CHAPTER

What Is Emotion?

2

One evening, a friend offered to drive Trevor the few blocks home after work. He got into her car and sat down, ready for the short ride. A minute or so after starting the car, an annoying beeping sound started. "Oh," she said, "you'll need to fasten your seatbelt to make that beeping stop." Grudgingly, Trevor fastened his seatbelt and the beeping ceased. But, the noise had accomplished its purpose; his seatbelt was safely fastened for the short trip.

This alarm is an example of **affective** or **emotional design**. Even though all design triggers emotions, in this book, we're using the term to refer to design that's created to intentionally trigger a conscious or unconscious emotional response. Emotional design attracts the user's attention through changes in the different types of emotional states, increasing the likelihood of the user performing a particular behavior.

Affective design is design that's created to intentionally trigger a conscious or unconscious emotional response.

The behavior you're designing for could be anything. At a simple level, it could consist of encouraging users to click a button, or drawing their attention to a "Help" icon through the use of contrast. It might consist of encouraging your users to sign up for a newsletter, or make a complex purchase online. You may be trying to encourage the behaviors that lead to the creation of a long-term relationship with a brand or service. Whatever the behavior is, employing the principles of emotional design can help you increase the likelihood that your users

FIG. 2.1 Color vs. Grayscale

By increasing physiological stimulation, saturated colors demand more attention than grayscale.
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Design for Emotion. DOI: 10.1016/B978-0-12-386531-1.00002-8

will take the desired action. Rendering a design element like a button in color, for example, will make it demand more attention than the same design element rendered in gray.

Negative emotional responses encourage us to avoid.

The beeping noise in Trevor's friend's car was purposefully designed to be unpleasant, triggering an urge to avoid. Negative emotional response encourage a particular behavior (i.e., avoidance). As a passenger, the simplest option for avoiding the annoying sound is to just fasten your seatbelt and get on with life. Given that most of us would rather fasten our seatbelts than suffer the inconvenience of walking, the emotional response is a perfect trigger for the behavior the designer is seeking.

In this chapter, we're going to do a deep dive into the concept of emotion to gain a fuller understanding of its dimensions. A lot of the material in Chapter 2 may seem as though it's pure psychology, but the concepts we're introducing here will be used throughout the remainder of the book, so bear with us. By the end of this chapter, you should understand the basic dimensions of emotion and be able to generalize the ways in which emotion affects cognition, the body and behavior. This knowledge will help in understanding and predicting how your design decisions will affect the emotions of the people who use your products. You may also find that having a better understanding of your own emotions will affect the way you design.

FIG. 2.2 Seatbelt Buckle

Your vehicle's seatbelt reminder sound uses negative affect to get you to buckle up.

UNDERSTANDING EMOTION

We tend to think we understand emotions. After all, almost everyone has experience with them. But what are emotions? How are they different from moods? What makes satisfaction different from disappointment, and how do you create the conditions that lead to one emotion rather than another? To effectively design for emotion, it's helpful to understand the different ways that emotion can be described or modeled. To help you gain this understanding, we'll introduce you to a few of the models used to tell emotions apart.

Our intent here isn't to provide an exhaustive account of all the ways that researchers have modeled emotion, but to focus on models that we've found helpful in increasing understanding and applicable in terms of generating design guidelines. Each model represents a different perspective on emotion. These perspectives include both the mental and physical components of emotion, as well as the different ways that emotions are expressed, both internally and externally.

To design for emotion, you'll need to understand the different ways that emotion can be described.

Experiencing Emotion

"Emotion" is a term that's often used to refer to a number of different responses. What we normally refer to as **emotion** or **emotions** are really a number of different mental and physical states. Each of these affective states has different characteristics and different effects on how we invest attention, make decisions, behave, and express ourselves.

We re-present the experiences we have and the objects we encounter in terms of information we receive from our senses: visual; tactile (i.e., touch); olfactory (i.e., smell); auditory (i.e., hearing); gustatory (i.e., taste); and proprioceptive (i.e., the sense of the relative position of parts of the body in space). The brain associates (or connects) this sensory information with the feelings that are experienced as the information is encountered. Repeated over time, associations become conditioning. Together, association and conditioning influence learning and the retention of information (Gagné, 1985).

Many of us will remember being fascinated by the glowing red element on the stove as children. If you finally touched the hot element and cried out in pain, the high arousal of the experience embedded it in your memory. By associating the feelings of pain and pleasure with people, places, and events, we learn to safely make our way in the world. Emotional responses allow us to evaluate our internal and external environments and respond appropriately. They affect how we feel, how we think, what we say and what we do. The effects of emotion directly influence the way we perceive our everyday lives, affecting how we categorize information, make decisions, evaluate risks and solve problems (Isen, 1999).

We re-present the objects we encounter and the experiences we have in terms of information from our senses.

Triggering an emotional response begins with a stimulus that is "emotionally competent" (Damasio, 2003), or carries emotional weight. This stimulus could be an external object or experience, or an internal thought or feeling. Stimuli in

the external environment include people, objects and experiences. Stimuli in the internal environment include internal representations, feelings and memories. Feelings can be triggered by association to past experiences or through conscious deliberation and evaluation. For example, remembering a loved one who has passed on can bring back both positive and negative feelings connected to their memory.

Feelings can be triggered by association to past experiences or through conscious deliberation and evaluation.

With both external and internal stimuli, what generates the emotional response is the way we re-present the object or experience internally, rather than the object or experience itself. Of course, that being said, the properties of the object (also known as the "design") have a lot to do with the signals the user receives and re-presents in their minds.

Expressing Emotion

One way we can tell emotions apart is based on how they are expressed. The public, external signs of emotion manifest as facial expressions and changes in body posture, vocalization, breathing patterns and behavior. The private, internal expressions (i.e., feelings) of emotions can be seen as a type of kinesthetic feedback from the body that has effects on subsequent thinking.

Public expressions of emotion communicate our feelings to others. These expressions include changes in how we appear (i.e., our facial expressions and breathing), what we say (i.e., our conversation or interaction) and what we do (i.e., how we behave). When the same public expressions of emotion occur consistently over time, what was once seen as an emotional response may come to be seen as a personality trait.

We can tell emotions apart based on how they are expressed.

In the Netherlands, the town of Groningen has installed microphones at street level to help monitor emotional expression on the street. The microphones are part of a system that includes acoustic recognition software. The software is capable of analyzing the voices of people on the street for high-frequency vowel sounds and picking up aggressive sounding voices. Police can then be sent to the scene to break up arguments or fights, hopefully before they escalate into larger altercations (van Hengel & Andringa, 2007).

This example illustrates how particular properties of sound can be linked with particular expressions of emotional experience. In other words, the emission of sounds at a particular frequency or volume almost always indicates that the person emitting the sound is experiencing a particular emotional state—in this case, anger. Anger can often lead to violent behavior. In the same way we can connect properties of sound such as frequency and volume to certain types of emotional expression, we can also connect other aesthetic properties to certain dimensions of emotion.

The Feeling of Emotions

Emotions are different from feelings. Feelings are the physiological experience of emotional states. Damasio defines a feeling as "the perception of a certain state of the body along with the perception of a certain mode of thinking and of thoughts with certain themes" (2003, p. 86).

Particular emotions are associated with certain body states, patterns of mental processing and ways of behaving. With all emotional responses, neurological and chemical responses change the viscera, internal organs, and musculoskeletal system of the body in specific ways depending on the nature of the emotion. When your heart rate increases in moments of anxiety or stress, you feel excited or afraid. The churning of the stomach lets you feel disgusted (Norman, 2004).

From these perceptions, the mind creates mental representations or models that describe the state of the body and its parts. Using these models allows the mind to ignore certain aspects of the body when necessary for survival. For example, it may be useful for the mind to ignore the experience of pain in the body when the most urgent need is to flee from danger (Damasio, 2003).

Our emotional responses result from the internal representations that we make of external objects and internal experiences.

Mental Models

We're constantly inundated with information about the world we receive from our senses. There is more written factual information in one edition of the Sunday *New York Times* than in all the written documents that were available to a reader in the 15th century. Today, more than 300,000 books are released annually worldwide (Davenport & Beck, 2001). Even without books, billions of websites, apps, games, blogs and text messages continually compete with objects in the physical world for our attention.

Emotions and feelings result from the internal representations that we make of thoughts, people, external objects and experiences. What do we mean by representations? For example, an image of a happy face is not actually a happy face, but rather a re-presentation of one. Even though we often mistake our mental images of people, events, objects and experiences for the real thing, they're really only representations. The brain shifts the meaning of these representations based on how we respond emotionally to them over time.

Our emotional responses result from the internal representations that we make of external objects and internal experiences. Externally, the object may stay the same, but internally, the emotional responses and feelings we have towards it may change. On the other hand, our preexisting feelings and emotions also influence how the internal representation takes shape. Almost all representations of objects and experiences cause emotional responses and feelings, but many of these feelings may be too weak to be perceived by the conscious mind (Damasio, 2003).

Your mental model can include only the features of reality that you've been exposed to and associated with feelings.

Because our mental models are really descriptions of how the various pieces and parts of a system work together, they define how we approach problems. Mental models are the unspoken rules that we've intuited from observing people, things and situations. They describe the parts of a system, the relationships between these parts, how we think things work, and the consequences of action (Johnson-Laird, 1983).

The information we take in from both our internal and external environments informs our mental models of particular situations, our immediate surroundings, and ultimately, each individual's "reality."

FIG. 2.3 This Is Not a Happy Face
Everything is a representation.
© *Trevor van Gorp*

The Map Is Not the Territory

Because no one can be exposed to everything, everyone's mental model of reality is incomplete. Even if someone could somehow be exposed to everything in life, that person's cognitive faculties couldn't process and assimilate all that information. As a matter of course, we regularly screen out or ignore information by selectively focusing our attention (Davenport & Beck, 2001). For this reason, no individual's model of reality can possibly encompass *all* of reality. Your mental model can include only the features of reality that you've been exposed to and associated with feelings. These features become memories. Because of this, all of our mental models of reality might be better described as "maps" (Korzybski, 1933).

Geographic maps represent important features in a landscape, such as roads, mountains, rivers, and forests. Like geographic maps, mental maps describe the important features of a person, object, situation, or context. In the same way that some maps describe more features of a landscape than others, some mental models describe more aspects of a situation or context than others. In the case of a mental model, the features that are judged to be important may vary from person to person, or within the same person at different times. In the same way that some maps are more accurate than others, some mental models are also more accurate than others.

A good model helps you to understand the users' requirements and how the product fulfills those requirements.

Everyone's personal "reality model" is necessarily composed of the information they've consciously or unconsciously focused attention on, absorbed, and incorporated (Korzybski, 1933). This is the information that has drawn their attention, become associated with a strong feeling, and been stored in their memory. Over time, these experiences create the narrative or *story* of people's lives. Stories are one way that people communicate the emotional meanings associated with their life experiences.

The models of emotion presented in this chapter could also be considered "maps." Just as a map shouldn't be mistaken for the territory it represents, a model shouldn't be mistaken for the thing it describes. Because all maps represent a set of important features or a particular perspective on some feature of a territory, they're necessarily limited. But this limitation is also their strong point. By limiting

the description to a single set of features or a particular perspective, models make it easier to define the boundaries of a problem.

A good model for understanding how to design:

- Is easy to understand, so that other people can enter the discussion and collaborate
- Helps predict what will occur so that you can adjust your own actions accordingly
- Helps share and communicate ideas that are abstract and can't be seen or touched
- Is easy to apply in the context of the design process

When applied to design, a good model helps you to understand both the users' requirements, and how the product interacts with the user to fulfill those requirements.

THE ANATOMY AND INFLUENCE OF EMOTION

Many people don't believe that an idea with as much subjective meaning as "emotion" can be clearly understood or purposefully "designed." It's true that conscious emotional responses are relatively complex and subjective. Emotional responses based on conscious evaluations or appraisals can vary depending on the current emotional state of individual, the context and a number of other factors.

Unconscious emotional responses are fairly consistent and trigger relatively predictable patterns of behavior.

However, unconscious emotional responses are fairly consistent and often trigger relatively predictable patterns of behavior. For example, the initial emotional effects of a fire alarm are relatively consistent. The irritating high-pitched noise

FIG. 2.4 Fire Alarm

A fire alarm uses negative affect to get you to leave the area.

results in an increase in heart rate and anxiety that triggers the urge to avoid. The natural behavior is to leave the area to escape the noise. In the context of a fire, this is the right behavior to encourage. With frequent false alarms, however, our conscious brains override this unconscious response, as we come to associate the alarm sound with little real danger.

Unconscious emotional responses are triggered automatically, without conscious thought.

In order to encourage behavior by triggering emotion, it's helpful to understand several of the models that have been created to describe emotion. These models can help us understand how emotions are triggered, what differentiates one emotion from another and the effects of emotions on information processing. Let's take a quick look at the concept of emotion from several different perspectives:

- Emotion is both conscious and unconscious.
- Emotion originates in different parts of the brain.
- Emotion combines the mental and the physical.
- Emotion affects attention and the processing of information in predictable ways.
- Emotion contributes to flow.
- Emotion influences motivation and behavior.
- Emotion is one type of "affective state" (emotions, moods, sentiments, and personality traits).

Emotion Is Both Conscious and Unconscious

When we hear the terms "conscious" and "unconscious," we tend to associate them with being awake or asleep. In this book, we'll be using these terms to refer to the conscious and unconscious (or subconscious) minds and how each processes information and responds emotionally.

The conscious mind is, well, conscious. In other words, we can "hear" it (in the form of thoughts) and participate in its decision-making process. Conscious emotional responses are triggered by our conscious evaluations and appraisals (i.e., the questions we ask ourselves about what we encounter in the world). For example, evaluating and comparing the features of three models of MP3 player is a conscious process.

Unconscious emotional responses can be much easier to design for, as they are relatively consistent.

Unconscious emotional responses are triggered automatically without conscious thought. In other words, we don't usually "hear" the thoughts associated with unconscious processes, possibly because they're occurring too quickly for our minds to verbalize. Unconscious emotional responses range from simple increases in physical stimulation (e.g., increased heart rate) when viewing deeply saturated colors (Fehrman & Fehrman, 2000) to more complex, multilayered, but yet still unconscious judgments (e.g., is that person attractive?). The first is an unconscious physiological reaction to a stimulus and the second is a decision made based on the unconscious processing of a number of stimuli.

When it comes to designing for emotion, unconscious responses are often much easier to design for, as they are relatively consistent, even in the face of

mixed conscious emotions. Some simple unconscious responses are automatic and are part of our genetic heritage. For example, barring advanced training in controlling unconscious processes, a saturated red will almost always raise a person's level of physical stimulation or arousal. Deep red is likely stimulating due to its evolutionary associations with blood (Fehrman & Fehrman, 2000). This association means that red draws attention, even in crowded physical and digital environments. That's one of the reasons we chose it as a color for the cover of this book.

Another example of an unconscious reaction is an emotional response to the smell of someone experiencing fear. Research has shown that although people couldn't

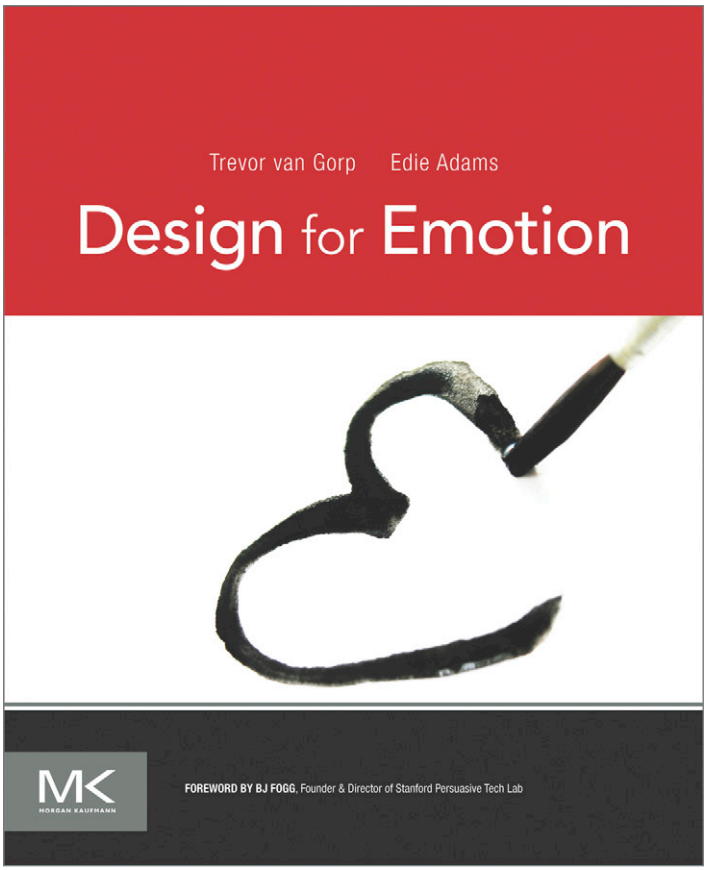

FIG. 2.5 Design for Emotion Cover

The book's cover uses color and contrast to unconsciously increase physiological stimulation and grab your attention.

detect a difference in the odor, their brains were much more activated when smelling the sweat of someone who had been afraid than the sweat of someone who was calm (Zhou & Chen, 2009).

Other, more conscious acts can also become unconscious responses when learned over time. Driving, for example, begins as a highly conscious act. New drivers are usually very nervous and somewhat awkward behind the wheel. Over time however, driving becomes an unconscious act for most. The experienced driver no longer needs to consider every action, with most common actions moving to the realm of the unconscious. However, when stress rises and demands on attention grow to a level that's impossible to maintain, even tasks that are normally simple and unconscious may become difficult and require conscious thought (Norman, 2004).

Recently, Edie was training a student to race high-performance cars at the track. On an average day, she would describe what she was doing to the student in the passenger seat as she'd drive around the track. But, on this particular day, it was pouring rain. Edie was surprised to find the driving conditions so challenging that she was unable to continue instructing the student verbally. "Normally, I can drive without thinking about it. It was as if my brain could no longer process everything that was going on. I couldn't seem to divide my attention between driving and thinking of what to say next. I had to stop talking and focus on the track."

Emotions Originate in Different Parts of the Brain

Emotional processing occurs in all three brains.

Emotions and other affective states are believed to originate in a number of different parts of the brain. If we examine the traces of evolution left in the physiology of the brain, we can relate them to the conscious and unconscious. McLean (1990) observed that brain structures similar to those seen deep within the human brain were also observed in lower mammals, reptiles, and other vertebrates. The human brain has been described in terms of three brain systems. Scientists have theorized that emotional processing occurs in all three of these "brains" (Norman, 2004). Based on evolutionary biology, the Triune Brain theory (McLean, 1990) describes the function of these three brain systems:

- Reptilian brain
- Mammalian brain
- Neomammalian brain (McLean, 1990)

Reptilian Brain

Our most primitive, unconscious emotional responses originate from what some have called the **reptilian brain** (or **old brain**), a brain structure that we share with reptiles and a few other vertebrates (McLean, 1990). The processing that occurs in the reptilian brain is nearly instantaneous and unconscious. This brain is responsible for basic survival and mating instincts, which are required by humans as well as other animals. These primitive instincts govern behavior around basic instincts such as fight, flight, food, and reproduction. The reptilian brain also keeps

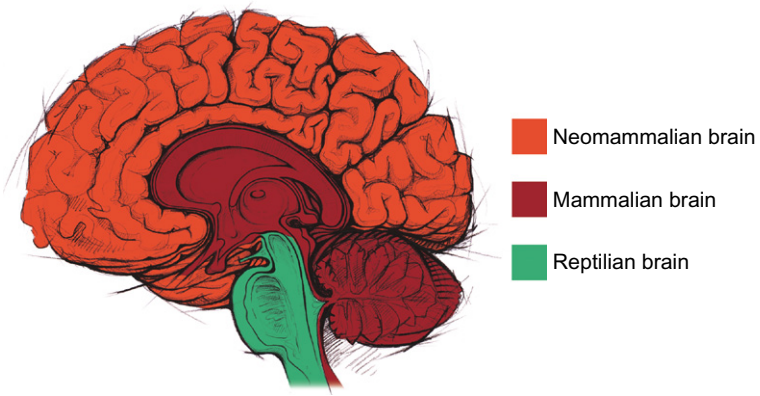

FIG. 2.6 Triune Brain

The triune brain is made up of the reptilian, mammalian, and neomammalian brains.
Adapted from (McLean, 1990). © alenah - Fotolia.com

all the body's automatic systems (such as breathing and digestion) going even when we are asleep or unconscious (Weinshenk, 2009).

Emotional reactions based on these survival instincts are elicited automatically and unconsciously (in other words, without thinking about them). This explains why physical attraction can be unconscious. You don't usually have to think about whether something is physically beautiful—it just is (or isn't)!

The reptilian brain is responsible for basic survival and mating instincts such as fight flight, food and reproduction.

Mammalian Brain

Although emotions have been said to originate in all three brains (Norman, 2004) the **mammalian brain** (or **mid brain**) is often referred to as the "emotional brain." This is the brain structure that we share with other mammals (and some vertebrates). The mammalian brain is involved in our responses to social interaction and generates our emotional responses to things like status, pair bonding and acceptance or rejection by the group (Graziano-Breuning, 2011).

Mammalian social instincts govern our behavior in groups (i.e., packs). These instincts allow us to make subtle judgments about power, status and social hierarchy. These judgments are useful when living in groups with other animals who may be larger or more powerful (Graziano-Breuning, 2011). At this level, feelings of attraction initiated in the reptilian brain can be muted or amplified through further interaction.

Social interactions between humans have been described as exchanges of *power* and *status* (Kemper, 1978) between the members of a group or pack. These interactions are influenced by judgments of power, as well as material, cultural and social status. Although the behavior of packs varies between species and even between packs, most mammals that congregate socially have some form of social ranking system.

Existing models of social hierarchy derived from evolutionary psychology are based at least in part on measures of relative power and status. Because our lower brain structures are very similar to those of other mammals (McLean, 1990), it's logical to assume that we have been wired to respond in similar ways.

The mammalian brain is involved in our emotional responses to social interaction.

In animal packs, the "alpha" is the animal of either sex with the highest rank among its peers. Generally, the highest status animals are those who are able to physically dominate their group. They are larger, stronger and faster than the others and are usually in early- to mid-adulthood. These traits allow the alpha to best any challengers in a physical confrontation for food, territory or access to mates. Chimpanzee groups show deference to the alpha animal by standing aside and allowing him or her to walk first. The alphas literally *lead* the way for the others. In a gesture that mirrors human social conventions, chimpanzees have also been observed bowing before the alpha. As the "leader" of the group, the alpha also tends to eat first and may take the first choice of mating partners (Darwin, 1877; de Waal, 2007; Mech, 1999).

In human society, the last 40–50 years have seen a reexamination of gender and sexuality that has redefined traditional gender roles. One group that appears to have retained a more traditional, if not exaggerated, approach to gender roles are biker clubs. Like animal groups in the wild, bikers judge power and status by displays of dominance.

People who become bikers tend to be bigger, louder, and stronger (i.e., more physically dominant) than average individuals. After they become part of an official gang, they may also be stronger smelling. This is intentional, as the part of the ceremony for induction into some biker gangs involves the inductee lying on the floor while gang members urinate and defecate on the inductee's patch or colors (Barker, 2007). Scent is a primitive and unconscious marker, and strong scents are difficult to avoid. Some mammals (e.g., primates) use urine and feces to scent mark territory (Johnson, 1973), which suggests some interesting parallels as new members become part of "the territory" of the biker club.

Conscious judgments originate in the neomammalian brain, where we can "hear" our thoughts and participate in decision making.

When your computer crashes, seemingly refusing to perform your requests, you may tell yourself that the source of your frustration is the inability to perform a task that needs to get done. Your conscious mind knows that the computer has no malicious intent. It's not purposefully defying you. Yet you still feel frustrated. Consider that your frustration may be unconsciously fueled by the machines refusal to acknowledge your higher power and status within the "pack."

Neomammalian Brain

Through experience, we learn to pause and evaluate the potential consequences of our actions with our conscious brain structures before responding automatically to situations. In this way, experience and socialization can help us judge whether an emotional response or behavior is appropriate for the situation. These types of conscious judgments originate in the **neomammalian brain** (the **neo cortex** or **new brain**). In the conscious, neomammalian brain, we can "hear" our own thoughts and actively, consciously participate in decision making.

The three brains are closely integrated, with the body providing feedback for emotions through feelings. Together, the three brains and the body operate in a continuous feedback loop. The neomammalian brain can act as a regulator (or an enabler) of urges from the more primitive brains. Meanwhile, the body provides feedback on conscious and unconscious thoughts in the form of feelings. The quality of those feelings then affects subsequent thoughts, emotions and behaviors.

Although we would all like to believe that we consistently make conscious, rational decisions, it turns out that in almost all instances, we consciously rationalize our feelings so that our decisions are congruent with the emotions originating in the reptilian and mammalian brains (Cafferata & Tybout, 1989).

The interaction of these three brains may play a part in the "mixed emotions" we sometimes feel. Our reptilian and mammalian brains may be sending us in one direction, while our neomammalian brain, better able to see the full consequences of taking that path, may tell us it's not the best option. Most of us have experienced the unconscious urge to fight when we feel threatened (reptilian brain), or insult someone when we feel slighted (mammalian brain). Fortunately, most of the time, we're able to hold back from retaliating due to the intervention of our conscious, neomammalian brain.

We consciously rationalize our feelings so that decisions are congruent with the emotions from our reptilian and mammalian brains.

When we examine the nature of the emotional responses that originate in each of the three brains, we can see several differences between emotions that originate in the unconscious, animal brains and those that originate in the conscious, human brain.

The emotions elicited by *conscious* interaction with products are by their nature:

- Varied, broad and not clearly defined
- Highly subjective
- Changing over time
- Mixed

And the emotional reactions elicited *unconsciously* by interaction with products could be characterized as:

- More clearly defined
- More objective
- Remain consistent over time
- Less mixed
  (Desmet, Ortiz Nicolas & Schoormans, 2008)

Emotion Combines the Mental and the Physical

Pain and pleasure may appear to be the basic dichotomy of emotion and experience. But they're really just one dimension of emotion. The emotions we experience can be described as a combination of two different dimensions. One dimension is comprised of our mental judgments about the **value** of things, which is influenced by our experience of pain and pleasure. The other is our level of physiological stimulation or **arousal** (Russell, 1980).

Everything we experience is either good, bad, or somewhere in between.

When we think about emotions in this way, it can be difficult to envision how these two simple dimensions describe the vast range of human emotions. Luckily, because the facial expressions of specific emotions are consistent all over the world (Ekman, 2003), we can map emotions to the way that they're expressed facially. This also helps us get a better understanding of how the different dimensions map to actual human emotional experiences.

Value

Everything we experience is either good, bad, or somewhere in between. The automatic unconscious brains tend to decide that pleasant things are good and unpleasant or painful things are bad. Consciously, however, we may realize that some painful or uncomfortable things, like exercising regularly, are good for us in the long term. Most of the time, however, we consciously rationalize the urges of our unconscious brains and stay on the couch. These conscious and unconscious judgments of good and bad, based on pain and pleasure, are called **valence** or **value**.

Value Judgments

Value judgments can be conscious or unconscious. Conscious judgments are triggered by **appraisals**. Appraisal theory describes how we make evaluations. There are two kinds of appraisals: primary and secondary. Primary appraisals focus on whether an object, event, or experience helps to achieve an individual's goals (i.e., value).

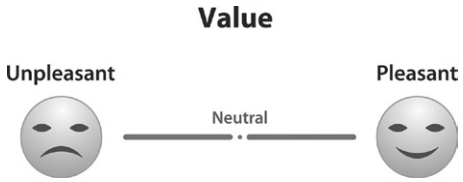

FIG. 2.7 Value (Unpleasant versus Pleasant)

Adapted from (Russell, 1980). © Trevor van Gorp

Secondary appraisals focus on whether an individual has the necessary internal and external resources to address the event, object, or experience (i.e., arousal) (Manstead & Fischer, 2001). This is the secondary dimension of emotion. We make appraisals when we judge a design against a concern we have. The result is an emotional response (Desmet, 2002).

Imagine that your dishwashing machine has just flooded your kitchen. You're not sure what caused the problem, but it could be the fault of the machine, or it could be a problem with the way you loaded it. You evaluate the situation to determine blame. Your initial, unconscious evaluation of the situation finds

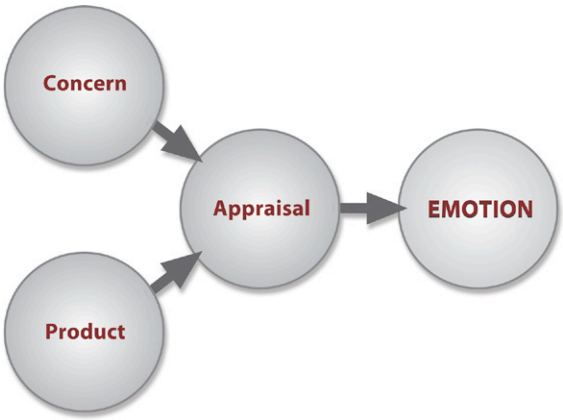

FIG. 2.8 Appraisal Process

Adapted from (Desmet, 2002). © Trevor van Gorp

that the manufacturer must be to blame. Deciding that someone else is at fault, you experience feelings of *relief* and then *anger*. You think to yourself, "Damn dishwashing machine company."

Before calling the manufacturer in a huff, you decide to consciously evaluate the cause of the problem in order to be certain of who is at fault. Upon investigation, you discover that a single utensil (that you previously dropped while rushing to load the dishwasher) fell behind in between the door and the wall of the machine, breaking the seal. Finding yourself responsible, you might experience *guilt*, *sadness*, or *regret*. Although appraisals of the same object or situation may elicit different emotional responses at different times, a similar pattern of evaluation is found in situations that evoke the same emotion (Roseman & Smith, 2001). For example, losing something that was valued results in sadness (Roseman & Smith, 2001).

When you find yourself responsible for a mistake, you might experience guilt, sadness, or regret.

When it comes to applying emotional appraisals in design, it's important to identify the user's primary concern for the situation and then design to satisfy that concern by improving users' emotional responses. If the user's main concern around using a floor mop is that it starts to smell foul after being used several times, alleviating that concern has a number of design implications. While ensuring that the mop adequately clean floors, a designer might also be sure to choose a material that remains hygienic, or in the case of newer floor sweepers, use a disposable cleaning pad that can be thrown away after each use. In this example, designing for emotion involves preventing negative emotional reactions as well as ensuring positive ones.

FIG. 2.9 Floor Sweeper

Newer floor sweepers help prevent the unpleasant odors associated with dirty mops and brooms by using disposable cleaning pads.
© *Trevor van Gorp*

Arousal

Higher levels of arousal focus attention, but too much arousal can lead to tunnel vision.

Our experience of reality is always affected by the state of our bodies. We've all had a bad day when everything seemed to go wrong. The alarm clock was set for PM instead of AM, so you were late getting up for work. There was no milk in the fridge, so you had to skip your breakfast cereal. The car wouldn't start, so you had to take the bus, delaying you even further. By the time you arrived at work, late, angry, frustrated, and wound up into a tight little ball, even the mildest bit of bad news might set you off. On another day, you might respond quite differently. But when you're already highly stimulated in a negative way, that additional piece of bad news might be the straw that breaks the camel's back.

This level of stimulation (also called "arousal" or "stress") is the physiological (i.e., bodily) dimension of emotion. Remember, emotions and feelings influence each other in a circular way. Without proper exercise, rest and relaxation, stress can be cumulative. Our preexisting physical state largely determines how intensely we experience feelings of pleasure or pain (van Gorp, 2006). High levels of physical

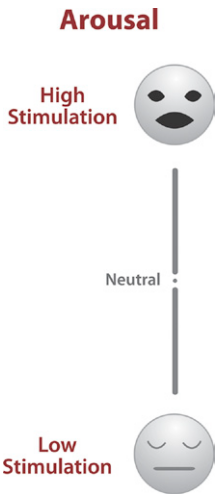

FIG. 2.10 Arousal (Low Stimulation to High Stimulation)

Arousal and stimulation.

and mental stimulation amplify the value of an experience, whether it's good or bad. Low levels of stimulation decrease the intensity.

Arousal is closely related to other concepts such as anxiety, attention, agitation, and motivation. Your arousal level can be thought of as the capacity or load that you can successfully take on. Too little arousal can make someone bored or unmotivated, their attention unfocused. Higher levels of arousal have a focusing affect on attention, but too much arousal can lead to tunnel vision.

Higher levels of arousal narrow focus, increase motivation and make people more intent on reaching their goals.

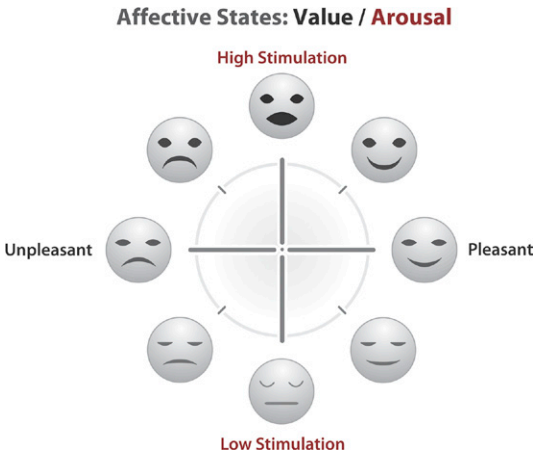

FIG. 2.11 Affective States: Value/Arousal

Adapted from (Russell, 1980). © Trevor van Gorp

Highly stimulated individuals may be better at taking action, but poorer at solving problems that require creative thought (Norman, 2004).

Dan Ariely (2008) describes the effects of one form of arousal (i.e., sexual arousal) on decision making. His study asked male undergraduates to give "yes" or "no" answers to a number of questions around sexual behavior and morality. The students gave answers to the questions in a normal state and also while sexually aroused. The difference was remarkable. While highly stimulated, the students gave more "yes" answers to questions regarding questionable moral and sexual behavior. Whether arousal is sexual or nonsexual in nature, high levels narrow focus, increase motivation, and make people more intent on reaching their goals. At some point, however, too much arousal becomes demotivating, leaving people overwhelmed and causing a sharp drop in performance.

When we combine value and arousal, we can describe the relationship between emotions in terms of these two dimensions: **value** and **arousal**.

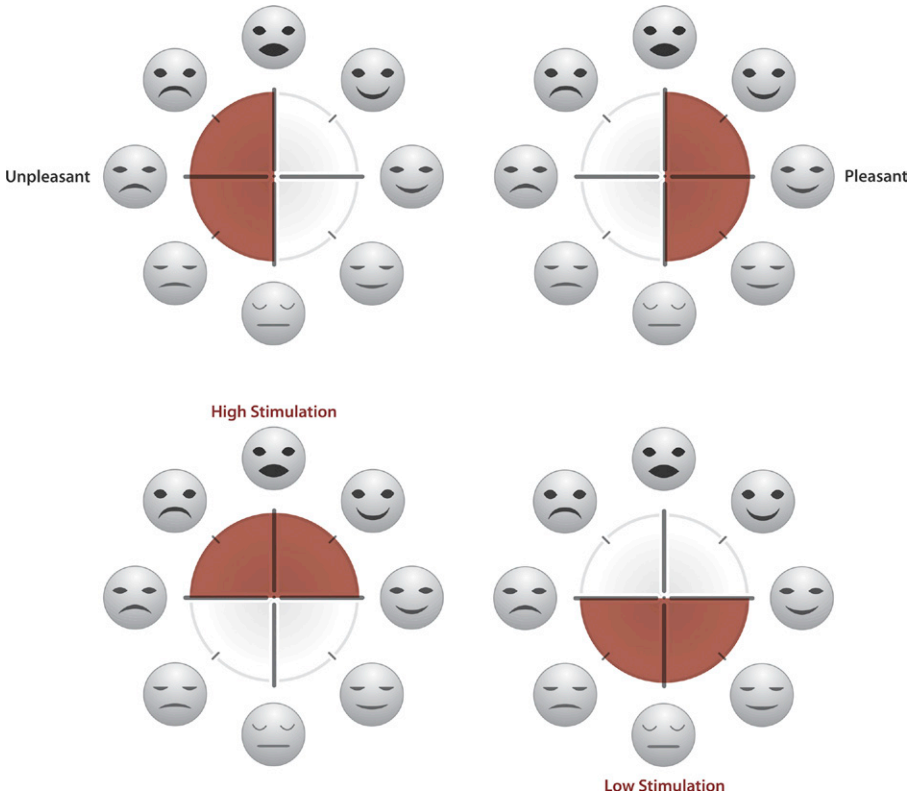

FIG. 2.12 Emotional Trends

Adapted from (Russell, 1980). © Trevor van Gorp

To aid your understanding of how this diagram can be used to model emotions, we've mapped four general types of emotions to the circumplex. Where these sections cross over, we can see that an emotion can be both high arousal and positive value (e.g., excitement) as well as high arousal and negative value (e.g., fear).

Desmet (2002) identified a set of 75 emotions triggered through product use. Based on a literature review of these emotions, we've placed them on the diagram to give you a better idea of how to visualize emotions with the model (Fig. 2.13).

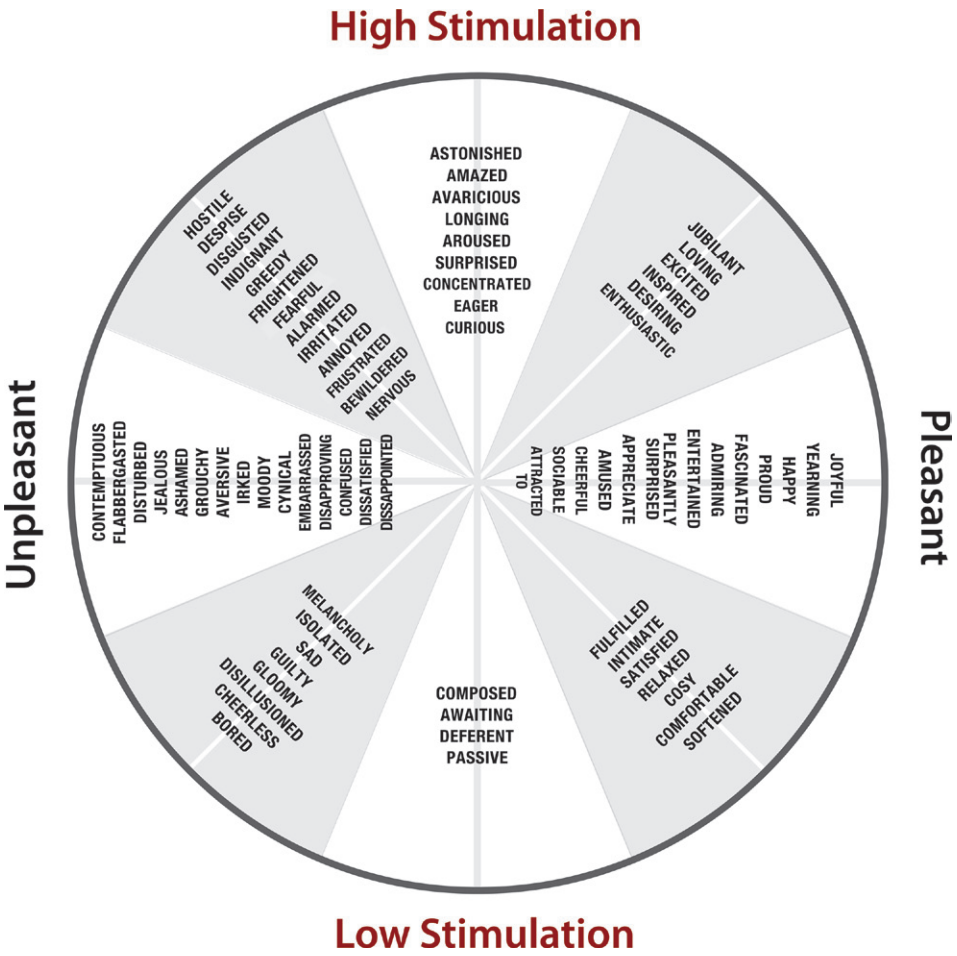

FIG. 2.13 75 Emotions Relevant to Products

Emotions have been ranked in terms of their relative levels of arousal and value.
Adapted from (Russell,1980) (Desmet, 2002) (van Gorp, 2006). © Trevor van Gorp

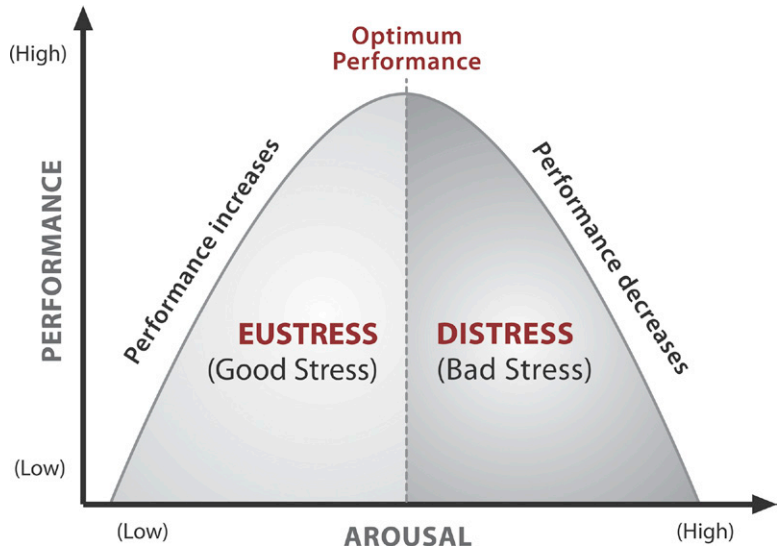

FIG. 2.14 Yerkes-Dodson Law

(Yerkes and Dodson, 1908) additions from (van Gorp, 2010). © Trevor van Gorp

Some stress or stimulation is good for performance, but too much damages performance.

Eustress and Distress

In psychology, the Yerkes-Dodson Law (1908) describes how arousal or stress levels affect performance. Most of us are used to thinking of "stress" as a purely negative thing. However, if we define **stress** as physical stimulation, with both high and low levels, we get a more accurate picture. As stress or stimulation rises, so does performance. This positive form of stress is called **eustress**, and it continues up to an optimum point. After this point, as arousal continues to rise, we enter what's commonly called "distress," and performance declines.

Attention can be invested voluntarily or held captive by high levels of emotional stimulation.

From the Yerkes-Dodson Law (1908), we can see that some stress or stimulation is good for performance, but too much damages performance. The amount of stress needed to trigger optimum performance will also differ from person to person and from day to day. Different applications and use contexts will also require different optimal levels of arousal. Entertainment-oriented media should be more highly arousing (i.e., more stimulating) than task-oriented media, for example. People tend to naturally bring a higher level of stimulation to the challenge of task-oriented activities (Novak & Hoffman, 1997).

A good example of this balancing principle is the sound created by the fire alarm. The fire alarm must be loud and irritating enough to raise physiological arousal and motivate you to leave the area, but not so arousing as to push people into feeling

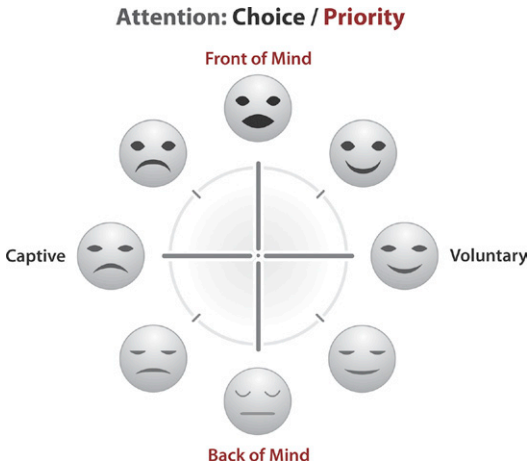

FIG. 2.15 Attention: Choice/Priority

Adapted from (Davenport and Beck, 2001). © Trevor van Gorp

overwhelmed. Ideally, arousal is high enough to motivate a quick escape from a hazardous situation.

Emotion, Attention and Information

Attention selects the information that will actually get into our brains and become part of our mental models of reality. In a world where attention is in constant demand, emotional affect changes where and how intensely we focus that attention. Attention selects relevant information by focusing on it and ignores or deletes information that's considered emotionally irrelevant. Emotion is the energy that drives and directs attention. Sometimes, attention is voluntarily invested; other times, attention is held captive by high levels of emotional stimulation. Anything that creates high arousal will be elevated to the top or front of the mind; things that create little or no arousal will naturally fall to the back of the mind.

Emotional Affect

Emotions and other "affective states" like moods influence every aspect of our interaction with brands, products, and websites. As Forlizzi and Battarbee (2004, p. 264) put it, "emotions affect how we plan to interact with products, how we actually interact with products, and the perceptions and outcomes that surround those interactions." This includes our intentions, our plans and any feedback on whether we've achieved success. As we mentioned in Chapter 1, the term used for the way that emotions affect cognition is **emotional affect** (Norman, 2004).

The term used for the way that emotions affect cognition is emotional affect.

"Emotional affect" is the term for emotional reactions that have a high probability of producing changes in awareness, facial expression, body language, physiologyical function and behavior. Affect can be differentiated from cognition because it tends to influence motivation and arouse feelings, whereas cognition is more concerned with facts (Cacioppo & Petty, 1989).

Donald Norman states that emotional affect is:

> the general term for the judgmental system, whether conscious or unconscious. Emotion is the conscious experience of affect complete with attribution of its cause and identification of its object. A queasy, uneasy feeling you might experience, without knowing why, is affect.
>
> (Norman, 2004, p. 11)

Positive affect serves as a signal to continue with one's current behaviors.

Because the lens of emotional affect directly influences much of the way we perceive our everyday lives (affecting how we categorize information, make decisions, evaluate risks, and solve problems) (Isen, 1999), the term "emotional affect" is used extensively throughout this book. The way that emotional affect influences information processing and task performance depends on whether the conditions are perceived as positive (e.g., pleasurable, supportive, caring) or negative (e.g., painful, threatening, punishing) (Hayes-Roth, Ball, Lisetti, Picard, & Stern, 1997).

Affect	POSITIVE	NEGATIVE
Value	Pleasant	Unpleasant
Visual	Smiling faces	Frowning disgusted faces
	Comfortably lit places	Extreme bright or dark
	Objects at safe distance	Looming Objects
	Bright, saturated colors	Faded, dingy colors
	---	Heights
Touch	Rounded objects	Sharp objects
	Warm, temperate climate	Extreme climates
Hearing	Soothing sounds	Harsh sounds
	Repetitive sounds	Abrupt sounds
	Harmonious sounds	Discordant sounds
Smell	Sweet smells	Sour smells
	Fresh smells	Rotting smells
Taste	Sweet tastes	Bitter tastes

FIG. 2.16 Positive and Negative Affect

Adapted from (Norman, 2004). © Trevor van Gorp

FIG. 2.17 **Affect and Personality**

© *Trevor van Gorp*

The Effects of Affect

Positive emotional affect serves as a signal to continue with one's current behaviors; negative emotional affect serves as a signal to adjust thought processes or change physical behavior. Emotional affect influences ongoing evaluations of information and experience. This influence is much more apparent when the information that is appraised is ambiguous in nature (as discussed shortly). The influence of affect on information that already has a strong positive or negative orientation is much smaller (Isen, 1999).

Emotional affect influences us in both individual and social situations. It can alter thought processes, changing how events are perceived and interpreted. It can change how people interact with one another and it can also change how people interact with objects. All of this makes emotional affect an important consideration for interactive products, especially those that are used in stressful emergency situations, where communicating clearly and effectively can be crucial.

In evolutionary terms, positive affect is linked with the tendency to approach and negative affect is linked with the tendency to avoid (Cacioppo, Larsen, Smith, & Berntson, 2004). Emotional affect guides cognition in the same direction as the affect (Cafferata & Tybout, 1989). This is one reason it's so easy to rationalize our decisions. The influence of emotional affect causes us to rationalize our emotional instincts with our conscious human brains.

Negative affect is a signal to adjust thought processes or change physical behavior.

Emotion Contributes to Flow

Most of us have experienced a mental/emotional state where all of our attention is totally focused on an activity. Csikszentmihalyi (1990) named this state "flow" based on how participants in his studies described the experience. In this state of consciousness, people can concentrate intensely and experience feelings of enjoyment, coupled with peak performance. Hours can pass by in what seems like minutes. We tend to enter these states in environments with few interruptions, where our attention becomes focused by a *challenge* that we're confident we can

handle with our existing *skills*. Feedback is instantaneous, so we can always get information about the success of our efforts (Csikszentmihalyi, 1990).

Flow occurs at the boundary between boredom and anxiety. You could also imagine it as the optimum point that lies between eustress and distress. When it comes to balancing the users' perception of challenge, think of it this way:

- Too much challenge with too little skill causes anxiety.
- Too little challenge with too much skill causes boredom.

Flow occurs at the boundary between boredom and anxiety.

As the challenges we face increase, we become more anxious and lose flow. Reentering flow involves increasing our skills to match these challenges and reduce anxiety. As we increase our skill level, we become bored unless we increase the challenge to match our greater abilities.

Flow tends to occur in situations with higher levels of challenge and skill. If the challenge is too easy, or user skill levels are very high, arousal can be so low that there is little motivation to do anything. Again, because this is the physiological (i.e., bodily) dimension of emotion, the level of arousal affects how intense any given experience is, and intense emotions demand our attention. In evolutionary terms, it's easy to see why. The more attention your ancestors paid to predators, the more likely they were to survive and reproduce, passing their genes on to their descendants, people like you and me.

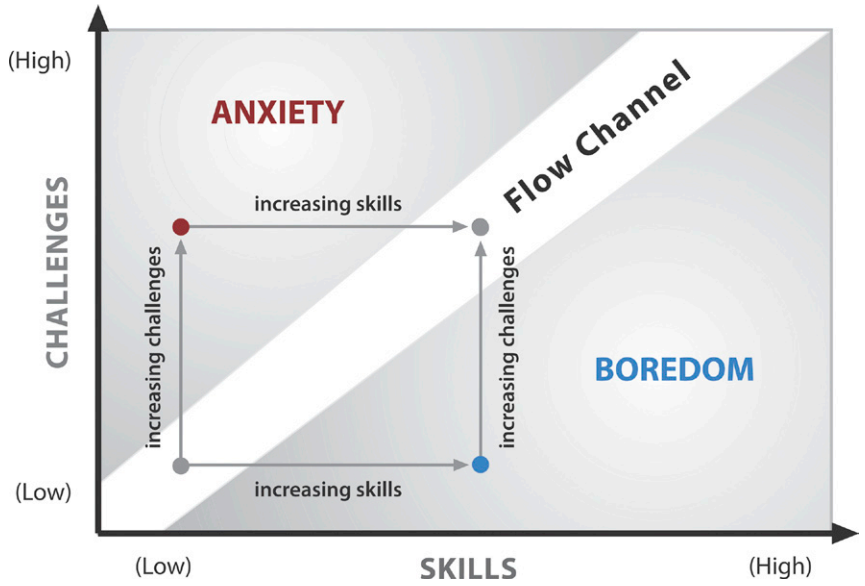

FIG. 2.18 Anxiety, Boredom, and Flow

(Csikszentmihalyi, 1990); captions (van Gorp, 2006). © Trevor van Gorp

FIG. 2.19 Interpersonal Distance and Arousal

How does looking at the picture on the right make you feel compared to the one on the left?
Photo by Curtis Lipscombe

Arousal and Flow

Both pleasant and unpleasant objects and experiences can increase or decrease arousal levels. Frustration and excitement, for example, are both high-arousal emotions. The elements that make up your design can also influence arousal levels as well as value. Large images, bright colors and high contrast all increase arousal and demand attention. Increasing the size of an image and moving anyone within the frame closer will also increase arousal levels (Reeves & Nass, 1998).

Both frustration and excitement are high-arousal emotions.

The key to balancing arousal is to match the perceived challenge to the skill level of the user. Because skill levels differ from one user to the next, interfaces should be very user-friendly for novices, but also allow more advanced users to find challenges appropriate for their skill level. These challenges can include the aesthetic aspects as well as the formatting of the content. To put it simply, everything about a site—including content, information architecture, interaction design and visual design—can and should contribute to flow.

Emotion, Motivation and Intention

The close relationship between emotional affect and behavior means that the body is almost always prepared to respond to a variety of events. Each dimension of emotion affects a different aspect of behavior. Value affects whether we **approach** (i.e., pleasure) or **avoid** (i.e., pain). Arousal affects how motivated we are to either approach or avoid. Low arousal results in low motivation; higher arousal results in higher motivation. Both pleasant and unpleasant experiences can raise or lower arousal levels. For example, fear and excitement are both high-arousal emotions.

Value affects whether we approach or avoid. Arousal affects how motivated we are to do either.

Designers can change the amount of motivation people have by altering the level of physiological arousal. Arousal levels can influence cognition because it's

The level of arousal affects how intensely we experience a given emotion.

easier for people to remember things that occurred when they were in a similar emotional state (Cafferata & Tybout, 1989). The level of arousal affects how intensely we experience a given emotion. The more intense the emotion, the more attention is demanded. This continues to an optimum level (i.e., the balance of flow), after which motivation, attention and performance decrease while arousal increases to distress and anxiety.

Dimensions of Behavior

The lower the amount of motivation and prior knowledge a user has about a product or service, the more that user will rely on unconscious emotional responses to make choices. When prior knowledge and the motivation to consider a choice is high (e.g., making a large investment), people are more likely to rely on their cognitive evaluations and minimize the influence of unconscious emotional responses (Cafferata & Tybout, 1989). In other words, both the difficulty and importance of the task (i.e., challenge) along with our level of knowledge and ability (i.e., skill) influence arousal levels, our level of motivation and perceptions of how difficult the task will be.

With the beeping sound in Trevor's friend's car, the value of the noise was negative (i.e., unpleasant). This unpleasant feeling created the urge to avoid. If the volume of the noise had increased, or the rate of the beeping had sped up, this would have unconsciously increased arousal levels, further increasing his motivation to avoid the noise.

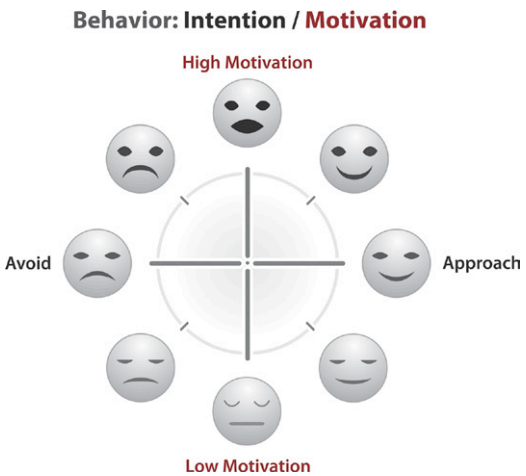

FIG. 2.20 Behavior: Intention/Motivation

The dimensions of behavior.

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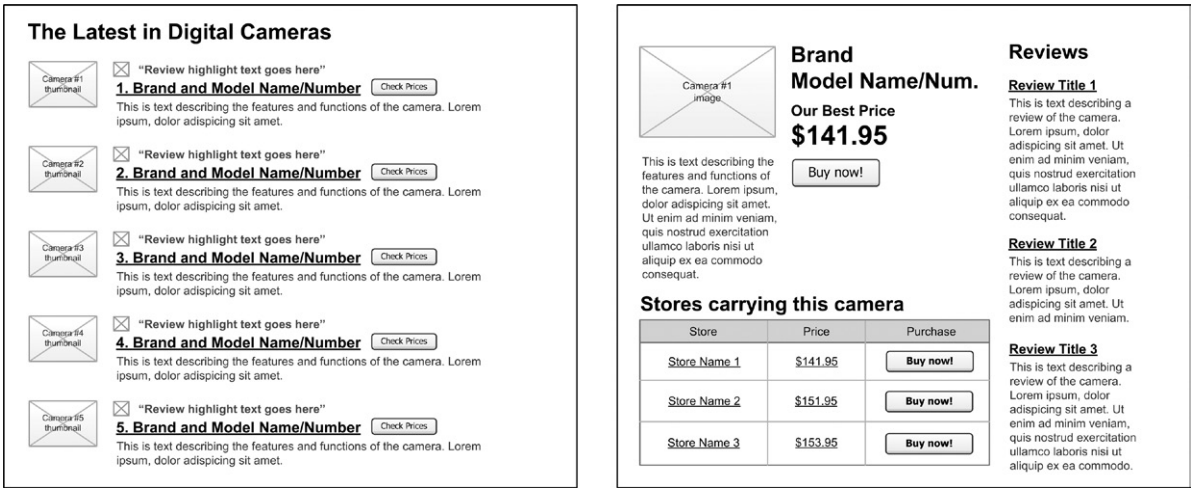

FIG. 2.21 Approaching Online

The design mimics the effect of approaching, as the image appears to grows in size.

© *Trevor van Gorp*

Shopping online mirrors this real-world approach/avoid experience. For example, when shopping online for a digital camera, we're generally presented with thumbnail images of the available model. If the look, brand, or features of the camera attract us, we decide to "approach" for further investigation and interaction by clicking or selecting the thumbnail image. As we "approach," the size of the camera increases in our view as though we're getting closer to it in space.

The term "emotion" is used to refer to a number of different experiences.

Emotions, Moods, Sentiments and Personality Traits

To utilize emotion in design, it's important to have an understanding of what actually constitutes an "emotion." As we all know, there are different types of experiences. Some experiences are more emotional than others, and some emotional experiences last longer than others. The term "emotion" is often used to refer to a number of experiences that are actually quite different and specific in nature.

Desmet (2002) differentiates four types of "affective states." This term includes emotions, moods, sentiments and emotional personality traits. As we mentioned earlier, *feelings* are part of the conscious experience of the physiological changes brought on by affective states.

At any given moment, we're always experiencing and/or expressing an emotion, mood, sentiment, or emotional trait. This is emotional affect, in which the current emotional state is always influencing both future cognition and action, while future cognition and action then create further affective states. In addition, emotional states can also be triggered by changes and movement in the body, and by chemical changes caused by the ingestion of food and drugs.

AFFECTIVE STATES	Intentional	Non-Intentional
Acute	Emotions	Moods
Dispositional	Sentiments	Emotional Traits

FIG. 2.22 Affective States

Adapted from (Desmet, 2002, p. 4). © Trevor van Gorp

We can separate affective states in terms of time and intention. We have emotional responses that are intentionally directed towards certain things, but we also have responses that are not intentionally directed towards anything in particular. Our day-to-day lives are the product of minute changes in our affective states throughout the day, with **emotions** changing from moment to moment, **moods** describing the pattern of emotional response over the short term, and **sentiments** emerging as persistent likes and dislikes.

These affective states combine over the long term to create what others perceive as emotional or **personality traits**. All of these affective states can lead to behavior and influence further affective states. In fact, our emotions themselves are likely the number one thing we get emotional about (Desmet, 2002).

Emotions

Emotions themselves are likely the number one thing we get emotional about.

Emotions are relatively short term in duration (i.e., acute), lasting only a short time, ranging from seconds to minutes. They are directed at some thing (Desmet, 2002). They can be triggered by sights, smells, sounds and events in the external environment, or by thoughts and the internal representations of past or future events and experiences.

Moods

Moods are affective states that last longer than emotions, usually for hours or days, but are still considered acute because they last for a limited amount of time. Moods generally have combined causes rather than being elicited by a particular event, so they're considered non-intentional, or not directed at anything in particular. In other words, they're directed at the world rather than towards a particular object or person (Frijda, 1994).

Sentiments

Sentiments are intentionally directed at something and they involve a person-object relationship. They constitute our likes and dislikes as well as our attitudes and standards. So, although you might be afraid of dogs, actually being frightened by a dog is a different emotional state (Frijda, 1994). People also display sentiments towards products and brands. "I love Macs" is an example of a sentiment.

Personality Traits

Emotional traits are personality characteristics that manifest over the long term. In terms of intent, they're like moods, but they persist for a long enough time that people can be characterized by their expression. Thus, emotional traits are often called "character" or personality traits and are generally directed at the world. When an emotional state becomes part of our disposition, we consistently express that state over time (Desmet, 2002). This is the case with both sentiments and personality traits.

Our tendency to perceive emotions as personality traits over time is easier to see in static or physical products than it is in interactive products, because physical products usually don't change forms over time. This means that their "personality" is embodied by the emotions they were designed to express for their useful lives. The important thing is that the personality is appropriate for the task the object was created to perform or the problem the object was created to help solve.

FIG. 2.23 Mike's Corkscrew

Is there anything I can open for you?

© *Trevor van Gorp*

CONCLUSION

In Chapter 2, we first learned that we're all acting on mental models of reality, rather than reality itself. Then, we explored a number of different ways of modeling emotion to enhance our understanding of how design decisions affect users' emotional responses.

What is emotion? We learned that emotion helps us to make our way safely through the world. Emotion is both conscious and unconscious, and it's simpler to design for unconscious emotional responses than for conscious ones. We saw that emotion originates in different parts of the brain, from the most primitive and unconscious, to the most conscious and human.

Positive affect enhances open, creative thought, and negative affect enhances narrow, focused thought.

We learned that emotion can be described as a combination of our levels of physical stimulation (i.e., arousal or stress) and our mental judgments (i.e., appraisals). We also learned that our arousal or stimulation levels determine how intensely we feel an emotion. Then we examined how emotions affect attention and the processing of information. Positive affect expands attention and enhances open, creative thought, while negative affect narrows attention and enhances focused thought.

Next, we learned that balancing arousal levels by matching the perceived challenge to users' skill levels can create a state of both optimum performance and optimum experience called "flow." And finally, we learned to classify the different emotional states according to their intent and duration into emotions, moods, sentiments and personality traits.

In Chapter 3, we'll continue to build on the concepts you've already learned to explore how emotion can be used to direct attention to the task at hand, enhancing performance and creating flow. We'll also examine how certain properties of aesthetics and interaction are associated with different emotions and personality types.

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