the assessment and treatment of people from groups who have not been members of the majority in society. For example, in the realm of psychological testing and assessment, experts have exhorted mental health professionals to develop '...more culturally sensitive ways of assessing individuals from diverse racial and ethnic backgrounds' (Suzuki, Meller, & Ponterotto, 1995, p. 680).

When diagnosing people from minority groups, it is imperative that clinicians attend to issues of cultural identity. DSM-IV (American Psychiatric Association, 1994) provides a systematic outline for attending to cultural issues in the diagnostic and treatment process. This approach prompts clinicians to consider the degree of involvement with the client's culture of origin, possible cultural explanations for the problem, and the ways in which the problem may be explained or interpreted within the individual's cultural framework.

Although advances have been made in sensitizing clinicians to the importance of attending to cultural issues in assessment and diagnosis, Casas (1995) contends that much more work is needed in the intervention realm. He points out that efforts have been made to revise traditional theories in order to increase their effectiveness with racial/ethnic minority groups, but many of these efforts have lacked a connection to theory or validation by means of controlled experimentation. In the decades to come, researchers and clinicians must sharpen their focus on these complex issues in order to respond to a society whose complexion, language, and cultural heritage will continue to change.

**Understanding and Treating Mental Disorders**

In addition to broad theoretical advances and refinements, we can also expect specific developments in how particular mental disorders are understood and treated. In this section I focus on several major diagnostic categories and offer some hypotheses about future directions that are informed by emerging trends.

Personality Disorders

Personality disorders involve long-lasting patterns of inner experience and behavior in which maladaptation is evidenced by disturbance in at least two of the following realms: (a) cognition, (b) affectivity, (c) interpersonal functioning, and (d) impulse control. This pattern is a rigid aspect of the individual and is pervasive in most situations of a person's life. People with these disorders are likely to suffer from intense inner distress or problems in most aspects of their life.

This group of disorders is comprised of a range of maladaptive personality patterns including paranoid, schizoid, schizotypal, antisocial, borderline, histrionic, narcissistic, avoidant, dependent, and obsessive-compulsive personality disorder. What factors distinguish these various conditions? This question is actually a central concern to researchers who study people with personality disorders. One of the most frustrating aspects of research on the topic of personality disorders is the lack of sharp distinctions within this group. In other words, diagnostic reliability and validity are problematic, leading to wide ranges of estimates of prevalence for several of these disorders. In the past, researchers have used various criteria in defining personality disorders and have relied on imprecise assessment instruments. Consequently, there is considerable diagnostic overlap among the disorders.

Responding to the fuzzy diagnostic situation of the recent past, some researchers have embarked on an ambitious journey to redefine the field by focusing on the relationship between personality disorders and what are referred to as the Big Five factors of personality. The Big Five consists of five broad factors of personality ' extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. As Dyce (1997) noted in his review of relevant studies, interest in this approach has intensified of late, even though the Big Five have been identified for nearly half a century. Instead of placing individuals into artificial discrete categories, proponents suggest a dimensional approach in which personality characteristics are viewed along a continuum ranging from normal to abnormal. A personality disorder would represent an extension of a set of normal personality traits that have exceeded an empirically determined level (Livesley, Schroeder, Jackson, & Jang, 1994; Millon, 1994; Widiger, & Ford-Black, 1994).

In the decades to come, investigators will strive to capture the essence of personality disorders as they move away from simplistic categories on which we have relied to capture a complex set of intrapersonal and interpersonal characteristics. Dyce (1997) contended that researchers will augment the Big Five with attention to nonpersonality factors, such as cognitive distortions, dysfunctional beliefs, and personal evaluations.

Psychopathologists will also intensify efforts to understand how and why people develop these maladaptive patterns. Central to such investigations will be exploration of spectrum models in which certain maladaptive patterns will be linked to other clinical conditions currently beyond the boundaries of the personality disorders category. For example, the hypothesized link between schizotypal personality disorder and schizophrenia may become clearer, as will the relationship between borderline personality disorder and mood disorder.

Biology is certain to provide a prominent clue to solving the puzzle of personality disorders. Researchers will determine with greater precision some of the ways in which the brain of a personality disordered individual differs from that of a person without this maladaptive pattern. For example, for decades theorists have been convinced that the brain of a person with antisocial personality disorder is somehow different from the norm. It has been presumed that these individuals have certain neuropsychological deficits that are reflected in abnormal patterns of learning and attention. But what are the differences, and what are their causes? Studies of family inheritance patterns have provided preliminary evidence in support of the heritability of criminality and psychopathy (Nigg & Goldsmith, 1994).

The study of early life experiences has also yielded clues to understanding the development of personality disorders. Of particular importance has been the effect of abuse and trauma on the emergence of a disturbed personality in adulthood (Millon, 1998). As the horrors of childhood abuse continue to come to light, we are more capable, sadly enough, of understanding what might lead so many people to lives of inner torment and interpersonal dissatisfaction. Even though a cause and effect relationship seems apparent, caution is imperative when drawing conclusions. As Paris (1997) asserts, 'Life events are rarely the cause of any mental disorder. At best, they are risk factors for psychopathology.' (p. 34) He points out that reliance on retrospective designs is a limitation of all studies of trauma in personality disordered patients. He urges researchers to examine the impact of trauma in a multidimensional framework.

In addition to the biological and interpersonal contributors to personality disorder, it will be important to consider societal influences. Millon (1998) attributes the increased prevalence of conditions such as borderline personality disorder to 'broad and pervasive sociocultural forces' (p. 19). He contends that when society's values and practices are fluid and inconsistent, as he regards them to be in contemporary Western culture, people are more likely to develop deficits in psychic solidity and stability.

Within the biopsychosocial framework, researchers will attempt to refine the understanding of personality disorders by zeroing in on the fabric and functioning of the nervous system, the role of early life experiences, and the impact of societal change. Clinicians treating personality-disordered individuals will turn to the findings of these researchers in their attempts to provide sound treatment.

Anxiety Disorders

Anxiety, a normal part of human experience, becomes a source of clinical concern when it reaches such an intense level that it interferes with a person's ability to function in daily life. Intense, irrational, and incapacitating experiences form the basis of anxiety disorders. Included in this group are the conditions of panic disorder, agoraphobia, phobias, obsessive-compulsive disorder, post-traumatic stress disorder, and generalized anxiety disorder.

Although this category shares the common feature of inordinate anxiety, the group is oddly heterogeneous when it comes to etiology. For example, it is a widely held notion that certain anxiety disorders, such as panic disorder and obsessive-compulsive disorder, are genetically loaded conditions with measurable physiological correlates (Pini, Goldstein, Wickramaratne, & Weissman, 1994). On the other hand, post-traumatic stress disorder is by definition a reactive condition in which an individual experiences an incapacitating response to a stressful life event (Meichenbaum, 1998).

Although the causes of the anxiety might differ, its manifestation in the various anxiety disorders is both physiological and emotional. In other words, people suffering a panic attack experience intense physical discomfort associated with shortness of breath, hyperventilation, dizziness, choking, heart palpitations, trembling, sweating, stomach distress, and so on. Researchers have long suspected that changes in the body trigger the sensation of panic. These changes may be the result of an underlying biochemical abnormality that may be inherited. For example, certain individuals with panic disorder seem to have higher levels of brain lactate, a normal bodily chemical whose production can be stimulated by such behaviors as aerobic exercise. And, Papp and his colleagues (1997) demonstrated that patients with panic disorder are abnormally sensitive to the anxiety producing effects of CO2 inhalation.

Even though the role of biology in understanding and treating anxiety disorders has been a central focus of some researchers, it would be naive to conclude that we could solve the puzzle of anxiety disorders by looking solely at body chemistry. During the past two decades David Barlow and his colleagues have changed the way mental health professionals understand what goes on in the whole organism of a person tormented by anxiety. Barlow and Brown (1998) have gone beyond the biochemistry of anxiety and have focused on the cognitions of a person with an anxiety disorder. Recognizing the fact that panic attacks represent brain or biochemical dysfunction, which can be activated by CO2 inhalation or injection of sodium lactate, Barlow and his colleagues focused on the individual's response to these substances as influenced mainly by psychological factors. As a result of extensive research, Barlow concluded that 'strong evidence exists that anxiety focused on future panic and the sensations associated with panic combine as a strong force in maintaining panic disorder' (p. 51).

A multitheoretical approach also makes sense for the other anxiety disorders. For example, physiological correlates of obsessive-compulsive disorder have been evident for years. Since the 1800s it has been known that obsessions and compulsions exist in people with neurological disorders, such as epilepsy and Parkinson's disease. Nearly a decade ago Judith Rapoport (1989) noted the connection between neurological conditions involving the basal ganglia and obsessive-compulsive symptoms, and she has focused on the relationship between serotonin and OCD symptoms. More recently other researchers (Robinson et al., 1995) have found anatomical differences in brain structure that suggest malfunctioning circuitry in the connections between the subcortical and cortical motor control centers. At the same time that advances have been made in understanding the biology of OCD, other researchers have progressed in their understanding of the psychology of the condition. Steketee (1998) has developed behavioral interventions involving exposure to feared obsessions and prevention of rituals that accompany the obsessions, and she has demonstrated impressive effectiveness of these psychological techniques. In fact, she notes that she would only bring in serotonergic medications prior to behavioral treatment with 'clients who have difficulty engaging in exposure treatment because their anxiety or depressed mood is extremely high' (p. 69). Steketee's work highlights the fact that for some conditions, therapeutic change can be achieved by helping clients use their own behavior-changing resources.

Dissociative Disorders

The category of dissociative disorders is comprised of dissociative amnesia, dissociative fugue, depersonalization disorder, and dissociative identity disorder. These disorders involve anxiety or conflict so extreme that part of the individual's personality becomes separated from the rest of conscious functioning. The person with a dissociative disorder experiences a temporary alteration in consciousness involving a loss of personal identity or decreased awareness of immediate surroundings. These conditions have fascinated mental health professionals for most of the 20th century and have generated considerable debate among those who study and treat people with dissociative disorders.

The phenomenon of dissociation, especially in the form of dissociative identity disorder, has been at the heart of tremendous controversy in recent years (Waller & Ross, 1997). Experts have debated the validity of the diagnosis. Prior to DSM-IV this condition was called multiple personality disorder. The label was changed to dispel some of the misunderstandings associated with the term 'multiple personality' (Hacking, 1995). Once considered an extremely rare clinical condition, diagnosis of this disorder became commonplace during the final few decades of the century. In the 50 years prior to 1970 only a handful of cases had been reported, but since 1970 there have been thousands of reports. Some experts maintain that the increase in reported prevalence of multiple personality is due to more accurate diagnosis of the disorder. On the other side of the debate are individuals who maintain that the increase in diagnosis can be attributed to the notoriety of several popular first-person characterizations and media attention. Spanos (1994) asserted that this condition had become a way for some people to understand and express their failures and frustrations, and a tactic for manipulating others for some attention and concern.

The debate over the validity of dissociative identity disorder intensifies when the topic of its relationship with childhood abuse is brought into the discussion. Researchers have noted that most clients with dissociative identity disorder report experiences of having been physically or sexually abused as children. Compounding the issue, however, are questions about the reliability of some recollections of childhood abuse. The most intense controversy in recent years has focused on the phenomenon of recovered memories, especially those that emerge during the course of psychotherapy (Bowers & Farvolden, 1996). Alarm has been expressed about the potential that some psychotherapists inadvertently plant the suggestion that an individual might have been exploited as a child. As Bowers and Farvolden (1996) note, 'we know now that suggestions of various kinds can powerfully alter belief, behavior, and memory' (p. 375). Just as clients may be led to believe that unremembered traumatic events actually occurred, they may also be led to believe that they have more than one personality.

On the other side of the debate are experts, such as Richard Kluft, who endorse the increased prevalence of dissociative identity disorder, but define the diagnosis much more broadly than the classic definition. Kluft (1998) contends that most individuals with dissociative identity disorder have dissociative experiences that are not evident to others; only a very small percentage show dramatic behaviors that would be symptoms of disturbance obvious to other people.

Looking toward future research on this diagnosis, Waller and Ross (1997) assert that the overinclusive use of the term dissociation has hampered efforts to understand the etiology and course of the dissociative disorders. They believe that 'progress in dissociation research will accrue much faster after investigators distinguish between normative and pathological dissociative states' (p. 508). Also needed is additional study of the processes of memory and the residual effects of early trauma.

Sexual Disorders

The category of sexual disorders is comprised of sexual dysfunctions, paraphilias, and gender identity disorders. During the 20th century psychologists made significant advances in understanding and treating sexual dysfunctions through the pioneering efforts of Masters and Johnson, and Helen Singer Kaplan. Particularly impressive have been integrative efforts in which clinicians blend divergent techniques in the treatment of people with sexual dysfunctions. For example, Kaplan (1998) brought together psychodynamic and behavioral work in the interventions she recommended. She also promoted a refreshing perspective on sexual problems, viewing neither person in a partnership as the patient; rather she believed that when conducting sex or marital therapy it is important to realize that it is their 'relationship that is ailing and needs to be healed' (p. 141).

As we approach the 21st century, there is less concern with the treatment of sexual dysfunction than there was two decades ago, but much greater attention to the paraphilias which involve the victimization of other people. There is no behavior in contemporary society considered more troubling than pedophilia. The sexual assault of any person, especially a child, is considered an extreme deviation from the standards of acceptable behavior in our society, and vigorous investigative efforts are under way to understand what leads people to engage in such exploitation.

With increasingly sophisticated understanding of the causes of sexual aggression, experts face the daunting task of developing intervention programs that alter the behavior of aggressors. Hall, Shondrick, and Hirschman (1993) promote differential treatments geared to the type of aggressor. For example, they contend that some individuals should be treated with physiological interventions, such as castration, hormonal treatments, and aversion therapy, while others would benefit from cognitive interventions such as victim empathy training.

Essential to the discussion of how society should respond to pedophiles is the issue of incarceration versus treatment. In American society, imprisonment is almost universally mandated, both because of the legal violations involved, and the revulsion of society to the behavior of the perpetrator. Unfortunately, no compelling evidence has emerged to support the notion that time in jail reduces the likelihood of sexually deviant behavior. As ineffective as incarceration may be, efforts to define effective therapeutic interventions have been limited in success.

Some medical interventions proposed for the treatment of pedophiles and other sexual perpetrators have created controversy which must be resolved in the years to come. Castration was a widely used treatment for sex offenders in the 1960s in European countries, but rarely used in the United States. Another invasive surgical intervention has involved psychosurgery in the form of hypothalamotomy, or destruction of the ventromedial nucleus of the hypothalamus. This procedure is intended to change the individual's sexual arousal patterns by targeting the source of these patterns in the central nervous system. In most places surgery has been replaced by other alternatives, such as medication (Berlin, 1997; Marshall, Jones, Ward, Johnston, & Barbaree, 1991).

Primary among the goals for dealing with sexual aggressors is the development of preventive strategies that reduce, ideally eradicate, this form of unacceptable behavior. Perhaps risk factors can be delineated such that parents, educators, and mental health professionals might accurately predict which young people are at greatest risk of moving toward this paraphilia in adolescence and adulthood. In the best of all worlds, corrective measures could be introduced before the problem emerges.

In reality, prevention will be only partially successful, and society will face the challenging questions of how to respond to people who are so intrusive in the lives of those less powerful. Mental health experts may be called upon to develop biological alterations for paraphilias that are far more extreme and long-lasting than any somatic interventions currently in use today.

Mood Disorders

Mood disturbance is a clinical condition with which every person can relate. At some time or other every person feels depressed, and many people experience symptoms to a degree sufficient to meet the criteria of major depressive disorder. Out of every 100 people, approximately 13 men and 21 women develop this disorder at some point in life (Kessler et al., 1994). Bipolar disorder is much less common than major depressive disorder; only 1.6 percent of Americans developing this condition at some point in life. Nevertheless, the lives of these individuals are thrown into chaos that warrants serious clinical attention.

The study of mood disorder etiology has yielded some of the most compelling findings about the role of genetics. The observation that mood disorders run in families is now well-established (Klein et al., 1995; Winokur, Coryell, Keller, Endicott, & Leon, 1995). Even in the case of suicide, genetic make-up seems to play a powerful role, as demonstrated by some carefully conducted twin research studies (Roy, Segal, & Sarchiapone, 1995).

Research on the biochemistry of mood disorder is still in a developmental stage, as investigators continue to sort out the role of various neurotransmitters. Focus has broadened beyond concern about catecholamines such as norepineprhine and dopamine to include attention to indolamines such as serotonin. Researchers are also looking at neuroanatomical differences, such as blood flow within the brain, in people with mood disorders such as depression (Bench, Frackowiak, & Dolan, 1995).

With all the excitement surrounding findings about the biological causes of depression, there is a risk that the importance of psychological and social factors will be underestimated. Attention has been drawn away from the fact that many people become seriously depressed in reaction to upsetting life events. Cognitive theorists, such as Aaron Beck, Donald Meichenbaum, and Albert Ellis, have been influential in emphasizing the role of disturbed thinking processes in the development and maintenance of depression. In the words of Ellis (1998), '...people largely depress themselves by taking their strong desires for success and relationships and irrationally raising them to absolute *musts* and demands' (p. 175). Ellis has taken an interesting integrative stance in which he acknowledges the possible causative role of biology in determining depression; however, he goes a step further by pointing out that people with endogenously caused depression may 'denigrate themselves for being depressed' (p. 176) and consequently develop low frustration tolerance.

Several researchers have focused on the powerful impact of disturbed interpersonal relationships in the lives of depressed people. Interpersonal theorists (Weissman & Markowitz, 1994) developed a model of understanding mood disorders that integrates several components. They take into consideration early life experiences that set the stage for intimacy and personal happiness later in life. Connecting the ideas of psychoanalytic theorists with behavioral and cognitive theorists, they look at the ways in which childhood failure to develop satisfying intimate relationships may lead to adult experiences of despair, isolation, and resulting depression.

Turning to the topic of therapeutic intervention for mood disorders, an increasing number of mental health professionals have turned to somatic interventions as components of a treatment plan. Although a minority of practitioners relies exclusively on medication to treat patients with serious depression or bipolar disorder, most recognize the importance of attending to interpersonal and emotional issues in treatment.

In the realm of medication, the advent of selective serotonin erupt inhibitors (SSRI's), such as Prozac, has revolutionalized the treatment of depression and several other disorders. In his 1993 book, Listening to Prozac, Peter Kramer caught the attention of millions of readers with his suggestion that Prozac need not be reserved for people diagnosed with depression. According to Kramer, Prozac (and similar medications) can quickly and easily help people with other conditions, such as low self-esteem or sensitivity to depression. Americans are apparently heeding this advice, as evidenced by annual sales of Prozac in excess of 700 million dollars (Standard & Poor's Industry Survey, 1995). The implications of such widespread prescription of this 'miracle drug' are difficult to assess, but there seems little question about the fact that countless numbers of people are seeking psychological changes and are finding that medications help them make life more pleasant. Will the daily SSRI dose become as commonplace as the morning vitamin?

In this pursuit of a panacea substance, Americans have also turned to herbs. Receiving special attention of late is the herb hypericum perforatum, more commonly known as St. John's Wort (Wills, 1996). In Germany St. John's Wort is prescribed much more widely than Prozac, and European researchers have found it to be more effective than placebo and as effective as mainstream antidepressants with fewer side effects (Klaus et al., 1996). With such promising results, we are led to wonder whether future treatment for mood disturbance will be found in one's garden or pantry.

In addition to the medical use of prescriptive substances, some practitioners are relying more and more on the incorporation of electroconvulsive therapy (ECT) in the treatment of mood disorders. For several decades this intervention was used only in the most extreme cases because of negative public attitudes and images of ECT. That has changed considerably during the 1990s, such that some practitioners actually recommend 'maintenance' ECT in which the treatment is administered over a period of several months to prevent recurrence of depressive symptoms (Steibel, 1995). For several years, practitioners were especially concerned about the possibility that long-lasting adverse effects might result from repeated administration of ECT; however, recent research reports have not provided grounds for such concern (Barnes, Hussein, Anderson, & Powell, 1997). Of continuing concern, however, for many practitioners and patients is the fact that the mechanism of the antidepressant action of ECT remains unknown, although vigorous investigative efforts have been undertaken to explain what happens in the brain as a result of this treatment (Werstiuk, Coote, Griffith, Shannon, & Steiner, 1996).

In the decades to come, the greatest promise for finding a widely accepted treatment for mood disorder would seem to lie in those interventions that can be self-generated efforts to change biological bases of mood. As evidence emerges in support of the therapeutic benefits of diet and exercise, people may take increasing control over their own emotions through behavioral changes that influence the biochemistry of the brain.

Schizophrenia

A profoundly disturbing and complex mental disorder, schizophrenia is a form of psychosis that causes havoc in the lives of people who suffer from this disorder and their family members. Between one and two percent of Americans have schizophrenia, but the resources needed to care for those whose lives are disrupted by this disorder are tremendous.

Of central importance in professional discussions about this disorder are questions about the nature of schizophrenia. Like several other conditions we have already discussed, schizophrenia is coming to be understood dimensionally rather than categorically. The notable dimensions include positive-negative and process-reactive. The most striking symptoms of schizophrenia are the 'positive' symptoms, such as delusions, hallucinations, disturbed speech, and disturbed behavior. However, experts have increased their attention to negative symptoms that involve functioning that is below that regarded as normal, such as emotional unresponsiveness, deficient communication, and loss of motivation. The process-reactive dimension differentiates schizophrenia according to how symptoms emerge ' either during a course of gradual deterioration or in reaction to stressors.

Implicit in questions about the dimensions of schizophrenia are questions about the definition of this disorder, a definition that has evolved considerably during the past century. Is schizophrenia a singular condition with many facets or a set of different but related disorders? As mentioned above, current thought leans toward the notion of a schizophrenia spectrum, with the psychotic expression of schizophrenia being related to conditions, such as schizoid personality disorder and schizotypal personality disorder.

After many decades of research on the etiology of schizophrenia, investigators have more certainty about the biological bases of this disorder than can be said about most other mental disorders. Experts are clear about the fact that the brains of people with schizophrenia differ from those of others, but investigators continue to lack certainty about the precise differences. As Stevens (1997) has noted, the search for an anatomy of schizophrenia has engendered an enormous mass of data, yet 'no morphological or microscopic abnormality has been found that is either necessary or sufficient for the diagnosis' (p. 373). In response to the heterogeneous biological picture of schizophrenia, experts are moving away from trying to understand this disorder as a single condition, but rather they are focusing their attention on symptom complexes to guide future neuroanatomical investigations (Buchanan & Carpenter, 1997).

As they continue their pursuit for an accurate biological characterization of schizophrenia, investigators will also try to pin down what causes the biological differences. Tremendous efforts have been made to define the genetics of schizophrenia transmission, yet thousands of questions remain. Family patterns of individuals with schizophrenia provide convincing evidence for genetic determinants. The closer a relative is to an individual with schizophrenia, the greater the concordance. For example, the highest concordance rate, 48%, is found in identical twins. However, the fact that the rate is not 100% leads to the conclusion that genetic influences cannot tell the whole story. In the years to come, researchers will try to understand what protects slightly more than half of the twin-siblings from developing the psychosis of their identical twin. By means of complex family studies involving efforts to separate out the role of biology from environment, investigators will continue their inquiry. Through such methods as the assessment of biological markers and genetic mapping, they will try to understand what goes on in the mind and the body of a person who develops this disturbing disorder. In other words, what is the diathesis and what are the stressors? It seems reasonable to expect that within a decade experts will be able to predict with a fair amount of certainty the odds of developing schizophrenia. They should also have a good grasp of what might increase an individual's vulnerability and what protective steps might be taken to reduce this vulnerability.

The realm of intervention for schizophrenia presents many challenges as well. Excitement has grown since the advent of such new antipsychotic medications as clozapine, a serotonin blocker that works on the neurotransmitter systems but has a different biochemical mode than traditional neuroleptics. The use of clozapine has increased substantially since the Food and Drug Administration approved it in 1990 and has been enthusiastically welcomed by the 10 to 20 percent of people with schizophrenia whose symptoms were unaffected by the other antipsychotic medications. Because major medical risks have been associated with clozapine use, pharmaceutical companies have worked diligently to develop similar medications that involve less risk. In the years to come, experts will continue to refine the formula for pharmacological interventions that are effective in quieting the tormenting symptoms of this disorder.

Even with the most effective of pharmacological interventions, experts recognize that psychological interventions will also be needed. At the very least, people who have been emotionally and behaviorally disturbed for years will need help readjusting to life once their symptoms are reduced or eradicated. In addition to social and family interventions, some therapists are promoting 'personal therapy.' In this approach, promoted by Gerard Hogarty and his colleagues, therapists strive to help schizophrenic individuals notice their physical and emotional reactions to stress, so they can learn strategies for coping with stress and relaxing in social situations. Research reports regarding the benefits of personal therapy have been startling (Hogarty et al., 1997). This kind of success serves as an important reminder to clinicians working with schizophrenic individuals that medication provides symptom relief, but not cure. People with schizophrenia need a more comprehensive intervention that returns them to and retains them in the mainstream of society.

Development-Related Disorders

The category comprising development-related disorders is large and diverse, consisting of conditions, such as mental retardation, autistic disorder, and learning disorders. Perhaps more than any other development-related disorder, attention-deficit/hyperactivity disorder (ADHD) has received the most research attention. This condition affects between 3% and 5% of the population and approximately 50% of clinical child populations (Cantwell, 1996). Children with ADHD are particularly intriguing to clinicians and educators both because of their deficits as well as their capacities. Some ADHD children are remarkably bright and charming; however, their lives are unhappy because they lack control over their own behaviors. The components of inattention and hyperactivity-impulsivity lead to a childhood or adolescence characterized by unhappiness and impaired functioning. Barkley and Edwards (1998) describe ADHD as a 'developmental disorder of self-regulation and future-directed behavior that adversely affects an individual's self-discipline, social effectiveness, and general adaptive functioning' (p. 232).

Researchers have worked earnestly to understand the biology of this disorder, with special attention to the role of genetics. During the past decade there has been increasing evidence in support of a genetic mechanism underlying ADHD, although researchers have questioned the extent to which the condition is categorical or dimensional (i.e., clearly delineated vs. behavior along a continuum). Levy and her colleagues (1997) support the notion that ADHD has an exceptionally high heritability compared with other behavior disorders; they contend that 'ADHD is best viewed as the extreme of a behavior that varies genetically throughout the entire population rather than as a disorder with discrete determinants' (p. 737).

In the years to come, experts will more precisely define the factors that cause ADHD. To date, they have focused attention on neurological deficits, genetics, birth complications, acquired brain damage, exposure to toxic substances, and infectious diseases. In addition to biological factors, they will attempt to understand the psychological contributors, such as the fact that individuals with ADHD are more likely to have grown up in a disturbed family environment (Biederman et al., 1995).

Controversy has emerged in recent years regarding the prescription of Ritalin (methylphenidate), a medication that has been demonstrated as effective in treating ADHD symptoms. Giving young children medication engenders mixed feelings in most parents, yet experts have demonstrated that most individuals with ADHD experience therapeutic benefits from these medications in which symptoms are reduced and overall adjustment is improved.

Greatest progress has been made in multifaceted treatments that involve work with the family, educators, and the child using behavior modification programs that are maintained for long periods, possibly years (Barkley & Edwards, 1998). Combining directive therapeutic interventions with medication as needed has been shown to be the most effective way of bringing order to the lives of children who feel out of control. Challenges in the decade ahead pertain to the early diagnosis of ADHD and the introduction of educative strategies directed toward caregivers during the earliest stages of ostensible ADHD behavior.

Addictive Behaviors

It is no secret that the abuse of substances has reached crisis proportions in contemporary society. Findings from the National Comorbidity Study have revealed that Americans between the ages of 15 and 54 are more affected by dependence on psychoactive substances than by any other psychiatric disturbance (Anthony, Warner, & Kessler, 1994). Over one-quarter of the U.S. population have abused or been dependent on substances at some point in their lifetime (Kessler et al., 1994).

Millions of dollars are being spent to determine why people abuse substances and how they should be treated. The biopsychosocial model (Zucker, Howard, & Boyd, 1994) has been particularly valuable in explaining the determinants of alcoholism. This model originated in part from longitudinal studies in which researchers followed individuals from childhood or adolescence to adulthood. The individuals most likely to become alcohol dependent had a history of antisocial behavior, including aggressive and sadistic behavior, trouble with the law, rebelliousness, lower achievement in school, completion of fewer years of school, and more truancy. They also showed a variety of behaviors possibly indicative of some type of early neural dysfunction, including nervousness and fretfulness as infants, hyperactivity as children, and poor coordination. These characteristics may reflect a genetically based vulnerability that, when combined with environmental stresses, leads to the development of alcohol dependence.

Children of alcoholic parents are likely to start their pattern of alcohol and drug use early in life, and by the age of 12, about one-fifth show negative consequences of substance abuse or symptoms of dependency (Chassin, Pillow, Curran, Molina, & Barrera, 1993). In addition to the fact that early alcohol use increases the likelihood of subsequent drug abuse, a person can develop a pattern of alcohol dependence by the early to mid-twenties that becomes fully established within two years (Langenbucher & Chung, 1995).

Moving beyond the notion of biological vulnerability, researchers have also focused attention on psychological processes involved in the transition from social drinking to dependence (Stacy, Widaman, & Marlatt, 1990). According to the expectancy model, people acquire the belief that alcohol will reduce stress; will make them feel more competent socially, physically, and sexually; and will give them feelings of pleasure. Young people are understandably drawn to want such experiences. In one longitudinal study of young teens, researchers found those individuals with the highest expectancies for the facilitating effects of alcohol began to drink earliest and heaviest, increasing their rate of drinking faster than teens who did not have strong alcohol expectancies (Smith, Goldman, Greenbaum, & Christiansen, 1995). This finding serves as a interesting segue into the social determinants of drinking behavior. Advertisers know that effective marketing of alcohol involves highlighting the social desirability of drinking. Drinkers are characterized as having fun, being relaxed, and being sexy, and are thus idealized as role models, especially for individuals who have only minimal experience of such pleasant feelings in their lives. As the social crisis regarding substance abuse continues to escalate, society will have to come to terms with the importance of finding less destructive pathways than psychoactive substances for achieving personal happiness and relieving inner psychological distress.

Corresponding to the integrative approach to understanding the causes of substance abuse, clinicians have recognized the importance of taking an integrative approach to the treatment of this problem. Complicating the treatment picture, however, is the fact that many individuals with a history of substance abuse also suffer from other mental and physical disorders. Schuckit (1998) highlights the complications that arise in the realm of dually diagnosed patients. He notes that 'one in three alcohol- or drug-dependent people present for care with temporary symptoms that resemble other Axis I major psychiatric disorders' (p. 262). Schuckit emphasizes the importance of careful diagnosis in which a time line is established in which the clinician considers issues of symptom onset. He also points out the fact that substance abusers are likely to suffer from one or more serious health problems that lead to the shortening of life from heart disease, cancers, suicide, and accidents.

In the realm of biological treatment of alcoholism, some clinicians have recommended the prescription of medications that are intended to alleviate symptoms of depression or anxiety. Schuckit (1998) contends that for the average alcohol-dependent individual not suffering from clearly documented independent depressive episodes, antidepressants are not particularly helpful. As for other medications, he believes that at the present time efficacy reports are preliminary. Antabuse (disulfiram) is a medication that is intended to produce a strongly aversive physiological reaction when a person drinks. Unfortunately, research on this medication has failed to demonstrate its widespread efficacy. Schuckit sees greater promise in the use of naltrexone (Trexan), an opiate antagonist. Clearly, much more research will be needed in the near future to determine which pharmacological agents are effective in reducing craving in people who are intensely addicted.

The greatest hope for effective intervention has been found in self-help contexts with Alcoholics Anonymous serving as a model for helping people who have lost control of their lives because of substance abuse. The 12 steps to recovery form the heart of AA's philosophy. The emphasis on honesty, confrontation, and storytelling are seen as essential elements of the 12-step program (Khantzian & Mack, 1994). Other important components of AA are the constant availability of people who can provide support during times of crisis and the spiritual element upon which the approach rests (Smith, 1994). It is difficult to generate data from controlled studies that self-help groups, such as AA, improve recovery rates, but clinical impressions certainly lead to such a conclusion (Schuckit, 1998).

In addition to the personal impact on the substance abuser of programs such as AA, supplementary interventions that focus on the individual's family and social circle have evolved. For example, Al-Anon provides support for people who are close to alcoholic individuals and who need help to cope with the problems that alcoholism has caused in their lives. Al-A-Teen is specifically designed for teenagers whose lives have been affected by alcoholism in the family.

Even though biological, psychological, and social interventions show promise for ameliorating the terrible emotional and medical crises in the lives of substance abusers, these efforts have had minimal impact on resolving the drug problem in society. The most important task for experts in the area of substance abuse pertains to the challenge of prevention. During the 1980s and 1990s federal, state, and local governments have poured millions of dollars into education and prevention programs directed at elementary and secondary school students. The DARE Program, the most widely tapped of these efforts, has failed to bring about a reduction in the drug problem. In fact, researchers have been dismayed by the finding that young people, who participated in this program a decade ago while in elementary school, are using illicit substances at alarming rates (Murray, 1997). Researchers, clinicians, and educators are desperately looking for ways to bring about long-lasting attitude change in young people so that they will have the wisdom to avoid falling into the catastrophic danger zone of drug abuse.

Other Psychopathological Conditions

In this chapter I focused on some of the major disorders that are of concern to researchers and clinicians in the field of psychopathology. Because of space limitations, it is not possible to discuss all the major conditions in the field despite the fact that tremendous advances are taking place in the way that certain disorders are understood and treated. Brief mention of some significant trends is warranted.

In the category of cognitive disorders, psychologists are giving increasing attention to research endeavors on conditions such as Alzheimer's Disease. All signs are pointing toward the likelihood that in the beginning years of the new millennium researchers will finally grasp the causes for this debilitating disorder of the brain. Methods are likely to be found that will suspend the deterioration that takes place and possibly even recover some of the capacities that are lost. Other forms of dementia will also be better understood. It is possible that the vigorous research efforts on various forms of dementia, such as that commonly found in people with AIDS, will lead to greater understanding of various forms of cognitive impairment. For the time being many clinicians working with patients suffering from dementia are focusing efforts to alleviate the emotional burden borne by caregivers who tend to loved ones afflicted by severe cognitive disabilities (Zarit & Zarit, 1998).

The category of eating disorders presents yet another challenge for researchers and clinicians. An alarming number of young people, mostly girls, have become entangled in patterns of eating disturbance with devastating, often fatal, consequences. Biopsychosocial approaches will serve as the means for deriving an explanation for what takes place in the body, mind, and social world of people who become caught up in a life characterized by dangerously self-destructive behaviors associated with eating. Experts in this area will continue their efforts to demonstrate how interventions such as cognitive-behavioral techniques can bring about demonstrable improvement in individuals whose lives have been ravaged by eating disorders (Agras & Apple, 1998).

**Advice to Aspiring Psychopathologists**

Each semester when I teach undergraduate courses in abnormal psychology students turn to me for recommendations about possible career paths related to the study of people with mental disorders. These students ask for pragmatic advice ranging from the kind of graduate study to pursue to the specific undergraduate courses they should take. My suggestions are rooted in the integrative approach that I have used to discuss the mental disorders in this chapter.

Of special importance to the aspiring psychopathologist is a sophisticated understanding of the human body. Beginning with the brain, it is essential to know the structure and functioning of the control center of human functioning. Advanced study of neuroscience provides tremendously important tools for understanding human behavior. In addition to focused study of the brain, the wise student studies all other major systems of the body. For example, knowledge of the endocrine system is essential for an investigator studying certain forms of mood disturbance. An appreciation for the emotional correlates of medical conditions, such as diabetes, allergies, and circulatory disease, can alert a researcher or clinician to the multifaceted causes of problems that might seem emotionally caused.

In recent years, psychologists have been debating the issue of whether they should have prescription privileges. This debate has been intense with proponents arguing that the prescription of medication will be an essential function in the work of a clinician. On the other side are those who are committed to maintaining the field of clinical psychology as one that focuses on cognitive, emotional, and psychological phenomena rather than biological and medical functions. In my view, these latter arguments are naive. As we come to grips with the fact that biological and psychological phenomena are inseparable, clinicians must be prepared to intervene somatically. Aspiring psychologists should be prepared for these modes of intervention and should be trained in procedures that involve the integration of somatic and psychotherapeutic interventions. If I were starting out today, I would still choose clinical psychology over medicine, but I would be certain to learn the most current information in the fields of physiology and psychopharmacology.

In addition to a strong foundation in the study of biological aspects of mental disorder, clinicians need to have sound training in the major psychological perspectives. This goal can be achieved by means of careful study of the history of psychology in which students develop a grasp of the tenets of the major schools of thought, with special attention to the contributions of the psychodynamic, behavioral, family systems, and interpersonal approaches. However, they will need more than academic study. The aspiring clinician needs hands-on experience working with different kinds of clients, using a variety of therapeutic techniques, in a diversity of settings. Those who are committed to working exclusively with adult clients in individual therapy should be certain to have training experiences involving the treatment of children, couples, and families. Those committed to working within a behavioral paradigm should look for opportunities to obtain supervision within a more exploratory framework. Through such broad exposure, they will gradually develop their own personal style, and in the process, learn the kind of clinical approach that works for their clients and that provides a sense of personal satisfaction for themselves.

In the decade ahead, I will continue to conduct research that I have recently initiated that focuses on helping trainees assess 'clinical style,' the qualities of personality and interpersonal interaction that enhance or impede their work with clients. This research begins by having the trainee characterize his or her therapeutic style along various dimensions (e.g., directive vs. evocative, educative vs. interpretive, confrontative vs. supportive). In addition to self-characterization, data about the trainee's clinical style are collected from supervisors and clients, as well as outcome measures, such as ratings of client satisfaction and clinical benefit. In this research, we will strive to help clinicians develop a greater understanding of the relationship between clinical style and effectiveness in general, as well as effectiveness with certain kinds of clients. My advice to aspiring clinicians is that they begin the process of self-assessment well before entering the field. In addition to intensive personal reflection, they may benefit from a personal therapy in which they explore their motivation for pursuing this career and give consideration to personal attributes that may enhance or impede their clinical work.

My research on clinical style takes place within a changing psychotherapeutic climate that is being defined by changes in the marketplace associated with the expansion of managed care health systems. Increasing emphasis is being placed on effectiveness and efficiency of interventions. For example, insurance companies are calling upon clinicians to use only empirically supported treatments in their practice. In response to such calls, leaders in the field of psychology have been working to formulate treatment recommendations called 'practice guidelines' (Nathan, 1998). Not surprisingly, these efforts have unleashed a storm of controversy, primarily because much of the research upon which these guidelines were formulated took place in laboratory rather than realistic clinical contexts. As the debate continues, educators are struggling with decisions about the content and techniques of psychotherapy training curricula. What is overlooked in many of these discussions is the personality and style of those providing clinical services. As we approach the new millennium, the onus will be on the educators of aspiring clinicians to respond to the challenges imposed by exciting new scientific findings about mental illness, inspiring data about innovative interventions, and powerful changes within health care delivery systems (Halgin, in press). At the same time we must realize that the clinician and his or her personal style will continue to be central factors in the equation. Imaginative research will be needed to understand the nature of this fascinating equation.

Finally, as we approach the 21st century, psychopathologists and clinicians need to understand our society and the forces and pressures that affect people adversely. The fields of sociology, and anthropology for that matter, provide important clues for solving pressing problems in the field. For example, researchers in the field of eating disorders know that they must attend to societal pressures on teenage girls in developing theories and interventions. In a multicultural society, clinicians are repeatedly called upon to explain phenomena and treat people within social contexts about which they have limited understanding. As the fabric of society changes, so also must the training and sensitivity of professionals. Those entering the field must make a determined effort to become educated about people whose backgrounds differ from their own. I urge my students to look for opportunities to meet and learn about people from other religious, ethnic, cultural, or socioeconomic backgrounds. In addition to social and educational pursuits, they should look for work contexts within which to expand their understanding about people.

When students ask me if I would follow the same career path if I had to do it over, I tell them that I am certain that I would. I have been fascinated over the past quarter century by my work with hundreds of clients whose lives I have tried to change for the better. In addition to facilitating changes in their lives, I have experienced change in my own life as a result of my work with these clients. I have developed a greater appreciation of the complexities of human nature. I have refined my clinical style so that I now have a better sense of what is helpful to my clients and with which kinds of clients I am most effective. And I have come to understand myself a great deal more ' my strengths, my limitations, my biases, and my sensitivities. I urge those beginning their careers to prepare for an exciting but arduous journey on which they will encounter an explosion of knowledge about human nature and abnormal behavior. On this journey they are certain also to learn a great deal about themselves. I urge them to engage in the kind of debates that excited me early in my career and to open themselves to evolving areas of investigation.

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# Chapter 13 Comparative Psychology and Animal Learning

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People have an abiding fascination with animals. Zoos and animals trained for entertainment have been popular for centuries. More recently, nature shows dealing with animal behavior can be seen on TV virtually any time of day, and pet ownership is at an all-time high. Animals can be fun, interesting, and emotionally satisfying. They can also provide important information about learning and cognition and the evolution of behavior. This kind of information can, in turn, provide important insights into what it means to be human. Scientists who have a personal fascination with animals can translate that interest into studying comparative psychology and animal learning and end up knowing more about the human animal as a result.

A Personal Odyssey

I (JEP) have been interested in science and nature most of my life. In high school I told my biology teacher I wanted to become a marine biologist and study the behavior of marine mammals. The teacher informed me that career opportunities in marine biology were nonexistent and suggested I become a physical oceanographer instead. After my first physics course in college, however, I decided to major in psychology. I discovered my passion in two courses, Experimental Psychology and the Psychology of Learning. I enjoyed designing experiments, collecting and analyzing data and I enjoyed thinking about the various theories of learning and how they might be tested. The instructor in Experimental Psychology was Dr. Henry A. Cross who conducted experiments with animals. Dr. Cross was a learning theorist who worked with rats at the time but had also conducted experiments with monkeys under the direction of Harry Harlow. What could be better, I thought, than to study animal learning and behavior in a controlled experimental setting?

I volunteered to work in Cross's laboratory and was delighted when he agreed. I was fascinated with the laboratory. In one study we examined the frustration effect; in another experiment we examined whether frustrative nonreward would stimulate alcohol intake. I worked in Cross's laboratory for three years before enrolling in graduate school. I counted myself lucky when Dr. Cross accepted me into his PhD program at Colorado State University.

Since becoming a faculty member at Southwestern University, I have been able to combine my interests in animal learning, animal behavior, comparative psychology, marine environments, and marine life. Since 1981, I have conducted experiments with a variety of aquatic animals including bass, bettas, carp, cichlids, crabs, cuttlefish, goldfish, koi, minnows, paddlefish, salmon, and shrimp,. The experiments have dealt with predator/prey interactions, basic learning phenomena including behavioral contrast and appetitive and aversive sign tracking, and problems in optimal foraging theory. I have also taken students to Northern Vancouver Island where we have observed killer whales and recorded their vocalizations related to foraging. During the summer of 1999, at the Bamfield Marine Station on Vancouver Island, British Columbia, we played back those sounds and others to salmon to determine their effects on salmon behavior. Plans are being made to extend the work in the summer of 2001.

I have come full circle since high school. I am not a marine biologist studying the behavior of marine animals, but I am a psychologist doing virtually the same thing. I am able to teach and conduct research in a laboratory, and when necessary for my personal sense of well being I am able to get away for 'field research.' A couple of months on an uninhabited island observing killer whales is good therapy. If you value nature, constantly wonder how things work, and are interested in questions about the brain and intelligence, comparative psychology may be for you. It also helps to have an abiding love and appreciation for nonhuman animals.

Remarkable Anecdotes

As one watches animals, it doesn't take long before one sees things that appear to reflect highly 'intelligent' behavior. In a lecture presented at Southwest Texas State University a number of years ago, Dr. Roger Fouts described the following conversation between a lab assistant and a chimpanzee that had learned sign language: As the lab assistant entered the chimp's living quarters, the chimp signed "Bring me orange." At this request, the assistant went to the refrigerator, opened the door, and discovered that there were no oranges. She returned to the chimp and signed "No orange." The chimp immediately signed with increased vigor, "Bring me orange." The lab assistant signed "No orange." The chimp, becoming agitated, signed again for an orange. The assistant, near despair, went to the refrigerator, opened it, looked at the chimpanzee and signed "No oranges." At this point, the chimpanzee signed, "You drive, bring me orange."

Although most of us have not conversed with chimpanzees, we have all observed or heard about episodes that appear to show remarkable intelligence in animals. Aristotle may have been the first to use anecdotes to argue for intelligence in nonhuman animals. In the *History of Animals*, he wrote: "In the neighborhood of Lake Marotis, it is said, wolves act in concert with the fishermen, and, if the fishermen decline to share with them, they tear the nets to pieces as they lie drying on the shores of the lake" (Barnes, 1984).

Anecdotes like these are fascinating, but what do they tell us about the cognitive abilities of nonhuman animals? Unfortunately, very little. Anecdotes provide captivating descriptions of behavior but the conclusions they imply are without proof. The wolves in Aristotle's story may have torn up the fishing nets for a number of reasons having little to do with revenge. Perhaps they were attracted by the smell of fish on the nets and chewed on the nets after a poor catch left them hungry. Only systematic experimentation with control groups can tell us why animals do the interesting things they do. The anecdotal method cannot accomplish that.

This chapter examines the approaches taken by scientists interested in comparative psychology and animal learning. Since both disciplines are rooted in Darwin's ideas about the evolution of morphological and psychological traits, we begin with a discussion of evolutionary theory and early considerations of the evolution of intelligence. We also describe the influence of ethology and Tinbergen's four questions. In the second part of the paper, we consider the current status of work in comparative psychology and animal learning. In the third and final section, we comment on where research on comparative psychology and animal learning are headed. Included in the last section is a bit of practical advice to students who are interested in going into comparative psychology and animal learning.

Historical Antecedents

From Charles Darwin to C. Lloyd Morgan

Modern studies of comparative psychology and animal learning have their origins in the work of Darwin and Romanes in the late nineteenth century (see Bornstein, 1980; Gottleib, 1979). Both Darwin and Romanes rejected the assumption that human mental life was unique and argued instead for continuity among animal species. Darwin became convinced that nonhuman animals had the same emotions and mental abilities as people (see Darwin's *The Descent of Man* and *Expression of Emotions in Man Animals)*. He proposed that the difference was quantitative not qualitative. Humans had more powerful intellects and a greater capacity for emotional restraint.

Romanes, who coined the term 'comparative psychology,' foresaw a field of psychological inquiry that compared the mental life of animals with human mental life (Romanes, 1884). Romanes saw a great future for comparative psychology. He believed that every known species of animal possessed intellect, and he argued that the actions of primitive species, in parallel with the homologues of biological structures, had their counterparts in the intelligent behaviors of more complex species, most notably in humans.

Romanes, and others before him, made liberal use of anecdotal evidence to support their claims. Unfortunately, the informality of anecdotes, and their inaccessibility to verification, makes them of little scientific value. Indeed, after the publication of Romanes's book *Mental Evolution in Man*, the use of the anecdotal method was seriously discredited (Waters, 1934). Guided by 'Morgan's Canon,' comparative psychologists adopted more rigorous empirical methods.

Morgan highlighted the dangers inherent in attempting to think about animals using anthropomorphic human terms. He pointed out that in comparisons between human and animal mental life, there was a tendency to ascribe to animals mental abilities that animals may not possess. He proposed a guiding principle to avoid this mistake: 'In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale' (Morgan, 1901, p. 53). Morgan's Cannon is one of the fundamental axioms of modern comparative psychology.

The Influence of Experimental Psychology

One of the major issues that interested early comparative psychologists was the evolution of intelligence. However, before they could study the evolution of intelligence, they had to decide what constitutes intelligence in animals. The definition early comparative psychologists settled on provided the impetus for the study of animal learning (see Domjan, 1987). Intelligence was defined in terms of behavioral plasticity and the ability to learn or to benefit from one's experiences. Armed with this definition, investigators began to study the evolution of intelligence by examining learning in nonhuman animals.

E. L. Thorndike was one of the first to apply a rigorous scientific methodology to the study of learning. For his doctoral dissertation, he invented the puzzle box technique, which allowed him to track the progress of learning by measuring changes in the latency of his subjects to escape from a box. Thorndike studied learning in cats, chickens, dogs, fish, and monkeys. In interpreting his findings, he rejected anthropomorphic concepts and formulated the Law of Effect, which explained learning in terms of the acquisition of S-R associations (Thorndike, 1911). Thorndike was one of the giants of early comparative psychology. The apparatus he developed for the study of learning (the puzzle box experiments), his strict methodology, and the negative conclusions he drew regarding the presence in animals of ideas, reasoning, and imitation learning all served to legitimize comparative psychology as science (Waters, 1934).

The Influence of Ethology

With research on learning, comparative psychology gained a predominantly experimental and laboratory flavor. However, comparative psychology also was heavily influenced by ethology (Jaynes, 1969). The term 'ethology' was coined in 1859 by Isidore Geoffroy-Saint-Hilaire, who advocated studying the behavior of animals in their natural habitats (Jaynes, 1969). This led ethologists to focus on naturalistic observations. The approach was systematized by Konrad Lorenz, Karl von Frisch, and Niko Tinbergen, who later shared the Nobel Prize for their efforts. Tinbergen (1951, 1963), in particular, spelled out the agenda that guides much of the contemporary research in comparative psychology.

*The Ethogram.* Tinbergen argued that the scientific study of animal behavior must begin with careful observation and description. We cannot explain why an animal acts in some fashion until we know the animal's ordinary activities. For Tinbergen, the description of behavior was a serious business. Its ultimate aim was 'an accurate picture of the patterns of muscle action' (Tinbergen, 1951, p. 7). Tinbergen championed the use of still and motion pictures, as well as careful study of the muscles involved in a particular behavior. In describing social interactions, he advocated concentrating on those behaviors in one animal that caused behavioral reactions in the other animal.

Ideally, description results in a complete inventory of the behavior patterns of a species. This is called an *ethogram.* The ethogram can then be used to formulate questions about the causes of behavior. However, Tinbergen cautioned against moving to causal issues before a complete ethogram had been obtained. A study by Baerends (1941) illustrates the strategy. Baerends observed that digger wasps dig a hole in the ground, kill or paralyze a caterpillar, place the caterpillar in the hole, and lay an egg on the caterpillar. Having laid an egg in one nest, the wasp repeats the entire sequence with other nests. After several nests have been set up, the wasp returns to her first nest where the larva has hatched and brings the larva additional caterpillars. The wasp then moves on to the second nest, and so on. Finally, the wasp returns again to the first nest and this time provides six or seven additional caterpillars. She then covers the nest and leaves it forever. The entire sequence is played out over an eight-day period, with the wasp keeping up with as many as five different nests.

How does the wasp know how much food to bring to each nest? Baerends changed the number of caterpillars in the nest by either adding or removing some and found that the number of caterpillars the wasp saw on her first visit of the day to a particular nest determined how many caterpillars she brought to that nest that day. If Baerends removed some of the caterpillars before the first visit, the wasp would bring extra ones; if Baerends added caterpillars, the wasp would bring fewer than the usual number. Changing the number of caterpillars after the first visit of the day did not influence the wasp's behavior.

This study attracted considerable attention because it showed that a wasp could remember what it saw on the first visit to a nest for at least 15 hours. This was remarkable because people at the time thought even orangutans could not remember things for more than about 5 minutes (Maier & Schneirla, 1935). Tinbergen was fond of the wasp study because it showed that with careful observations, and by studying an animal in its own habitat, one can discover remarkable mental abilities, even in the lowly wasp.

After observation and description of an animal's behavior under natural circumstances, one can begin to examine the causes of the behavior. Tinbergen (1951, 1963) pointed out that the causes of behavior can be approached from four different perspectives. These have come to be known as*Tinbergen's four questions*: 1) How does the behavior develop during the animal's life time, or what is the ontogeny of the behavior? 2) How does the animal's immediate environment activate the physiological mechanisms that generate the behavior, or what are the proximal mechanisms of the behavior? 3) How does the behavior contribute to survival and reproductive success, or what is the adaptive significance of the behavior? 4) What is the evolutionary history or phylogeny of the behavior?

*Behavioral Ontogeny*. The ontogeny question focuses on how behavior is determined or 'caused' by the progression of events that occur during an animal's life. Tinbergen considered three primary causal factors in this category: maturation, practice, and learning. Maturation refers to growth processes, in receptors, effectors, and the nervous system. Maturation can lead to the emergence of new forms of behavior without specific practice. In contrast, practice effects refer to improvements in an existing behavior brought about by mere repetition of that behavior (or of similar activities).

Learning involves a relatively permanent change in behavioral patterns that occurs as a result of experience. How learning phenomena interact with maturational and other processes was of particular interest to ethologists. Tinbergen (1951) reported, for example, that parent gulls will accept any chick that enters the nest during the first 5 days after their chicks hatch. After that, however, the parents will neglect chicks that were not in the nest earlier, and may even kill them. Evidently, parent gulls learn the identity of their offspring during the first 5 days after their chicks hatch.

Analogous individual recognition learning does not seem to occur during incubation. Although gull eggs differ in color, size, and speckling pattern, incubating hens will accept strange eggs with impunity. Learning during the incubation period seems to be focused on information identifying the spatial location of the nest. If an experimenter removes the eggs from an established nest and places them a few feet away, the gull may continue to sit on the empty nest in full view of the displaced eggs.

The fact that gulls learn about the spatial cues of their nest but not the identity of their eggs makes sense in terms of their natural habitat. During the incubation phase, the hen leaves the nest periodically to obtain food or to scare off or decoy predators, after which she has to be able to find her way back. Ordinarily the location of the eggs and the nest does not change. On the other hand, once the chicks hatch, they soon become mobile. Therefore, the hen has to be able to distinguish her chicks from those of neighboring hens. These differences in what the gulls learn about at different stages of their reproductive cycle illustrate what Tinbergen called special 'dispositions to learn' (Tinbergen, 1951, p. 145). Such specializations in learning remain of considerable contemporary interest (e.g., Domjan, 1997).

*Proximate Mechanisms or Immediate Causation*. The second question posed by Tinbergen concerns immediate causation or the proximate mechanisms of a behavior. To identify immediate causes, it is important to know what external and internal stimuli are available to the animal. Weakly electric fish, for example, are able to produce and perceive slight changes in an electrical field. These animals use changes in electrical fields to detect prey, conspecifics, and mates, and to regulatetheir dominance hierarchies (Hopkins, 1977). Most other organisms, including humans, cannot perceive these subtle changes in electric fields. Given the contrasting sensory worlds of diverse species, Tinbergen (1951) noted that investigations of sensation and perception are critical to the study of immediate causation.

Numerous investigations have addressed the external causes of behavior. Tinbergen referred to one class of stimuli that cause behavioral patterns to be emitted as sign stimuli or releasing stimuli. Such stimuli release species typical response patterns. For example, Gallup (1974) examined tonic immobility, which appears to be an innate response that evolved as a defense against predation (Ratner, 1967). During a period of tonic immobility, or death feign, the animal becomes immobile in response to some aspect of the predator. Gallup and his co-workers were able to show that the death feign response in chickens was released primarily by visual presentation of the eyes of a predator. Even artificial eyes mounted on wooden dowels and directed at young chickens produced the tonic immobility response (Gallup, Nash, & Ellison, 1971). The eyes of a chicken hawk, the red breast of a robin, the red belly of a stickleback fish are all examples of external stimuli that elicit certain behaviors.

*Adaptive Function*. Tinbergen viewed organisms as living in an extremely unstable state and advised scientists to examine how particular behavior patterns aid survival. This question is not as easy as it seems at first glance. Different species solve problems related to survival in different ways. For example, pigeons drink water by sucking whereas most other birds drink water by scooping. Both behaviors are adaptive, and one is no better than the other in an absolute sense. The difference between them is best explained by the evolutionary history of the species involved. Sucking and scooping are convergent solutions based on different evolutionary histories. Tinbergen (1951) suggested that the 'study of convergences helps to show up adaptiveness.'

Tinbergen (1963) distinguished between questions of adaptive significance and immediate causation in the following manner. Immediate causation examines the preceding events that contribute to a behavior. In studying immediate causation, the researcher looks 'back in time' to determine why an animal behaves in a particular fashion. In contrast, in studying adaptive function, the researcher looks 'forward in time' to determine how a particular behavior contributes to the animal's survival or reproductive success. Questions of adaptive significance are more difficult to answer because the researcher has to compare how one behavior, structure, or learned event actually increases reproductive success or survival over another behavior, structure, or learned event.

*Evolutionary History*. Tinbergen (1951) noted that studies of the evolution of behavior have lagged far behind studies of the evolution of morphological traits. This is probably because describing behavior is more difficult than describing morphology. Distinguishing between innate differences in behavior versus acquired differences is often also difficult, and behavior is not well represented in the fossil record. However, studying fossilized animal tracks (Seilacher, 1967), examining the structure and type of environment in which the fossil was found, and identifying fossilized bones found in the stomachs of fossilized animals can tell us much about the behavior patterns of ancient organisms.

The evolutionary origins of a behavior also may be uncovered by studying behavioral homologies. Tinbergen advocated comparing behaviors in one species with corresponding behaviors in another species, and then determining whether the similarities reflect a common genetic background or convergent evolution. Lorenz provided careful descriptions of behavior in birds and showed how such descriptions could be used to develop classification systems (Lorenz, 1971). Other approaches to uncovering the evolutionary origins of a behavior involve studying behavior genetics, relations between mutations and behavior, and the formation of new species (speciation) and behavior.

Current Status

Where have these historical antecedents led the study of comparative psychology and animal learning? If we were to ask particular investigators, the answers we would get would be colored by their individual perspectives and biases. A more even-handed description might emerge from a content analysis of what is being published in comparative psychology and animal learning. We elected that approach and examined the articles that appeared from 1990 to 2000 in a prominent journal that contains primarily research on comparative psychology (the *Journal of Comparative Psychology* or JCP) and a journal that contains primarily research on animal learning (the *Journal of Experimental Psychology: Animal Behavior Processes* or JEP:ABP). Both of these journals are published by the American Psychological Association and have a long and distinguished history that goes back more than a hundred years. Although they are not the only journals in which research relevant to comparative psychology and animal learning may be found, JCP and JEP:ABP publish primarily the work of psychologists (rather than zoologists or biologists) and therefore provide a good window on the activities of psychologists in these fields.

Perusing current research in comparative psychology and animal learning, one is immediately struck by the wide range of issues that are addressed. There are virtually no limits to what aspect of behavior a particular scientist may choose to study. As a starting point for our content analysis, we were guided by Tinbergen's questions of ontogeny, immediate causation, adaptive function, and evolutionary history. However, we deviated a bit from his definition of these categories to be more consistent with current usage. In contemporary thinking, studies of learning are considered to involve questions of immediate causation rather than ontogeny. We followed this convention and categorized studies of learning as relevant to immediate causation unless an explicit developmental issue was being addressed.

[Table 1](http://teachpsych.org/ebooks/faces/text/Ch13.htm#table1) summarizes the proportion of the papers published in JCP and JEP:ABP that were devoted to questions of ontogeny, immediate causation, adaptive function, and evolutionary history. Modern studies of comparative psychology focused primarily on behavioral ontogeny and immediate causation. Only 4% of the papers in JCP addressed the adaptive function question, or how a particular behavior contributes to survival and reproductive fitness. Nearly three times as many papers (11%) address the question of evolutionary history. In contrast, studies of animal learning, as exemplified by the research published in JEP:ABP, dealt primarily with questions of immediate causation. Ontogenetic investigations and studies with a focus on adaptive function or evolutionary history hardly ever appeared. Overall, comparative psychologists examined a wider range of activities than students of animal learning and were more concerned with the ontogenetic and phylogenetic context of behavior. In contrast, students of animal learning concentrated on how a behavior is controlled by recently experienced events.

Specific Issues and Examples

*Ontogeny.* In JCP, most of the studies of behavioral ontogeny focused on either cognition (30%) or social behavior (51%). Interestingly, 70% of the studies of cognitive development involved primates (apes, humans, or monkeys). Investigators reported on issues of cognitive development raised by Piaget, such as ontogeny of sensorimotor intelligence, object permanence, and conservation. Research on the ontogeny of social behavior addressed issues of agonistic behavior in mice, maternity (maternal attachment, parental care by the mother, and maternal aggression) and communication within a social context (song development in birds, affiliative vocalizations in birds and monkeys, grunt communication in humans, and whistle contour development in dolphins).

One of the studies of ontogeny published in JCP characterized the development of tool use in infant chimpanzees (Inoue-Nakamura & Matsuzawa, 1997). These investigators observed chimpanzees in the field at Bossou, Guinea, from 1992 to 1995. On 692 occasions they saw an infant manipulate a nut with a stone. They also recorded 150 episodes of an infant observing an adult manipulate a nut with a stone. The results showed that the wild chimpanzees began to use hammer and anvil stones to crack open oil-palm nuts at three and a half years of age. The infant chimps demonstrated mastery of all the basic actions necessary for nut cracking by two and a half years of age, but they did not combine the responses in an appropriate sequence until they were a year older.

In another study of behavioral ontogeny, Hanson and Coss (1997) examined age differences in the response of California ground squirrels (*Spermophilus beecheyi*) to predators. California ground squirrels encounter a variety of predators including snakes, mammals (badgers, dogs, coyotes), and birds (hawks and eagles). The degree of danger presented by these predators differs depending on age. For example, adult ground squirrels are in less danger from snakes than infants due to their ability to physically retaliate and their strong resistance to rattlesnake venom.

Hanson and Coss (1997) asked whether the antipredator responses to bird and mammal predators would differ according to age. Juvenile and adult ground squirrels were videotaped responding to a brief presentation of a live dog or a model of a red-tailed hawk in simulated flight. The juveniles did not differentiate between the bird and mammal predators and responded to both as dangerous. In contrast, the adults treated the hawk as of more immediate danger than the dog. In a second experiment, juveniles and adults were presented models of red-tailed hawks, nonthreatening turkey vultures, and crows. At neither age did the ground squirrels discriminate among the bird predators, though adults treated the aerial predators as more dangerous than the juveniles. The authors concluded that learning might play a role in the anti-predatory behavior of California ground squirrels.

*Immediate Causation.* The second question proposed by Tinbergen concerned immediate causation. More of the articles we looked at dealt with immediate causation than with any of the other four categories of research questions. However, the emphasis on studies of immediate causation was greater in JEP:ABP than in JCP.

Immediate causal mechanisms can be examined for any behavior. Indeed, the studies of immediate causation covered a remarkably large range of behavioral phenomena.

A list of the topics and the number of papers relevant to each topic that we encountered in studies of immediate causation in JCP and JEP:ABP are presented in [Table 2](http://teachpsych.org/ebooks/faces/text/Ch13.htm#table2). Both comparative and learning psychologists studied perception/attention, memory mechanisms, basic learning processes, and complex cognition. However, there were differences in emphasis. As might be expected, learning and memory phenomena were addressed in much greater detail in JEP:ABP than in JCP. In addition, studies in JEP:ABP dealt with forms of learning (such as drug conditioning and conditioned changes in pain sensitivity) that were not examined by comparative psychologists. In contrast, comparative psychologists examined a much wider range of behaviors. These included various aspects of reproductive behavior, social behavior, foraging, as well as defensive behavior and aggression.

Another interesting point of contrast between comparative psychologists and investigators of animal learning is that comparative psychologists were more likely to tackle forms of cognition that have been primarily associated with human beings. These included topics such as perspective taking, theory of knowledge, and imitation. An important task in studies of these and other forms of animal cognition is to isolate the factors that control the animal's behavior. Only if the immediate causes of the behavior are clearly identified can one decide whether the observed behavior reflects complex cognitive processes or simpler associative and perceptual mechanisms. Studies of imitation clearly illustrate this problem.

In 1949, Fisher and Hinde reported on birds (blue tits) that had been robbing cream from milk bottles delivered to the doors of English homes. Observers speculated that a single blue tit had discovered, probably quite by accident, how to peck through a bottle cap and consume the rich cream that floated on top of the milk. The occurrence of milk theft then gradually spread throughout the whole of England and into Europe through some form of social learning.

Fisher and Hinde argued that animals can acquire information through social interaction and that acquisition of such information may prove to be adaptive. The question is what exactly is being transmitted? Is information about stimuli being transmitted or are the animals learning about responses? Did the first bird to open a milk bottle transmit information about the stimulus (milk bottles are predictive of food) or about the response required to open the bottle (when you encounter these types of objects, open the bottle in the following manner)?

Social learning that occurs because of increased attention to particular stimuli is called 'local enhancement.' Local enhancement was defined by Thorpe (1956) as 'an apparent imitation that resulted in one animal directing another animal's attention to a particular object or to a particular part of the environment' (p. 134). The cream theft behavior exhibited by blue tits may have been an instance of local enhancement in that the behavior of one blue tit served to direct the attention of a naive bird to the milk bottle. Once drawn to the milk bottle, the naive bird may have learned to open it without paying attention to how another bird did that.

Local enhancement is difficult to rule out in studies of imitative learning because the imitated response usually occurs in the context of distinctive cues that may attract more attention when the demonstrator performs its prescribed response. A particularly effective procedure for controlling local enhancement effects is called the 'two-action method'. In the two-action method, different demonstrators respond to a stimulus in distinctive ways. In a recent study, for example, Akins and Zentall (1996) trained domesticated quail to manipulate a small platform (3.8 cm square) by either pecking it or stepping on it. Once the demonstrators learned to either peck or step on the treadle, one group of observers was allowed to watch a demonstrator peck the treadle, and a second group was allowed to watch a demonstrator step on the treadle. The purpose of the experiment was to determine whether observers acquired the specific response they saw their demonstrator perform.

The two-action method assumes that local enhancement will occur with either demonstrated response. In the Akins and Zentall study, pecking the treadle and stepping on it should have drawn attention to the treadle equally. Thus, if seeing the demonstrators manipulate the treadle produced local enhancement, it should not have mattered whether the demonstrators pecked or stepped on the treadle. Contrary to that prediction, however, the response of the observers matched the response form they had seen their demonstrator perform. Quail that observed demonstrators peck the treadle were more likely to peck than to step on the treadle, and quail that observed demonstrators stepping on the treadle were more likely to do that than to peck. This shows that imitative learning can occur independent of local enhancement.

*Adaptive Function*. Psychologists rarely examined the question of adaptive function - how a particular behavior increased an animal's chances of survival and reproductive fitness. Only 20 papers in JCP focused on this issue and none examined adaptive significance in JEP:ABP. In JCP, the majority of the papers on adaptive function examined reproductive fitness. Investigations addressed paternity advantages accrued from conditioned stimuli, preference for phenotypical variation in mates, acoustic behaviors related to increased survivability and mating success, the strange-male effect, and unusual patterns of copulatory behavior. Other papers examined investigation behavior in snakes, predatory and anti-predatory behavior in snakes and mice, and cues used to increase foraging efficiency in monkeys who forage at night.

In one of the most dramatic studies of reproductive behavior, Karen Hollis and her undergraduate students at Mount Holyoke College asked whether stimuli that reliably predict events of biological significance (classically conditioned stimuli) lead to greater survival or reproductive success (Hollis, Pharr, Dumas, Britton, & Field, 1997). They worked with blue gouramis (*Trichogaster trichopterus*), a freshwater fish that lives in the tropics. Male blue gourami are territorial and aggressively defend their nest sites. Often this aggressiveness interferes with their ability to attract females and mate because males chase off females as well as males. To determine whether classically conditioned stimuli could have adaptive value in this situation, Hollis presented male blue gourami with a signal followed by presentation of a receptive female fish. Subjects in a second group also received presentations of the stimulus and a receptive female, but these were unpaired.

Following a short training phase, the males were given an opportunity to mate. For one group, the arrival of a female was signaled by presentation of the classically conditioned stimulus. For the other group, the arrival of the female was not signaled. Signaling the arrival of the female had multiple effects. First, males that received the Pavlovian signal showed less aggression towards the females compared to the males in the control group. Second, the classically conditioned males spawned with the females sooner, clasped the females more often, and most importantly, produced far more young than did males in the control group. This experiment provided the first direct demonstration that classically conditioned stimuli can significantly contribute to reproductive success and supported Hollis's contention that classical conditioned stimuli have adaptive value.

*Evolutionary History*. Perhaps the most difficult of Tinbergen's questions to get evidence for concerns the evolutionary history of a behavior. The evolution of behavior is rarely addressed by any single research report. Rather evolutionary issues are discussed in papers that attempt to integrate the results of studies with various species. As [Table 1](http://teachpsych.org/ebooks/faces/text/Ch13.htm#table1) indicates, such papers appeared primarily in JCP. Of the 53 papers in JCP concerned with ultimate causation, 32 dealt with laterality or handedness and were conducted with primates. Other papers concerned the heritability of behavior, the evolutionary history of tool use, evolution of foraging and defense behavior, and evolution of communication signals.

What is the point of studying laterality in primates? Comparative psychologists study handedness in an effort to obtain information about the evolution and development of complex cognition. Annett (1985) reported that approximately 90% of the human population is right-handed. Because movements of the right hand are controlled by the left side of the brain, right-handedness reflects a left hemisphere specialization for manual control. Language is also controlled by the left side of the brain. These observations have been used to argue that left-hemispheric specialization for manual control played an important role in the evolution of language and other cognitive functions (Calvin, 1994). The possible connection between handedness and complex cognition has encouraged comparative psychologists to study the extent and the nature of handedness in animals and to use that information to answer questions related to the evolution of intelligence.

Westergaard and Suomi (1996) of the National Institute of Child Health and Human Development examined hand preference in tufted capuchins (*Cebus apella*) and rhesus macaques (*Macaca mulatta*). Plastic tubes lined with food were presented to the monkeys. To get the food, the monkeys had to hold the plastic tube with one hand and dig out the food with the other. The tests showed a population-level bias toward use of the right hand in rhesus monkeys but not in capuchin monkeys. In addition, the capuchin monkeys showed greater hand preference on an individual basis than did the rhesus monkeys. Finally, for capuchins, but not for rhesus monkeys, the hand preference was greater for adults than for immature animals.

In a recent follow up, Westergaard, Kuhn, and Suomi (1998) studied the influence of bipedal posture on hand preference in humans and rhesus monkeys. Humans and rhesus monkeys were observed reaching for objects from either a quadrapedal or bipedal posture. Human participants demonstrated a right-hand population-level preference for the right hand regardless of whether they reached from a quadrapedal or bipedal posture. Rhesus macaques showed a left hand population-level preference when reaching from the quadrapedal posture, but a significant shift toward the right hand when reaching from the bipedal posture. When the authors examined preferences for 10 primate species, they discovered that right hand preferences appear to be correlated with bipedal reaching. The authors conclude with the interesting idea that bipedalism 'may have facilitated species-typical right-handedness in humans.'

Species Diversity

In 1951 Tinbergen denounced comparative psychology as being too narrow in its focus on learning and in its use of a small number of laboratory species (see also Beach, 1950). He was not amused by the fact that Tolman dedicated his famous 1932 book *Purposive Behavior in Animals and Men* to the albino rat. Tinbergen commented that 'in spite of the high respect deserved by the interesting work done with rats, one should be a little skeptical of the laboratory rat as a representative of the whole animal kingdom' (Tinbergen, 1951, p. 11.).

Tinbergen's criticism was justified at the time but does not apply to contemporary work in comparative psychology. Between 1990 and 2000, articles in JCP involved research with 132 different species. Each year, an average of 33 different species served in comparative experiments. The most frequently used species were rats (*Rattus norvegicus*), chimpanzees (*Pan troglodyte*), humans (*Homo sapiens*), rhesus macaques (*Macaca mulata*), capuchin monkeys (Cebus apella), pigeons (*Columba livia*), and honeybees (*Apis mellifera*). Primates (humans, apes, and monkeys) were the subjects of investigation in 36% of the papers published in JCP. Studies with birds (23%) and rodents (22%) constituted the next most popular choices. The diversity of species employed was remarkable. From earthworms(*Lumbricus terristris*) and cuttlefish (*Sepia officinalis*) to bonobos chimpanzees (*Pan paniscus*), comparative psychologists are using many different kinds of animals.

The diversity of species that we found in JCP did not carry over to JEP:ABP. In JEP:ABP, primates (including humans) were the subject of 11% of the research reports. In contrast, rats and pigeons accounted for 78% of the papers. However, since 1990 JEP:ABP has also included studies with zebra finches, dolphins, Clark's nutcrackers, chickadees, ferrets, gerbils, honey bees, humming birds, junkos, scrub jays, starlings, and quail.

The Future of Comparative Psychology and Animal Learning

Coming Back Together

Although comparative psychology and animal learning had common origins in the writings of Darwin and Romanes, the two areas subsequently developed in different directions. Animal learning came to focus on the mechanisms of behavior and invested much of its energy in detailed exploration of a limited number of species and a small number of experimental preparations. In contrast, comparative psychology was moved by the influence of ethologists to consider a broad range of behaviors and species, using a variety of experimental techniques. However, investigators of both comparative psychology and animal learning have preferred the laboratory to the field. Between 1990 and 2000, only nine papers in JCP and none in JEP:ABP focused on field observations. Interestingly, of the nine papers, seven were from 1998 and four of these papers were published in 2000. Perhaps we are seeing the beginning of a trend toward greater use of field observation in comparative psychology.

We predict that the future will see comparative psychology and animal learning come back together again. Investigators of animal learning will increasingly turn their attention to the wide range of behaviors that comparative psychologists have been studying. This will lead to more studies of how learning is involved in various forms of social behavior, such as sexual behavior, maternal and paternal care, kin selection, dominance hierarchies, territorial behavior, and predator/prey interactions.

Both comparative psychology and animal learning will continue to be concerned with issues of behavioral evolution. In particular, studies of behavioral evolution should get a special boost from technological advances in biology such as gene splicing and DNA fingerprinting. In addition, we hope that studies of animal learning will include a broader range of species, and species specifically selected to highlight adaptive specializations and evolutionary influences on learning.

It will continue to be important for investigators in comparative psychology and animal learning to be sensitive to how their laboratory paradigms are related to the ecology of their species. As Tinbergen (1951, 1963) pointed out, it is important to know the behavioral patterns of the species being studied. Naturalistic observation can inform investigators of what aspects of behavior can profitably be investigated to address questions related to learning and cognition. Naturalistic observation is also a rich source of hypotheses for later laboratory investigations.

One of the dramatic findings from our content analysis was the relatively little effort being devoted to studies of how certain behaviors or behavioral mechanisms promote survival and reproductive fitness (see [Table 1](http://teachpsych.org/ebooks/faces/text/Ch13.htm#table1)). We hope that studies of the adaptive functions of behavior will attract more of the attention of both comparative psychologists and students of animal learning in the coming years. Tinbergen's four questions were proposed nearly half a century ago and all of them have become well accepted as necessary for a comprehensive account of the causes of a behavior. It may be time to put these sentiments more fully into practice by devoting more effort to studying the functional significance of the behaviors that attract our attention.

Some of the trends we are predicting are already underway. Contemporary interest in mechanisms of memory and other forms of animal cognition are evident in recent issues of JEP:ABP. This represents a shift away from associationistic problems to broader issues of comparative cognition. Some investigators of learning are also starting to move away from the simple lights and tones that were commonly used in traditional studies of learning to more complex, and presumably more ecologically valid, stimuli (Cook, Cavoto, Katz, & Cavoto, 1997; Fetterman, 1996; Spetch, 1995).

Another trend that will be evident in comparative psychology and animal learning is greater interest in the physiological mechanisms of behavior. This in turn will lead to more interdisciplinary research. Traditional boundaries between different fields of science (chemistry, biology, physics) are eroding, and this is accompanied by greater interest in investigating phenomena at multiple levels of analysis. Psychological phenomena like cognition and learning can be described at the level of behavior, or at the level of neural structures and networks, neurotransmitter systems, or cellular mechanisms. In the past, individual investigators worked primarily at one or another level of analysis. It is now time to put all the parts and levels back together. We need to know how events occurring at the cellular level influence the operation of neural systems and how neural networks determine observable behavioral actions. Increasingly investigators will be working in interdisciplinary teams to create an integrated model of animal learning and behavior.

Two Nagging Unresolved (Unresolvable?) Problems

The evolution of cognition and learning has been difficult to study because as one traces back an evolutionary lineage, at some point one has to demonstrate the absence of a phenomenon or skill. However, the failure to find a particular cognitive skill may say more about the ineptitude of the experimenter than the ineptitude of the animal being studied. As experimenters have become more skillful in examining the behavioral potentials of animals, the documented skills of the animals havealso increased. For example, early comparisons of pigeons and monkeys suggested that pigeons cannot learn a generalized same-different concept but monkeys can. However, with subsequent improvements in behavioral technology, pigeons have been shown to be perfectly capable of the task (e.g., Wright, Cook, Rivera, Sands, & Delius, 1988). Thus, as the experimenters have become smarter in examining the cognitive capacities of pigeons, they have found pigeons to seem smarter as well.

Interpretation of the evolutionary lineage of a particular cognitive or learning capacity also has been hampered, ironically, by increases in theoretical sophistication. In some cases, seemingly 'intelligent' behavior has turned out to be mediated by fairly elementary associative mechanisms. Recent analyses of the phenomenon of transitive interference illustrate this type of development.

Transitive inference involves forming a mental representation of a sequence of stimuli based on training with only two of the stimuli at a time. Consider for example, five stimuli, which we could label A, B, C, D, and E. During training trials, subjects are exposed to one pair of stimuli at a time. The training pairs are A-B, B-C, C-D, and D-E. Which stimulus is presented on the right or the left in the stimulus display is varied randomly across trials. With each stimulus pair, the subject is reinforced (with food, for example) for selecting the stimulus that is closer to the beginning of the alphabet. Thus, in a choice between A and B, the subject is reinforced for choosing A, but in a choice of B and C, the subject is reinforced for choosing B.

With this kind of training, stimuli (B, C, and D) appear equally often as reinforced and non reinforced stimuli. The main point of the experiment is to determine how the subjects will respond during a test trial when they encounter a novel pair of stimuli, B vs. D for example. Based on how often stimuli B and D were reinforced during training, there should be no basis for selecting between them. However, if the subject learned that the stimuli form a linear sequence A ® E, it should select B over D. Such a choice is considered to be evidence of 'transitive inference' and is presumably based on the subject having extracted the entire stimulus sequence A® E from its experience with the stimulus pairs during training.

Transitive inference was first documented in chimpanzees and people and was interpreted as demonstrating a complex cognitive skill. More recently, however, transitive inference has been demonstrated in pigeons as well, and this work showed that such seemingly complex cognitive performance can in fact be explained by the fairly elementary associative mechanism of value transfer (Couvillon & Bitterman, 1992; von Fersen, Wynne, Delius, & Staddon, 1991; Zentall & Sherburne, 1994). According to value transfer, a non reinforced stimulus gains some 'value' or associative strength by stimulus generalization if it occurs in combination with another cue that is reinforced. This mechanism predicts that subjects will select B over D following training with adjacent stimulus pairs in a transitive inference procedure because the training pairs permit more transfer or generalization of associative value to stimulus B than to stimulus D.

The history of research on transitive inference illustrates how pigeons have become more capable as experimenters have become more sophisticated in the design of their experiments. This history also illustrates that a phenomenon that appears to reflect the operation of a fairly complex cognitive process (transitive inference) may in fact be produced by simple associative mechanisms once those associative mechanisms are successfully identified. Clever Hans was an early example of cleverness that upon further analysis turned out to be not so clever (see Pfungst, 1965). The future will no doubt continue to challenge us with examples of complex cognition that turn out to be not so complex.

Keeping the Torch Burning

Comparative psychology and animal learning originated as areas of pure research. Some of the findings have formed the basis for applications to education and behavior therapy, but comparative psychology and animal learning continue primarily as scholarly and intellectual endeavors. Students seeking a career in these areas are pretty much restricted to positions at colleges, universities, and research institutes. Unfortunately, not many positions explicitly calling for someone in comparative psychology or animal learning become available each year. Students are more likely to succeed in obtaining employment if they also have strong skills in experimental design, statistics, and various laboratory procedures so that they can fulfill the requirements for positions in general experimental psychology.

Experimentation in comparative psychology and animal learning is expensive and most of it is funded by government agencies. Because of this, future investigators are well advised to hone their writing skills, learn as much as they can about potential sources of funding, and gain experience in writing grant applications.

Whether young or old, all investigators have to justify their work to be successful. One approach to justifying comparative psychology and animal learning is to argue that knowledge in these areas is essential for other important lines of inquiry. For example, one cannot begin to examine the physiological basis of a behavior without first studying the behavior itself. This requires determining how to measure various aspects of the behavior and figuring out how these behavioral parameters are governed by procedural and stimulus variables. Comparative psychology and animal learning provide the behavioral technology that is the foundation for physiological investigations of brain-behavior relationships. Behavioral work with animals is also essential for the development and testing of psychopharmacological agents, for understanding how commonly abused drugs affect behavior, and for research on the psychological effects of toxins in the environment and in food.

Research in comparative psychology and animal learning is also easy to justify for its own sake. Insight into comparative psychology does not lead to wealth, but it leads to wisdom. The comparative method is essential for our understanding of just about everything. One cannot appreciate the size of the Earth without comparing it to other planets. One cannot appreciate the warmth of a sunny day except in comparison to the cold of a winter day. And, most importantly in the present context, one cannot comprehend what it is to be human without understanding nonhuman animal life. Just as astronomy is essential for us to appreciate how special planet earth is in the greater scheme of celestial objects, solar systems, and galaxies, so too comparative psychology is essential for us to understand the place of humanity in the broader context of animal life and living things in general. As long as we want to know about ourselves, we will have to continue learning about other animals as well.

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Table 1

Percentage of Published Articles Devoted to Four Major Types of Research Questions

|  |  |  |
| --- | --- | --- |
| Question | Journal of Comparative Psychology\*# | Journal of Experimental Psychology: Animal Behavior Processes\* |
| Ontogeny | 20% | 0.5% |
| Immediate Causation | 62% | 98.4% |
| Adaptive Function | 4% | 0% |
| Evolutionary History | 11% | 1.1% |

\*1990-2000

# Percentages in JCP column do not add to 100 due to publication of several non-empirical papers of either a historical or theoretical nature

Table 2

Studies of Immediate Causation

Journal of Comparative Psychology\*#

Perception/Attention/Motor Skills

* echoic object perception (1)
* motor behavior (1)
* novel stimulus recognition (1)
* object permanence (4)
* perception of complex geometric fig. (2)
* perception of conspecific faces (6)
* perceptual estimation of physical
* quantities (3)
* self-recognition (4)
* sensation & perception (43)
* use of landmark configuration (6)

Basic Learning Processes

* associative processes (2)
* avoidance conditioning (2)
* discrimination learning (10)
* habituation (1)
* magnitude of reward effects (4)
* negative contrast effects (1)
* Pavlovian conditioning (4)
* place learning (3)
* reward schedule effects (1)

Memory mechanisms

* encoding (1)
* spatial learning & memory (14)
* spatial representation (1)
* working & reference memory (2)

Complex cognition

* causal reasoning (3)
* deception (2)
* imitation (6)
* intentionality (1)
* language comprehension (7)
* mental rotation (2)
* numerosity (6)
* object retrieval (1)
* perceptual categorization (13)
* perspective taking (1)
* point & gaze following (8)
* referential learning (2)
* same/different discrimination (1)
* serial list learning (2)
* theory of knowledge (2)
* transitive inference (1)
* self-control (1)

Reproductive Behavior

* affiliative behavior (5)
* estrous induced social organization (5)
* maternal & paternal parental care (2)
* mating behavior (7)
* pair bonding (1)
* sexual behavior (4)
* sexual selection (1)
* sexual learning (1)
* socially learned courtship (1)

Social Learning & Behavior

* dominance hierarchies (8)
* kin recognition (3)
* play behavior 5)
* social communication (1)
* social discrimination (3)
* social organization (4)
* social recognition (2)
* socially mediated learning (7)

Foraging

* diet preference (9)
* food protection (1)
* learned taste aversion (2)
* memory for food location (2)
* optimal foraging strategies (5)
* search behavior (9)
* social competition in foraging (1)
* social learning in foraging (13)
* tool use to procure food (5)

Defensive Behavior and Aggression

* alarm calls (7)
* inter- & intra-specific aggression (7)
* predator/prey interactions & defensive
* behavior (13)
* territorial behavior (2)

Table 2

Studies of Immediate Causation

Journal of Experimental Psychology: Animal Behavior Processes\*#

Perception/Attention and Learning

* acquired equivalence of cues (4)
* acquired distinctiveness of cues (1)
* call discrimination (1)
* configural vs. elemental stimulus
* processing (17)
* numerosity discrimination (8)
* object recognition (7)
* time perception (38)
* visual attention & visual search (24)
* perceptual learning (1)

Basic Learning Processes

* avoidance conditioning (1)
* backward conditioning (2)
* behavioral contrast (8)
* blocking & overshadowing (12)
* concurrent schedules and choice behavior (13)
* conditioned inhibition (8)
* conditioned modification of the UR (1)
* context effects (17)
* contingency effects (2)
* CR factors (7)
* extinction/ spontaneous recovery (10)
* habituation (2)
* instrumental or operant learning (14)
* latent inhibition (6)
* learned helplessness (4)
* learned irrelevance (2)
* learning set (1)
* mediated associations (1)
* occasion setting (9)
* schedules of reinforcement (6)
* second-order conditioning (3)
* selective associations (3)
* sensory preconditioning (1)

Other Forms of Learning

* conditioned anti sickness (1)
* conditioned changes in pain sensitivity (3)
* drug conditioning (2)
* evaluative conditioning (2)
* fear conditioning (7)
* foraging (8)
* imprinting (1)
* negative sign tracking (1)
* schedule-induced behavior (2)
* sexual conditioning (5)
* spatial learning (34)
* taste-aversion learning (6)
* US-US conditioning (2)

Memory Mechanisms

* directed forgetting (1)
* encoding (16)
* primacy/recency (1)
* priming (2)
* retrieval processes (3)
* serial position effects (5)

Complex Cognition

* invisible displacement task (1)
* metamemory (1)
* perceptual categorization (6)
* same/different discrimination (9)
* serial pattern learning (10)
* transitive inference effects (4)

·\* 1990-2000  
# Numbers in parentheses ( ) represent total number of papers in category. Numbers do not add to total due to some papers covering multiple topics and others not classified

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I received my B. S. in psychology in 1974, my M. S. in general - experimental psychology in 1976 and my PhD in 1978 from Colorado State University. I graduated with an emphasis in comparative psychology and my areas of specialization included animal learning and animal behavior. I am currently Brown Distinguished Research Pofessor and chair of the Department of Psychology at Southwestern University where I have been since 1978.  
  
I direct an active research program that involves undergraduate students exclusively. With the help of these students I have authored and co-authored over 30 articles and made over 40 professional presentations. In November 2000 Wadsworth published a textbook in learning and memory that I wrote with Markham, Schwartz, and Gordon. My research is primarily carried out at Southwestern University's Aquatic Animal Research Laboratory a facility that houses both fresh water and salt water organisms. Since arriving at Southwestern University I have spent summers conducting research at the University of Hawaii (Bekesy Laboratory for Neurobiology), National Marine Fisheries Service in Seattle, Washington, University of Texas Marine Science Institute in Port Aransas, TX, the National Resource Center for Cephalopods in Galveston, TX and the Bamfield Marine Station on Vancouver Island, British Columbia, Canada.   
  
My research program focuses on basic animal learning processes in aquatic animals where I continue to explore the mechanisms and the adaptive role of learning involved in aquatic animals. I am also interested in questions relating to optimal foraging in aquatic animals, defensive behaviors in aquatic animals, and predator-prey interactions. The research with cuttlefish has been highlighted on the Discovery Channel's World of Wonder. Currently I am involved in a project examining anti-predator responses by salmon to sights and sounds of killer whales. To obtain the sounds of killer whales my students and I traveled to Telegraph Cove, Vancouver Island, British Columbia where from a 15-foot inflatable raft we observed and recorded sounds from the northern resident pod of Orcinus orca.   
I am active in several professional organizations including the Southwestern Comparative Psychology Association, the Southwestern Psychological Association, and Psi Chi. I served on the board of directors for SCPA and I served as President-elect, President, and Past President of SWPA. I am also active in Psi Chi, the National Honor Society in Psychology. Nationally, I served as the Southwestern Regional Vice President from 1994 - 1997 and I was critically involved in developing Psi Chi's undergraduate small research grants program. I was elected National President-elect of Psi Chi in 1999 and I currently serve as National President.

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**Michael Domjan**

As many people, I first became interested in psychology because I was curious about why others around me acted the way they did and because I was not entirely comfortable with my own behavior. My formal encounter with psychology began with a summer science program for high school students sponsored by the National Science Foundation (NSF). This sparked my interest sufficiently to take additional psychology courses while still in high school and then major in psychology as an undergraduate at Grinnell College. I enjoyed the experimental rigor and conceptual clarity of conditioning approaches to the analysis of behavior. I also enjoyed the satisfactions of tinkering in the laboratory. This combination, together with the camaraderie and friendships that develop among people working in a laboratory, has kept me in the profession ever since.   
  
I obtained my Ph.D. under the supervision of Shepard Siegel at McMaster University, and in 1973 I was hired as an Assistant Professor at the University of Texas at Austin with an annual salary of $11,500. I have been at Texas ever since, but thankfully neither my title nor my salary have remained the same. Currently, I am Professor and Chairman of the Department of Psychology.  
  
While in graduate school, I became interested in taste aversion learning and the generality of the laws of learning. Since 1985, I have been exploring questions about the generality of the laws of learning through studies of sexual conditioning. My research on sexual conditioning has been generously supported by the National Science Foundation and the National Institutes of Health (NIH) and has earned me a Golden Fleece Award from Senator Proxmire, a MERIT Award from NIH, and the G. Stanley Hall Lectureship from the American Psychological Association. Along the way, I managed to write the Principles of Learning and Behavior, which is now in its fourth edition, and the Essentials of Conditioning and Learning, which is now in its second edition. I also managed to serve as Editor of the Journal of Experimental Psychology: Animal Behavior Processes from 1985 to 1991, and as President of the Division of Behavioral Neuroscience and Comparative Psychology of the American Psychological Association in 2000. My work has been a major source of satisfaction. Through it all, I have also been sustained by my three wonderful children and by my graduate students who have contributed as much to my life as I have tried to contribute to theirs.

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# About the Editors

**Jane S. Halonen** began her academic career in 1981 at Alverno College, a small private college for women in Milwaukee, Wisconsin, renowned for its performance-based curriculum and educational innovations. In 1998, Halonen assumed the position of Director of the School of Psychology at James Madison University and is extremely proud of the exceptional teaching quality of both their graduate and undergraduate programs.

Halonen has been President of the Society for the Teaching of Psychology and the Council of Teachers of Undergraduate Psychology. She also serves as Associate Editor for the journal Teaching of Psychology. She is an Advisory Board member for the international Improving University Teaching conference. She has served as a faculty consultant at numerous high school teacher institutes, as advisor to the Teachers of Psychology in Secondary Schools (TOPSS), and as part of the management team for the Advanced Placement readings of the Educational Testing Service.

She served on the APA steering committees of both the St. Mary's Conference in 1991 and the 1999 Psychology Partnerships Project Conference held at James Madison University. She currently serves on the Task Force exploring the next phase of the Preparing Future Faculty Initiative. She also is an advisor to the two conferences: the 2002 National Assessment Conference in Psychology to be held at Kennesaw State University and the 2002 International Conference of Teaching in Psychology to be held in St. Petersburg, Russia.

As a faculty consultant, Halonen has conducted psychology department reviews and also assisted in broader curriculum faculty interests, including curriculum reform, ethics, and faculty development. Her teaching scholarship focuses on critical thinking and academic and clinical integrity. She has been the author or co-author of several textbooks and faculty development resource books.

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Dr. Davis's research interests include academic dishonesty, student professional development, student responsibility, conditioned taste aversion learning, and olfactory communication in animal maze learning. Since 1966 he has published 252 articles and textbooks and presented 809 professional papers; the vast majority of these publications and presentations include undergraduate and graduate student coauthors.

Dr. Davis has served as the President of APA Division 2 (the Society for the Teaching of Psychology), the Southern Society for Philosophy and Psychology, the Southwestern Psychological Association, and Psi Chi (the National Honor Society in Psychology). In 1987 Dr. Davis received the first annual Psi Chi/Florence L. Denmark National Faculty Advisor. In 1988 he received the American Psychological Foundation Distinguished Teaching in Psychology Award, and in 1989 he received the APA Division 2 Teaching Excellence Award. Dr. Davis is a Fellow of APA Divisions 1 (General), 2 (Society for the Teaching of Psychology), and 6 (Behavioral Neuroscience and Comparative Psychology)

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