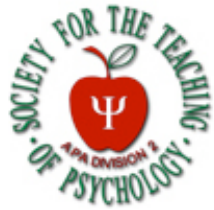

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Using the Drawing and Animation Tools in PowerPoint®

to Build Your Own Visual Perception Demonstrations

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Abstract

Although innumerable computer-based visual demonstrations are available to enhance the teaching of perceptual concepts, quite often a demonstration that worked flawlessly on an office computer will break down when ported to the classroom. In contrast, Microsoft's presentation graphics program PowerPoint® is a familiar and reliable tool for creating and presenting one's own color images and animated text and graphics. Here I describe the drawing and animation tools in PowerPoint that may be unfamiliar even to the experienced user and how to use them to make three well-known perceptual demonstrations. All three can profitably be used with introductory as well as advanced students and even to illustrate general principles of how we see the world. Creating the demonstrations described here can form the basis for making your own collection.

In recent years there has been a profusion of websites and CD-ROMs packed with visual demonstrations appropriate for teaching perception to students in General Psychology as well as upper-division courses. Visual demonstrations are nearly indispensable to convey abstract and complex material to students, and animation has been found to be particularly effective at promoting comprehension (Brown, Haynes, & Schmidt, 2008; ChanLin, 1998). However, it is a common experience that visual demonstrations that worked well on an office computer will break down in the classroom. Furthermore, for a professor who presents class material in PowerPoint, having to exit PowerPoint in order to open another application such as a web browser can interrupt the flow of lecture. Although many professors are adept at using PowerPoint to present color images and animated text and graphics (Hardin, 2007; Leffingwell, Thomas, & Elliott, 2007), they may be unfamiliar with the drawing and animation tools in PowerPoint, or they may have never realized how useful these tools can be for creating perceptual demonstrations. Here I show how to create your own visual demonstrations that can be embedded within your pre-existing PowerPoint lecture slides.

The drawing and animation tools in PowerPoint are surprisingly powerful and flexible, but can be intimidating. Below I step through the process of creating three displays that are well-known to vision scientists: (a) simultaneous contrast [begins on p. 4], (b) the Kanizsa triangle [begins on p. 10] , and (c) structure from motion [begins on p. 18]. In the various versions of PowerPoint available for Windows and the Macintosh over the past 10 years, the particular steps needed to access the drawing and animation tools have changed, but the tools themselves have remained fairly stable. In the procedures below I describe how to access the tools in PowerPoint 2007 for Windows; different versions of PowerPoint require different menu commands or keystrokes to access the tools, but the tools themselves work pretty much as described. I have

arranged the three demonstrations so that the effort and knowledge required increase slightly from one to the next, and some procedures that are described in detail for one demonstration are not so meticulously described later.

Some Notes on Stylistic Conventions Used Here

- I use the same orthographic and naming conventions as in the PowerPoint help program, in which names of items and button captions are written in **boldface**.
- An arrow symbol (→) to indicates that one command follows another, or is in a drop-down menu or dialog box from a previous command.
- Both Windows and Mac keyboards have several command keys that typically have an effect only when held down at the same time as another key. The most familiar example is holding **Shift** while typing an alphanumeric key into a word processing program, which makes the uppercase version of the alphanumeric character appear on the screen. Both Windows and Mac keyboards have **Ctrl**, **Alt**, and **Shift**, and Macs also have **Apple**; to indicate that the Control key should be held down as the *g* key is pressed, I write "Press **Ctrl-g**."
- I use "Click" as shorthand for "Click the left button"; to specify clicking the right button I write "Right click." On Macs the mouse has just one button so there is no way to click the "right button"; instead, holding down **Ctrl** and clicking the single button typically has the same effect on a Mac as right-clicking in Windows.

Simultaneous Contrast

One recurring theme in perception is the fact that we do not perceive features such as brightness in isolation, but only in contrast to the brightness at adjacent locations. In Seckel's (2002, p. 20) collection of optical illusions is a version of simultaneous contrast, in which a long

gray bar in the foreground lies against a background that varies smoothly from white on one side of the page to black on the other. Although the bar has a uniform shade of gray, the *apparent* brightness of the bar varies so that it looks dark where the background is light and light where the background is dark. In Figure 1 the two discs are the same shade of gray but the one on the right appears to be brighter than the one on the left. Below are directions for making a slide that varies from white to black along a gradient, and a disc that appears to change its brightness as it drifts across the screen.

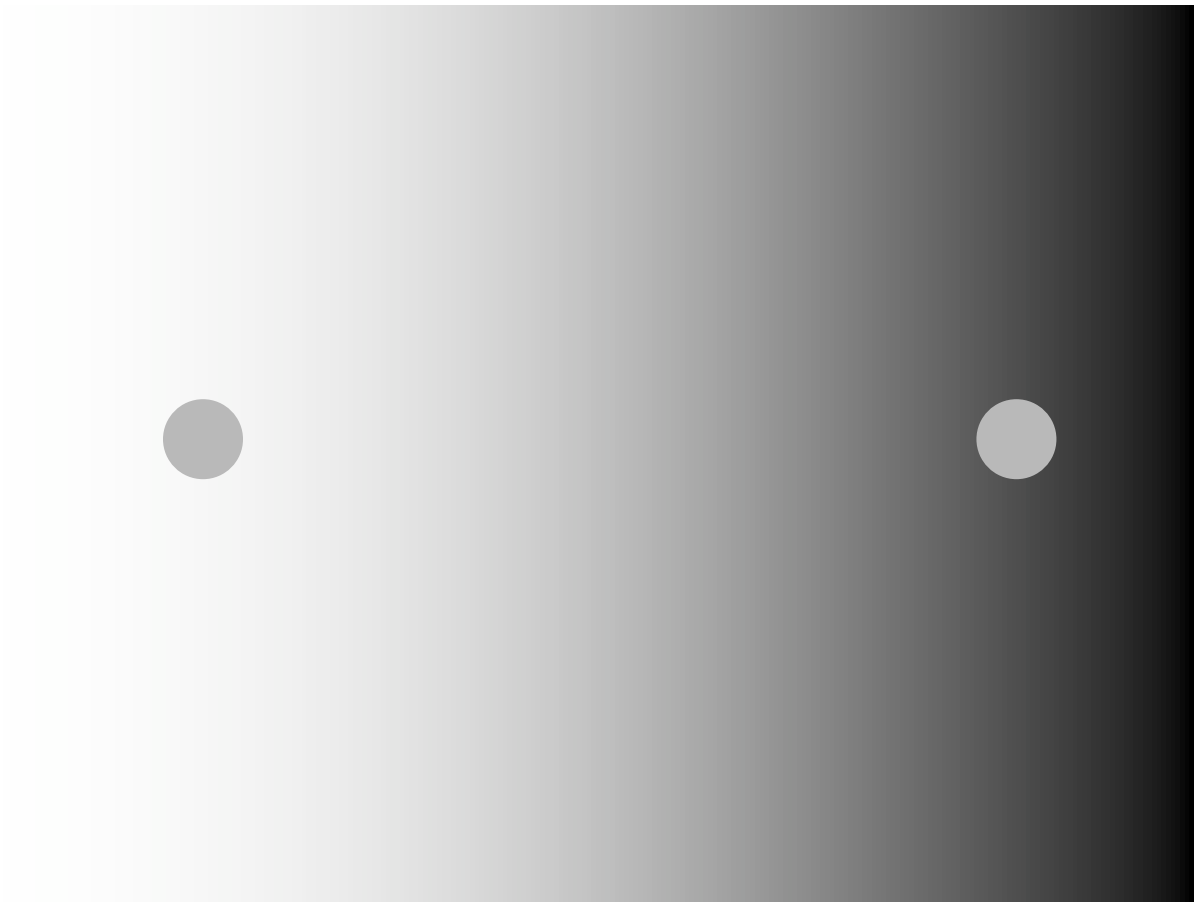

Figure 1. Simultaneous contrast: The two gray discs are equally bright, but the one on the right appears brighter than the one on the left.

Make a Blank Slide With a Gradient Background

When you open PowerPoint there should already be a slide ready for revision.

1. Click the **Home** tab

Notice that there is a toolbar with numerous tools arranged in groups; to draw your attention to a portion of the toolbar I mention a group, then a tool in that group.

2. In the **Slides** group, click **Layout** → select the Blank slide.

Now give the blank slide a gradient background. Each of the preset gradients has a set number of "stops"; we would like a gradient with just two stops, but the fewest number of stops available is three, so you will have to remove one of the stops, then set the first stop to white and the second to black.

3. Select the **Design** tab → in the **Background** group click **Background Styles → Format Background… → Gradient Fill → Preset Colors →** select **Parchment** from the fourth column and third row (when you "hover" the arrow cursor by placing it on an icon then leaving it stationary, after a moment a short title should appear, e.g., "Parchment") → set **Angle** to **0**° → under **Gradient Stops** is a textbox containing a list of stops; click the textbox → **Stop 2 → Remove →** in the list of stops select **Stop 1 → Color → White → Stop 2 → Color → Black → Close**.

Now you should see a slide that is white on one side and black on the other, and changes smoothly across the slide.

Make a Gray Disc

Make the cursor into an oval drawing tool.

1. Click the **Home** tab → in the **Drawing** group click **Shapes →** in the **Basic Shapes** group select the oval-shaped icon (the one that says "Oval" when you hover over it).

Position the cursor anywhere on the slide, then by clicking and dragging the mouse you will draw an oval. If you press **Shift** while at the same time holding down the mouse button, you will notice that the oval becomes circular.

2. Hold the **Shift** key → click and drag the cursor until the circle is the desired size → release the mouse → release **Shift**.

Give the disc a gray color and no outline.

3. In the **Drawing** group click **Shape Outline → No Outline → Shape Fill → More Fill Colors…**, → **Standard** → select the gray patch toward the bottom of the box that seems best to match the gray in the middle of the slide's gradient → **OK**.

Animate the Gray Disc

Place the disc just outside the visible portion of the slide.

1. Click and drag the disc until it lies just off the left edge of the slide; you may need to use the **Zoom** slider at the bottom-right corner of the PowerPoint window to reduce the size of the slide in order to give you enough room to place the disc → you should now see a screen that looks like the screenshot in Figure 2.

Set up the animation so that the disc will drift across the slide when the mouse is clicked.

2. Click the **Animations** tab → in the **Animations** group click **Custom Animation** → select the gray disc (if not already selected) → in the **Custom Animation** box click **Add Effect → Entrance → More Effects… → Crawl In → OK →** in the **Custom Animation** box, for **Direction:**, select **From Right → Close.**

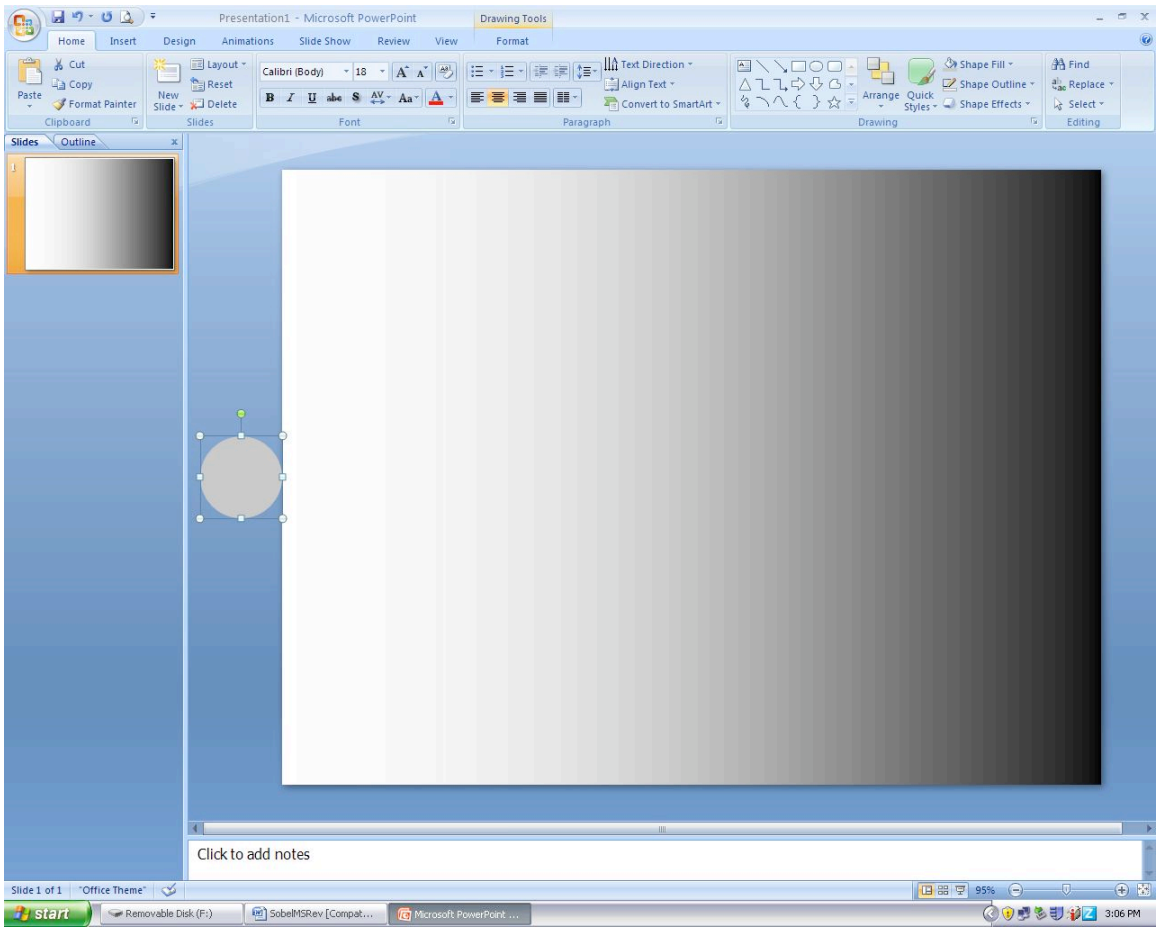

Figure 2. Screenshot after the slide background has been set to a gradient from white to black, and the medium-gray disc has been placed off the left side of the slide.

Brightness Contrast in the Classroom

In slide show mode, when you click the mouse, a gray disc will drift across the screen and appear to change, even though it remains unchanged as its *background* changes. Equipped with your new demonstration, you can describe to your introductory students the difference between sensation and perception by noting that as the circle drifts across the slide the brightness of the disc as presented to the eye (sensation) remains constant, but the visual experience

(perception) changes continuously. Advanced students can benefit from seeing how center-surround organization in retinal ganglion cells underlies the experience of brightness contrast. More generally, the fact that appearance varies with context explains why we prefer pictures of ourselves in which we are surrounded by large friends rather than skinny friends; size, like brightness is perceived in context, so we feel as if we look skinnier when surrounded by large friends.

Kanizsa Triangle

Gaetano Kanizsa was a gifted artist and vision scientist who created dozens of drawings (see Kanizsa, 1979) that illustrate key principles of Gestalt psychology, including the well-known triangle that bears his name, depicted on the left in Figure 3. Because the three sectored circles in Kanizsa figures such as Figure 3 resemble the Pacman character in the eponymous videogame, "pacman" is typically used as a shorthand for the less descriptive and more cumbersome "sectored circle." While researching Kanizsa figures (Sobel & Blake, 2003) I noticed that they appear completely differently when the pacmen are rotated from their canonical orientation, and as a result I was inspired to create the display on the right in Figure 3. Below I show how to create the two figures so that you will be able to toggle instantly from one to the other, alternately creating then destroying the experience of a good Gestalt with the push of a button.

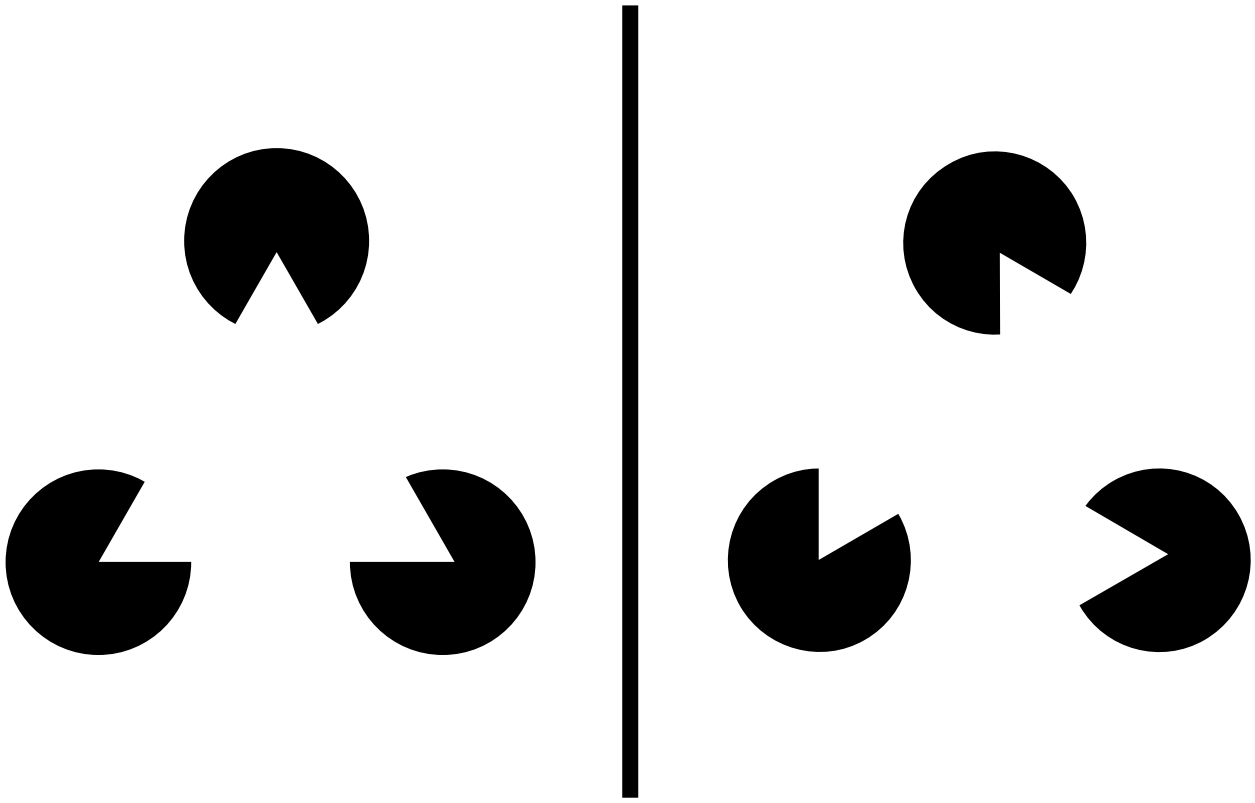

Figure 3. Kanizsa triangle: When the three pacmen are arranged as in the left panel, there appears to be a triangle. When the orientations of the same three pacmen are changed, as in the right panel, the sense of a triangle is broken.

Make A Slide That Contains a Kanizsa Triangle

Start with a blank slide and the **Home** tab selected; then draw an equilateral triangle.

1. In the **Drawing** group click **Shapes** → in the **Basic Shapes** group select the **Isosceles Triangle** → hold **Shift** (this forces the resulting triangle to be equilateral) → click and drag the mouse to make an equilateral triangle that is about half as tall as the slide → release the mouse and **Shift** key.

Ultimately you will make the triangle the same color as the slide background, but for now leave it with the default fill and outline colors as you draw a circle.

2. In the **Drawing** group click **Shapes** → in the **Basic Shapes** group select **Oval** → hold the **Shift** key → click and drag the mouse to make an circle that is about a third as tall as the triangle → release the mouse and **Shift** key → select fill and outline colors for the circle that suit your tastes (I used black in Figure 3) → click and drag the circle so that its center coincides with one of the triangle's vertices.

You may notice that as you drag the circle around it moves a little jerkily and that you may not be able to place the circle exactly where you would like; the shape "snaps" to an invisible grid. Holding down the **Alt** key in Windows or the **Apple** key on a Macintosh as you drag the shape around will allow you to position the circle exactly where you would like it. When you are satisfied with the placement of the circle, make and arrange two duplicate circles.

3. Select the circle (if not already selected) → typing **Ctrl-d** in Windows or **Apple-d** on a Mac makes a duplicate circle → click and drag the newly created duplicate circle until its center coincides with a second of the triangle's vertices → make another duplicate circle and move it into position at the third vertex.

You may notice that the circles appear as if they are closer to you than the triangle because they "hide" the triangle from your view, but for the Kanizsa triangle you need the triangle to be in front.

4. Right click the triangle (**Ctrl**-click on a Mac) → in the menu that appears, select **Bring to Front** in Windows → on a Mac, select **Arrange** then **Bring to Front.**

Finally, make the fill and outline of the triangle the same color as the slide background so that the triangle is invisible. You have created your own Kanizsa triangle.

Make a Slide in Which the Gestalt is Ruined

Duplicate the slide you made that contains the Kanizsa triangle.

1. In the pane that contains the **Outline** and **Slides** tabs, select **Slides** → select the slide containing the Kanizsa triangle → in the **Slides** group, select **New Slide** → **Duplicate Selected Slides**.

The remainder of work for the Kanizsa triangle takes place in the newly created duplicate slide. Make a duplicate of the bottom-right circle and place it to coincide with the original bottom-right circle as a placeholder.

2. Select the bottom-right circle → **Ctrl-d** in Windows or **Apple-d** on a Mac → drag the duplicate circle to the same location as the original bottom-right circle → right click the duplicate circle and send it to the back.

Make the triangle smaller so that it still occludes a wedge in the original bottom-right circle but does not occlude either of the other two circles.

3. Place the cursor on the tiny shape to the upper left hand corner of the triangle's frame as seen in Figure 4 → press and hold **Shift** to keep the triangle an equilateral → drag the cursor towards the bottom-right circle until the edge of the triangle lies just outside the bottom-right circle → release the mouse and **Shift** key.

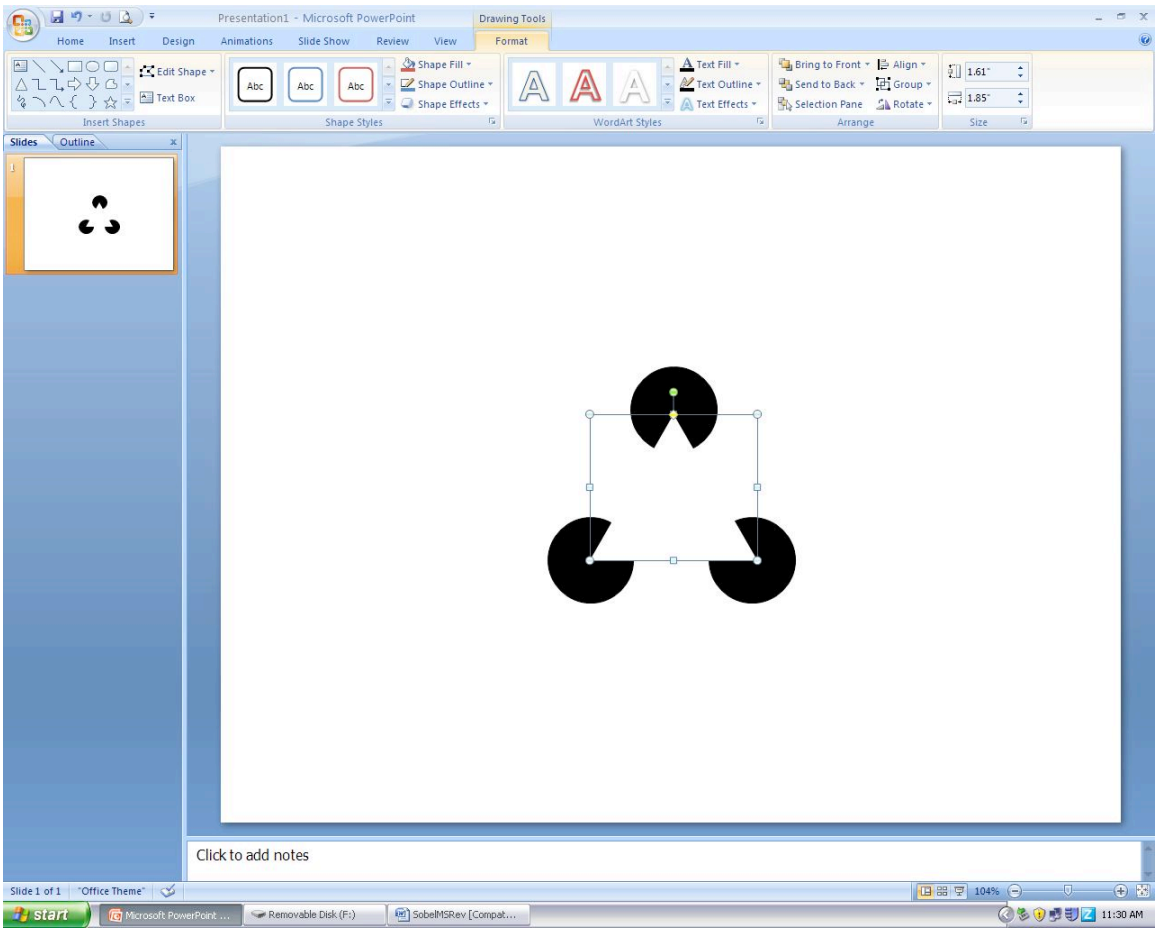

Figure 4. Screenshot after the triangle has been selected; to compress the triangle, place the mouse on the tiny shape in the upper-right corner of the frame that surrounds it, then click and drag it toward the lower-right circle while holding **Shift**.

Select both the triangle and circle at the same time and make them a single "group."

4. With the triangle already selected, press and hold **Shift** → click the bottom-right circle so that both are selected at the same time→ type **Ctrl-g,** and you should see a screen that looks like Figure 5.

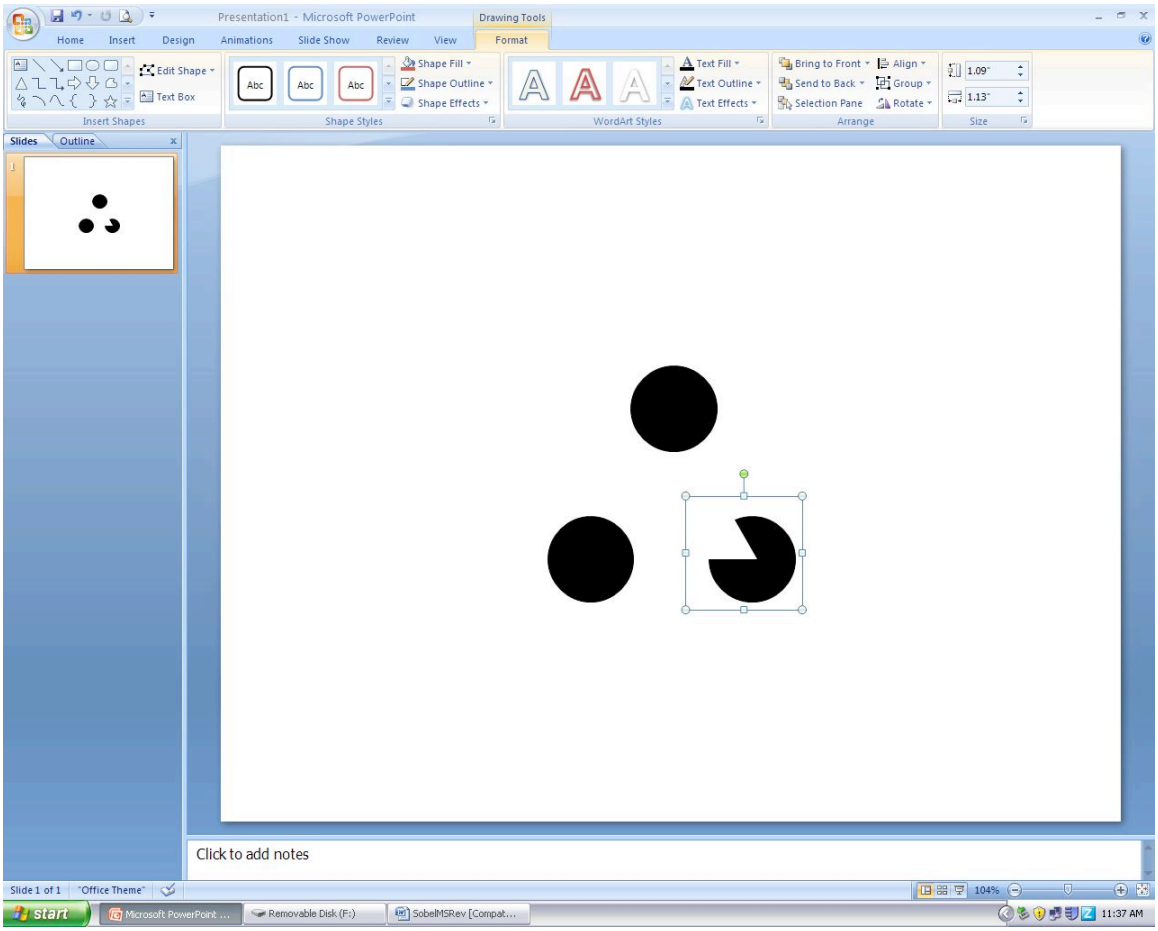

Figure 5. Screenshot after the large triangle has been compressed and grouped with the bottom-right circle to form a single group that resembles a pacman.

Because your newly-created circle-triangle group resembles a pacman, I refer to it as such. Rotate the pacman from its original orientation.

5. With the pacman selected, it is surrounded by a frame → above the frame and connected to it by a line is a yellowish circle; when you hover over it, the cursor changes from an

arrow to a spiral → click and move the yellowish circle slightly to rotate it → notice that if you hold **Shift** it will constrain the rotation to increments of 15° → Rotate the pacman two increments of 15° (i.e., 30°) counterclockwise, and your screen should resemble the screenshot in Figure 6.

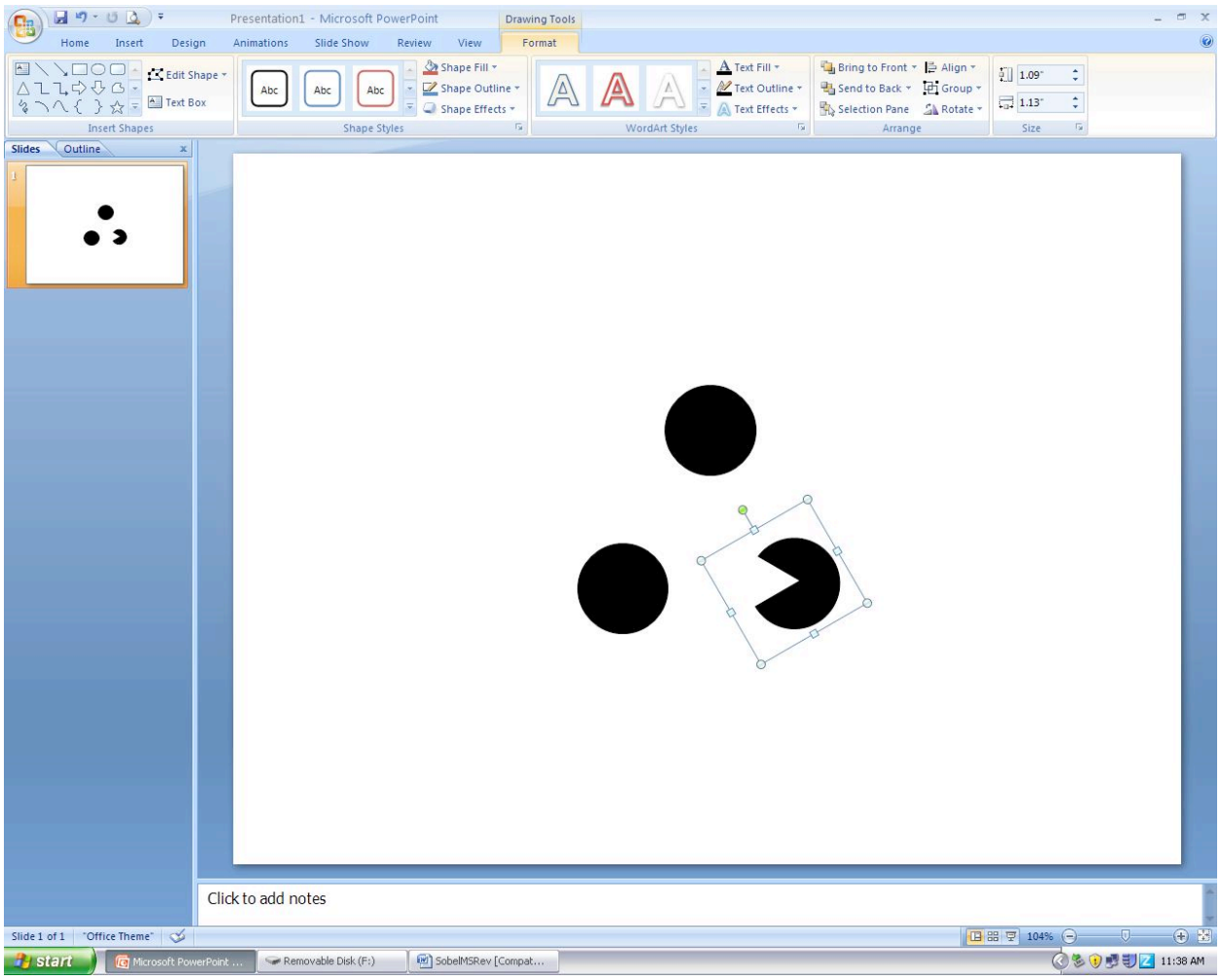

Figure 6. Screenshot after the pacman has been rotated 30° counter-clockwise.

When you rotated the pacman, it moved a bit from its original location.

6. Move the pacman so that it lies directly on top of the placeholder circle that you made in Step 2 (remember to use the **Alt** or **Apple** key to make fine adjustments to the pacman's position).
7. Duplicate the pacman, then rotate it eight increments of 15° (i.e., 120°) clockwise and position it on the bottom-left circle, then make another duplicate and rotate it 120° clockwise, and position it on the top circle.

Gestalt in the Classroom

The central theme of Gestalt might be paraphrased to say that when sensations are arranged just right, the resulting experience is more than the sum of the parts. These two slides clearly and immediately convey the essence of Gestalt to an introductory audience: Both slides contain the same objects (three pacmen), but in just one of the slides the pacmen are arranged just right so that an apparent triangle is visible as well; because of the good Gestalt, there appears to be more than the sum of the parts. For more advanced students you might mention neurophysiological studies (such as von der Heydt & Perterhans, 1989) showing that cells early in visual processing respond to illusory contours such as the three edges of the triangle; we all feel as if we can see a triangle because cells in our early visual processing are saying "I can see it!"

Structure From Motion

One of Gibson's (1979) many provocative claims about vision is that we do not see by staring fixedly at objects from a single perspective. Instead we actively investigate objects, turning them over in our hands to look at them from every possible angle. Perhaps one reason we feel compelled to actively investigate unfamiliar objects is that motion can impart a potent sense of three-dimensional structure to an object that might have appeared flat if seen from a single perspective (Wallach & O'Connell, 1953). The artist Marcel Duchamp experimented with animated displays that created a sense of three-dimensional structure (Tomkins, 1996), much like the shape in Figure 7. Although flat, when rotated it appears to have a clear three-dimensional shape, as if you were looking down on the hollow cone of a volcano.

Figure 7. Structure from motion: When the drawing is set in motion, it generates a potent sense of three-dimensional structure, as if the viewer were looking down on the hollow cone of a volcano.

Build and Animate a "Volcano"

1. In a blank slide use the **Oval** tool and **Shift** key to make a relatively large circle.
2. Duplicate the first circle → resize the second circle to be smaller than the first → continue making smaller and smaller circles until you have made about eight circles (as there are in Figure 7).
3. Set the fill and outline colors in the circles to suit your tastes.

4. Select every circle in the slide by typing **Ctrl-a** (in Windows) or **Apple-a** (in Mac OS), which is shorthand for "select all."
5. Under **Drawing tools**, select the **Format** tab → in the **Arrange** group click **Align** → **Align Middle** → **Align** → **Align Left**.
6. Deselect all the circles by hitting **Esc** → **shift-click** to reselect the five smallest circles → align their right sides, after which your drawing should resemble Figure 7.
7. Select all the circles (**Ctrl-a**) and group them (**Ctrl-g**) into a single object that when rotated will resemble the hollow cone of a volcano as seen from above.
8. Click the **Animations** tab → in the **Animations** group click **Custom Animation** → select the volcano (if not already selected) → **Add Effect** → **Emphasis** → **Spin** → next to the newly created animation event is a down-pointing arrow; click it → **Timing…** → for **Repeat:**, select **Until End of Slide** → **OK**.

Structure-From-Motion in the Classroom

Structure-from-motion displays indicate why a friend who has just bought a new truck insists that you walk up to it and inspect it from every angle, and will not be satisfied if you glance at it from one perspective. With just one perspective, you cannot get a sense of the truck's three-dimensional shape as you could from active exploration, using vision in concert with motion.

Conclusions

Constructing the three displays described here gives you experience using many of the tools and keystrokes that are essential to building your own collection of visual demonstrations. Any displays that you create in PowerPoint will be reliable, as opposed to anything created by someone else that seems to break at inopportune moments. Besides reliability, other benefits of

building your own demonstrations include pride of accomplishment, the opportunity to indulge your creative impulse, and having access to custom-built demonstrations that suit your particular style of teaching. Most of all, students often appreciate the efforts invested by professors who have created their own classroom demonstrations. Now when you see a cool illusion or demonstration, ask yourself, “How can I make a PowerPoint version of that?”

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Author's Note

I am grateful to Elson Bihm and Art Gillaspy for comments on a previous version of this manuscript.