Downloadable Reproducible eBooks

Sample Pages

These sample pages from this eBook are provided for evaluation purposes. The entire eBook is available for purchase at www.socialstudies.com or www.writingco.com.

To browse more eBook titles, visit
http://www.socialstudies.com/ebooks.html

To learn more about eBooks, visit our help page at
http://www.socialstudies.com/ebookshelp.html

For questions, please e-mail eBooks@socialstudies.com

To learn about new eBook and print titles, professional development resources, and catalogs in the mail, sign up for our monthly e-mail newsletter at
http://socialstudies.com/newsletter/

Mysteries of Seeing

Why We See What Is ***Not*** *There and Fail to See What* ***Is***

Overview

Mysteries of Seeing is an introduction to the psychology of vision. It explains why how we see is more like a construction project than collection of data, more like creating a work of art than taking a photograph. The paradox of sight is that while it seems so familiar and simple, its workings still remain shrouded in doubt and mystery. The program explores how our brains work to create what we see, the psychology of perception, and how decisions are influenced by mental shortcuts (biases or heuristics) we use without conscious awareness.

During this journey into the mysteries of seeing viewers will learn that:

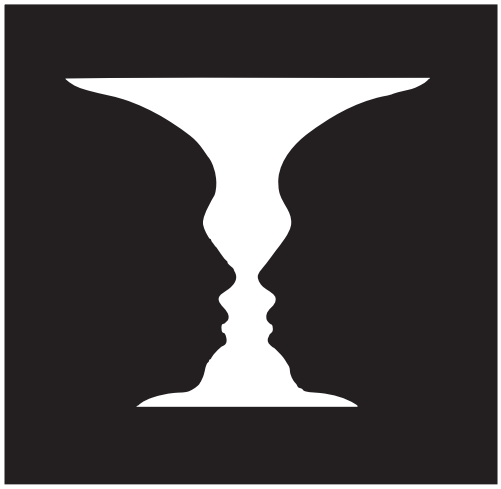
- seeing is more about creating reality than capturing it
- eyes are not the prime organ of vision
- optical illusions are neither optical nor illusions
- perception is filled with educated guesses
- what we ignore is as important as what we see

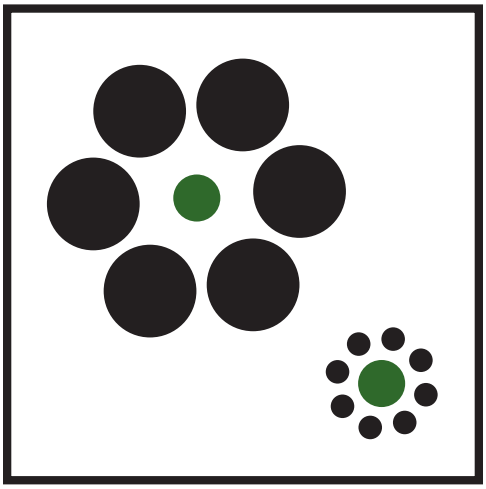
Key points for discussion or contemplation:

- We create our perceptions.
- We see with our brain and body interacting with the world.
- What we see is often not there; we often do not see what is there.
- We often say, "I'll believe it when I see it," but we operate as if "I'll see it when I believe it."
- What we see is a combination of raw data from our senses combined with our expectations.
- "I saw it with my own eyes," is a statement about our perception, not proof of reality.
- We don't see what we sense—we see what we think we sense.
- Pre-judgment is part of all perception.
- Our awareness lags perception—we live a fraction of a second in the past.
- Some of what we sense as "now" is really "then."
- The brain hides most of its visual construction project from our awareness.
- We use a variety of energy-conserving shortcuts to make sense of a complex world.
- Optical illusions are windows into the brain's construction project.
- Color is the most obvious example of seeing "what is not there."

Discussion questions

1. Below are two of the "optical illusions" shown in *Mysteries of Seeing*:





You may have seen these illustrations and thought of them as clever visual tricks. The program suggests you view them as insight into your brain's inner workings in creating your visual world. What do these two illusions reveal about "the mysteries of seeing"?

2. The program points out that if you suffer from "double vision," you are not really creating an "extra copy" of what you see. Double vision, like an optical illusion, provides insight into how our brain works in processing visual information. Explain.

3. The program notes that the act of "window shopping" feels easy and effortless while solving a Sudoku puzzle feels like heavy-duty brain work. What do these judgments about these two activities reveal about our brains at work?

4. The program illustrates that knowledge about an optical illusion does not "protect" you from seeing the illusion. We know the sun doesn't actually "set" or "go down," yet that's what we see. We know the moon doesn't shrink as it moves away from the horizon, yet that's what we see. You can easily understand why people living thousands of years ago saw the sun go up and down in the sky. Why doesn't our knowledge of the solar system protect us from this illusion?

5. Picture a face in a dark room lit by a single light from below (for example, a face lit only by a flashlight held beneath and slightly in front of the chin and pointing up). Such a face will appear "creepy" or "scary." This lighting is often used in movies to create a feeling of dread. Based on what you know about our use of visual biases or shortcuts, why should this type of lighting seem "scary" rather than "beautiful"?

6. In what sense do we really "see things twice"?

7. A common explanation for "why movies move" is that the image from the screen remains on our eyeballs long enough to blend into the next picture. This is often called "persistence of vision." In other words, the projector is faster than our eyeballs. The PowerPoint® offers a different explanation and states that while we sit in a movie theater we spend half the time looking at a blank screen. Why then do we think that movies "move"?

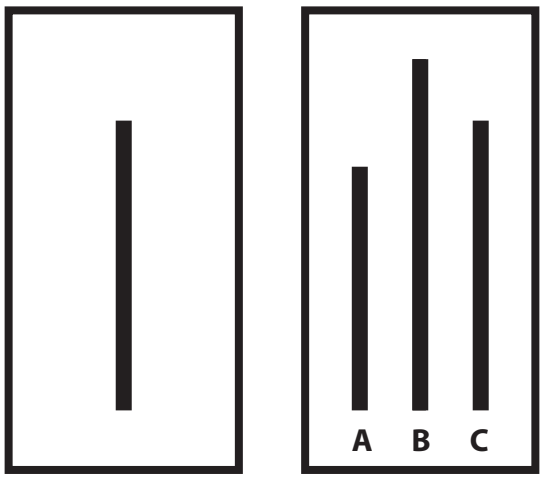
8. In what way is prejudice (in the sense of pre-judgment, not racial discrimination) is part of all perception?

9. The program asks you to imagine you have the perceptual tools of a bee instead of a human. Why would you *not* say, "The world sure looks different to a bee," but *would* say, "I'm in a different world"?

10. One of our perceptual shortcuts is to make educated guesses based on partial information. We play an ongoing game of fill-in-the-blanks as we attempt to make sense of the world. This habit sometimes causes us to make mistakes. Explain why we need to make guesses.

11. The PowerPoint illustrates that what surrounds an object influences how we judge it, especially in terms of color and size. How might this perceptual habit influence us as consumers? Consider marketing techniques used to influence our judgment of pricing and quality.

12. A 1950s experiment seemed to reveal that people will ignore what they see in order to be "part of the crowd." The experiment asked them to judge which line on the right was the same length as the line on the left:



When a similar experiment was conducted more recently, subjects had their brain activity monitored by a magnetic imaging machine (fMRI). What did this second study find that was different from the original study?

13. Where have all the mermaids gone?

14. How do some of our perceptual biases cause problems when we are asked to make an eyewitness identification?

15. What perceptual biases do we use that enable magicians and con artists to work their "magic"?

16. Many states require that any cell phone use by the driver of a car be "hands-free." From what you learned in *Mysteries of Seeing,* why might these laws misinterpret the core problem?

Discussion question answers

1. a) The two possibilities (the vase and the faces) "flip" in and out of your awareness. You cannot choose which version to see—at least without practice. In everyday perception, we see the most expected interpretation and are surprisingly blind to unexpected alternatives. Your brain "plays the odds" on what to present as visual awareness. You are not aware that there are choices to be made. You could say the brain selects one without your permission.

   b) You perceive the blue circle above as larger than the one below, even though they are identical. The "illusion" is not really an illusion at all: it is an illustration of everyday perception. The "illusion" helps reveal the mental shortcuts you use to judge size and color. It makes clear that your perceptions of color and size are heavily influenced by the context of the object being perceived—by the "company it keeps." Optical illusions help make transparent some of the mental gymnastics normally hidden from your awareness.

   Follow-up question: Why are these "mental shortcuts" hidden from your awareness? Answer: They "run in the background" so your mind is free to attend to more important functions. If these processes ran "in the foreground," they would require a great deal of mental energy, leaving less energy available to function as a rational human being.

   Extension activity: Find an example of an optical illusion and explain what it shows about our everyday perception. Note that many optical illusions still puzzle scientists who study perception—there is much about our perceptual system that we still do not understand. Explaining an optical illusion can be surprisingly difficult.

2. A blow to the head or too much alcohol can cause double vision. However, "seeing double" is not an illusion—it is our default state of seeing. You do indeed register two images, one for each eye; you "see double" because you have two eyes. Your brain takes data from two eyes and creates a unified, 3-D image. You are normally aware only of the final result, not the double images. The original double images are hidden from your awareness. What you "see" is a sort of edited version of raw data your senses gather from the world.

   Alcohol or a blow to the head does not create a second image. It interferes with your ability to knit the signals from two eyes. Thus, double vision is *not* a case of creating extra images. It reveals the brain's usually hidden work in creating your visual world.

   Note: Double vision (*binocular diplopia)* can also result from eyes that are physically misaligned so that they "aim at two different targets." Two non-matching images are sent to the viewer's brain. Double vision is the result of the brain using the two non-matching images at the same time.

3. Window shopping "feels" easy simply because you are not aware of the mental processes involved in seeing, making quick judgments, and feeling emotions. Your brain and perceptual tools are hard at work while window shopping. In solving a Sudoku puzzle, you are more conscious of your effort, so it "feels" harder. Solving a logic puzzle is not an automatic or unconscious response to the environment.

4. Even though you know the two circles in an optical illusion are the same size, you still see them as different. In another optical illusion, you know two lines are the same length, yet you still see one as considerably longer than the other.

Our perceptual system is not a finely tuned instrument designed to detect reality. Instead, it is a mix of systems using shortcuts and assumptions that work most of the time. Thinking requires a lot of calories—it takes energy. Therefore, using these shortcuts saves energy. For example, all movement is relative. You've experienced sitting in a train or plane and seeing the train or plane parked next to you move away. There is a momentary confusion—are you moving, or is it the vehicle outside that's moving? Since motion is relative, we need more sensory input to answer the question. If you feel a bump from the tire or feel the train rock, you "know" you are moving.

Another assumption we use to answer the "what is moving" question is relative sizes. One shortcut is to assume that the smaller object is moving. The sun is visually smaller than the horizon, so we assume it is the object in motion. Seeing a sun that moves is an incorrect perception, but it is based on a hidden assumption that works most of the time.

New York University psychologist Gary Marcus refers to these mental shortcuts as "kluges." He considers our perceptual system not as a finely-tuned supersensory miracle, but as a series of shortcuts "held together by paper clips and duct tape." These shortcuts free our awareness from basic mental processes and enable us the luxury to be human. The trade-off is that these perceptual shorts only work *most of the time*.

5. Humans have always lived on a planet in which light comes from above—light from above is the "norm," and it shapes our expectation of how light "should be." Light from below violates our expectations—we find it discomforting.

   Extension activity: Find an example in art (drawing, comics, animation, film, video, or commercial art) that illustrates the use of light from an unusual angle to produce an emotional response in the viewer.

6. In what sense do we really "see things twice"? First, we capture a coarse and blurry set of data that is not part of our awareness. About 50 milliseconds later, we are aware of an image that has been tweaked, edited, and interpreted. That awareness is what we call reality. We are aware only of our edited vision of the world, yet we are not even aware that we edit.

7. When you watch a movie, you are seeing a series of still images at the rate of 24 images per second. A movie projector has a spinning disk that blacks out the light while the next image is pulled into place. However, you are not aware that the screen is black for much of the movie. During a 90-minute movie, you see about 130,000 motionless photographs. These pictures have no more movement than do snapshots in a family album. Your brain works very hard to create the illusion of motion. It fills in the gap between the still images so you see the smooth (and seemingly effortless) illusion of a "motion picture." Note that you don't need to go to school to learn how to watch a movie—you just do it.

   A movie might be silly or offensive, but it is never "mindless entertainment." Without a mind, there would be no movie.

   Extension activity: Make a presentation that clearly shows how a movie projector works to produce the illusion of motion.

8. This may be the most difficult concept in the entire PowerPoint. The idea that "we see what we *think* we sense" rather than what we sense, might seem confusing. It suggests we do some kind of interpretation (such as like/dislike) before we are aware we see something.

Brain imaging suggests that this is true even though it goes against what we "feel" about our perceptions and judgments.

The PowerPoint explains this "pre-judgment" as follows: "We do not see what we sense. We see what we think we sense. By the time we are aware of something, unconscious processing has already edited and arranged the raw data. This processing happens *before* we are aware of what we see. Seeing feels instantaneous, but we interpret first and see later."

9. The difference between the "seeing system" of a bee is and that of a human is more than a matter of degree. It would not be a matter of lighter or darker, or seeing some colors and not others. The world would appear so totally different that a reasonable conclusion would be that this is a "different world."

10. We constantly make predictions or "educated guesses" about the world around us. Imagine a baseball outfielder catching a fly ball. He might calculate the ball's speed, trajectory of flight, and weight using a mathematical formula to determine where and when the ball will arrive at a spot where he could catch it. Such a mathematical solution would take too long to be effective. Instead, the outfielder makes an educated guess as soon as the ball leaves the bat, and moves in the correct direction. He then makes more educated guesses and refines the location to one that enables a catch. The outfielder is not aware of the mental computations made and most likely could not explain how the catch was made. A baseball player is unlikely to be able to explain or describe how to catch a fly ball. The reward of correct guesses is one of the reasons human play games. We need to make these "guesses" because we cannot act fast enough without them.

11. Marketers know that consumers make judgments based on comparisons. The key is not as much "how good is my product?" as it is "how does it compare with other brands on the shelf or on the showroom floor?" We often judge products in much the same way we judge the size of circles in optical illusions—our decision about a product is shaped by context, by what surrounds it.

    Consumers often select the "middle choice" with the feeling that it is "just right." Many merchandisers use product "lines" featuring items of varying price, even though each of the items costs about the same to produce. Some oil companies discovered they could increase the average pump price by offering a middle grade of gasoline. It attracted people who didn't want premium yet sought a product that they perceived as somehow "better" than regular.

    Luxury stores or catalogs often feature an extremely high-priced article displayed not so much to sell as to act as a comparison point or anchor for shoppers. The jeweled handbag for $80,000 helps make an $800 handbag seem downright affordable. The anchor *is* for sale—but its real purpose is to act as a basis of comparison. It's there because shoppers make decisions based on comparisons.

    Shoppers tend to make buying decisions based on comparative values. Merchandisers often use a technique called "advertised reference pricing" that encourages shoppers to judge based on context. That's why you often see signs such as "compare to shoes costing $100." It's also why stores often leave old price tags in place when they discount items for clearance sales. Our perceptual habit of judging something by its surroundings also helps explain why "regular prices" are shown along with so-called sales prices. We see a "sale" price as a bargain because we judge it in comparison to what the store claims is a "regular price."

Few people pay the "sticker price" for a new car, but the sticker serves as an anchor, a comparison designed to make the actual price seem more palatable.

Imagine a taste test of coffees, wines, or chocolate: you could also consider A/B testing of several loudspeakers or video systems. When you judge by comparing "A" with other choices, the very act of comparing can make something ordinary seem superior. That cup of coffee or glass of wine that tasted extraordinary after the tour of the coffee farm or winery on your vacation might seem utterly unexceptional when you drink it back home.

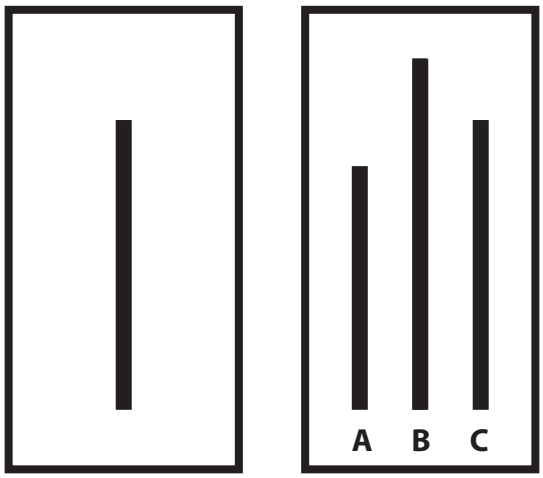
When you buy a car or any purchase that requires negotiating, a good salesperson will not give you the best price first; much to your annoyance, he or she makes a first offer. Maybe you'll just say yes and the salesperson makes a great sale (because the first offer is a high price). He or she knows that, like most savvy shoppers, you will judge the first price as "too high."

So the salesperson goes "back to the boss" to "see what I can do." He or she returns, and often with a dramatic flair, shows you a number—a lower price.

Why didn't the salesperson do that right away? Why play games? The salesperson uses these "games" to control the context and thus influence your perception. You now compare that number with the first offer, and it *seems* lower because you compare it with the higher number.

Extension activity: Find ads, sales brochures, or marketing literature that illustrate our perceptual habit of making decisions based on the context of the product.

12. Solomon Asch conducted a now-classic experiment in the early 1950s involving subjects judging the length of lines when influenced by the opinion of peers. The setup was for the subject to state if line A, B, or C was the same length as the line on the left. In a control group with no social pressure, 97% identified the correct answer in a series of questions.



In Asch's experiments, the subjects were placed in a classroom setting and were told to announce their answers to a series of questions similar to the one shown above. Unbeknownst to the subject, others in the classroom who announced their answers first were "in on" the experiment. These so-called confederates gave a few correct answers then switched to wrong answers. Would the subject stick to his or her perception or be swayed by social pressure?

Asch found that when surrounded by others giving obviously wrong answers, the subject "went with the crowd" 37% of the time. Three quarters of the subjects gave an incorrect

answer to at least one question. The experiment was widely seen as evidence that social conformity influences our judgment.

About 50 years later a similar (but far more complex) experiment was conducted by Gregory Berns and others at Emory University School of Medicine. This study included some important differences and suggested that apparent errors of judgment are not merely caused by our desire to follow the crowd.

In this study, subjects mentally rotated three-dimensional objects and were asked to judge if the objects were the same or different. This experiment used functional magnetic-resonance imaging (fMRI) to study the subjects' brain activity while they made their choices. Participants were presented with the responses of four peers who were actually confederates and who gave wrong answers half the time.

The authors stated, "our results affirm the hypothesis that brain regions classically associated with perception can be altered by social influences." In other words, it's not that we know we are giving a wrong answer and simply duck into the safety of the crowd. We actually see the answer as correct. The context of social pressure alters our perception.

The original Asch study is often seen as evidence of pressure to conform. The fMRI study suggests that we don't alter our answer in order to conform. Instead, we actually see the lines differently. This might help explain why people who have perceptions altered by peer pressure firmly believe they are not influenced by the opinions of others.

13. The question "Where have all the mermaids gone?" refers to the fact that mermaid sightings in past centuries were quite common but are nearly nonexistent today. The question suggests that our perceptions are shaped by culture. People today are much more likely to see a UFO than a mermaid. Perceptions are shaped by expectations. To some extent, we see what our culture teaches us to see.

    Extension activity: Prepare a report on some creature that was once a part of specific cultures but is rarely mentioned today. Possible topics: mermaids, fairies, sprites, dragons, flying witches.

14. We tend to place a high degree of confidence in eyewitness identification. If someone says, "I saw this happen," we have a bias to believe it. "I saw it with my own eyes," is a trump card in the evidence deck. Recent research into the accuracy of eyewitness identification suggests that such confidence is misplaced. We often see our expectations and prejudices rather than what actually happens. We also see only a small part of the picture and often fill in what remains yet treat our "filling in" as actual eyewitness evidence. We consider this guessing and filling-in to be clear and objective truth. This is why eyewitness identification is so convincing. Even a totally wrong eyewitness believes in the truth of his or her perception: "Of course, I'm sure that line B is longer or the top blue circle is larger. I know what I see."

    Psychologist Gary Wells of Iowa State University conducted a study in which he asked 172 college students to watch a convenience-store murder captured on a surveillance videotape. Afterward, each student was asked to point out the gunman from a book of photos. Although the real murderer was not pictured, every student singled out someone in the book as the man they'd seen on the video.

After the identification, an interviewer hinted to some of the students that they'd gotten the right man. Others heard suggestions that they had picked the wrong one; the remainder was told nothing about their choices. The researchers then gave the students a psychological test to find out how confident they were in their judgments.

Every student had chosen the wrong man, of course, but half of those who had heard approving comments were convinced they had chosen the culprit. Few of the others were sure. The students who had been given encouragement also claimed that they had gotten a clear view of the gunman's face on the tape and said they had been paying close attention to his features, although the other students reported that they could not see the man clearly.

Eyewitness recollections are corrupted in the same way at police stations every day, according to Wells. "The procedures used to obtain these identifications are horrible," he says. "There's no law against a detective saying 'That's the guy!' or leading a witness on. When that happens, the witness's confidence skyrockets." Many police departments have changed policies regarding eyewitness accounts in order to minimize prompting or biasing information.

Extension activity: Prepare a written or verbal report on the problem of eyewitness identification in court cases. Report on the findings of Gary Wells or Elizabeth Loftus. What procedures do the police in your city use to insure more accurate and useful eyewitness accounts?

15. We tend to believe that we see most of what is around us; but this see-it-all idea is an illusion. We see only parts of what is before us and guess the rest. We see what we expect and ignore much of what does not fit our preconceptions. We believe we can multitask but our perception happens mostly on a one-thing-at-a-time basis.

    Magicians use these misconceptions to mislead or con us into believing that objects appear and disappear (or simply to pick pockets or win money in a shell game). One common device is misdirection, in which the magician or con artist directs attention to point A in order to hide what is happening at point B. When a trick is explained, it sounds so simple. The magician knows we attend to only one thing at a time, yet we firmly believe we can attend to multiple events.

16. The problem with cell phones is not that they occupy the hands, but that they occupy our attention—our limited ability to attend to what is happening in front of us. We feel that we can safely drive and talk on the phone because we are under the illusion that we can multitask and see the unexpected.