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Whether you're designing a Web site or a medical device—or something somewhere in between—your audience is comprised of the people who will benefit from that design.

And the totality of your audience's experience is profoundly impacted by what you know—or *don't know*—about them.

How do they think? How do they decide? What motivates them to click or purchase or whatever it is you want them to do?

You'll learn those things in this book.

You'll also learn what grabs their attention, what errors they will make and why, as well as other things that will help you design better.

And you'll design better because I've already done most of the heavy lifting for you. I'm one of those strange people who likes to read research. Lots and lots of research. So I read—or in some cases, *re-read*—dozens of books and hundreds of research articles. I picked my favorite theories, concepts, and research studies.

Then I combined them with experience I've gained throughout the many years I've been designing technology interfaces.

And you're holding the result: 100 things I think you need to know about people.

HOW PEOPLE SEE

Vision trumps all the senses. Half of the brain's resources are dedicated to seeing and interpreting what we see. What our eyes physically perceive is only one part of the story. The images coming in to our brains are changed and interpreted. It's really our brains that are "seeing."

1 WHAT YOU SEE ISN'T WHAT YOUR BRAIN GETS

You think that as you're walking around looking at the world, your eyes are sending information to your brain, which processes it and gives you a realistic experience of "what's out there." But the truth is that what your brain comes up with *isn't* exactly what your eyes are seeing. Your brain is constantly interpreting everything you see. Take a look at **Figure 1.1**, for example.

What do you see? At first you probably see a triangle with a black border in the background, and an upside-down, white triangle on top of it. Of course, that's not really what's there, is it? In reality there are merely lines and partial circles. Your brain creates the shape of an upside-down triangle out of empty space, because that's what it expects to see. This particular illusion is called a Kanizsa triangle, named for the Italian psychologist Gaetano Kanizsa, who developed it in 1955. Now look at **Figure 1.2**, which creates a similar illusion with a rectangle.

THE BRAIN CREATES SHORTCUTS

Your brain creates these shortcuts in order to quickly make sense out of the world around you. Your brain receives millions of sensory inputs every second (the estimate is 40 million) and it's trying to make sense of all of that input. It uses rules of thumb, based on past experience, to make guesses about what you see. Most of the time that works, but sometimes it causes errors.

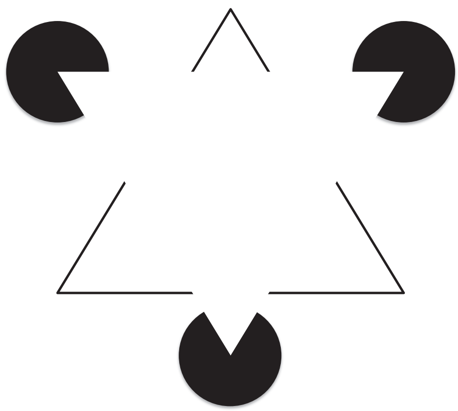

FIGURE 1.1 You see triangles, but they are not really there

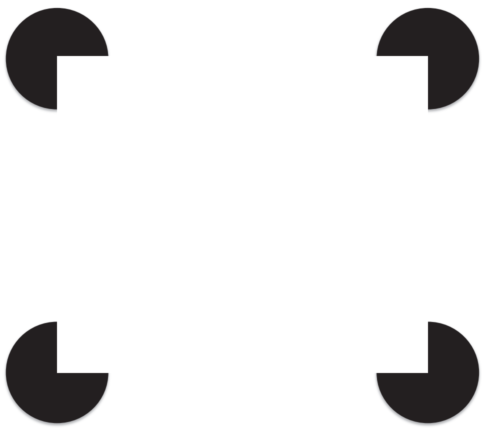

FIGURE 1.2 An example of a Kanizsa rectangle

You can influence what people see, or think they see, by the use of shapes and colors. **Figure 1.3** shows how color can draw attention to one message over another.

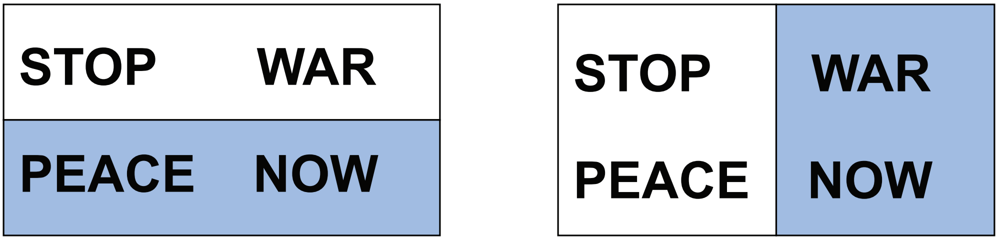

FIGURE 1.3 Color and shapes can influence what people see

If you need to see in the dark, don't look straight ahead.

The eye has 7 million cones that are sensitive to bright light and 125 million rods that are sensitive to low light. The cones are in the fovea (central area of vision) and rods are less central. So if you're in low light, you'll see better if you don't look right at the area you're trying to see.

Optical illusions show us the errors

Optical illusions are examples of how the brain misinterprets what the eyes see. For example, in **Figure 1.4** the line on the left looks longer than the line on the right, but they're actually the same length. Named for Franz Müller-Lyer, who created it in 1889, this is one of the oldest optical illusions.

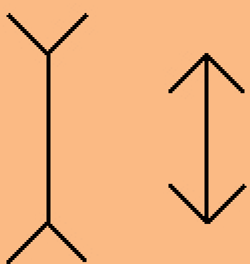

FIGURE 1.4 These lines are actually the same length

We see in 2D, not 3D

Light rays enter the eye through the cornea and lens. The lens focuses an image on the retina. On the retina it is always a two-dimensional representation, even if it is a three-dimensional object. This image is sent to the visual cortex in the brain, and that's where recognition of patterns takes place, for example, "Oh, I recognize that as a door." The visual cortex turns the 2D image into a 3D representation.

The visual cortex puts all the information together

According to John Medina (2009), the retina receives electrical patterns from what we look at and creates several tracks from the patterns. Some tracks contain information about shadows, others about movement, and so on. As many as 12 tracks of information are then sent to the brain's visual cortex. There, different regions respond to and process the information. For example, one area responds only to lines that are tilted to 40 degrees, another only to color, another only to motion, and another only to edges. Eventually all of these data get combined into just two tracks: one for movement (is the object moving?) and another for location (where is this object in relation to me?).

Takeaways

* What you think people are going to see on your Web page may not be what they do see. It might depend on their background, knowledge, familiarity with what they are looking at, and expectations.
* You might be able to persuade people to see things in a certain way, depending on how they are presented.

2 PERIPHERAL VISION IS USED MORE THAN CENTRAL VISION TO GET THE GIST OF WHAT YOU SEE

You have two types of vision: central and peripheral. Central vision is what you use to look at things directly and to see details. Peripheral vision encompasses the rest of the visual field—areas that are visible, but that you're not looking at directly. Being able to see things out of the corner of your eye is certainly useful, but new research from Kansas State University shows that peripheral vision is more important in understanding the world around us than most people realize. It seems that we get information on what type of scene we're looking at from our peripheral vision.

Why blinking on a screen is so annoying

People can't help but notice movement in their peripheral vision. For example, if you're reading text on a computer screen, and there's some animation or something blinking off to the side, you can't help but look at it. This can be quite annoying if you're trying to concentrate on reading the text in front of you. This is peripheral vision at work! This is why advertisers use blinking and flashing in the ads that are at the periphery of web pages. Even though we may find it annoying, it does get our attention.

Adam Larson and Lester Loschky (2009) showed people photographs of common scenes, such as a kitchen or a living room. In some of the photographs the outside of the image was obscured, and in others the central part of the image was obscured. The images were shown for very short amounts of time, and were purposely shown with a gray filter so they were somewhat hard to see (see **Figure 2.1** and **Figure 2.2**). Then they asked the research participants to identify what they were looking at.

Larson and Loschky found that if the central part of the photo was missing, people could still identify what they were looking at. But when the peripheral part of the image was missing, then they couldn't say whether the scene was a living room or a kitchen. They tried obscuring different amounts of the photo. They concluded that central vision is the most critical for specific object recognition, but peripheral vision is used for getting the gist of a scene.

FIGURE 2.1 A central vision photo used in Larson and Loschky research

FIGURE 2.2 A peripheral vision photo used in Larson and Loschky research

Peripheral vision kept our ancestors alive on the savannah

The theory, from an evolutionary standpoint, is that early humans who were sharpening their flint, or looking up at the clouds, and yet still noticed that a lion was coming at them in their peripheral vision survived to pass on their genes. Those with poor peripheral vision didn't survive to pass on genes.

Recent research confirms this idea. Dimitri Bayle (2009) placed pictures of fearful objects in subjects' peripheral vision or central vision. Then he measured how long it took for the amygdala (the emotional part of the brain that responds to fearful images) to react. When the fearful object was shown in the central vision, it took between 140 to 190 milliseconds for the amygdala to react. But when objects were shown in peripheral vision, it only took 80 milliseconds for the amygdala to react.

Takeaways

* People use peripheral vision when they look at a computer screen, and usually decide what a page is about based on a quick glimpse of what is in their peripheral vision.
* Although the middle of the screen is important for central vision, don't ignore what is in the viewers' peripheral vision. Make sure the information in the periphery communicates clearly the purpose of the page and the site.
* If you want users to concentrate on a certain part of the screen, don't put animation or blinking elements in their peripheral vision.

3 PEOPLE IDENTIFY OBJECTS BY RECOGNIZING PATTERNS

Recognizing patterns helps you make quick sense of the sensory input that comes to you every second. Your eyes and brain want to create patterns, even if there are no real patterns there. In **Figure 3.1**, you probably see four sets of two dots each rather than eight individual dots. You interpret the white space, or lack of it, as a pattern.

FIGURE 3.1 Your brain wants to see patterns

Individual cells respond to certain shapes

In 1959 David Hubel and Torsten Wiesel showed that some cells in the visual cortex respond only to horizontal lines, others respond only to vertical lines, others respond only to edges, and still others respond only to certain angles.

THE GEON THEORY OF OBJECT RECOGNITION

There have been many theories over the years about how we see and recognize objects. An early theory was that the brain has a memory bank that stores millions of objects, and when you see an object, you compare it with all the items in your memory bank until you find the one that matches. But research now suggests that you recognize basic shapes in what you are looking at, and use these basic shapes, called geometric icons (or geons), to identify objects. Irving Biederman came up with the idea of geons in 1985 (**Figure 3.2**). It's thought that there are 24 basic shapes that we recognize; they form the building blocks of all the objects we see and identify.

The visual cortex is more active when you are imagining

The visual cortex is more active when you are imagining something than when you are actually perceiving it (Solso, 2005). Activity occurs in the same location in the visual cortex, but there is more activity when we imagine. The theory is that the visual cortex has to work harder since the stimulus is not actually present.

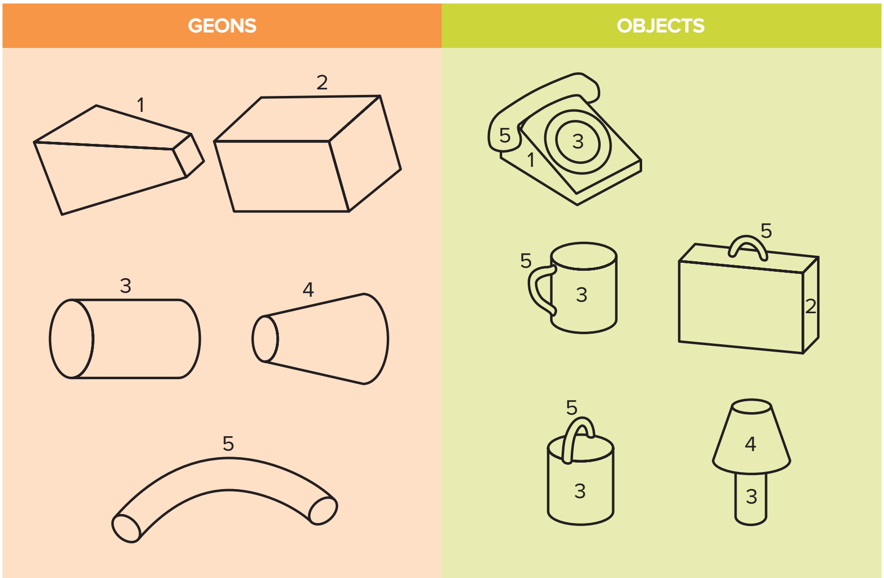

FIGURE 3.2 Some samples of Biederman's geons

Takeaways

- Use patterns as much as possible, since people will automatically be looking for them. Use grouping and white space to create patterns.
- If you want people to recognize an object (for example, an icon), use a simple geometric drawing of the object. This will make it easier to recognize the underlying geons, and thus make the object easier and faster to recognize.
- Favor 2D elements over 3D ones. The eyes communicate what they see to the brain as a 2D object. 3D representations on the screen may actually slow down recognition and comprehension.

WHAT MOTIVATES PEOPLE

New research on motivation reveals that some of the supposedly tried-and-true methods for getting and keeping people motivated may have been tried, but they're not quite true.

50 PEOPLE ARE MORE MOTIVATED AS THEY GET CLOSER TO A GOAL

You're given a frequent buyer card for your local coffee shop. Each time you buy a cup of coffee you get a stamp on your card. When the card is filled, you get a free cup of coffee. Here are two different scenarios:

- **Card A:** The card has 10 boxes for the stamps, and when you get the card, all the boxes are blank.
- **Card B:** The card has 12 boxes for the stamps, and when you get the card the first two boxes are already stamped.

Question: How long will it take you to get the card filled up? Will it take longer or shorter for scenario A versus scenario B? After all, you have to buy 10 cups of coffee in both scenarios in order to get the free coffee. So does it make a difference which card you use?

The answer, apparently, is yes. You'll fill up the card faster with Card B than with Card A. And the reason is called the *goal-gradient effect*.

The goal-gradient effect was first studied in 1934 by Clark Hull using rats. He found that rats that were running a maze to get food at the end would run faster as they got to the end of the maze.

The goal-gradient effect says that you will accelerate your behavior as you progress closer to your goal. The coffee reward card scenarios I describe above were part of a research study by Ran Kivetz (2006) to see if people would act like the rats did in the original 1934 study. And the answer is, yes, they do. In addition to the coffee shop study, Kivetz found that people would go to a Web site more frequently and rate more songs during each visit as they got closer to a reward goal at the site.

The Dropbox Web site (**Figure 50.1**) shows how close you are to reaching a goal that gives you extra storage space. As you get closer to the goal, you'll be more motivated to take the one or two steps left to reach it.

People focus on what's left more than what's completed

Minjung Koo and Ayelet Fishbach (2010) conducted research to see which would motivate people more to reach a goal: a) focusing on what they'd already completed, or b) focusing on what remained to accomplish. The answer was b—people were more motivated to continue when they focused on what was left to do.

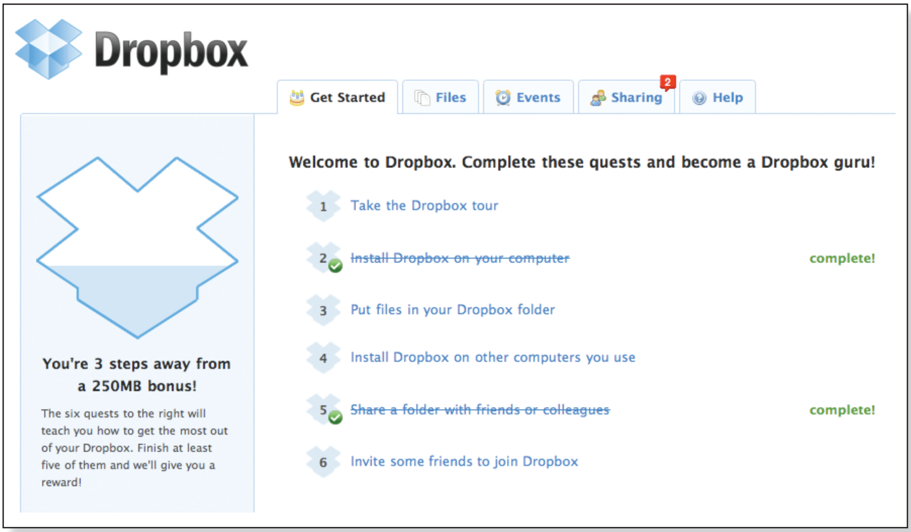

FIGURE 50.1 Dropbox shows you how close you are to the goal

Takeaways

- The shorter the distance to the goal, the more motivated people are to reach it. People are even more motivated when the end is in sight.
- You can get this extra motivation even with the illusion of progress, as in the coffee card B example in this section. There really isn't any progress (you still have to buy 10 coffees), but it seems like there has been some progress so it has the same effect.
- People enjoy being part of a reward program. When compared to customers who were not part of the program, Kivetz found that the customers with reward cards smiled more, chatted longer with café employees, said "thank you" more often, and left a tip more often.
- Motivation and purchases plummet right after the goal is reached. This is called a *post-reward resetting phenomenon*. If you have a second reward level people won't initially be very motivated to reach that second reward.
- You're most at risk of losing your customer right after a reward is reached.

51 VARIABLE REWARDS ARE POWERFUL

If you studied psychology in the twentieth century, you may remember B. F. Skinner and his work on operant conditioning. Skinner studied whether behavior increased or decreased based on how often, and in what manner, a *reinforcement* (reward) was given.

WHAT THE CASINOS KNOW

Let's say you put a rat in a cage with a bar. If the rat presses the bar he gets a food pellet. The food pellet is called the reinforcement. But what if you set it up so that the rat does not get the food pellet every time he presses the bar. Skinner tested out various scenarios, and found that the frequency with which you gave the food pellet, and whether you give it based on elapsed time or bar presses, affected how often the rat would press the bar. Here's a synopsis of the different schedules:

★ **Interval schedules.** You provide a food pellet after a certain interval of time has passed, for example, five minutes. The rat gets a food pellet the first time he presses the bar after five minutes is up.

★ **Ratio schedules.** Instead of basing the reinforcement on time, you base it on the number of bar presses. The rat gets a food pellet after every 10 bar presses.

There's another twist. You can have fixed or variable variations on each schedule. If it's a fixed schedule, then you keep the same interval or ratio, for example, every five minutes or every 10 presses. If it's variable, then you vary the time or ratio, but it averages out; for example, sometimes you provide the reinforcement after two minutes, sometimes after eight minutes, but it averages out to five minutes.

So altogether there are four possible schedules:

★ **Fixed interval.** Reinforcement is based on time and the time interval is always the same.

★ **Variable interval.** Reinforcement is based on time. The amount of time varies, but it averages to a particular time.

★ **Fixed ratio.** Reinforcement is based on the number of bar presses, and the number is always the same.

★ **Variable ratio.** Reinforcement is based on the number of bar presses. The number varies, but it averages to a particular ratio.

It turns out that rats (and people) behave in predictable ways based on the schedule you're using. **Figure 51.1** shows a chart of the kind of behavior you'll get based on the type of schedule.

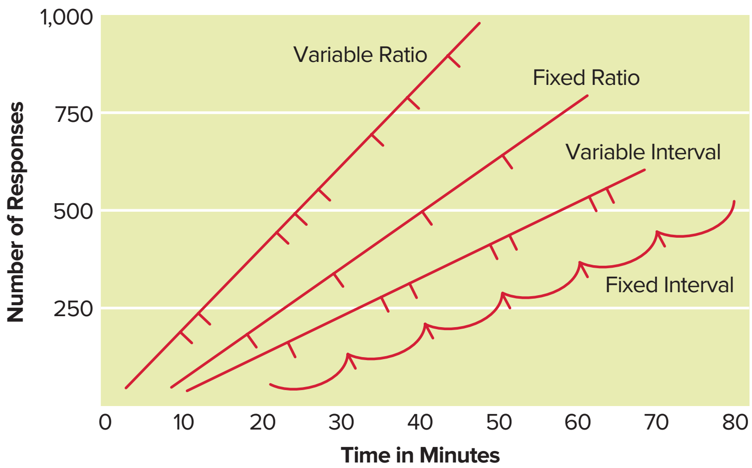

FIGURE 51.1 Reinforcement schedules for operant conditioning

Operant conditioning fell out of favor

In the 1960s and 1970s operant conditioning was *the* theory at many university psychology departments around the world. But many psychologists from other points of view (for example, cognitive or social psychology) were not fans, and it fell out of favor after that. Other learning and motivation theories became more popular, and these days operant conditioning gets maybe one lecture and a few pages in the textbook during a college Introductory Psychology class. If you haven't guessed, I was trained in operant conditioning during my undergraduate work, and I'm a fan. Although I do not believe that operant conditioning explains all behavior and motivation, I do believe that the theories are well tested, and they work. I've personally used them in my management style, my classroom style when I'm teaching, and in my child-rearing practices.

You can predict, then, how often people will engage in a certain behavior based on the way they are reinforced or rewarded. If you want someone to engage in a certain behavior the most, then you would use a variable ratio schedule.

If you've ever been to Las Vegas, then chances are you've seen a variable ratio schedule in operation. You put your money in the slot machine and press the button. You don't know how often you'll win. It's not based on time, but rather on the number of times you play. And it's not a fixed schedule, but a variable one. It's not predictable. You're not sure when you're going to win, but you know that your odds of winning increase the more times you play. So it will result in you playing the most, and the casino making the most money.

OPERANT THEORY AND DESIGN

If you're not sure that operant conditioning is related to design, think about it more deeply. Many times as designers you want to encourage people to engage in a certain behavior continuously. Skinner's work is still relevant, but people don't realize it. Take the study by Kivetz in the beginning of this chapter. The rewards card is actually an example of a fixed ratio schedule: you buy 10 cups of coffee (press the bar 10 times), and then you get a free coffee.

At Dropbox.com, for every friend you get to join Dropbox you receive extra storage space (**Figure 51.2**). This is called a continuous reinforcement schedule. (Skinner's work suggests that Dropbox might get better results if it gave a larger reward for every three or five friends, in other words, if it switched to a fixed ratio schedule rather than a continuous schedule).

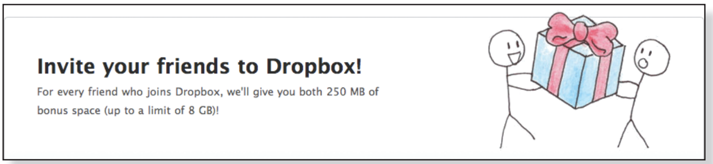

FIGURE 51.2 For every friend who joins Dropbox, you get a reward

Takeaways

* For operant conditioning to work, the reinforcement (reward) must be something that particular audience wants. Hungry rats want food pellets. What does your particular audience really want?
* Think about the pattern of behavior you're looking for, and then adjust the schedule of rewards to fit that schedule. Use a variable ratio schedule for the maximum behavior repetition.