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About Noba

The Diener Education Fund (DEF) is a non-profit organization founded with the mission of re-inventing higher education to serve the changing needs of students and professors. The initial focus of the DEF is on making information, especially of the type found in textbooks, widely available to people of all backgrounds. This mission is embodied in the Noba project.

Noba is an open and free online platform that provides high-quality, flexibly structured textbooks and educational materials. The goals of Noba are three-fold:

- To reduce financial burden on students by providing access to free educational content
- To provide instructors with a platform to customize educational content to better suit their curriculum
- To present material written by a collection of experts and authorities in the field

The Diener Education Fund is co-founded by Drs. Ed and Carol Diener. Ed is the Joseph Smiley Distinguished Professor of Psychology (Emeritus) at the University of Illinois. Carol Diener is the former director of the Mental Health Worker and the Juvenile Justice Programs at the University of Illinois. Both Ed and Carol are award-winning university teachers.

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College of Staten Island PSY100
Prejudice, Discrimination, and Stereotyping

Susan T. Fiske

People are often biased against others outside of their own social group, showing prejudice (emotional bias), stereotypes (cognitive bias), and discrimination (behavioral bias). In the past, people used to be more explicit with their biases, but during the 20th century, when it became less socially acceptable to exhibit bias, such things like prejudice, stereotypes, and discrimination became more subtle (automatic, ambiguous, and ambivalent). In the 21st century, however, with social group categories even more complex, biases may be transforming once again.

Learning Objectives

• Distinguish prejudice, stereotypes, and discrimination.
• Distinguish old-fashioned, blatant biases from contemporary, subtle biases.
• Understand old-fashioned biases such as social dominance orientation and right-wing authoritarianism.
• Understand subtle, unexamined biases that are automatic, ambiguous, and ambivalent.
• Understand 21st century biases that may break down as identities get more complicated.

Introduction

Even in one’s own family, everyone wants to be seen for who they are, not as “just another typical X.” But still, people put other people into groups, using that label to inform their evaluation of the person as a whole—a process that can result in serious consequences. This
This module focuses on biases against social groups, which social psychologists sort into emotional *prejudices*, mental *stereotypes*, and behavioral *discrimination*. These three aspects of bias are related, but they each can occur separately from the others (Dovidio & Gaertner, 2010; Fiske, 1998). For example, sometimes people have a negative, emotional reaction to a social group (prejudice) without knowing even the most superficial reasons to dislike them (stereotypes).

Old-fashioned Biases: Almost Gone

You would be hard pressed to find someone today who openly admits they don’t believe in equality. Regardless of one’s demographics, most people believe everyone is entitled to the same, natural rights. However, as much as we now collectively believe this, not too far back in our history, this ideal of equality was an unpracticed sentiment. Of all the countries in the world, only a few have equality in their constitution, and those who do, originally defined it for a select group of people.

At the time, old-fashioned biases were simple: people openly put down those not from their own group. For example, just 80 years ago, American college students unabashedly thought Turkish people were “cruel, very religious, and treacherous” (Katz & Braly, 1933). So where did they get those ideas, assuming that most of them had never met anyone from Turkey? Old-fashioned stereotypes were overt, unapologetic, and expected to be shared by others—what
we now call “blatant biases.”

**Blatant biases** are conscious beliefs, feelings, and behavior that people are perfectly willing to admit, which mostly express hostility toward other groups (outgroups) while unduly favoring one’s own group (in-group). For example, organizations that preach contempt for other races (and praise for their own) is an example of a blatant bias. And scarily, these blatant biases tend to run in packs: People who openly hate one outgroup also hate many others. To illustrate this pattern, we turn to two personality scales next.

**Social Dominance Orientation**

*Social dominance orientation* (SDO) describes a belief that group hierarchies are inevitable in all societies and are even a good idea to maintain order and stability (Sidanius & Pratto, 1999). Those who score high on SDO believe that some groups are inherently better than others, and because of this, there is no such thing as group “equality.” At the same time, though, SDO is not just about being personally dominant and controlling of others; SDO describes a preferred arrangement of groups with some on top (preferably one’s own group) and some on the bottom. For example, someone high in SDO would likely be upset if someone from an outgroup moved into his or her neighborhood. It’s not that the person high in SDO wants to “control” what this outgroup member does; it’s that moving into this “nice neighborhood” disrupts the social hierarchy the person high in SDO believes in (i.e. living in a nice neighborhood denotes one’s place in the social hierarchy—a place reserved for one’s in-group members).

Although research has shown that people higher in SDO are more likely to be politically conservative, there are other traits that more strongly predict one’s SDO. For example, researchers have found that those who score higher on SDO are usually lower than average on tolerance, empathy, altruism, and community orientation. In general, those high in SDO
have a strong belief in work ethic—that hard work always pays off and leisure is a waste of time. People higher on SDO tend to choose and thrive in occupations that maintain existing group hierarchies (police, prosecutors, business), compared to those lower in SDO, who tend to pick more equalizing occupations (social work, public defense, psychology).

The point is that SDO—a preference for inequality as normal and natural—also predicts endorsing the superiority of certain groups: men, native-born residents, heterosexuals, and believers in the dominant religion. This means seeing women, minorities, homosexuals, and non-believers as inferior. Understandably, the first list of groups tend to score higher on SDO, while the second group tends to score lower. For example, the SDO gender difference (men higher, women lower) appears all over the world.

At its heart, SDO rests on a fundamental belief that the world is tough and competitive with only a limited number of resources. Thus, those high in SDO see groups as battling each other for these resources, with winners at the top of the social hierarchy and losers at the bottom (see Table 1).

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<td>Groups compete for economic resources</td>
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<td>Group hierarchies are inevitable, good</td>
<td>Groups must follow authority</td>
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<tr>
<td>Ingroup Belief</td>
<td>Ingroup must be tough, competitive</td>
<td>Ingroup must unite, protect</td>
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<td>Outgroup Belief</td>
<td>“They” are trying to beat “us”</td>
<td>“They” have bad values</td>
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Table 1. Old-Fashioned Biases

**Right-wing Authoritarianism**

**Right-wing authoritarianism** (RWA) focuses on value conflicts, whereas SDO focuses on the economic ones. That is, RWA endorses respect for obedience and authority in the service of group conformity (Altemeyer, 1988). Returning to an example from earlier, the homeowner who’s high in SDO may dislike the outgroup member moving into his or her neighborhood because it “threatens” one’s economic resources (e.g. lowering the value of one’s house; fewer openings in the school; etc.). Those high in RWA may equally dislike the outgroup member moving into the neighborhood but for different reasons. Here, it’s because this outgroup
member brings in values or beliefs that the person high in RWA disagrees with, thus “threatening” the collective values of his or her group. RWA respects group unity over individual preferences, wanting to maintain group values in the face of differing opinions. Despite its name, though, RWA is not necessarily limited to people on the right (conservatives). Like SDO, there does appear to be an association between this personality scale (i.e. the preference for order, clarity, and conventional values) and conservative beliefs. However, regardless of political ideology, RWA focuses on groups’ competing frameworks of values. Extreme scores on RWA predict biases against outgroups while demanding in-group loyalty and conformity. Notably, the combination of high RWA and high SDO predicts joining hate groups that openly endorse aggression against minority groups, immigrants, homosexuals, and believers in non-dominant religions (Altemeyer, 2004).

20th Century Biases: Subtle but Significant

Fortunately, old-fashioned biases have diminished over the 20th century and into the 21st century. Openly expressing prejudice is like blowing second-hand cigarette smoke in someone’s face: It’s just not done any more in most circles, and if it is, people are readily criticized for their behavior. Still, these biases exist in people; they’re just less in view than before. These subtle biases are unexamined and sometimes unconscious but real in their consequences. They are automatic, ambiguous, and ambivalent, but nonetheless biased, unfair, and disrespectful to the belief in equality.

Automatic Biases

Most people like themselves well enough, and most people identify themselves as members of certain groups but not others. Logic suggests, then, that because we like ourselves, we therefore like the groups we associate with more, whether those groups are our hometown, school, religion, gender, or ethnicity. Liking yourself and your groups is human nature. The larger issue, however, is that own-group preference often results in liking
other groups less. And whether you recognize this “favoritism” as wrong, this trade-off is relatively automatic, that is, unintended, immediate, and irresistible.

Social psychologists have developed several ways to measure this relatively automatic own-group preference, the most famous being the Implicit Association Test (IAT; Greenwald, Banaji, Rudman, Farnham, Nosek, & Mellott, 2002; Greenwald, McGhee, & Schwartz, 1998). The test itself is rather simple and you can experience it yourself if you Google “implicit” or go to understandingprejudice.org. Essentially, the IAT is done on the computer and measures how quickly you can sort words or pictures into different categories. For example, if you were asked to categorize “ice cream” as good or bad, you would quickly categorize it as good. However, imagine if every time you ate ice cream, you got a brain freeze. When it comes time to categorize ice cream as good or bad, you may still categorize it as “good,” but you will likely be a little slower in doing so compared to someone who has nothing but positive thoughts about ice cream. Related to group biases, people may explicitly claim they don’t discriminate against outgroups—and this is very likely true. However, when they’re given this computer task to categorize people from these outgroups, that automatic or unconscious hesitation (a result of having mixed evaluations about the outgroup) will show up in the test. And as countless studies have revealed, people are mostly faster at pairing their own group with good categories, compared to pairing others’ groups. In fact, this finding generally holds regardless if one’s group is measured according race, age, religion, nationality, and even temporary, insignificant memberships.

This all-too-human tendency would remain a mere interesting discovery except that people’s reaction time on the IAT predicts actual feelings about individuals from other groups, decisions about them, and behavior toward them, especially nonverbal behavior (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). For example, although a job interviewer may not be “blatantly biased,” his or her “automatic or implicit biases” may result in unconsciously acting distant

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Table 2: Subtle Biases
and indifferent, which can have devastating effects on the hopeful interviewee’s ability to perform well (Word, Zanna, & Cooper, 1973). Although this is unfair, sometimes the automatic associations—often driven by society’s stereotypes—trump our own, explicit values (Devine, 1989). And sadly, this can result in consequential discrimination, such as allocating fewer resources to disliked outgroups (Rudman & Ashmore, 2009). See Table 2 for a summary of this section and the next two sections on subtle biases.

## Ambiguous Biases

As the IAT indicates, people’s biases often stem from the spontaneous tendency to favor their own, at the expense of the other. Social identity theory (Tajfel, Billig, Bundy, & Flament, 1971) describes this tendency to favor one’s own in-group over another’s outgroup. And as a result, outgroup disliking stems from this in-group liking (Brewer & Brown, 1998). For example, if two classes of children want to play on the same soccer field, the classes will come to dislike each other not because of any real, objectionable traits about the other group. The dislike originates from each class’s favoritism toward itself and the fact that only one group can play on the soccer field at a time. With this preferential perspective for one’s own group, people are not punishing the other one so much as neglecting it in favor of their own. However, to justify this preferential treatment, people will often exaggerate the differences between their in-group and the outgroup. In turn, people see the outgroup as more similar in personality than they are. This results in the perception that “they” really differ from us, and “they” are all alike. Spontaneously, people categorize people into groups just as we categorize furniture or food into one type or another. The difference is that we people inhabit categories ourselves, as self-categorization theory points out (Turner, 1975). Because the attributes of group categories can be either good or bad, we tend to favor the groups with people like us and incidentally disfavor the others. In-group favoritism is an ambiguous form of bias because it disfavors the outgroup by exclusion. For example, if a politician has to decide between funding one program or another, s/he may be more likely to give resources to the group that more closely represents his in-group. And this life-changing decision stems from
the simple, natural human tendency to be more comfortable with people like yourself.

A specific case of comfort with the ingroup is called aversive racism, so-called because people do not like to admit their own racial biases to themselves or others (Dovidio & Gaertner, 2010). Tensions between, say, a White person’s own good intentions and discomfort with the perhaps novel situation of interacting closely with a Black person may cause the White person to feel uneasy, behave stiffly, or be distracted. As a result, the White person may give a good excuse to avoid the situation altogether and prevent any awkwardness that could have come from it. However, such a reaction will be ambiguous to both parties and hard to interpret. That is, was the White person right to avoid the situation so that neither person would feel uncomfortable? Indicators of aversive racism correlate with discriminatory behavior, despite being the ambiguous result of good intentions gone bad.

Bias Can Be Complicated - Ambivalent Biases

Not all stereotypes of outgroups are all bad. For example, ethnic Asians living in the United States are commonly referred to as the “model minority” because of their perceived success in areas such as education, income, and social stability. Another example includes people who feel benevolent toward traditional women but hostile toward nontraditional women. Or even ageist people who feel respect toward older adults but, at the same time, worry about the burden they place on public welfare programs. A simple way to understand these mixed feelings, across a variety of groups, results from the Stereotype Content Model (Fiske, Cuddy, & Glick, 2007).

When people learn about a new group, they first want to know if its intentions of the people in this group are for good or ill. Like the guard at night: “Who goes there, friend or foe?” If the other group has good, cooperative intentions, we view them as warm and trustworthy and often consider them part of “our side.” However, if the other group is cold and competitive or full of exploiters, we often view them as a threat and treat them accordingly. After learning the group's intentions, though, we also want to know whether they are competent enough to act on them (if they are incompetent, or unable, their intentions matter less). These two simple dimensions—warmth and competence—together map how groups relate to each other in society.

There are common stereotypes of people from all sorts of categories and occupations that lead them to be classified along these two dimensions. For example, a stereotypical “housewife” would be seen as high in warmth but lower in competence. This is not to suggest that actual housewives are not competent, of course, but that they are not widely admired
for their competence in the same way as scientific pioneers, trendsetters, or captains of industry. At another end of the spectrum are homeless people and drug addicts, stereotyped as not having good intentions (perhaps exploitative for not trying to play by the rules), and likewise being incompetent (unable) to do anything useful. These groups reportedly make society more disgusted than any other groups do.

Some group stereotypes are mixed, high on one dimension and low on the other. Groups stereotyped as competent but not warm, for example, include rich people and outsiders good at business. These groups that are seen as “competent but cold” make people feel some envy, admitting that these others may have some talent but resenting them for not being “people like us.” The “model minority” stereotype mentioned earlier includes people with this excessive competence but deficient sociability.

The other mixed combination is high warmth but low competence. Groups who fit this combination include older people and disabled people. Others report pitying them, but only so long as they stay in their place. In an effort to combat this negative stereotype, disability- and elderly-rights activists try to eliminate that pity, hopefully gaining respect in the process.

Altogether, these four kinds of stereotypes and their associated emotional prejudices (pride, disgust, envy, pity) occur all over the world for each of society's own groups. These maps of the group terrain predict specific types of discrimination for specific kinds of groups, underlining how bias is not exactly equal opportunity.
Conclusion: 21st Century Prejudices

As the world becomes more interconnected—more collaborations between countries, more intermarrying between different groups—more and more people are encountering greater diversity of others in everyday life. Just ask yourself if you’ve ever been asked, “What are you?” Such a question would be preposterous if you were only surrounded by members of your own group. Categories, then, are becoming more and more uncertain, unclear, volatile, and complex (Bodenhausen & Peery, 2009). People’s identities are multifaceted, intersecting across gender, race, class, age, region, and more. Identities are not so simple, but maybe as the 21st century unfurls, we will recognize each other by the content of our character instead of the cover on our outside.
Outside Resources

Web: Website exploring the causes and consequences of prejudice.  
http://www.understandingprejudice.org/

Web: Website that provides helpful information about prejudice including definition and statistics. This content is provided by OnlinePsychology@Pepperdine, the Online Master of Psychology program from Pepperdine University.  
https://onlinepsych.pepperdine.edu/blog/prejudice-discrimination-coping-skills/

Discussion Questions

1. Do you know more people from different kinds of social groups than your parents did?
2. How often do you hear people criticizing groups without knowing anything about them?
3. Take the IAT. Could you feel that some associations are easier than others?
4. What groups illustrate ambivalent biases, seemingly competent but cold, or warm but incompetent?
5. Do you or someone you know believe that group hierarchies are inevitable? Desirable?
6. How can people learn to get along with people who seem different from them?
Vocabulary

Automatic bias
Automatic biases are unintended, immediate, and irresistible.

Aversive racism
Aversive racism is unexamined racial bias that the person does not intend and would reject, but that avoids inter-racial contact.

Blatant biases
Blatant biases are conscious beliefs, feelings, and behavior that people are perfectly willing to admit, are mostly hostile, and openly favor their own group.

Discrimination
Discrimination is behavior that advantages or disadvantages people merely based on their group membership.

Implicit Association Test
Implicit Association Test (IAT) measures relatively automatic biases that favor own group relative to other groups.

Prejudice
Prejudice is an evaluation or emotion toward people merely based on their group membership.

Right-wing authoritarianism
Right-wing authoritarianism (RWA) focuses on value conflicts but endorses respect for obedience and authority in the service of group conformity.

Self-categorization theory
Self-categorization theory develops social identity theory’s point that people categorize themselves, along with each other into groups, favoring their own group.

Social dominance orientation
Social dominance orientation (SDO) describes a belief that group hierarchies are inevitable in all societies and even good, to maintain order and stability.

Social identity theory
Social identity theory notes that people categorize each other into groups, favoring their own group.

**Stereotype Content Model**
Stereotype Content Model shows that social groups are viewed according to their perceived warmth and competence.

**Stereotypes**
Stereotype is a belief that characterizes people based merely on their group membership.

**Subtle biases**
Subtle biases are automatic, ambiguous, and ambivalent, but real in their consequences.
References


We often change our attitudes and behaviors to match the attitudes and behaviors of the people around us. One reason for this conformity is a concern about what other people think of us. This process was demonstrated in a classic study in which college students deliberately gave wrong answers to a simple visual judgment task rather than go against the group. Another reason we conform to the norm is because other people often have information we do not, and relying on norms can be a reasonable strategy when we are uncertain about how we are supposed to act. Unfortunately, we frequently misperceive how the typical person acts, which can contribute to problems such as the excessive binge drinking often seen in college students. Obeying orders from an authority figure can sometimes lead to disturbing behavior. This danger was illustrated in a famous study in which participants were instructed to administer painful electric shocks to another person in what they believed to be a learning experiment. Despite vehement protests from the person receiving the shocks, most participants continued the procedure when instructed to do so by the experimenter. The findings raise questions about the power of blind obedience in deplorable situations such as atrocities and genocide. They also raise concerns about the ethical treatment of participants in psychology experiments.

Learning Objectives

• Become aware of how widespread conformity is in our lives and some of the ways each of us changes our attitudes and behavior to match the norm.

• Understand the two primary reasons why people often conform to perceived norms.

• Appreciate how obedience to authority has been examined in laboratory studies and some of the implications of the findings from these investigations.

• Consider some of the remaining issues and sources of controversy surrounding Milgram's
Introduction

When he was a teenager, my son often enjoyed looking at photographs of me and my wife taken when we were in high school. He laughed at the hairstyles, the clothing, and the kind of glasses people wore “back then.” And when he was through with his ridiculing, we would point out that no one is immune to fashions and fads and that someday his children will probably be equally amused by his high school photographs and the trends he found so normal at the time.

Everyday observation confirms that we often adopt the actions and attitudes of the people around us. Trends in clothing, music, foods, and entertainment are obvious. But our views on political issues, religious questions, and lifestyles also reflect to some degree the attitudes of the people we interact with. Similarly, decisions about behaviors such as smoking and drinking are influenced by whether the people we spend time with engage in these activities. Psychologists refer to this widespread tendency to act and think like the people around us as conformity.

Conformity

What causes all this conformity? To start, humans may possess an inherent tendency to imitate the actions of others. Although we usually are not aware of it, we often mimic the gestures, body posture, language, talking speed, and many other behaviors of the people we interact with. Researchers find that this mimicking increases the connection between people and allows our interactions to flow more smoothly (Chartrand & Bargh, 1999).

Beyond this automatic tendency to imitate others, psychologists have identified two primary reasons for conformity. The first of these is normative influence. When normative influence is operating, people go along with the crowd because they are concerned about what others think of them. We don't want to look out of step or become the target of criticism just because we like different kinds of music or dress differently than everyone else. Fitting in also brings rewards such as camaraderie and compliments.

How powerful is normative influence? Consider a classic study conducted many years ago by Solomon Asch (1956). The participants were male college students who were asked to engage in a seemingly simple task. An experimenter standing several feet away held up a card that depicted one line on the left side and three lines on the right side. The participant’s job was to say aloud which of the three lines on the right was the same length as the line on the left. Sixteen cards were presented one at a time, and the correct answer on each was so obvious as to make the task a little boring. Except for one thing. The participant was not alone. In fact, there were six other people in the room who also gave their answers to the line-judgment task aloud. Moreover, although they pretended to be fellow participants, these other individuals were, in fact, confederates working with the experimenter. The real participant was seated so that he always gave his answer after hearing what five other “participants” said. Everything went smoothly until the third trial, when inexplicably the first “participant” gave an obviously incorrect answer. The mistake might have been amusing, except the second participant gave the same answer. As did the third, the fourth, and the fifth participant. Suddenly the real participant was in a difficult situation. His eyes told him one thing, but five out of five people apparently saw something else.

It’s one thing to wear your hair a certain way or like certain foods because everyone around you does. But, would participants intentionally give a wrong answer just to conform with the other participants? The confederates uniformly gave incorrect answers on 12 of the 16 trials, and 76 percent of the participants went along with the norm at least once and also gave the wrong answer. In total, they conformed with the group on one-third of the 12 test trials. Although we might be impressed that the majority of the time participants answered honestly,
most psychologists find it remarkable that so many college students caved in to the pressure of the group rather than do the job they had volunteered to do. In almost all cases, the participants knew they were giving an incorrect answer, but their concern for what these other people might be thinking about them overpowered their desire to do the right thing.

Variations of Asch’s procedures have been conducted numerous times (Bond, 2005; Bond & Smith, 1996). We now know that the findings are easily replicated, that there is an increase in conformity with more confederates (up to about five), that teenagers are more prone to conforming than are adults, and that people conform significantly less often when they believe the confederates will not hear their responses (Berndt, 1979; Bond, 2005; Crutchfield, 1955; Deutsch & Gerard, 1955). This last finding is consistent with the notion that participants change their answers because they are concerned about what others think of them. Finally, although we see the effect in virtually every culture that has been studied, more conformity is found in collectivist countries such as Japan and China than in individualistic countries such as the United States (Bond & Smith, 1996). Compared with individualistic cultures, people who live in collectivist cultures place a higher value on the goals of the group than on individual preferences. They also are more motivated to maintain harmony in their interpersonal relations.

The other reason we sometimes go along with the crowd is that people are often a source of information. Psychologists refer to this process as informational influence. Most of us, most of the time, are motivated to do the right thing. If society deems that we put litter in a proper container, speak softly in libraries, and tip our waiter, then that’s what most of us will do. But sometimes it’s not clear what society expects of us. In these situations, we often rely on descriptive norms (Cialdini, Reno, & Kallgren, 1990). That is, we act the way most people—or most people like us—act. This is not an unreasonable strategy. Other people often have information that we do not, especially when we find ourselves in new situations. If you have ever been part of a conversation that went something like this,

“Do you think we should?”
“Sure. Everyone else is doing it.,”

you have experienced the power of informational influence.

However, it's not always easy to obtain good descriptive norm information, which means we sometimes rely on a flawed notion of the norm when deciding how we should behave. A good example of how misperceived norms can lead to problems is found in research on binge drinking among college students. Excessive drinking is a serious problem on many campuses (Mita, 2009). There are many reasons why students binge drink, but one of the most important is their perception of the descriptive norm. How much students drink is highly correlated with how much they believe the average student drinks (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). Unfortunately, students aren't very good at making this assessment. They notice the boisterous heavy drinker at the party but fail to consider all the students not attending the party. As a result, students typically overestimate the descriptive norm for college student drinking (Borsari & Carey, 2003; Perkins, Haines, & Rice, 2005). Most students believe they consume significantly less alcohol than the norm, a miscalculation that creates a dangerous push toward more and more excessive alcohol consumption. On the positive side, providing students with accurate information about drinking norms has been found to reduce overindulgent drinking (Burger, LaSalvia, Hendricks, Mehdipour, & Neudeck, 2011; Neighbors, Lee, Lewis, Fossos, & Walter, 2009).

Researchers have demonstrated the power of descriptive norms in a number of areas. Homeowners reduced the amount of energy they used when they learned that they were consuming more energy than their neighbors (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Undergraduates selected the healthy food option when led to believe that other students had made this choice (Burger et al., 2010). Hotel guests were more likely to reuse their towels when a hanger in the bathroom told them that this is what most guests do.

Efforts to influence people to engage in healthier or more sustainable behaviors have benefitted from the informational influence. For example, hotels have been able to significantly increase the numbers of people who re-use bath towels (reducing water and energy use) by informing them on signs in their rooms that re-using towels is a typical behavior of other hotel guests. [Image: Infrogmation of New Orleans, https://goo.gl/5P5F0v, CC BY 2.0, https://goo.gl/BRvSA7]
Obedience

Although we may be influenced by the people around us more than we recognize, whether we conform to the norm is up to us. But sometimes decisions about how to act are not so easy. Sometimes we are directed by a more powerful person to do things we may not want to do. Researchers who study obedience are interested in how people react when given an order or command from someone in a position of authority. In many situations, obedience is a good thing. We are taught at an early age to obey parents, teachers, and police officers. It's also important to follow instructions from judges, firefighters, and lifeguards. And a military would fail to function if soldiers stopped obeying orders from superiors. But, there is also a dark side to obedience. In the name of “following orders” or “just doing my job,” people can violate ethical principles and break laws. More disturbingly, obedience often is at the heart of some of the worst of human behavior—massacres, atrocities, and even genocide.

It was this unsettling side of obedience that led to some of the most famous and most controversial research in the history of psychology. Milgram (1963, 1965, 1974) wanted to know why so many otherwise decent German citizens went along with the brutality of the Nazi leaders during the Holocaust. “These inhumane policies may have originated in the mind of a single person,” Milgram (1963, p. 371) wrote, “but they could only be carried out on a massive scale if a very large number of persons obeyed orders.”

To understand this obedience, Milgram conducted a series of laboratory investigations. In all but one variation of the basic procedure, participants were men recruited from the community surrounding Yale University, where the research was carried out.
out. These citizens signed up for what they believed to be an experiment on learning and memory. In particular, they were told the research concerned the effects of punishment on learning. Three people were involved in each session. One was the participant. Another was the experimenter. The third was a confederate who pretended to be another participant.

The experimenter explained that the study consisted of a memory test and that one of the men would be the teacher and the other the learner. Through a rigged drawing, the real participant was always assigned the teacher’s role and the confederate was always the learner. The teacher watched as the learner was strapped into a chair and had electrodes attached to his wrist. The teacher then moved to the room next door where he was seated in front of a large metal box the experimenter identified as a “shock generator.” The front of the box displayed gauges and lights and, most noteworthy, a series of 30 levers across the bottom. Each lever was labeled with a voltage figure, starting with 15 volts and moving up in 15-volt increments to 450 volts. Labels also indicated the strength of the shocks, starting with “Slight Shock” and moving up to “Danger: Severe Shock” toward the end. The last two levers were simply labeled “XXX” in red.

Through a microphone, the teacher administered a memory test to the learner in the next room. The learner responded to the multiple-choice items by pressing one of four buttons that were barely within reach of his strapped-down hand. If the teacher saw the correct answer light up on his side of the wall, he simply moved on to the next item. But if the learner got the item wrong, the teacher pressed one of the shock levers and, thereby, delivered the learner’s punishment. The teacher was instructed to start with the 15-volt lever and move up to the next highest shock for each successive wrong answer.

In reality, the learner received no shocks. But he did make a lot of mistakes on the test, which forced the teacher to administer what he believed to be increasingly strong shocks. The purpose of the study was to see how far the teacher would go before refusing to continue. The teacher’s first hint that something was amiss came after pressing the 75-volt lever and hearing through the wall the learner say “Ugh!” The learner’s reactions became stronger and louder with each lever press. At 150 volts, the learner yelled out, “Experimenter! That’s all. Get me out of here. I told you I had heart trouble. My heart’s starting to bother me now. Get me out of here, please. My heart’s starting to bother me. I refuse to go on. Let me out.”

The experimenter’s role was to encourage the participant to continue. If at any time the teacher asked to end the session, the experimenter responded with phrases such as, “The experiment requires that you continue,” and “You have no other choice, you must go on.” The experimenter ended the session only after the teacher stated four successive times that he did not want to continue. All the while, the learner’s protests became more intense with each shock. After 300
volts, the learner refused to answer any more questions, which led the experimenter to say that no answer should be considered a wrong answer. After 330 volts, despite vehement protests from the learner following previous shocks, the teacher heard only silence, suggesting that the learner was now physically unable to respond. If the teacher reached 450 volts—the end of the generator—the experimenter told him to continue pressing the 450 volt lever for each wrong answer. It was only after the teacher pressed the 450-volt lever three times that the experimenter announced that the study was over.

If you had been a participant in this research, what would you have done? Virtually everyone says he or she would have stopped early in the process. And most people predict that very few if any participants would keep pressing all the way to 450 volts. Yet in the basic procedure described here, 65 percent of the participants continued to administer shocks to the very end of the session. These were not brutal, sadistic men. They were ordinary citizens who nonetheless followed the experimenter’s instructions to administer what they believed to be excruciating if not dangerous electric shocks to an innocent person. The disturbing implication from the findings is that, under the right circumstances, each of us may be capable of acting in some very uncharacteristic and perhaps some very unsettling ways.

Milgram conducted many variations of this basic procedure to explore some of the factors that affect obedience. He found that obedience rates decreased when the learner was in the same room as the experimenter and declined even further when the teacher had to physically touch the learner to administer the punishment. Participants also were less willing to continue the procedure after seeing other teachers refuse to press the shock levers, and they were significantly less obedient when the instructions to continue came from a person they believed to be another participant rather than from the experimenter. Finally, Milgram found that women participants followed the experimenter’s instructions at exactly the same rate the men had.
Milgram's obedience research has been the subject of much controversy and discussion. Psychologists continue to debate the extent to which Milgram's studies tell us something about atrocities in general and about the behavior of German citizens during the Holocaust in particular (Miller, 2004). Certainly, there are important features of that time and place that cannot be recreated in a laboratory, such as a pervasive climate of prejudice and dehumanization. Another issue concerns the relevance of the findings. Some people have argued that today we are more aware of the dangers of blind obedience than we were when the research was conducted back in the 1960s. However, findings from partial and modified replications of Milgram's procedures conducted in recent years suggest that people respond to the situation today much like they did a half a century ago (Burger, 2009).

Another point of controversy concerns the ethical treatment of research participants. Researchers have an obligation to look out for the welfare of their participants. Yet, there is little doubt that many of Milgram's participants experienced intense levels of stress as they went through the procedure. In his defense, Milgram was not unconcerned about the effects of the experience on his participants. And in follow-up questionnaires, the vast majority of his participants said they were pleased they had been part of the research and thought similar experiments should be conducted in the future. Nonetheless, in part because of Milgram's studies, guidelines and procedures were developed to protect research participants from these kinds of experiences. Although Milgram's intriguing findings left us with many
unanswered questions, conducting a full replication of his experiment remains out of bounds by today's standards.

Finally, it is also worth noting that although a number of factors appear to lead to obedience, there are also those who would not obey. In one conceptual replication of the Milgram studies, conducted with a small sample in Italy, the researchers explored the moment that approximately two-thirds of the sample refused to cooperate (Bocchiaro & Zimbardo, 2010). The investigators identified compassion, ethics, and recognition of the situation as problematic as major influences on refusal. Thus, just as there are pressures to obey there are also instances in which people can stand up to authority.

Social psychologists are fond of saying that we are all influenced by the people around us more than we recognize. Of course, each person is unique, and ultimately each of us makes choices about how we will and will not act. But decades of research on conformity and obedience make it clear that we live in a social world and that—for better or worse—much of what we do is a reflection of the people we encounter.
Outside Resources

Student Video: Christine N. Winston and Hemali Maher's 'The Milgram Experiment' gives an excellent 3-minute overview of one of the most famous experiments in the history of psychology. It was one of the winning entries in the 2015 Noba Student Video Award.
https://www.youtube.com/watch?v=uVIUZwkM_G0

Video: An example of information influence in a field setting
http://www.youtube.com/watch?v=4yFeaS60nWk

Video: Scenes from a recent partial replication of Milgram's obedience studies
http://www.youtube.com/watch?v=HwqNP9HRy7Y

Video: Scenes from a recent replication of Asch's conformity experiment
http://www.youtube.com/watch?v=VgDx5g9ql1g

Web: Website devoted to scholarship and research related to Milgram's obedience studies
http://www.stanleymilgram.com

Discussion Questions

1. In what ways do you see normative influence operating among you and your peers? How difficult would it be to go against the norm? What would it take for you to not do something just because all your friends were doing it?

2. What are some examples of how informational influence helps us do the right thing? How can we use descriptive norm information to change problem behaviors?

3. Is conformity more likely or less likely to occur when interacting with other people through social media as compared to face-to-face encounters?

4. When is obedience to authority a good thing and when is it bad? What can be done to prevent people from obeying commands to engage in truly deplorable behavior such as atrocities and massacres?

5. In what ways do Milgram's experimental procedures fall outside the guidelines for research with human participants? Are there ways to conduct relevant research on obedience to authority without violating these guidelines?
Vocabulary

Conformity
Changing one's attitude or behavior to match a perceived social norm.

Descriptive norm
The perception of what most people do in a given situation.

Informational influence
Conformity that results from a concern to act in a socially approved manner as determined by how others act.

Normative influence
Conformity that results from a concern for what other people think of us.

Obedience
Responding to an order or command from a person in a position of authority.
References


People often act to benefit other people, and these acts are examples of prosocial behavior. Such behaviors may come in many guises: helping an individual in need; sharing personal resources; volunteering time, effort, and expertise; cooperating with others to achieve some common goals. The focus of this module is on helping—prosocial acts in dyadic situations in which one person is in need and another provides the necessary assistance to eliminate the other's need. Although people are often in need, help is not always given. Why not? The decision of whether or not to help is not as simple and straightforward as it might seem, and many factors need to be considered by those who might help. In this module, we will try to understand how the decision to help is made by answering the question: Who helps when and why?

Learning Objectives

• Learn which situational and social factors affect when a bystander will help another in need.
• Understand which personality and individual difference factors make some people more likely to help than others.
• Discover whether we help others out of a sense of altruistic concern for the victim, for more self-centered and egoistic motives, or both.

Introduction

Go to YouTube and search for episodes of “Primetime: What Would You Do?” You will find
video segments in which apparently innocent individuals are victimized, while onlookers typically fail to intervene. The events are all staged, but they are very real to the bystanders on the scene. The entertainment offered is the nature of the bystanders’ responses, and viewers are outraged when bystanders fail to intervene. They are convinced that they would have helped. But would they? Viewers are overly optimistic in their beliefs that they would play the hero. Helping may occur frequently, but help is not always given to those in need. So when do people help, and when do they not? All people are not equally helpful—who helps? Why would a person help another in the first place? Many factors go into a person’s decision to help—a fact that the viewers do not fully appreciate. This module will answer the question: Who helps when and why?

When Do People Help?

Social psychologists are interested in answering this question because it is apparent that people vary in their tendency to help others. In 2010 for instance, Hugo Alfredo Tale-Yax was stabbed when he apparently tried to intervene in an argument between a man and woman. As he lay dying in the street, only one man checked his status, but many others simply glanced at the scene and continued on their way. (One passerby did stop to take a cellphone photo, however.) Unfortunately, failures to come to the aid of someone in need are not unique, as the segments on “What Would You Do?” show. Help is not always forthcoming for those who may need it the most. Trying to understand why people do not always help became the focus of bystander intervention research (e.g., Latané & Darley, 1970).

To answer the question regarding when people help, researchers have focused on

1. how bystanders come to define emergencies,
2. when they decide to take responsibility for helping, and
3. how the costs and benefits of intervening affect their decisions of whether to help.

**Defining the situation: The role of pluralistic ignorance**

The decision to help is not a simple yes/no proposition. In fact, a series of questions must be addressed before help is given—even in emergencies in which time may be of the essence. Sometimes help comes quickly; an onlooker recently jumped from a Philadelphia subway platform to help a stranger who had fallen on the track. Help was clearly needed and was quickly given. But some situations are ambiguous, and potential helpers may have to decide whether a situation is one in which help, in fact, needs to be given.

To define ambiguous situations (including many emergencies), potential helpers may look to the action of others to decide what should be done. But those others are looking around too, also trying to figure out what to do. Everyone is looking, but no one is acting! Relying on others to define the situation and to then erroneously conclude that no intervention is necessary when help is actually needed is called **pluralistic ignorance** (Latané & Darley, 1970). When people use the *inactions* of others to define their own course of action, the resulting pluralistic ignorance leads to less help being given.

**Do I have to be the one to help?:**

**Diffusion of responsibility**

Simply being with others may facilitate or inhibit whether we get involved in other ways as well. In situations in which help is needed, the presence or absence of others may affect whether a bystander will assume personal responsibility to give the assistance. If the bystander is alone, personal responsibility to help falls solely on the shoulders of that person. But what if others are present? Although it might seem that having more potential helpers around would increase the chances of the victim getting help, the opposite is often the case. Knowing that someone else *could* help seems to relieve bystanders of how does in a crowd decrease someone's chance of being helped? How does in a crowd increase someone's chance of being helped? [Image: flowcomm, https://goo.gl/5RlPch, CC BY 2.0, https://goo.gl/BrvSA7]
personal responsibility, so bystanders do not intervene. This phenomenon is known as **diffusion of responsibility** (Darley & Latané, 1968).

On the other hand, watch the video of the race officials following the 2013 Boston Marathon after two bombs exploded as runners crossed the finish line. Despite the presence of many spectators, the yellow-jacketed race officials immediately rushed to give aid and comfort to the victims of the blast. Each one no doubt felt a personal responsibility to help by virtue of their official capacity in the event; fulfilling the obligations of their roles overrode the influence of the diffusion of responsibility effect.

There is an extensive body of research showing the negative impact of pluralistic ignorance and diffusion of responsibility on helping (Fisher et al., 2011), in both emergencies and everyday need situations. These studies show the tremendous importance potential helpers place on the social situation in which unfortunate events occur, especially when it is not clear what should be done and who should do it. Other people provide important social information about how we should act and what our personal obligations might be. But does knowing a person needs help and accepting responsibility to provide that help mean the person will get assistance? Not necessarily.

**The costs and rewards of helping**

The nature of the help needed plays a crucial role in determining what happens next. Specifically, potential helpers engage in a **cost–benefit analysis** before getting involved (Dovidio et al., 2006). If the needed help is of relatively low cost in terms of time, money, resources, or risk, then help is more likely to be given. Lending a classmate a pencil is easy; confronting someone who is bullying your friend is an entirely different matter. As the unfortunate case of Hugo Alfredo Tale-Yax demonstrates, intervening may cost the life of the helper.

The potential rewards of helping someone will also enter into the equation, perhaps offsetting the cost of helping. Thanks from the recipient of help may be a sufficient reward. If helpful acts are recognized by others, helpers may receive social rewards of praise or monetary rewards. Even avoiding feelings of guilt if one does not help may be considered a benefit. Potential helpers consider how much helping will cost and compare those costs to the rewards that might be realized; it is the economics of helping. If costs outweigh the rewards, helping is less likely. If rewards are greater than cost, helping is more likely.

**Who Helps?**
Do you know someone who always seems to be ready, willing, and able to help? Do you know someone who never helps out? It seems there are personality and individual differences in the helpfulness of others. To answer the question of who chooses to help, researchers have examined 1) the role that sex and gender play in helping, 2) what personality traits are associated with helping, and 3) the characteristics of the “prosocial personality.”

Who are more helpful—men or women?

In terms of individual differences that might matter, one obvious question is whether men or women are more likely to help. In one of the “What Would You Do?” segments, a man takes a woman's purse from the back of her chair and then leaves the restaurant. Initially, no one responds, but as soon as the woman asks about her missing purse, a group of men immediately rush out the door to catch the thief. So, are men more helpful than women? The quick answer is “not necessarily.” It all depends on the type of help needed. To be very clear, the general level of helpfulness may be pretty much equivalent between the sexes, but men and women help in different ways (Becker & Eagly, 2004; Eagly & Crowley, 1986). What accounts for these differences?

Two factors help to explain sex and gender differences in helping. The first is related to the cost–benefit analysis process discussed previously. Physical differences between men and women may come into play (e.g., Wood & Eagly, 2002); the fact that men tend to have greater upper body strength than women makes the cost of intervening in some situations less for a man. Confronting a thief is a risky proposition, and some strength may be needed in case the perpetrator decides to fight. A bigger, stronger bystander is less likely to be injured and more likely to be successful.

The second explanation is simple socialization. Men and women have traditionally been raised to play different social roles that prepare them to respond differently to the needs of others,
and people tend to help in ways that are most consistent with their gender roles. Female gender roles encourage women to be compassionate, caring, and nurturing; male gender roles encourage men to take physical risks, to be heroic and chivalrous, and to be protective of those less powerful. As a consequence of social training and the gender roles that people have assumed, men may be more likely to jump onto subway tracks to save a fallen passenger, but women are more likely to give comfort to a friend with personal problems (Diekman & Eagly, 2000; Eagly & Crowley, 1986). There may be some specialization in the types of help given by the two sexes, but it is nice to know that there is someone out there—man or woman—who is able to give you the help that you need, regardless of what kind of help it might be.

A trait for being helpful: Agreeableness

Graziano and his colleagues (e.g., Graziano & Tobin, 2009; Graziano, Habishi, Sheese, & Tobin, 2007) have explored how agreeableness—one of the Big Five personality dimensions (e.g., Costa & McCrae, 1988)—plays an important role in prosocial behavior. Agreeableness is a core trait that includes such dispositional characteristics as being sympathetic, generous, forgiving, and helpful, and behavioral tendencies toward harmonious social relations and likeability. At the conceptual level, a positive relationship between agreeableness and helping may be expected, and research by Graziano et al. (2007) has found that those higher on the agreeableness dimension are, in fact, more likely than those low on agreeableness to help siblings, friends, strangers, or members of some other group. Agreeable people seem to expect that others will be similarly cooperative and generous in interpersonal relations, and they, therefore, act in helpful ways that are likely to elicit positive social interactions.

Searching for the prosocial personality

Rather than focusing on a single trait, Penner and his colleagues (Penner, Fritzsche, Craiger, & Freifeld, 1995; Penner & Orom, 2010) have taken a somewhat broader perspective and identified what they call the prosocial personality orientation. Their research indicates that two major characteristics are related to the prosocial personality and prosocial behavior. The first characteristic is called other-oriented empathy: People high on this dimension have a strong sense of social responsibility, empathize with and feel emotionally tied to those in need, understand the problems the victim is experiencing, and have a heightened sense of moral obligation to be helpful. This factor has been shown to be highly correlated with the trait of agreeableness discussed previously. The second characteristic, helpfulness, is more behaviorally oriented. Those high on the helpfulness factor have been helpful in the past, and because they believe they can be effective with the help they give, they are more likely to be helpful in the future.
Why Help?

Finally, the question of why a person would help needs to be asked. What motivation is there for that behavior? Psychologists have suggested that 1) evolutionary forces may serve to predispose humans to help others, 2) egoistic concerns may determine if and when help will be given, and 3) selfless, altruistic motives may also promote helping in some cases.

**Evolutionary roots for prosocial behavior**

Our evolutionary past may provide keys about why we help (Buss, 2004). Our very survival was no doubt promoted by the prosocial relations with clan and family members, and, as a hereditary consequence, we may now be especially likely to help those closest to us—blood-related relatives with whom we share a genetic heritage. According to evolutionary psychology, we are helpful in ways that increase the chances that our DNA will be passed along to future generations (Burnstein, Crandall, & Kitayama, 1994)—the goal of the “selfish gene” (Dawkins, 1976). Our personal DNA may not always move on, but we can still be successful in getting some portion of our DNA transmitted if our daughters, sons, nephews, nieces, and cousins survive to produce offspring. The favoritism shown for helping our blood relatives is called *kin selection* (Hamilton, 1964).

But, we do not restrict our relationships just to our own family members. We live in groups that include individuals who are unrelated to us, and we often help them too. Why? *Reciprocal altruism* (Trivers, 1971) provides the answer. Because of reciprocal altruism, we are all better off in the long run if we help one another. If helping someone now increases the chances that you will be helped later, then your overall chances of survival are increased. There is the chance that someone will take advantage of your help and not return your favors. But people seem predisposed to identify those who fail to reciprocate, and punishments including social
Exclusion may result (Buss, 2004). Cheaters will not enjoy the benefit of help from others, reducing the likelihood of the survival of themselves and their kin.

Evolutionary forces may provide a general inclination for being helpful, but they may not be as good an explanation for why we help in the here and now. What factors serve as proximal influences for decisions to help?

**Egoistic motivation for helping**

Most people would like to think that they help others because they are concerned about the other person’s plight. In truth, the reasons why we help may be more about ourselves than others: Egoistic or selfish motivations may make us help. Implicitly, we may ask, “What’s in it for me?” There are two major theories that explain what types of reinforcement helpers may be seeking. The *negative state relief model* (e.g., Cialdini, Darby, & Vincent, 1973; Cialdini, Kenrick, & Baumann, 1982) suggests that people sometimes help in order to make themselves feel better. Whenever we are feeling sad, we can use helping someone else as a positive mood boost to feel happier. Through socialization, we have learned that helping can serve as a secondary reinforcement that will relieve negative moods (Cialdini & Kenrick, 1976).

The *arousal: cost–reward model* provides an additional way to understand why people help (e.g., Piliavin, Dovidio, Gaertner, & Clark, 1981). This model focuses on the aversive feelings aroused by seeing another in need. If you have ever heard an injured puppy yelping in pain, you know that feeling, and you know that the best way to relieve that feeling is to help and to comfort the puppy. Similarly, when we see someone who is suffering in some way (e.g., injured, homeless, hungry), we vicariously experience a sympathetic arousal that is unpleasant, and we are motivated to eliminate that aversive state. One way to do that is to help the person in need. By eliminating the victim’s pain, we eliminate our own aversive arousal. Helping is an effective way to alleviate our own discomfort.

As an egoistic model, the arousal: cost–reward model explicitly includes the cost/reward considerations that come into play. Potential helpers will find ways to cope with the aversive arousal that will minimize their costs—maybe by means other than direct involvement. For example, the costs of directly confronting a knife-wielding assailant might stop a bystander from getting involved, but the cost of some indirect help (e.g., calling the police) may be acceptable. In either case, the victim’s need is addressed. Unfortunately, if the costs of helping are too high, bystanders may reinterpret the situation to justify not helping at all. For some, fleeing the situation causing their distress may do the trick (Piliavin et al., 1981).
The egoistically based negative state relief model and the arousal: cost–reward model see the primary motivation for helping as being the helper’s own outcome. Recognize that the victim’s outcome is of relatively little concern to the helper—benefits to the victim are incidental byproducts of the exchange (Dovidio et al., 2006). The victim may be helped, but the helper’s real motivation according to these two explanations is egoistic: Helpers help to the extent that it makes them feel better.

Altruistic help

Although many researchers believe that egoism is the only motivation for helping, others suggest that altruism—helping that has as its ultimate goal the improvement of another’s welfare—may also be a motivation for helping under the right circumstances. Batson (2011) has offered the empathy-altruism model to explain altruistically motivated helping for which the helper expects no benefits. According to this model, the key for altruism is empathizing with the victim, that is, putting oneself in the shoes of the victim and imagining how the victim must feel. When taking this perspective and having empathic concern, potential helpers become primarily interested in increasing the well-being of the victim, even if the helper must incur some costs that might otherwise be easily avoided. The empathy–altruism model does not dismiss egoistic motivations; helpers not empathizing with a victim may experience personal distress and have an egoistic motivation, not unlike the feelings and motivations explained by the arousal: cost–reward model. Because egoistically motivated individuals are primarily concerned with their own cost–benefit outcomes, they are less likely to help if they think they can escape the situation with no costs to themselves. In contrast, altruistically motivated helpers are willing to accept the cost of helping to benefit a person with whom they have empathized—this “self-sacrificial” approach to helping is the hallmark of altruism (Batson, 2011).

Although there is still some controversy about whether people can ever act for purely altruistic
motives, it is important to recognize that, while helpers may derive some personal rewards by helping another, the help that has been given is also benefitting someone who was in need. The residents who offered food, blankets, and shelter to stranded runners who were unable to get back to their hotel rooms because of the Boston Marathon bombing undoubtedly received positive rewards because of the help they gave, but those stranded runners who were helped got what they needed badly as well. “In fact, it is quite remarkable how the fates of people who have never met can be so intertwined and complementary. Your benefit is mine; and mine is yours” (Dovidio et al., 2006, p. 143).

Conclusion

We started this module by asking the question, “Who helps when and why?” As we have shown, the question of when help will be given is not quite as simple as the viewers of “What Would You Do?” believe. The power of the situation that operates on potential helpers in real time is not fully considered. What might appear to be a split-second decision to help is actually the result of consideration of multiple situational factors (e.g., the helper’s interpretation of the situation, the presence and ability of others to provide the help, the results of a cost–benefit analysis) (Dovidio et al., 2006). We have found that men and women tend to help in different ways—men are more impulsive and physically active, while women are more nurturing and supportive. Personality characteristics such as agreeableness and the prosocial personality orientation also affect people’s likelihood of giving assistance to others. And, why would people help in the first place? In addition to evolutionary forces (e.g., kin selection, reciprocal altruism), there is extensive evidence to show that helping and prosocial acts may be motivated by selfish, egoistic desires; by selfless, altruistic goals; or by some combination of egoistic and altruistic motives. (For a fuller consideration of the field of prosocial behavior, we refer you to Dovidio et al. [2006].)
Outside Resources


Institution: Center for Generosity, University of Notre Dame, 936 Flanner Hall, Notre Dame, IN 46556.
http://www.generosityresearch.nd.edu

Institution: The Greater Good Science Center, University of California, Berkeley.
http://www.greatergood.berkeley.edu

News Article: Bystanders Stop Suicide Attempt
http://jfmueller.faculty.noctrl.edu/crow/bystander.pdf

Social Psychology Network (SPN)
http://www.socialpsychology.org/social.htm#prosocial

Video: Episodes (individual) of “Primetime: What Would You Do?”
http://www.YouTube.com

Video: Episodes of “Primetime: What Would You Do?” that often include some commentary from experts in the field may be available at
http://www.abc.com
Video: From The Inquisitive Mind website, a great overview of different aspects of helping and pro-social behavior including - pluralistic ignorance, diffusion of responsibility, the bystander effect, and empathy. 
https://www.youtube.com/watch?v=i2aVjU3F_t0

Discussion Questions

1. Pluralistic ignorance suggests that inactions by other observers of an emergency will decrease the likelihood that help will be given. What do you think will happen if even one other observer begins to offer assistance to a victim?

2. In addition to those mentioned in the module, what other costs and rewards might affect a potential helper’s decision of whether to help? Receiving help to solve some problem is an obvious benefit for someone in need; are there any costs that a person might have to bear as a result of receiving help from someone?

3. What are the characteristics possessed by your friends who are most helpful? By your friends who are least helpful? What has made your helpful friends and your unhelpful friends so different? What kinds of help have they given to you, and what kind of help have you given to them? Are you a helpful person?

4. Do you think that sex and gender differences in the frequency of helping and the kinds of helping have changed over time? Why? Do you think that we might expect more changes in the future?

5. What do you think is the primary motive for helping behavior: egoism or altruism? Are there any professions in which people are being “pure” altruists, or are some egoistic motivations always playing a role?

6. There are other prosocial behaviors in addition to the kind of helping discussed here. People volunteer to serve many different causes and organizations. People come together to cooperate with one another to achieve goals that no one individual could reach alone. How do you think the factors that affect helping might affect prosocial actions such as volunteering and cooperating? Do you think that there might be other factors that make people more or less likely to volunteer their time and energy or to cooperate in a group?
Vocabulary

Agreeableness
A core personality trait that includes such dispositional characteristics as being sympathetic, generous, forgiving, and helpful, and behavioral tendencies toward harmonious social relations and likeability.

Altruism
A motivation for helping that has the improvement of another's welfare as its ultimate goal, with no expectation of any benefits for the helper.

Arousal: cost–reward model
An egoistic theory proposed by Piliavin et al. (1981) that claims that seeing a person in need leads to the arousal of unpleasant feelings, and observers are motivated to eliminate that aversive state, often by helping the victim. A cost–reward analysis may lead observers to react in ways other than offering direct assistance, including indirect help, reinterpretation of the situation, or fleeing the scene.

Bystander intervention
The phenomenon whereby people intervene to help others in need even if the other is a complete stranger and the intervention puts the helper at risk.

Cost–benefit analysis
A decision-making process that compares the cost of an action or thing against the expected benefit to help determine the best course of action.

Diffusion of responsibility
When deciding whether to help a person in need, knowing that there are others who could also provide assistance relieves bystanders of some measure of personal responsibility, reducing the likelihood that bystanders will intervene.

Egoism
A motivation for helping that has the improvement of the helper's own circumstances as its primary goal.

Empathic concern
According to Batson's empathy–altruism hypothesis, observers who empathize with a person in need (that is, put themselves in the shoes of the victim and imagine how that person feels)
will experience empathic concern and have an altruistic motivation for helping.

**Empathy–altruism model**
An altruistic theory proposed by Batson (2011) that claims that people who put themselves in the shoes of a victim and imagining how the victim feel will experience empathic concern that evokes an altruistic motivation for helping.

**Helpfulness**
A component of the prosocial personality orientation; describes individuals who have been helpful in the past and, because they believe they can be effective with the help they give, are more likely to be helpful in the future.

**Helping**
Prosocial acts that typically involve situations in which one person is in need and another provides the necessary assistance to eliminate the other's need.

**Kin selection**
According to evolutionary psychology, the favoritism shown for helping our blood relatives, with the goals of increasing the likelihood that some portion of our DNA will be passed on to future generations.

**Negative state relief model**
An egoistic theory proposed by Cialdini et al. (1982) that claims that people have learned through socialization that helping can serve as a secondary reinforcement that will relieve negative moods such as sadness.

**Other-oriented empathy**
A component of the prosocial personality orientation; describes individuals who have a strong sense of social responsibility, empathize with and feel emotionally tied to those in need, understand the problems the victim is experiencing, and have a heightened sense of moral obligations to be helpful.

**Personal distress**
According to Batson's empathy–altruism hypothesis, observers who take a detached view of a person in need will experience feelings of being “worried” and “upset” and will have an egoistic motivation for helping to relieve that distress.

**Pluralistic ignorance**
Relying on the actions of others to define an ambiguous need situation and to then erroneously
conclude that no help or intervention is necessary.

**Prosocial behavior**
Social behavior that benefits another person.

**Prosocial personality orientation**
A measure of individual differences that identifies two sets of personality characteristics (other-oriented empathy, helpfulness) that are highly correlated with prosocial behavior.

**Reciprocal altruism**
According to evolutionary psychology, a genetic predisposition for people to help those who have previously helped them.
References


Social Cognition and Attitudes

Yanine D. Hess & Cynthia L. Pickett

Social cognition is the area of social psychology that examines how people perceive and think about their social world. This module provides an overview of key topics within social cognition and attitudes, including judgmental heuristics, social prediction, affective and motivational influences on judgment, and explicit and implicit attitudes.

Learning Objectives

• Learn how we simplify the vast array of information in the world in a way that allows us to make decisions and navigate our environments efficiently.

• Understand some of the social factors that influence how we reason.

• Determine if our reasoning processes are always conscious, and if not, what some of the effects of automatic/nonconscious cognition are.

• Understand the difference between explicit and implicit attitudes, and the implications they have for behavior.

Introduction

Imagine you are walking toward your classroom and you see your teacher and a fellow student you know to be disruptive in class whispering together in the hallway. As you approach, both of them quit talking, nod to you, and then resume their urgent whispers after you pass by. What would you make of this scene? What story might you tell yourself to help explain this interesting and unusual behavior?
People know intuitively that we can better understand others’ behavior if we know the thoughts contributing to the behavior. In this example, you might guess that your teacher harbors several concerns about the disruptive student, and therefore you believe their whispering is related to this. The area of social psychology that focuses on how people think about others and about the social world is called social cognition.

Researchers of social cognition study how people make sense of themselves and others to make judgments, form attitudes, and make predictions about the future. Much of the research in social cognition has demonstrated that humans are adept at distilling large amounts of information into smaller, more usable chunks, and that we possess many cognitive tools that allow us to efficiently navigate our environments. This research has also illuminated many social factors that can influence these judgments and predictions. Not only can our past experiences, expectations, motivations, and moods impact our reasoning, but many of our decisions and behaviors are driven by unconscious processes and implicit attitudes we are unaware of having. The goal of this module is to highlight the mental tools we use to navigate and make sense of our complex social world, and describe some of the emotional, motivational, and cognitive factors that affect our reasoning.

Simplifying Our Social World

Consider how much information you come across on any given day; just looking around your bedroom, there are hundreds of objects, smells, and sounds. How do we simplify all this information to attend to what is important and make decisions quickly and efficiently? In part, we do it by forming schemas of the various people, objects, situations, and events we encounter. A schema is a mental model, or representation, of any of the various things we come across in our daily lives. A schema (related to the word schematic) is kind of like a mental blueprint for how we expect something to be or behave. It is an organized body of general information or beliefs we develop from direct encounters, as well as from secondhand sources. Rather than spending copious amounts of time learning about each new individual object (e.g., each new dog we see), we rely on our schemas to tell us that a newly encountered dog probably barks, likes to fetch, and enjoys treats. In this way, our schemas greatly reduce the amount of cognitive work we need to do and allow us to “go beyond the information given” (Bruner, 1957).

We can hold schemas about almost anything—individual people (person schemas), ourselves (self-schemas), and recurring events (event schemas, or scripts). Each of these types of schemas is useful in its own way. For example, event schemas allow us to navigate new situations efficiently and seamlessly. A script for dining at a restaurant would indicate that one should
wait to be seated by the host or hostess, that food should be ordered from a menu, and that one is expected to pay the check at the end of the meal. Because the majority of dining situations conform to this general format, most diners just need to follow their mental scripts to know what to expect and how they should behave, greatly reducing their cognitive workload.

Another important way we simplify our social world is by employing heuristics, which are mental shortcuts that reduce complex problem-solving to more simple, rule-based decisions. For example, have you ever had a hard time trying to decide on a book to buy, then you see one ranked highly on a book review website? Although selecting a book to purchase can be a complicated decision, you might rely on the “rule of thumb” that a recommendation from a credible source is likely a safe bet—so you buy it. A common instance of using heuristics is when people are faced with judging whether an object belongs to a particular category. For example, you would easily classify a pit bull into the category of “dog.” But what about a coyote? Or a fox? A plastic toy dog? In order to make this classification (and many others), people may rely on the representativeness heuristic to arrive at a quick decision (Kahneman & Tversky, 1972, 1973). Rather than engaging in an in-depth consideration of the object’s attributes, one can simply judge the likelihood of the object belonging to a category, based on how similar it is to one’s mental representation of that category. For example, a perceiver may quickly judge a female to be an athlete based on the fact that the female is tall, muscular, and wearing sports apparel—which fits the perceiver’s representation of an athlete’s characteristics.

In many situations, an object’s similarity to a category is a good indicator of its membership in that category, and an individual using the representativeness heuristic will arrive at a correct judgment. However, when base-rate information (e.g., the actual percentage of athletes in the area and therefore the probability that this person actually is an athlete) conflicts with representativeness information, use of this heuristic is less appropriate. For example, if asked to judge whether a quiet, thin man who likes to read poetry is a classics professor at a
prestigious university or a truck driver, the representativeness heuristic might lead one to guess he's a professor. However, considering the base-rates, we know there are far fewer university classics professors than truck drivers. Therefore, although the man fits the mental image of a professor, the actual probability of him being one (considering the number of professors out there) is lower than that of being a truck driver.

In addition to judging whether things belong to particular categories, we also attempt to judge the likelihood that things will happen. A commonly employed heuristic for making this type of judgment is called the availability heuristic. People use the availability heuristic to evaluate the frequency or likelihood of an event based on how easily instances of it come to mind (Tversky & Kahneman, 1973). Because more commonly occurring events are more likely to be cognitively accessible (or, they come to mind more easily), use of the availability heuristic can lead to relatively good approximations of frequency. However, the heuristic can be less reliable when judging the frequency of relatively infrequent but highly accessible events. For example, do you think there are more words that begin with “k,” or more that have “k” as the third letter? To figure this out, you would probably make a list of words that start with “k” and compare it to a list of words with “k” as the third letter. Though such a quick test may lead you to believe there are more words that begin with “k,” the truth is that there are 3 times as many words that have “k” as the third letter (Schwarz et al., 1991). In this case, words beginning with “k” are more readily available to memory (i.e., more accessible), so they seem to be more numerous. Another example is the very common fear of flying: dying in a plane crash is extremely rare, but people often overestimate the probability of it occurring because plane crashes tend to be highly memorable and publicized.

In summary, despite the vast amount of information we are bombarded with on a daily basis, the mind has an entire kit of “tools” that allows us to navigate that information efficiently. In addition to category and frequency judgments, another common mental calculation we perform is predicting the future. We rely on our predictions about the future to guide our actions. When deciding what entrée to select for dinner, we may ask ourselves, “How happy will I be if I choose this over that?” The answer we arrive at is an example of a future prediction. In the next section, we examine individuals’ ability to accurately predict others’ behaviors, as well as their own future thoughts, feelings, and behaviors, and how these predictions can impact their decisions.

Making Predictions About the Social World

Whenever we face a decision, we predict our future behaviors or feelings in order to choose the best course of action. If you have a paper due in a week and have the option of going out
to a party or working on the paper, the decision of what to do rests on a few things: the amount of time you predict you will need to write the paper, your prediction of how you will feel if you do poorly on the paper, and your prediction of how harshly the professor will grade it.

In general, we make predictions about others quickly, based on relatively little information. Research on “thin-slice judgments” has shown that perceivers are able to make surprisingly accurate inferences about another person's emotional state, personality traits, and even sexual orientation based on just snippets of information—for example, a 10-second video clip (Ambady, Bernieri, & Richeson, 2000; Ambady, Hallahan, & Conner, 1999; Ambady & Rosenthal, 1993). Furthermore, these judgments are predictive of the target's future behaviors. For example, one study found that students' ratings of a teacher's warmth, enthusiasm, and attentiveness from a 30-second video clip strongly predicted that teacher's final student evaluations after an entire semester (Ambady & Rosenthal, 1993). As might be expected, the more information there is available, the more accurate many of these judgments become (Carney, Colvin, & Hall, 2007).

Because we seem to be fairly adept at making predictions about others, one might expect predictions about the self to be foolproof, given the considerable amount of information one has about the self compared to others. To an extent, research has supported this conclusion. For example, our own predictions of our future academic performance are more accurate than peers' predictions of our performance, and self-expressed interests better predict occupational choice than career inventories (Shrauger & Osberg, 1981). Yet, it is not always the case that we hold greater insight into ourselves. While our own assessment of our personality traits does predict certain behavioral tendencies better than peer assessment of our personality, for certain behaviors, peer reports are more accurate than self-reports (Kolar, Funder, & Colvin, 1996; Vazire, 2010). Similarly, although we are generally aware of our knowledge, abilities, and future prospects, our perceptions are often overly positive, and we display overconfidence in their accuracy and potential (Metcalfe, 1998). For example, we tend
to underestimate how much time it will take us to complete a task, whether it is writing a paper, finishing a project at work, or building a bridge—a phenomenon known as the planning fallacy (Buehler, Griffin, & Ross, 1994). The planning fallacy helps explain why so many college students end up pulling all-nighters to finish writing assignments or study for exams. The tasks simply end up taking longer than expected. On the positive side, the planning fallacy can also lead individuals to pursue ambitious projects that may turn out to be worthwhile. That is, if they had accurately predicted how much time and work it would have taken them, they may have never started it in the first place.

The other important factor that affects decision-making is our ability to predict how we will feel about certain outcomes. Not only do we predict whether we will feel positively or negatively, we also make predictions about how strongly and for how long we will feel that way. Research demonstrates that these predictions of one's future feelings—known as affective forecasting—are accurate in some ways but limited in others (Gilbert & Wilson, 2007). We are adept at predicting whether a future event or situation will make us feel positively or negatively (Wilson & Gilbert, 2003), but we often incorrectly predict the strength or duration of those emotions. For example, you may predict that if your favorite sports team loses an important match, you will be devastated. Although you're probably right that you will feel negative (and not positive) emotions, will you be able to accurately estimate how negative you'll feel? What about how long those negative feelings will last?

Predictions about future feelings are influenced by the impact bias: the tendency for a person to overestimate the intensity of their future feelings. For example, by comparing people's estimates of how they expected to feel after a specific event to their actual feelings after the event, research has shown that people generally overestimate how badly they will feel after a negative event—such as losing a job—and they also overestimate how happy they will feel after a positive event—such as winning the lottery (Brickman, Coates, & Janoff-Bullman, 1978). Another factor in these estimations is the durability bias. The durability bias refers to the tendency for people to overestimate how long (or, the duration) positive and negative events will affect them. This bias is much greater for predictions regarding negative events than positive events, and occurs because people are generally unaware of the many psychological mechanisms that help us adapt to and cope with negative events (Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998; Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000).

In summary, individuals form impressions of themselves and others, make predictions about the future, and use these judgments to inform their decisions. However, these judgments are shaped by our tendency to view ourselves in an overly positive light and our inability to appreciate our habituation to both positive and negative events. In the next section, we will discuss how motivations, moods, and desires also shape social judgment.
Hot Cognition: The Influence of Motivations, Mood, and Desires on Social Judgment

Although we may believe we are always capable of rational and objective thinking (for example, when we methodically weigh the pros and cons of two laundry detergents in an unemotional—i.e., “cold”—manner), our reasoning is often influenced by our motivations and mood. **Hot cognition** refers to the mental processes that are influenced by desires and feelings. For example, imagine you receive a poor grade on a class assignment. In this situation, your ability to reason objectively about the quality of your assignment may be limited by your anger toward the teacher, upset feelings over the bad grade, and your motivation to maintain your belief that you are a good student. In this sort of scenario, we may want the situation to turn out a particular way or our belief to be the truth. When we have these **directional goals**, we are motivated to reach a particular outcome or judgment and do not process information in a cold, objective manner.

Directional goals can bias our thinking in many ways, such as leading to **motivated skepticism**, whereby we are skeptical of evidence that goes against what we want to believe despite the strength of the evidence (Ditto & Lopez, 1992). For example, individuals trust medical tests less if the results suggest they have a deficiency compared to when the results suggest they are healthy. Through this motivated skepticism, people often continue to believe what they want to believe, even in the face of nearly incontrovertible evidence to the contrary.

There are also situations in which we do not have wishes for a particular outcome but our goals bias our reasoning, anyway. For example, being motivated to reach an accurate conclusion can influence our reasoning processes by making us more cautious—leading to indecision. In contrast, sometimes individuals are motivated to make a quick decision, without being particularly concerned about the quality of it. Imagine trying to
choose a restaurant with a group of friends when you’re really hungry. You may choose whatever’s nearby without caring if the restaurant is the best or not. This need for closure (the desire to come to a firm conclusion) is often induced by time constraints (when a decision needs to be made quickly) as well as by individual differences in the need for closure (Webster & Kruglanski, 1997). Some individuals are simply more uncomfortable with ambiguity than others, and are thus more motivated to reach clear, decisive conclusions.

Just as our goals and motivations influence our reasoning, our moods and feelings also shape our thinking process and ultimate decisions. Many of our decisions are based in part on our memories of past events, and our retrieval of memories is affected by our current mood. For example, when you are sad, it is easier to recall the sad memory of your dog’s death than the happy moment you received the dog. This tendency to recall memories similar in valence to our current mood is known as mood-congruent memory (Blaney, 1986; Bower 1981, 1991; DeSteno, Petty, Wegener, & Rucker, 2000; Forgas, Bower, & Krantz, 1984; Schwarz, Strack, Kommer, & Wagner, 1987). The mood we were in when the memory was recorded becomes a retrieval cue; our present mood primes these congruent memories, making them come to mind more easily (Fiedler, 2001). Furthermore, because the availability of events in our memory can affect their perceived frequency (the availability heuristic), the biased retrieval of congruent memories can then impact the subsequent judgments we make (Tversky & Kahneman, 1973). For example, if you are retrieving many sad memories, you might conclude that you have had a tough, depressing life.

In addition to our moods influencing the specific memories we retrieve, our moods can also influence the broader judgments we make. This sometimes leads to inaccuracies when our current mood is irrelevant to the judgment at hand. In a classic study demonstrating this effect, researchers found that study participants rated themselves as less-satisfied with their lives in general if they were asked on a day when it happened to be raining vs. sunny (Schwarz & Clore, 1983). However, this occurred only if the participants were not aware that the weather might be influencing their mood. In essence, participants were in worse moods on rainy days than sunny days, and, if unaware of the weather’s effect on their mood, they incorrectly used their mood as evidence of their overall life satisfaction.

In summary, our mood and motivations can influence both the way we think and the decisions we ultimately make. Mood can shape our thinking even when the mood is irrelevant to the judgment, and our motivations can influence our thinking even if we have no particular preference about the outcome. Just as we might be unaware of how our reasoning is influenced by our motives and moods, research has found that our behaviors can be determined by unconscious processes rather than intentional decisions, an idea we will explore in the next
Automaticity

Do we actively choose and control all our behaviors or do some of these behaviors occur automatically? A large body of evidence now suggests that many of our behaviors are, in fact, automatic. A behavior or process is considered automatic if it is unintentional, uncontrollable, occurs outside of conscious awareness, or is cognitively efficient (Bargh & Chartrand, 1999). A process may be considered automatic even if it does not have all these features; for example, driving is a fairly automatic process, but is clearly intentional. Processes can become automatic through repetition, practice, or repeated associations. Staying with the driving example: although it can be very difficult and cognitively effortful at the start, over time it becomes a relatively automatic process, and aspects of it can occur outside conscious awareness.

In addition to practice leading to the learning of automatic behaviors, some automatic processes, such as fear responses, appear to be innate. For example, people quickly detect negative stimuli, such as negative words, even when those stimuli are presented subliminally (Dijksterhuis & Aarts, 2003; Pratto & John, 1991). This may represent an evolutionarily adaptive response that makes individuals more likely to detect danger in their environment. Other innate automatic processes may have evolved due to their pro-social outcomes. The chameleon effect—where individuals nonconsciously mimic the postures, mannerisms, facial expressions, and other behaviors of their interaction partners—is an example of how people may engage in certain behaviors without conscious intention or awareness (Chartrand & Bargh, 1999). For example, have you ever noticed that you've picked up some of the habits of your friends? Over time, but also in brief encounters, we will nonconsciously mimic those around us because of the positive social effects of doing so. That is, automatic mimicry has been shown to lead to more positive social interactions and to increase liking between the mimicked person and the mimicking person.

When concepts and behaviors have been repeatedly associated with each other, one of them
can be primed—i.e., made more cognitively accessible—by exposing participants to the (strongly associated) other one. For example, by presenting participants with the concept of a doctor, associated concepts such as “nurse” or “stethoscope” are primed. As a result, participants recognize a word like “nurse” more quickly (Meyer, & Schvaneveldt, 1971). Similarly, stereotypes can automatically prime associated judgments and behaviors. Stereotypes are our general beliefs about a group of people and, once activated, they may guide our judgments outside of conscious awareness. Similar to schemas, stereotypes involve a mental representation of how we expect a person will think and behave. For example, someone’s mental schema for women may be that they’re caring, compassionate, and maternal; however, a stereotype would be that all women are examples of this schema. As you know, assuming all people are a certain way is not only wrong but insulting, especially if negative traits are incorporated into a schema and subsequent stereotype.

In a now classic study, Patricia Devine (1989) primed study participants with words typically associated with Blacks (e.g., “blues,” “basketball”) in order to activate the stereotype of Blacks. Devine found that study participants who were primed with the Black stereotype judged a target’s ambiguous behaviors as being more hostile (a trait stereotypically associated with Blacks) than nonprimed participants. Research in this area suggests that our social context—which constantly bombards us with concepts—may prime us to form particular judgments and influence our thoughts and behaviors.

In summary, there are many cognitive processes and behaviors that occur outside of our awareness and despite our intentions. Because automatic thoughts and behaviors do not require the same level of cognitive processing as conscious, deliberate thinking and acting, automaticity provides an efficient way for individuals to process and respond to the social world. However, this efficiency comes at a cost, as unconsciously held stereotypes and attitudes can sometimes influence us to behave in unintended ways. We will discuss the consequences of both consciously and unconsciously held attitudes in the next section.

Attitudes and Attitude Measurement

When we encounter a new object or person, we often form an attitude toward it (him/her). An attitude is a “psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly & Chaiken, 1993, p. 1). In essence, our attitudes are our general evaluations of things (i.e., do you regard this thing positively or negatively?) that can bias us toward having a particular response to it. For example, a negative attitude toward mushrooms would predispose you to avoid them and think negatively of them in other ways. This bias can be long- or short-term and can be overridden by another experience with
the object. Thus, if you encounter a delicious mushroom dish in the future, your negative attitude could change to a positive one.

Traditionally, attitudes have been measured through explicit attitude measures, in which participants are directly asked to provide their attitudes toward various objects, people, or issues (e.g., a survey).

For example, in a semantic-differential scale, respondents are asked to provide evaluations of an attitude object using a series of negative to positive response scales—which have something like “unpleasant” at one end of the scale and “pleasant” at the other (Osgood, Suci, & Tannenbaum, 1957). In a Likert scale, respondents are asked to indicate their agreement level with various evaluative statements, such as, “I believe that psychology is the most interesting major” (Likert, 1932). Here, participants mark their selection between something like “strongly disagree” and “strongly agree.” These explicit measures of attitudes can be used to predict people’s actual behavior, but there are limitations to them. For one thing, individuals aren’t always aware of their true attitudes, because they’re either undecided or haven’t given a particular issue much thought. Furthermore, even when individuals are aware of their attitudes, they might not want to admit to them, such as when holding a certain attitude is viewed negatively by their culture. For example, sometimes it can be difficult to measure people’s true opinions on racial issues, because participants fear that expressing their true attitudes will be viewed as socially unacceptable. Thus, explicit attitude measures may be unreliable when asking about controversial attitudes or attitudes that are not widely accepted by society.

In order to avoid some of these limitations, many researchers use more subtle or covert ways of measuring attitudes that do not suffer from such self-presentation concerns (Fazio & Olson, 2003). An implicit attitude is an attitude that a person does not verbally or overtly express. For example, someone may have a positive, explicit attitude toward his job; however, nonconsciously, he may have a lot of negative associations with it (e.g., having to wake up
early, the long commute, the office heating is broken) which results in an implicitly negative attitude. To learn what a person's implicit attitude is, you have to use implicit measures of attitudes. These measures infer the participant's attitude rather than having the participant explicitly report it. Many implicit measures accomplish this by recording the time it takes a participant (i.e., the reaction time) to label or categorize an attitude object (i.e., the person, concept, or object of interest) as positive or negative. For example, the faster someone categorizes his or her job (measured in milliseconds) as negative compared to positive, the more negative the implicit attitude is (i.e., because a faster categorization implies that the two concepts—"work" and "negative"—are closely related in one's mind).

One common implicit measure is the Implicit Association Test (IAT; Greenwald & Banaji, 1995; Greenwald, McGhee, & Schwartz, 1998), which does just what the name suggests, measuring how quickly the participant pairs a concept (e.g., cats) with an attribute (e.g., good or bad). The participant's response time in pairing the concept with the attribute indicates how strongly the participant associates the two. Another common implicit measure is the evaluative priming task (Fazio, Jackson, Dunton, & Williams, 1995), which measures how quickly the participant labels the valence (i.e., positive or negative) of the attitude object when it appears immediately after a positive or negative image. The more quickly a participant labels the attitude object after being primed with a positive versus negative image indicates how positively the participant evaluates the object.

Individuals' implicit attitudes are sometimes inconsistent with their explicitly held attitudes. Hence, implicit measures may reveal biases that participants do not report on explicit measures. As a result, implicit attitude measures are especially useful for examining the pervasiveness and strength of controversial attitudes and stereotypic associations, such as racial biases or associations between race and violence. For example, research using the IAT has shown that about 66% of white respondents have a negative bias toward Blacks (Nosek, Banaji, & Greenwald, 2002), that bias on the IAT against Blacks is associated with more discomfort during interracial interactions (McConnell, & Leibold, 2001), and that implicit associations linking Blacks to violence are associated with a greater tendency to shoot unarmed Black targets in a video game (Payne, 2001). Thus, even though individuals are often unaware of their implicit attitudes, these attitudes can have serious implications for their behavior, especially when these individuals do not have the cognitive resources available to override the attitudes' influence.

Conclusion

Decades of research on social cognition and attitudes have revealed many of the “tricks” and
“tools” we use to efficiently process the limitless amounts of social information we encounter. These tools are quite useful for organizing that information to arrive at quick decisions. When you see an individual engage in a behavior, such as seeing a man push an elderly woman to the ground, you form judgments about his personality, predictions about the likelihood of him engaging in similar behaviors in the future, as well as predictions about the elderly woman's feelings and how you would feel if you were in her position. As the research presented in this module demonstrates, we are adept and efficient at making these judgments and predictions, but they are not made in a vacuum. Ultimately, our perception of the social world is a subjective experience, and, consequently, our decisions are influenced by our experiences, expectations, emotions, motivations, and current contexts. Being aware of when our judgments are most accurate, and how our judgments are shaped by social influences, prepares us to be in a much better position to appreciate, and potentially counter, their effects.
Outside Resources

Video: Daniel Gilbert discussing affective forecasting.
http://www.dailymotion.com/video/xbnl3_dan-gilbert-on-what-affective-forec_people#.UQlwDx3WLm4

Video: Focus on heuristics.
http://study.com/academy/lesson/heuristics.html

Web: BBC Horizon documentary How to Make Better Decisions that discusses many module topics (Part 1).
http://www.youtube.com/watch?v=ul-FqOfrX-t8

Web: Implicit Attitudes Test.
https://implicit.harvard.edu/implicit/

Discussion Questions

1. Describe your event-schema, or script, for an event that you encounter regularly (e.g., dining at a restaurant). Now, attempt to articulate a script for an event that you have encountered only once or a few times. How are these scripts different? How confident are you in your ability to navigate these two events?

2. Think of a time when you made a decision that you thought would make you very happy (e.g., purchasing an item). To what extent were you accurate or inaccurate? In what ways were you wrong, and why do you think you were wrong?

3. What is an issue you feel strongly about (e.g., abortion, death penalty)? How would you react if research demonstrated that your opinion was wrong? What would it take before you would believe the evidence?

4. Take an implicit association test at the Project Implicit website (https://implicit.harvard.edu/implicit). How do your results match or mismatch your explicit attitudes.
Vocabulary

**Affective forecasting**
Predicting how one will feel in the future after some event or decision.

**Attitude**
A psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor.

**Automatic**
A behavior or process has one or more of the following features: unintentional, uncontrollable, occurring outside of conscious awareness, and cognitively efficient.

**Availability heuristic**
A heuristic in which the frequency or likelihood of an event is evaluated based on how easily instances of it come to mind.

**Chameleon effect**
The tendency for individuals to nonconsciously mimic the postures, mannerisms, facial expressions, and other behaviors of one’s interaction partners.

**Directional goals**
The motivation to reach a particular outcome or judgment.

**Durability bias**
A bias in affective forecasting in which one overestimates for how long one will feel an emotion (positive or negative) after some event.

**Evaluative priming task**
An implicit attitude task that assesses the extent to which an attitude object is associated with a positive or negative valence by measuring the time it takes a person to label an adjective as good or bad after being presented with an attitude object.

**Explicit attitude**
An attitude that is consciously held and can be reported on by the person holding the attitude.

**Heuristics**
A mental shortcut or rule of thumb that reduces complex mental problems to more simple...
rule-based decisions.

**Hot cognition**  
The mental processes that are influenced by desires and feelings.

**Impact bias**  
A bias in affective forecasting in which one overestimates the strength or intensity of emotion one will experience after some event.

**Implicit Association Test**  
An implicit attitude task that assesses a person's automatic associations between concepts by measuring the response times in pairing the concepts.

**Implicit attitude**  
An attitude that a person cannot verbally or overtly state.

**Implicit measures of attitudes**  
Measures of attitudes in which researchers infer the participant's attitude rather than having the participant explicitly report it.

**Mood-congruent memory**  
The tendency to be better able to recall memories that have a mood similar to our current mood.

**Motivated skepticism**  
A form of bias that can result from having a directional goal in which one is skeptical of evidence despite its strength because it goes against what one wants to believe.

**Need for closure**  
The desire to come to a decision that will resolve ambiguity and conclude an issue.

**Planning fallacy**  
A cognitive bias in which one underestimates how long it will take to complete a task.

**Primed**  
A process by which a concept or behavior is made more cognitively accessible or likely to occur through the presentation of an associated concept.

**Representativeness heuristic**
A heuristic in which the likelihood of an object belonging to a category is evaluated based on the extent to which the object appears similar to one's mental representation of the category.

**Schema**
A mental model or representation that organizes the important information about a thing, person, or event (also known as a script).

**Social cognition**
The study of how people think about the social world.

**Stereotypes**
Our general beliefs about the traits or behaviors shared by group of people.
References


McConnell, A. R., & Leibold, J. M. (2001). Relations among the implicit association test,


Personality traits reflect people's characteristic patterns of thoughts, feelings, and behaviors. Personality traits imply consistency and stability—someone who scores high on a specific trait like Extraversion is expected to be sociable in different situations and over time. Thus, trait psychology rests on the idea that people differ from one another in terms of where they stand on a set of basic trait dimensions that persist over time and across situations. The most widely used system of traits is called the Five-Factor Model. This system includes five broad traits that can be remembered with the acronym OCEAN: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Each of the major traits from the Big Five can be divided into facets to give a more fine-grained analysis of someone's personality. In addition, some trait theorists argue that there are other traits that cannot be completely captured by the Five-Factor Model. Critics of the trait concept argue that people do not act consistently from one situation to the next and that people are very influenced by situational forces. Thus, one major debate in the field concerns the relative power of people's traits versus the situations in which they find themselves as predictors of their behavior.

Learning Objectives

- List and describe the “Big Five” (“OCEAN”) personality traits that comprise the Five-Factor Model of personality.
- Describe how the facet approach extends broad personality traits.
- Explain a critique of the personality-trait concept.
- Describe in what ways personality traits may be manifested in everyday behavior.
- Describe each of the Big Five personality traits, and the low and high end of the dimension.
- Give examples of each of the Big Five personality traits, including both a low and high example.
• Describe how traits and social learning combine to predict your social activities.
• Describe your theory of how personality traits get refined by social learning.

Introduction

When we observe people around us, one of the first things that strikes us is how different people are from one another. Some people are very talkative while others are very quiet. Some are active whereas others are couch potatoes. Some worry a lot, others almost never seem anxious. Each time we use one of these words, words like “talkative,” “quiet,” “active,” or “anxious,” to describe those around us, we are talking about a person’s personality—the characteristic ways that people differ from one another. Personality psychologists try to describe and understand these differences.

Although there are many ways to think about the personalities that people have, Gordon Allport and other “personologists” claimed that we can best understand the differences between individuals by understanding their personality traits. Personality traits reflect basic dimensions on which people differ (Matthews, Deary, & Whiteman, 2003). According to trait psychologists, there are a limited number of these dimensions (dimensions like Extraversion, Conscientiousness, or Agreeableness), and each individual falls somewhere on each dimension, meaning that they could be low, medium, or high on any specific trait.

An important feature of personality traits is that they reflect continuous distributions rather than distinct personality types. This means that when personality psychologists talk about Introverts and Extraverts, they are not really talking about two distinct types of people who are completely and qualitatively different from one another. Instead, they are talking about people who score relatively low or relatively high along a
continuous distribution. In fact, when personality psychologists measure traits like Extraversion, they typically find that most people score somewhere in the middle, with smaller numbers showing more extreme levels. The figure below shows the distribution of Extraversion scores from a survey of thousands of people. As you can see, most people report being moderately, but not extremely, extraverted, with fewer people reporting very high or very low scores.

Figure 1. Distribution of Extraversion Scores in a Sample Higher bars mean that more people have scores of that level. This figure shows that most people score towards the middle of the extraversion scale, with fewer people who are highly extraverted or highly introverted.

There are three criteria that are characterize personality traits: (1) consistency, (2) stability, and (3) individual differences.

1. To have a personality trait, individuals must be somewhat consistent across situations in their behaviors related to the trait. For example, if they are talkative at home, they tend also to be talkative at work.

2. Individuals with a trait are also somewhat stable over time in behaviors related to the trait. If they are talkative, for example, at age 30, they will also tend to be talkative at work.

3. People differ from one another on behaviors related to the trait. Using speech is not a personality trait and neither is walking on two feet—virtually all individuals do these activities, and there are almost no individual differences. But people differ on how frequently they talk and how active they are, and thus personality traits such as Talkativeness and Activity Level do exist.

A challenge of the trait approach was to discover the major traits on which all people differ. Scientists for many decades generated hundreds of new traits, so that it was soon difficult to keep track and make sense of them. For instance, one psychologist might focus on individual differences in “friendliness,” whereas another might focus on the highly related concept of “sociability.” Scientists began seeking ways to reduce the number of traits in some systematic way and to discover the basic traits that describe most of the differences between people.

The way that Gordon Allport and his colleague Henry Odbert approached this was to search
the dictionary for all descriptors of personality (Allport & Odbert, 1936). Their approach was guided by the **lexical hypothesis**, which states that all important personality characteristics should be reflected in the language that we use to describe other people. Therefore, if we want to understand the fundamental ways in which people differ from one another, we can turn to the words that people use to describe one another. So if we want to know what words people use to describe one another, where should we look? Allport and Odbert looked in the most obvious place—the dictionary. Specifically, they took all the personality descriptors that they could find in the dictionary (they started with almost 18,000 words but quickly reduced that list to a more manageable number) and then used statistical techniques to determine which words “went together.” In other words, if everyone who said that they were “friendly” also said that they were “sociable,” then this might mean that personality psychologists would only need a single trait to capture individual differences in these characteristics. Statistical techniques were used to determine whether a small number of dimensions might underlie all of the thousands of words we use to describe people.

**The Five-Factor Model of Personality**

Research that used the lexical approach showed that many of the personality descriptors found in the dictionary do indeed overlap. In other words, many of the words that we use to describe people are synonyms. Thus, if we want to know what a person is like, we do not necessarily need to ask how sociable they are, how friendly they are, and how gregarious they are. Instead, because sociable people tend to be friendly and gregarious, we can summarize this personality dimension with a single term. Someone who is sociable, friendly, and gregarious would typically be described as an “Extravert.” Once we know she is an extravert, we can assume that she is sociable, friendly, and gregarious.

Statistical methods (specifically, a technique called **factor analysis**) helped to determine whether a small number of dimensions underlie the diversity of words that people like Allport and Odbert identified. The most widely accepted system to emerge from this approach was “The Big Five” or **“Five-Factor Model”** (Goldberg, 1990; McCrae & John, 1992; McCrae & Costa, 1987). The Big Five comprises five major traits shown in the Figure 2 below. A way to remember these five is with the acronym OCEAN (O is for **Openness**; C is for **Conscientiousness**; E is for **Extraversion**; A is for **Agreeableness**; N is for **Neuroticism**). Figure 3 provides descriptions of people who would score high and low on each of these traits.

Scores on the Big Five traits are mostly independent. That means that a person's standing on one trait tells very little about their standing on the other traits of the Big Five. For example, a person can be extremely high in Extraversion and be either high or low on Neuroticism.
Similarly, a person can be low in Agreeableness and be either high or low in Conscientiousness. Thus, in the Five-Factor Model, you need five scores to describe most of an individual's personality.

In the Appendix to this module, we present a short scale to assess the Five-Factor Model of personality (Donnellan, Oswald, Baird, & Lucas, 2006). You can take this test to see where you stand in terms of your Big Five scores. John Johnson has also created a helpful website that has personality scales that can be used and taken by the general public:

http://www.personal.psu.edu/j5j/IPIP/ipipneo120.htm

After seeing your scores, you can judge for yourself whether you think such tests are valid.

Traits are important and interesting because they describe stable patterns of behavior that persist for long periods of time (Caspi, Roberts, & Shiner, 2005). Importantly, these stable patterns can have broad-ranging consequences for many areas of our life (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). For instance, think about the factors that determine success in college. If you were asked to guess what factors predict good grades in college, you might guess something like intelligence. This guess would be correct, but we know much more about who is likely to do well. Specifically, personality researchers have also found the personality traits like Conscientiousness play an important role in college and beyond, probably because highly conscientious individuals study hard, get their work done on time, and are less distracted by nonessential activities that take time away from school work. In addition, highly conscientious people are often healthier than people low in conscientiousness because they are more likely to maintain healthy diets, to exercise, and to follow basic safety procedures like wearing seat belts or bicycle helmets. Over the long term, this consistent pattern of

<table>
<thead>
<tr>
<th>Big 5 Trait</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>The tendency to appreciate new art, ideas, values, feelings, and behaviors.</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>The tendency to be careful, on-time for appointments, to follow rules, and to be hardworking.</td>
</tr>
<tr>
<td>Extraversion</td>
<td>The tendency to be talkative, sociable, and to enjoy others; the tendency to have a dominant style.</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>The tendency to agree and go along with others rather than to assert one's own opinions and choices.</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>The tendency to frequently experience negative emotions such as anger, worry, and sadness, as well as being interpersonally sensitive.</td>
</tr>
</tbody>
</table>
behaviors can add up to meaningful differences in health and longevity. Thus, personality traits are not just a useful way to describe people you know; they actually help psychologists predict how good a worker someone will be, how long he or she will live, and the types of jobs and activities the person will enjoy. Thus, there is growing interest in personality psychology among psychologists who work in applied settings, such as health psychology or organizational psychology.

Facets of Traits (Subtraits)

So how does it feel to be told that your entire personality can be summarized with scores on just five personality traits? Do you think these five scores capture the complexity of your own and others’ characteristic patterns of thoughts, feelings, and behaviors? Most people would probably say no, pointing to some exception in their behavior that goes against the general pattern that others might see. For instance, you may know people who are warm and friendly and find it easy to talk with strangers at a party yet are terrified if they have to perform in front of others or speak to large groups of people. The fact that there are different ways of being extraverted or conscientious shows that there is value in considering lower-level units of personality that are more specific than the Big Five traits. These more specific, lower-level units of personality are often called facets.

To give you a sense of what these narrow units are like, Figure 4 shows facets for each of the
Big Five traits. It is important to note that although personality researchers generally agree about the value of the Big Five traits as a way to summarize one’s personality, there is no widely accepted list of facets that should be studied. The list seen here, based on work by researchers Paul Costa and Jeff McCrae, thus reflects just one possible list among many. It should, however, give you an idea of some of the facets making up each of the Five-Factor Model.

Facets can be useful because they provide more specific descriptions of what a person is like. For instance, if we take our friend who loves parties but hates public speaking, we might say that this person scores high on the “gregariousness” and “warmth” facets of extraversion, while scoring lower on facets such as “assertiveness” or “excitement-seeking.” This precise profile of facet scores not only provides a better description, it might also allow us to better predict how this friend will do in a variety of different jobs (for example, jobs that require public speaking versus jobs that involve one-on-one interactions with customers; Paunonen & Ashton, 2001). Because different facets within a broad, global trait like extraversion tend to go together (those who are gregarious are often but not always assertive), the broad trait often provides a useful summary of what a person is like. But when we really want to know a person, facet scores add to our knowledge in important ways.

### Other Traits Beyond the Five-Factor Model

Despite the popularity of the Five-Factor Model, it is certainly not the only model that exists. Some suggest that there are more than five major traits, or perhaps even fewer. For example, in one of the first comprehensive models to be proposed, Hans Eysenck suggested that
Extraversion and Neuroticism are most important. Eysenck believed that by combining people's standing on these two major traits, we could account for many of the differences in personality that we see in people (Eysenck, 1981). So for instance, a neurotic introvert would be shy and nervous, while a stable introvert might avoid social situations and prefer solitary activities, but he may do so with a calm, steady attitude and little anxiety or emotion. Interestingly, Eysenck attempted to link these two major dimensions to underlying differences in people's biology. For instance, he suggested that introverts experienced too much sensory stimulation and arousal, which made them want to seek out quiet settings and less stimulating environments. More recently, Jeffrey Gray suggested that these two broad traits are related to fundamental reward and avoidance systems in the brain—extraverts might be motivated to seek reward and thus exhibit assertive, reward-seeking behavior, whereas people high in neuroticism might be motivated to avoid punishment and thus may experience anxiety as a result of their heightened awareness of the threats in the world around them (Gray, 1981. This model has since been updated; see Gray & McNaughton, 2000). These early theories have led to a burgeoning interest in identifying the physiological underpinnings of the individual differences that we observe.

Another revision of the Big Five is the HEXACO model of traits (Ashton & Lee, 2007). This model is similar to the Big Five, but it posits slightly different versions of some of the traits, and its proponents argue that one important class of individual differences was omitted from the Five-Factor Model. The HEXACO adds Honesty-Humility as a sixth dimension of personality. People high in this trait are sincere, fair, and modest, whereas those low in the trait are manipulative, narcissistic, and self-centered. Thus, trait theorists are agreed that personality traits are important in understanding behavior, but there are still debates on the exact number and composition of the traits that are most important.

There are other important traits that are not included in comprehensive models like the Big Five. Although the five factors capture much that is important about personality, researchers have suggested other traits that capture interesting aspects of our behavior. In Figure 5 below we present just a few, out of hundreds, of the other traits that have been studied by personologists.

Not all of the above traits are currently popular with scientists, yet each of them has experienced popularity in the past. Although the Five-Factor Model has been the target of more rigorous research than some of the traits above, these additional personality characteristics give a good idea of the wide range of behaviors and attitudes that traits can cover.

The Person-Situation Debate and Alternatives to the Trait Perspective
The ideas described in this module should probably seem familiar, if not obvious to you. When asked to think about what our friends, enemies, family members, and colleagues are like, some of the first things that come to mind are their personality characteristics. We might think about how warm and helpful our first teacher was, how irresponsible and careless our brother is, or how demanding and insulting our first boss was. Each of these descriptors reflects a personality trait, and most of us generally think that the descriptions that we use for individuals accurately reflect their “characteristic pattern of thoughts, feelings, and behaviors,” or in other

<table>
<thead>
<tr>
<th>Personality Trait</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machiavellianism</td>
<td>Named after the famous political philosopher, Niccolo Machiavelli, this trait refers to individuals who manipulate the behavior of others, often through duplicity. Machiavellians are often interested in money and power, and pragmatically use others in this quest.</td>
</tr>
<tr>
<td>Need for Achievement</td>
<td>Those high in need for achievement want to accomplish a lot and set high standards of excellence for themselves. They are able to work persistently and hard for distant goals. David McClelland argued that economic growth depends in part on citizens with high need for achievement.</td>
</tr>
<tr>
<td>Need for Cognition</td>
<td>People high in need for cognition find it rewarding to understand things, and are willing to use considerable cognitive effort in this quest. Such individuals enjoy learning, and the process of trying to understand new things.</td>
</tr>
<tr>
<td>Authoritarianism</td>
<td>Authoritarians believe in strict social hierarchies, in which they are totally obedient to those above them, and expect complete obedience from their subordinates. Rigid in adherence to rules, the authoritarian personality is very uncomfortable with uncertainty.</td>
</tr>
<tr>
<td>Narcissism</td>
<td>The narcissistic personality has self-love that is so strong that it results in high levels of vanity, conceit, and selfishness. The narcissistic individual often has problems feeling empathetic toward others and grateful to others.</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>The tendency to evaluate oneself positively. Self-esteem does not imply that one believes that he or she is better than others, only that he or she is a person of worth.</td>
</tr>
<tr>
<td>Optimism</td>
<td>The tendency to expect positive outcomes in the future. People who are optimistic expect good things to happen, and indeed they often have more positive outcomes, perhaps because they work harder to achieve them.</td>
</tr>
<tr>
<td>Alexithymia</td>
<td>The inability to recognize and label emotions in oneself. The individual also has a difficult time recognizing emotions in others, and often has difficulties in relationships.</td>
</tr>
</tbody>
</table>

Figure 5. Other Traits Beyond Those Included in the Big Five
words, their personality.

But what if this idea were wrong? What if our belief in personality traits were an illusion and people are not consistent from one situation to the next? This was a possibility that shook the foundation of personality psychology in the late 1960s when Walter Mischel published a book called *Personality and Assessment* (1968). In this book, Mischel suggested that if one looks closely at people's behavior across many different situations, the consistency is really not that impressive. In other words, children who cheat on tests at school may steadfastly follow all rules when playing games and may never tell a lie to their parents. In other words, he suggested, there may not be any general trait of honesty that links these seemingly related behaviors. Furthermore, Mischel suggested that observers may believe that broad personality traits like honesty exist, when in fact, this belief is an illusion. The debate that followed the publication of Mischel's book was called the *person-situation debate* because it pitted the power of personality against the power of situational factors as determinants of the behavior that people exhibit.

Because of the findings that Mischel emphasized, many psychologists focused on an alternative to the trait perspective. Instead of studying broad, context-free descriptions, like the trait terms we've described so far, Mischel thought that psychologists should focus on people's distinctive reactions to specific situations. For instance, although there may not be a broad and general trait of honesty, some children may be especially likely to cheat on a test when the risk of being caught is low and the rewards for cheating are high. Others might be motivated by the sense of risk involved in cheating and may do so even when the rewards are not very high. Thus, the behavior itself results from the child's unique evaluation of the risks and rewards present at that moment, along with her evaluation of her abilities and values. Because of this, the same child might act very differently in different situations. Thus, Mischel thought that specific behaviors were driven by the interaction between very specific, psychologically meaningful features of the situation in which people found themselves, the person's unique way of perceiving that situation, and his or her abilities for dealing with it.
Mischel and others argued that it was these social-cognitive processes that underlie people's reactions to specific situations that provide some consistency when situational features are the same. If so, then studying these broad traits might be more fruitful than cataloging and measuring narrow, context-free traits like Extraversion or Neuroticism.

In the years after the publication of Mischel's (1968) book, debates raged about whether personality truly exists, and if so, how it should be studied. And, as is often the case, it turns out that a more moderate middle ground than what the situationists proposed could be reached. It is certainly true, as Mischel pointed out, that a person's behavior in one specific situation is not a good guide to how that person will behave in a very different specific situation. Someone who is extremely talkative at one specific party may sometimes be reticent to speak up during class and may even act like a wallflower at a different party. But this does not mean that personality does not exist, nor does it mean that people's behavior is completely determined by situational factors. Indeed, research conducted after the person-situation debate shows that on average, the effect of the “situation” is about as large as that of personality traits. However, it is also true that if psychologists assess a broad range of behaviors across many different situations, there are general tendencies that emerge. Personality traits give an indication about how people will act on average, but frequently they are not so good at predicting how a person will act in a specific situation at a certain moment in time. Thus, to best capture broad traits, one must assess aggregate behaviors, averaged over time and across many different types of situations. Most modern personality researchers agree that there is a place for broad personality traits and for the narrower units such as those studied by Walter Mischel.

Appendix

The Mini-IPIP Scale

(Donnellan, Oswald, Baird, & Lucas, 2006)

Instructions: Below are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. Please read each statement carefully, and put a number from 1 to 5 next to it to describe how accurately the statement describes you.

1 = Very inaccurate
2 = Moderately inaccurate

3 = Neither inaccurate nor accurate

4 = Moderately accurate

5 = Very accurate

1. _____ Am the life of the party (E)
2. _____ Sympathize with others’ feelings (A)
3. _____ Get chores done right away (C)
4. _____ Have frequent mood swings (N)
5. _____ Have a vivid imagination (O)
6. _____ Don’t talk a lot (E)
7. _____ Am not interested in other people’s problems (A)
8. _____ Often forget to put things back in their proper place (C)
9. _____ Am relaxed most of the time (N)
10. _____ Am not interested in abstract ideas (O)
11. _____ Talk to a lot of different people at parties (E)
12. _____ Feel others’ emotions (A)
13. _____ Like order (C)
14. _____ Get upset easily (N)
15. _____ Have difficulty understanding abstract ideas (O)
16. _____ Keep in the background (E)
17. _____ Am not really interested in others (A)
18. _____ Make a mess of things (C)
19. _____ Seldom feel blue (N)
20. _____ Do not have a good imagination (O)

Scoring: The first thing you must do is to reverse the items that are worded in the opposite direction. In order to do this, subtract the number you put for that item from 6. So if you put a 4, for instance, it will become a 2. Cross out the score you put when you took the scale, and
put the new number in representing your score subtracted from the number 6.

Items to be reversed in this way: 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20

Next, you need to add up the scores for each of the five OCEAN scales (including the reversed numbers where relevant). Each OCEAN score will be the sum of four items. Place the sum next to each scale below.

_______ Openness: Add items 5, 10, 15, 20

_______ Conscientiousness: Add items 3, 8, 13, 18

_______ Extraversion: Add items 1, 6, 11, 16

_______ Agreeableness: Add items 2, 7, 12, 17

_______ Neuroticism: Add items 4, 9, 14, 19

Compare your scores to the norms below to see where you stand on each scale. If you are low on a trait, it means you are the opposite of the trait label. For example, low on Extraversion is Introversion, low on Openness is Conventional, and low on Agreeableness is Assertive.

19–20 Extremely High, 17–18 Very High, 14–16 High,

11–13 Neither high nor low; in the middle, 8–10 Low, 6–7 Very low, 4–5 Extremely low
Outside Resources

Video 1: Gabriela Cintron's – 5 Factors of Personality (OCEAN Song). This is a student-made video which cleverly describes, through song, common behavioral characteristics of the Big 5 personality traits. It was one of the winning entries in the 2016-17 Noba + Psi Chi Student Video Award.
https://www.youtube.com/watch?feature=youtu.be&v=Rk8CDXMb8_U&app=desktop

Video 2: Michael Harris’ – Personality Traits: The Big 5 and More. This is a student-made video that looks at characteristics of the OCEAN traits through a series of funny vignettes. It also presents on the Person vs Situation Debate. It was one of the winning entries in the 2016-17 Noba + Psi Chi Student Video Award.
https://vimeo.com/218245492

Video 3: David M. Cole’s – Grouchy with a Chance of Stomping. This is a student-made video that makes a very important point about the relationship between personality traits and behavior using a handy weather analogy. It was one of the winning entries in the 2016-17 Noba + Psi Chi Student Video Award.
https://www.youtube.com/watch?v=GnaFMjajtIY

Web: International Personality Item Pool
http://ipip.ori.org/

Web: John Johnson personality scales
http://www.personal.psu.edu/j5j/IPIP/ipipneo120.htm

Web: Personality trait systems compared
http://www.personalityresearch.org/bigfive/goldberg.html

Web: Sam Gosling website
http://homepage.psy.utexas.edu/homepage/faculty/gosling/samgosling.htm

Discussion Questions

1. Consider different combinations of the Big Five, such as O (Low), C (High), E (Low), A (High), and N (Low). What would this person be like? Do you know anyone who is like this? Can you select politicians, movie stars, and other famous people and rate them on the Big Five?
2. How do you think learning and inherited personality traits get combined in adult personality?

3. Can you think of instances where people do not act consistently—where their personality traits are not good predictors of their behavior?

4. Has your personality changed over time, and in what ways?

5. Can you think of a personality trait not mentioned in this module that describes how people differ from one another?

6. When do extremes in personality traits become harmful, and when are they unusual but productive of good outcomes?
Vocabulary

Agreeableness
A personality trait that reflects a person's tendency to be compassionate, cooperative, warm, and caring to others. People low in agreeableness tend to be rude, hostile, and to pursue their own interests over those of others.

Conscientiousness
A personality trait that reflects a person's tendency to be careful, organized, hardworking, and to follow rules.

Continuous distributions
Characteristics can go from low to high, with all different intermediate values possible. One does not simply have the trait or not have it, but can possess varying amounts of it.

Extraversion
A personality trait that reflects a person's tendency to be sociable, outgoing, active, and assertive.

Facets
Broad personality traits can be broken down into narrower facets or aspects of the trait. For example, extraversion has several facets, such as sociability, dominance, risk-taking and so forth.

Factor analysis
A statistical technique for grouping similar things together according to how highly they are associated.

Five-Factor Model
(also called the Big Five) The Five-Factor Model is a widely accepted model of personality traits. Advocates of the model believe that much of the variability in people's thoughts, feelings, and behaviors can be summarized with five broad traits. These five traits are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.

HEXACO model
The HEXACO model is an alternative to the Five-Factor Model. The HEXACO model includes six traits, five of which are variants of the traits included in the Big Five (Emotionality [E], Extraversion [X], Agreeableness [A], Conscientiousness [C], and Openness [O]). The sixth
factor, Honesty-Humility [H], is unique to this model.

**Independent**

Two characteristics or traits are separate from one another-- a person can be high on one and low on the other, or vice-versa. Some correlated traits are relatively independent in that although there is a tendency for a person high on one to also be high on the other, this is not always the case.

**Lexical hypothesis**

The lexical hypothesis is the idea that the most important differences between people will be encoded in the language that we use to describe people. Therefore, if we want to know which personality traits are most important, we can look to the language that people use to describe themselves and others.

**Neuroticism**

A personality trait that reflects the tendency to be interpersonally sensitive and the tendency to experience negative emotions like anxiety, fear, sadness, and anger.

**Openness to Experience**

A personality trait that reflects a person's tendency to seek out and to appreciate new things, including thoughts, feelings, values, and experiences.

**Personality**

Enduring predispositions that characterize a person, such as styles of thought, feelings and behavior.

**Personality traits**

Enduring dispositions in behavior that show differences across individuals, and which tend to characterize the person across varying types of situations.

**Person-situation debate**

The person-situation debate is a historical debate about the relative power of personality traits as compared to situational influences on behavior. The situationist critique, which started the person-situation debate, suggested that people overestimate the extent to which personality traits are consistent across situations.
References


Personality Assessment

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This module provides a basic overview to the assessment of personality. It discusses objective personality tests (based on both self-report and informant ratings), projective and implicit tests, and behavioral/performance measures. It describes the basic features of each method, as well as reviewing the strengths, weaknesses, and overall validity of each approach.

Learning Objectives

• Appreciate the diversity of methods that are used to measure personality characteristics.
• Understand the logic, strengths and weaknesses of each approach.
• Gain a better sense of the overall validity and range of applications of personality tests.

Introduction

Personality is the field within psychology that studies the thoughts, feelings, behaviors, goals, and interests of normal individuals. It therefore covers a very wide range of important psychological characteristics. Moreover, different theoretical models have generated very different strategies for measuring these characteristics. For example, humanistically oriented models argue that people have clear, well-defined goals and are actively striving to achieve them (McGregor, McAdams, & Little, 2006). It, therefore, makes sense to ask them directly about themselves and their goals. In contrast, psychodynamically oriented theories propose that people lack insight into their feelings and motives, such that their behavior is influenced by processes that operate outside of their awareness (e.g., McClelland, Koestner, &
Weinberger, 1989; Meyer & Kurtz, 2006). Given that people are unaware of these processes, it does not make sense to ask directly about them. One, therefore, needs to adopt an entirely different approach to identify these nonconscious factors. Not surprisingly, researchers have adopted a wide range of approaches to measure important personality characteristics. The most widely used strategies will be summarized in the following sections.

Do people possess the necessary awareness to see themselves as they are and provide accurate insights into their own personalities?


**Objective Tests**

**Definition**

Objective tests (Loevinger, 1957; Meyer & Kurtz, 2006) represent the most familiar and widely used approach to assessing personality. Objective tests involve administering a standard set of items, each of which is answered using a limited set of response options (e.g., true or false; strongly disagree, slightly disagree, slightly agree, strongly agree). Responses to these items then are scored in a standardized, predetermined way. For example, self-ratings on items assessing talkativeness, assertiveness, sociability, adventurousness, and energy can be
It must be emphasized that the term “objective” refers to the method that is used to score a person’s responses, rather than to the responses themselves. As noted by Meyer and Kurtz (2006, p. 233), “What is objective about such a procedure is that the psychologist administering the test does not need to rely on judgment to classify or interpret the test-taker’s response; the intended response is clearly indicated and scored according to a pre-existing key.” In fact, as we will see, a person’s test responses may be highly subjective and can be influenced by a number of different rating biases.

Basic Types of Objective Tests

Self-report measures

Objective personality tests can be further subdivided into two basic types. The first type—which easily is the most widely used in modern personality research—asks people to describe themselves. This approach offers two key advantages. First, self-raters have access to an unparalleled wealth of information: After all, who knows more about you than you yourself? In particular, self-raters have direct access to their own thoughts, feelings, and motives, which may not be readily available to others (Oh, Wang, & Mount, 2011; Watson, Hubbard, & Weise, 2000). Second, asking people to describe themselves is the simplest, easiest, and most cost-effective approach to assessing personality. Countless studies, for instance, have involved administering self-report measures to college students, who are provided some relatively simple incentive (e.g., extra course credit) to participate.

The items included in self-report measures may consist of single words (e.g., assertive), short phrases (e.g., am full of energy), or complete sentences (e.g., I like to spend time with others). Table 1 presents a sample self-report measure assessing the general traits comprising the influential five-factor model (FFM) of personality: neuroticism, extraversion, openness, agreeableness, and conscientiousness (John & Srivastava, 1999; McCrae, Costa, & Martin, 2005). The sentences shown in Table 1 are modified versions of items included in the International Personality Item Pool (IPIP) (Goldberg et al., 2006), which is a rich source of personality-related content in the public domain (for more information about IPIP, go to: http://ipip.ori.org/).

Self-report personality tests show impressive validity in relation to a wide range of important
outcomes. For example, self-ratings of conscientiousness are significant predictors of both overall academic performance (e.g., cumulative grade point average; Poropat, 2009) and job performance (Oh, Wang, and Mount, 2011). Roberts, Kuncel, Shiner, Caspi, and Goldberg (2007) reported that self-rated personality predicted occupational attainment, divorce, and mortality. Similarly, Friedman, Kern, and Reynolds (2010) showed that personality ratings collected early in life were related to happiness/well-being, physical health, and mortality risk.
assessed several decades later. Finally, self-reported personality has important and pervasive links to psychopathology. Most notably, self-ratings of neuroticism are associated with a wide array of clinical syndromes, including anxiety disorders, depressive disorders, substance use disorders, somatoform disorders, eating disorders, personality and conduct disorders, and schizophrenia/schizotypy (Kotov, Gamez, Schmidt, & Watson, 2010; Mineka, Watson, & Clark, 1998).

At the same time, however, it is clear that this method is limited in a number of ways. First, raters may be motivated to present themselves in an overly favorable, socially desirable way (Paunonen & LeBel, 2012). This is a particular concern in “high-stakes testing,” that is, situations in which test scores are used to make important decisions about individuals (e.g., when applying for a job). Second, personality ratings reflect a self-enhancement bias (Vazire & Carlson, 2011); in other words, people are motivated to ignore (or at least downplay) some of their less desirable characteristics and to focus instead on their more positive attributes. Third, self-ratings are subject to the reference group effect (Heine, Buchtel, & Norenzayan, 2008); that is, we base our self-perceptions, in part, on how we compare to others in our sociocultural reference group. For instance, if you tend to work harder than most of your friends, you will see yourself as someone who is relatively conscientious, even if you are not particularly conscientious in any absolute sense.

**Informant ratings**

Another approach is to ask someone who knows a person well to describe his or her personality characteristics. In the case of children or adolescents, the informant is most likely to be a parent or teacher. In studies of older participants, informants may be friends, roommates, dating partners, spouses, children, or bosses (Oh et al., 2011; Vazire & Carlson, 2011; Watson et al., 2000).

Generally speaking, informant ratings are similar in format to self-ratings. As was the case with self-report, items may consist of single words, short phrases, or complete sentences. Indeed, many popular instruments include parallel self- and informant-rating versions, and it often is relatively easy to convert a self-report measure so that it can be used to obtain informant ratings. Table 2 illustrates how the self-report instrument shown in Table 1 can be converted to obtain spouse-ratings (in this case, having a husband describe the personality characteristics of his wife).

Informant ratings are particularly valuable when self-ratings are impossible to collect (e.g., when studying young children or cognitively impaired adults) or when their validity is suspect.
e.g., as noted earlier, people may not be entirely honest in high-stakes testing situations). They also may be combined with self-ratings of the same characteristics to produce more reliable and valid measures of these attributes (McCrae, 1994).

Informant ratings offer several advantages in comparison to other approaches to assessing personality. A well-acquainted informant presumably has had the opportunity to observe large samples of behavior in the person he or she is rating. Moreover, these judgments presumably are not subject to the types of defensiveness that potentially can distort self-ratings (Vazire & Carlson, 2011). Indeed, informants typically have strong incentives for being accurate in their judgments. As Funder and Dobroth (1987, p. 409), put it, “Evaluations of the people in our social environment are central to our decisions about who to befriend and avoid, trust and distrust, hire and fire, and so on.”

Informant personality ratings have demonstrated a level of validity in relation to important
life outcomes that is comparable to that discussed earlier for self-ratings. Indeed, they outperform self-ratings in certain circumstances, particularly when the assessed traits are highly evaluative in nature (e.g., intelligence, charm, creativity; see Vazire & Carlson, 2011). For example, Oh et al. (2011) found that informant ratings were more strongly related to job performance than were self-ratings. Similarly, Oltmanns and Turkheimer (2009) summarized evidence indicating that informant ratings of Air Force cadets predicted early, involuntary discharge from the military better than self-ratings.

Nevertheless, informant ratings also are subject to certain problems and limitations. One general issue is the level of relevant information that is available to the rater (Funder, 2012). For instance, even under the best of circumstances, informants lack full access to the thoughts, feelings, and motives of the person they are rating. This problem is magnified when the informant does not know the person particularly well and/or only sees him or her in a limited range of situations (Funder, 2012; Beer & Watson, 2010).

Informant ratings also are subject to some of the same response biases noted earlier for self-ratings. For instance, they are not immune to the reference group effect. Indeed, it is well-established that parent ratings often are subject to a *sibling contrast effect*, such that parents exaggerate the true magnitude of differences between their children (Pinto, Rijsdijk, Frazier-Wood, Asherson, & Kuntsi, 2012). Furthermore, in many studies, individuals are allowed to nominate (or even recruit) the informants who will rate them. Because of this, it most often is the case that informants (who, as noted earlier, may be friends, relatives, or romantic partners) like the people they are rating. This, in turn, means that informants may produce overly favorable personality ratings. Indeed, their ratings actually can be more favorable than the corresponding self-ratings (Watson & Humrichouse, 2006). This tendency for informants to produce unrealistically positive ratings has been termed the *letter of recommendation effect* (Leising, Erbs, & Fritz, 2010) and the *honeymoon effect*.

Informant personality ratings are generally a reliable and valid assessment instrument, however in certain cases the informant may have some significant biases that make the rating less reliable. Newly married individuals for example are likely to rate their partners in an unrealistically positive way. [Image: Sociales El Heraldo de Saltillo, https://goo.gl/3g3Qhh, CC BY-NC-SA 2.0, https://goo.gl/Toc0ZF]
when applied to newlyweds (Watson & Humrichouse, 2006).

Other Ways of Classifying Objective Tests

Comprehensiveness

In addition to the source of the scores, there are at least two other important dimensions on which personality tests differ. The first such dimension concerns the extent to which an instrument seeks to assess personality in a reasonably comprehensive manner. At one extreme, many widely used measures are designed to assess a single core attribute. Examples of these types of measures include the Toronto Alexithymia Scale (Bagby, Parker, & Taylor, 1994), the Rosenberg Self-Esteem Scale (Rosenberg, 1965), and the Multidimensional Experiential Avoidance Questionnaire (Gamez, Chmielewski, Kotov, Ruggero, & Watson, 2011). At the other extreme, a number of omnibus inventories contain a large number of specific scales and purport to measure personality in a reasonably comprehensive manner. These instruments include the California Psychological Inventory (Gough, 1987), the Revised HEXACO Personality Inventory (HEXACO-PI-R) (Lee & Ashton, 2006), the Multidimensional Personality Questionnaire (Patrick, Curtin, & Tellegen, 2002), the NEO Personality Inventory-3 (NEO-PI-3) (McCrae et al., 2005), the Personality Research Form (Jackson, 1984), and the Sixteen Personality Factor Questionnaire (Cattell, Eber, & Tatsuoka, 1980).

Breadth of the target characteristics

Second, personality characteristics can be classified at different levels of breadth or generality. For example, many models emphasize broad, “big” traits such as neuroticism and extraversion. These general dimensions can be divided up into several distinct yet empirically correlated component traits. For example, the broad dimension of extraversion contains such specific component traits as dominance (extraverts are assertive, persuasive, and exhibitionistic), sociability (extraverts seek out and enjoy the company of others), positive emotionality (extraverts are active, energetic, cheerful, and enthusiastic), and adventurousness (extraverts enjoy intense, exciting experiences).

Some popular personality instruments are designed to assess only the broad, general traits. For example, similar to the sample instrument displayed in Table 1, the Big Five Inventory (John & Srivastava, 1999) contains brief scales assessing the broad traits of neuroticism, extraversion, openness, agreeableness, and conscientiousness. In contrast, many instruments—including several of the omnibus inventories mentioned earlier—were
designed primarily to assess a large number of more specific characteristics. Finally, some inventories—including the HEXACO-PI-R and the NEO-PI-3—were explicitly designed to provide coverage of both general and specific trait characteristics. For instance, the NEO-PI-3 contains six specific facet scales (e.g., Gregariousness, Assertiveness, Positive Emotions, Excitement Seeking) that then can be combined to assess the broad trait of extraversion.

**Projective and Implicit Tests**

**Projective Tests**

As noted earlier, some approaches to personality assessment are based on the belief that important thoughts, feelings, and motives operate outside of conscious awareness. Projective tests represent influential early examples of this approach. Projective tests originally were based on the *projective hypothesis* (Frank, 1939; Lilienfeld, Wood, & Garb, 2000): If a person is asked to describe or interpret ambiguous stimuli—that is, things that can be understood in a number of different ways—their responses will be influenced by nonconscious needs, feelings, and experiences (note, however, that the theoretical rationale underlying these measures has evolved over time) (see, for example, Spangler, 1992). Two prominent examples of projective tests are the Rorschach Inkblot Test (Rorschach, 1921) and the Thematic Apperception Test (TAT) (Morgan & Murray, 1935). The former asks respondents to interpret symmetrical blots of ink, whereas the latter asks them to generate stories about a series of pictures.

For instance, one TAT picture depicts an elderly woman with her back turned to a young man; the latter looks downward with a somewhat perplexed expression. Another picture displays a man clutched from behind by three mysterious hands. What stories could you generate in response to these pictures?

In comparison to objective tests, projective tests tend to be somewhat cumbersome and labor intensive to administer. The biggest challenge, however, has been to develop a reliable and
valid scheme to score the extensive set of responses generated by each respondent. The most widely used Rorschach scoring scheme is the Comprehensive System developed by Exner (2003). The most influential TAT scoring system was developed by McClelland, Atkinson and colleagues between 1947 and 1953 (McClelland et al., 1989; see also Winter, 1998), which can be used to assess motives such as the need for achievement.

The validity of the Rorschach has been a matter of considerable controversy (Lilienfeld et al., 2000; Mihura, Meyer, Dumitrascu, & Bombel, 2012; Society for Personality Assessment, 2005). Most reviews acknowledge that Rorschach scores do show some ability to predict important outcomes. Its critics, however, argue that it fails to provide important incremental information beyond other, more easily acquired information, such as that obtained from standard self-report measures (Lilienfeld et al., 2000).

Validity evidence is more impressive for the TAT. In particular, reviews have concluded that TAT-based measures of the need for achievement (a) show significant validity to predict important criteria and (b) provide important information beyond that obtained from objective measures of this motive (McClelland et al., 1989; Spangler, 1992). Furthermore, given the relatively weak associations between objective and projective measures of motives, McClelland et al. (1989) argue that they tap somewhat different processes, with the latter assessing implicit motives (Schultheiss, 2008).

Implicit Tests

In recent years, researchers have begun to use implicit measures of personality (Back, Schmuckle, & Egloff, 2009; Vazire & Carlson, 2011). These tests are based on the assumption that people form automatic or implicit associations between certain concepts based on their previous experience and behavior. If two concepts (e.g., me and assertive) are strongly associated with each other, then they should be sorted together more quickly and easily than two concepts (e.g., me and shy) that are less strongly associated. Although validity evidence for these measures still is relatively sparse, the results to date are encouraging: Back et al. (2009), for example, showed that implicit measures of the FFM personality traits predicted behavior even after controlling for scores on objective measures of these same characteristics.

Behavioral and Performance Measures

A final approach is to infer important personality characteristics from direct samples of behavior. For example, Funder and Colvin (1988) brought opposite-sex pairs of participants into the laboratory and had them engage in a five-minute “getting acquainted” conversation;
raters watched videotapes of these interactions and then scored the participants on various personality characteristics. Mehl, Gosling, and Pennebaker (2006) used the electronically activated recorder (EAR) to obtain samples of ambient sounds in participants’ natural environments over a period of two days; EAR-based scores then were related to self- and observer-rated measures of personality. For instance, more frequent talking over this two-day period was significantly related to both self- and observer-ratings of extraversion. As a final example, Gosling, Ko, Mannarelli, and Morris (2002) sent observers into college students’ bedrooms and then had them rate the students’ personality characteristics on the Big Five traits. The averaged observer ratings correlated significantly with participants’ self-ratings on all five traits. Follow-up analyses indicated that conscientious students had neater rooms, whereas those who were high in openness to experience had a wider variety of books and magazines.

Observing real world behavior is one way to assess personality. Tendencies such as messiness and neatness are clues to personality. [Image: Crumley Roberts, https://goo.gl/6Ahn8q, CC BY 2.0, https://goo.gl/BRvSA7]

Behavioral measures offer several advantages over other approaches to assessing personality. First, because behavior is sampled directly, this approach is not subject to the types of response biases (e.g., self-enhancement bias, reference group effect) that can distort scores on objective tests. Second, as is illustrated by the Mehl et al. (2006) and Gosling et al. (2002) studies, this approach allows people to be studied in their daily lives and in their natural environments, thereby avoiding the artificiality of other methods (Mehl et al., 2006). Finally, this is the only approach that actually assesses what people do, as opposed to what they think or feel (see Baumeister, Vohs, & Funder, 2007).

At the same time, however, this approach also has some disadvantages. This assessment strategy clearly is much more cumbersome and labor intensive than using objective tests, particularly self-report. Moreover, similar to projective tests, behavioral measures generate a rich set of data that then need to be scored in a reliable and valid way. Finally, even the most ambitious study only obtains relatively small samples of behavior that may provide a somewhat distorted view of a person’s true characteristics. For example, your behavior during a “getting acquainted” conversation on a single given day inevitably will reflect a number of
transient influences (e.g., level of stress, quality of sleep the previous night) that are idiosyncratic to that day.

Conclusion

No single method of assessing personality is perfect or infallible; each of the major methods has both strengths and limitations. By using a diversity of approaches, researchers can overcome the limitations of any single method and develop a more complete and integrative view of personality.
Discussion Questions

1. Under what conditions would you expect self-ratings to be most similar to informant ratings? When would you expect these two sets of ratings to be most different from each other?

2. The findings of Gosling, et al. (2002) demonstrate that we can obtain important clues about students’ personalities from their dorm rooms. What other aspects of people’s lives might give us important information about their personalities?

3. Suppose that you were planning to conduct a study examining the personality trait of honesty. What method or methods might you use to measure it?
Vocabulary

Big Five
Five, broad general traits that are included in many prominent models of personality. The five traits are neuroticism (those high on this trait are prone to feeling sad, worried, anxious, and dissatisfied with themselves), extraversion (high scorers are friendly, assertive, outgoing, cheerful, and energetic), openness to experience (those high on this trait are tolerant, intellectually curious, imaginative, and artistic), agreeableness (high scorers are polite, considerate, cooperative, honest, and trusting), and conscientiousness (those high on this trait are responsible, cautious, organized, disciplined, and achievement-oriented).

High-stakes testing
Settings in which test scores are used to make important decisions about individuals. For example, test scores may be used to determine which individuals are admitted into a college or graduate school, or who should be hired for a job. Tests also are used in forensic settings to help determine whether a person is competent to stand trial or fits the legal definition of sanity.

Honeymoon effect
The tendency for newly married individuals to rate their spouses in an unrealistically positive manner. This represents a specific manifestation of the letter of recommendation effect when applied to ratings made by current romantic partners. Moreover, it illustrates the very important role played by relationship satisfaction in ratings made by romantic partners: As marital satisfaction declines (i.e., when the “honeymoon is over”), this effect disappears.

Implicit motives
These are goals that are important to a person, but that he/she cannot consciously express. Because the individual cannot verbalize these goals directly, they cannot be easily assessed via self-report. However, they can be measured using projective devices such as the Thematic Apperception Test (TAT).

Letter of recommendation effect
The general tendency for informants in personality studies to rate others in an unrealistically positive manner. This tendency is due a pervasive bias in personality assessment: In the large majority of published studies, informants are individuals who like the person they are rating (e.g., they often are friends or family members) and, therefore, are motivated to depict them in a socially desirable way. The term reflects a similar tendency for academic letters of recommendation to be overly positive and to present the referent in an unrealistically
desirable manner.

**Projective hypothesis**
The theory that when people are confronted with ambiguous stimuli (that is, stimuli that can be interpreted in more than one way), their responses will be influenced by their unconscious thoughts, needs, wishes, and impulses. This, in turn, is based on the Freudian notion of projection, which is the idea that people attribute their own undesirable/unacceptable characteristics to other people or objects.

**Reference group effect**
The tendency of people to base their self-concept on comparisons with others. For example, if your friends tend to be very smart and successful, you may come to see yourself as less intelligent and successful than you actually are. Informants also are prone to these types of effects. For instance, the sibling contrast effect refers to the tendency of parents to exaggerate the true extent of differences between their children.

**Reliability**
The consistency of test scores across repeated assessments. For example, test-retest reliability examines the extent to which scores change over time.

**Self-enhancement bias**
The tendency for people to see and/or present themselves in an overly favorable way. This tendency can take two basic forms: defensiveness (when individuals actually believe they are better than they really are) and impression management (when people intentionally distort their responses to try to convince others that they are better than they really are). Informants also can show enhancement biases. The general form of this bias has been called the letter-of-recommendation effect, which is the tendency of informants who like the person they are rating (e.g., friends, relatives, romantic partners) to describe them in an overly favorable way. In the case of newlyweds, this tendency has been termed the honeymoon effect.

**Sibling contrast effect**
The tendency of parents to use their perceptions of all of their children as a frame of reference for rating the characteristics of each of them. For example, suppose that a mother has three children; two of these children are very sociable and outgoing, whereas the third is relatively average in sociability. Because of operation of this effect, the mother will rate this third child as less sociable and outgoing than he/she actually is. More generally, this effect causes parents to exaggerate the true extent of differences between their children. This effect represents a specific manifestation of the more general reference group effect when applied to ratings made by parents.
Validity
Evidence related to the interpretation and use of test scores. A particularly important type of evidence is criterion validity, which involves the ability of a test to predict theoretically relevant outcomes. For example, a presumed measure of conscientiousness should be related to academic achievement (such as overall grade point average).
References


Anxiety is a natural part of life and, at normal levels, helps us to function at our best. However, for people with anxiety disorders, anxiety is overwhelming and hard to control. Anxiety disorders develop out of a blend of biological (genetic) and psychological factors that, when combined with stress, may lead to the development of ailments. Primary anxiety-related diagnoses include generalized anxiety disorder, panic disorder, specific phobia, social anxiety disorder (social phobia), post traumatic stress disorder, and obsessive-compulsive disorder. In this module, we summarize the main clinical features of each of these disorders and discuss their similarities and differences with everyday experiences of anxiety.

Learning Objectives

- Understand the relationship between anxiety and anxiety disorders.
- Identify key vulnerabilities for developing anxiety and related disorders.
- Identify main diagnostic features of specific anxiety-related disorders.
- Differentiate between disordered and non-disordered functioning.

Introduction

What is anxiety? Most of us feel some anxiety almost every day of our lives. Maybe you have an important test coming up for school. Or maybe there's that big game next Saturday, or that first date with someone new you are hoping to impress. Anxiety can be defined as a negative mood state that is accompanied by bodily symptoms such as increased heart rate,
muscle tension, a sense of unease, and apprehension about the future (APA, 2013; Barlow, 2002).

Anxiety is what motivates us to plan for the future, and in this sense, anxiety is actually a good thing. It’s that nagging feeling that motivates us to study for that test, practice harder for that game, or be at our very best on that date. But some people experience anxiety so intensely that it is no longer helpful or useful. They may become so overwhelmed and distracted by anxiety that they actually fail their test, fumble the ball, or spend the whole date fidgeting and avoiding eye contact. If anxiety begins to interfere in the person’s life in a significant way, it is considered a disorder.

Anxiety and closely related disorders emerge from “triple vulnerabilities,” a combination of biological, psychological, and specific factors that increase our risk for developing a disorder (Barlow, 2002; Suárez, Bennett, Goldstein, & Barlow, 2009). Biological vulnerabilities refer to specific genetic and neurobiological factors that might predispose someone to develop anxiety disorders. No single gene directly causes anxiety or panic, but our genes may make us more susceptible to anxiety and influence how our brains react to stress (Drabant et al., 2012; Gelernter & Stein, 2009; Smoller, Block, & Young, 2009). Psychological vulnerabilities refer to the influences that our early experiences have on how we view the world. If we were confronted with unpredictable stressors or traumatic experiences at younger ages, we may come to view the world as unpredictable and uncontrollable, even dangerous (Chorpita & Barlow, 1998; Gunnar & Fisher, 2006). Specific vulnerabilities refer to how our experiences lead us to focus and channel our anxiety (Suárez et al., 2009). If we learned that physical illness is dangerous, maybe through witnessing our family’s reaction whenever anyone got sick, we may focus our anxiety on physical sensations. If we learned that disapproval from others has negative, even dangerous consequences, such as being yelled at or severely punished for even the slightest offense, we might focus our anxiety on social evaluation. If we learn that the “other shoe might drop” at any moment, we may focus our anxiety on worries about the future. None of these vulnerabilities directly
causes anxiety disorders on its own—instead, when all of these vulnerabilities are present, and we experience some triggering life stress, an anxiety disorder may be the result (Barlow, 2002; Suárez et al., 2009). In the next sections, we will briefly explore each of the major anxiety based disorders, found in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) (APA, 2013).

### Generalized Anxiety Disorder

Most of us worry some of the time, and this worry can actually be useful in helping us to plan for the future or make sure we remember to do something important. Most of us can set aside our worries when we need to focus on other things or stop worrying altogether whenever a problem has passed. However, for someone with [generalized anxiety disorder (GAD)](#), these worries become difficult, or even impossible, to turn off. They may find themselves worrying excessively about a number of different things, both minor and catastrophic. Their worries also come with a host of other symptoms such as muscle tension, fatigue, agitation or restlessness, irritability, difficulties with sleep (either falling asleep, staying asleep, or both), or difficulty concentrating. The *DSM-5* criteria specify that at least six months of excessive anxiety and worry of this type must be ongoing, happening more days than not for a good proportion of the day, to receive a diagnosis of GAD. About 5.7% of the population has met criteria for GAD at some point during their lifetime (Kessler, Berglund, et al., 2005), making it one of the most common anxiety disorders (see Table 1).

<table>
<thead>
<tr>
<th>Disorder</th>
<th>1-Year Prevalence Rates</th>
<th>Lifetime Prevalence Rates</th>
<th>Prevalence by Gender</th>
<th>Median Age of Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized Anxiety Disorder</td>
<td>3.1%</td>
<td>5.7%</td>
<td>67% female</td>
<td>31 yrs.</td>
</tr>
<tr>
<td>OCD</td>
<td>1%</td>
<td>1.6%</td>
<td>55% female</td>
<td>19 yrs.</td>
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<td>Panic Disorder</td>
<td>2.7%</td>
<td>4.7%</td>
<td>67% female</td>
<td>24 yrs.</td>
</tr>
<tr>
<td>PTSD</td>
<td>3.5%</td>
<td>6.8%</td>
<td>52% female&lt;sup&gt;3&lt;/sup&gt;</td>
<td>23 yrs.</td>
</tr>
<tr>
<td>Social Anxiety</td>
<td>6.8%</td>
<td>12.1%</td>
<td>50% female</td>
<td>13 yrs.</td>
</tr>
<tr>
<td>Specific Phobia</td>
<td>8.7%</td>
<td>12.5%</td>
<td>60% - 90% female&lt;sup&gt;4&lt;/sup&gt;</td>
<td>7-9 yrs.</td>
</tr>
</tbody>
</table>

What makes a person with GAD worry more than the average person? Research shows that individuals with GAD are more sensitive and vigilant toward possible threats than people who are not anxious (Aikins & Craske, 2001; Barlow, 2002; Bradley, Mogg, White, Groom, & de Bono, 1999). This may be related to early stressful experiences, which can lead to a view of the world as an unpredictable, uncontrollable, and even dangerous place. Some have suggested that people with GAD worry as a way to gain some control over these otherwise uncontrollable or unpredictable experiences and against uncertain outcomes (Dugas, Gagnon, Ladouceur, & Freeston, 1998). By repeatedly going through all of the possible “What if?” scenarios in their mind, the person might feel like they are less vulnerable to an unexpected outcome, giving them the sense that they have some control over the situation (Wells, 2002). Others have suggested people with GAD worry as a way to avoid feeling distressed (Borkovec, Alcaine, & Behar, 2004). For example, Borkovec and Hu (1990) found that those who worried when confronted with a stressful situation had less physiological arousal than those who didn’t worry, maybe because the worry “distracted” them in some way.

The problem is, all of this “what if?”-ing doesn't get the person any closer to a solution or an answer and, in fact, might take them away from important things they should be paying attention to in the moment, such as finishing an important project. Many of the catastrophic outcomes people with GAD worry about are very unlikely to happen, so when the catastrophic event doesn't materialize, the act of worrying gets reinforced (Borkovec, Hazlett-Stevens, & Diaz, 1999). For example, if a mother spends all night worrying about whether her teenage daughter will get home safe from a night out and the daughter returns home without incident, the mother could easily attribute her daughter’s safe return to her successful “vigil.” What the mother hasn't learned is that her daughter would have returned home just as safe if she had been focusing on the movie she was watching with her husband, rather than being preoccupied with worries. In this way, the cycle of worry is perpetuated, and, subsequently, people with GAD often miss out on many otherwise enjoyable events in their lives.

**Panic Disorder and Agoraphobia**

Have you ever gotten into a near-accident or been taken by surprise in some way? You may have felt a flood of physical sensations, such as a racing heart, shortness of breath, or tingling sensations. This alarm reaction is called the “fight or flight” response (Cannon, 1929) and is your body's natural reaction to fear, preparing you to either fight or escape in response to threat or danger. It's likely you weren't too concerned with these sensations, because you knew what was causing them. But imagine if this alarm reaction came “out of the blue,” for no apparent reason, or in a situation in which you didn't expect to be anxious or fearful. This is called an “unexpected” panic attack or a false alarm. Because there is no apparent reason
or cue for the alarm reaction, you might react to the sensations with intense fear, maybe thinking you are having a heart attack, or going crazy, or even dying. You might begin to associate the physical sensations you felt during this attack with this fear and may start to go out of your way to avoid having those sensations again.

Unexpected panic attacks such as these are at the heart of panic disorder (PD). However, to receive a diagnosis of PD, the person must not only have unexpected panic attacks but also must experience continued intense anxiety and avoidance related to the attack for at least one month, causing significant distress or interference in their lives. People with panic disorder tend to interpret even normal physical sensations in a catastrophic way, which triggers more anxiety and, ironically, more physical sensations, creating a vicious cycle of panic (Clark, 1986, 1996). The person may begin to avoid a number of situations or activities that produce the same physiological arousal that was present during the beginnings of a panic attack. For example, someone who experienced a racing heart during a panic attack might avoid exercise or caffeine. Someone who experienced choking sensations might avoid wearing high-necked sweaters or necklaces. Avoidance of these internal bodily or somatic cues for panic has been termed interoceptive avoidance (Barlow & Craske, 2007; Brown, White, & Barlow, 2005; Craske & Barlow, 2008; Shear et al., 1997).

The individual may also have experienced an overwhelming urge to escape during the unexpected panic attack. This can lead to a sense that certain places or situations—particularly situations where escape might not be possible—are not “safe.” These situations become external cues for panic. If the person begins to avoid several places or situations, or still endures these situations but does so with a significant amount of apprehension and anxiety, then the person also has agoraphobia (Barlow, 2002; Craske & Barlow, 1988; Craske & Barlow, 2008). Agoraphobia can cause significant disruption to a person’s life, causing them to go out of their way to avoid situations, such as adding hours to a commute to avoid taking the train.
or only ordering take-out to avoid having to enter a grocery store. In one tragic case seen by our clinic, a woman suffering from agoraphobia had not left her apartment for 20 years and had spent the past 10 years confined to one small area of her apartment, away from the view of the outside. In some cases, agoraphobia develops in the absence of panic attacks and therefor is a separate disorder in DSM-5. But agoraphobia often accompanies panic disorder.

About 4.7% of the population has met criteria for PD or agoraphobia over their lifetime (Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Kessler et al., 2006) (see Table 1). In all of these cases of panic disorder, what was once an adaptive natural alarm reaction now becomes a learned, and much feared, false alarm.

Specific Phobia

The majority of us might have certain things we fear, such as bees, or needles, or heights (Myers et al., 1984). But what if this fear is so consuming that you can’t go out on a summer’s day, or get vaccines needed to go on a special trip, or visit your doctor in her new office on the 26th floor? To meet criteria for a diagnosis of specific phobia, there must be an irrational fear of a specific object or situation that substantially interferes with the person’s ability to function. For example, a patient at our clinic turned down a prestigious and coveted artist residency because it required spending time near a wooded area, bound to have insects. Another patient purposely left her house two hours early each morning so she could walk past her neighbor’s fenced yard before they let their dog out in the morning.

The list of possible phobias is staggering, but four major subtypes of specific phobia are recognized: blood-injury-injection (BII) type, situational type (such as planes, elevators, or enclosed places), natural environment type for events one may encounter in nature (for example, heights, storms, and water), and animal type.

A fifth category “other” includes phobias that do not fit any of the four major subtypes (for example, fears of choking, vomiting, or contracting an illness). Most phobic reactions cause a surge of activity in the sympathetic nervous system and...
increased heart rate and blood pressure, maybe even a panic attack. However, people with BII type phobias usually experience a marked drop in heart rate and blood pressure and may even faint. In this way, those with BII phobias almost always differ in their physiological reaction from people with other types of phobia (Barlow & Liebowitz, 1995; Craske, Antony, & Barlow, 2006; Hofmann, Alpers, & Pauli, 2009; Ost, 1992). BII phobia also runs in families more strongly than any phobic disorder we know (Antony & Barlow, 2002; Page & Martin, 1998). Specific phobia is one of the most common psychological disorders in the United States, with 12.5% of the population reporting a lifetime history of fears significant enough to be considered a “phobia” (Arrindell et al., 2003; Kessler, Berglund, et al., 2005) (see Table 1). Most people who suffer from specific phobia tend to have multiple phobias of several types (Hofmann, Lehman, & Barlow, 1997).

Social Anxiety Disorder (Social Phobia)

Many people consider themselves shy, and most people find social evaluation uncomfortable at best, or giving a speech somewhat mortifying. Yet, only a small proportion of the population fear these types of situations significantly enough to merit a diagnosis of social anxiety disorder (SAD) (APA, 2013). SAD is more than exaggerated shyness (Bogels et al., 2010; Schneier et al., 1996). To receive a diagnosis of SAD, the fear and anxiety associated with social situations must be so strong that the person avoids them entirely, or if avoidance is not possible, the person endures them with a great deal of distress. Further, the fear and avoidance of social situations must get in the way of the person's daily life, or seriously limit their academic or occupational functioning. For example, a patient at our clinic compromised her perfect 4.0 grade point average because she could not complete a required oral presentation in one of her classes, causing her to fail the course. Fears of negative evaluation might make someone repeatedly turn down invitations to social events or avoid having conversations with people, leading to greater and greater isolation.

The specific social situations that trigger anxiety and fear range from one-on-one interactions, such as starting or maintaining a conversation; to performance-based situations, such as giving a speech or performing on stage; to assertiveness, such as asking someone to change disruptive or undesirable behaviors. Fear of social evaluation might even extend to such things as using public restrooms, eating in a restaurant, filling out forms in a public place, or even reading on a train. Any type of situation that could potentially draw attention to the person can become a feared social situation. For example, one patient of ours went out of her way to avoid any situation in which she might have to use a public restroom for fear that someone would hear her in the bathroom stall and think she was disgusting. If the fear is limited to performance-based situations, such as public speaking, a diagnosis of SAD performance only
What causes someone to fear social situations to such a large extent? The person may have learned growing up that social evaluation in particular can be dangerous, creating a specific psychological vulnerability to develop social anxiety (Bruch & Heimberg, 1994; Lieb et al., 2000; Rapee & Melville, 1997). For example, the person’s caregivers may have harshly criticized and punished them for even the smallest mistake, maybe even punishing them physically.

Or, someone might have experienced a social trauma that had lasting effects, such as being bullied or humiliated. Interestingly, one group of researchers found that 92% of adults in their study sample with social phobia experienced severe teasing and bullying in childhood, compared with only 35% to 50% among people with other anxiety disorders (McCabe, Antony, Summerfeldt, Liss, & Swinson, 2003). Someone else might react so strongly to the anxiety provoked by a social situation that they have an unexpected panic attack. This panic attack then becomes associated (conditioned response) with the social situation, causing the person to fear they will panic the next time they are in that situation. This is not considered PD, however, because the person’s fear is more focused on social evaluation than having unexpected panic attacks, and the fear of having an attack is limited to social situations. As many as 12.1% of the general population suffer from social phobia at some point in their lives (Kessler, Berglund, et al., 2005), making it one of the most common anxiety disorders, second only to specific phobia (see Table 1).

Posttraumatic Stress Disorder

With stories of war, natural disasters, and physical and sexual assault dominating the news, it is clear that trauma is a reality for many people. Many individual traumas that occur every day never even make the headlines, such as a car accident, domestic abuse, or the death of a loved one. Yet, while many people face traumatic events, not everyone who faces a trauma
develops a disorder. Some, with the help of family and friends, are able to recover and continue on with their lives (Friedman, 2009). For some, however, the months and years following a trauma are filled with intrusive reminders of the event, a sense of intense fear that another traumatic event might occur, or a sense of isolation and emotional numbing. They may engage in a host of behaviors intended to protect themselves from being vulnerable or unsafe, such as constantly scanning their surroundings to look for signs of potential danger, never sitting with their back to the door, or never allowing themselves to be anywhere alone. This lasting reaction to trauma is what characterizes posttraumatic stress disorder (PTSD).

A diagnosis of PTSD begins with the traumatic event itself. An individual must have been exposed to an event that involves actual or threatened death, serious injury, or sexual violence. To receive a diagnosis of PTSD, exposure to the event must include either directly experiencing the event, witnessing the event happening to someone else, learning that the event occurred to a close relative or friend, or having repeated or extreme exposure to details of the event (such as in the case of first responders). The person subsequently re-experiences the event through both intrusive memories and nightmares. Some memories may come back so vividly that the person feels like they are experiencing the event all over again, what is known as having a flashback. The individual may avoid anything that reminds them of the trauma, including conversations, places, or even specific types of people. They may feel emotionally numb or restricted in their ability to feel, which may interfere in their interpersonal relationships. The person may not be able to remember certain aspects of what happened during the event. They may feel a sense of a foreshortened future, that they will never marry, have a family, or live a long, full life. They may be jumpy or easily startled, hypervigilant to their surroundings, and quick to anger.  The prevalence of PTSD among the population as a whole is relatively low, with 6.8% having experienced PTSD at some point in their life (Kessler, Berglund, et al., 2005) (see Table 1). Combat and sexual assault are the most common precipitating traumas (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Whereas PTSD was previously categorized as an Anxiety Disorder, in the most recent version of the DSM (DSM-5; APA, 2013) it has been reclassified under the more specific category of Trauma- and Stressor-Related Disorders.

A person with PTSD is particularly sensitive to both internal and external cues that serve as reminders of their traumatic experience. For example, as we saw in PD, the physical sensations of arousal present during the initial trauma can become threatening in and of themselves, becoming a powerful reminder of the event. Someone might avoid watching intense or emotional movies in order to prevent the experience of emotional arousal. Avoidance of conversations, reminders, or even of the experience of emotion itself may also be an attempt to avoid triggering internal cues. External stimuli that were present during the trauma can also become strong triggers. For example, if a woman is raped by a man wearing a red t-shirt,
she may develop a strong alarm reaction to the sight of red shirts, or perhaps even more indiscriminately to anything with a similar color red. A combat veteran who experienced a strong smell of gasoline during a roadside bomb attack may have an intense alarm reaction when pumping gas back at home. Individuals with a psychological vulnerability toward viewing the world as uncontrollable and unpredictable may particularly struggle with the possibility of additional future, unpredictable traumatic events, fueling their need for hypervigilance and avoidance, and perpetuating the symptoms of PTSD.

**Obsessive-Compulsive Disorder**

Have you ever had a strange thought pop into your mind, such as picturing the stranger next to you naked? Or maybe you walked past a crooked picture on the wall and couldn't resist straightening it. Most people have occasional strange thoughts and may even engage in some “compulsive” behaviors, especially when they are stressed (Boyer & Liénard, 2008; Fullana et al., 2009). But for most people, these thoughts are nothing more than a passing oddity, and the behaviors are done (or not done) without a second thought. For someone with obsessive-compulsive disorder (OCD), however, these thoughts and compulsive behaviors don't just come and go. Instead, strange or unusual thoughts are taken to mean something much more important and real, maybe even something dangerous or frightening. The urge to engage in some behavior, such as straightening a picture, can become so intense that it is nearly impossible not to carry it out, or causes significant anxiety if it can't be carried out. Further, someone with OCD might become preoccupied with the possibility that the behavior wasn't carried out to completion and feel compelled to repeat the behavior again and again, maybe several times before they are “satisfied.”

To receive a diagnosis of OCD, a person must experience obsessive thoughts and/or compulsions that seem irrational or nonsensical, but that keep coming into their mind. Some examples of obsessions include doubting thoughts (such as doubting a door is locked or an appliance is turned off), thoughts of contamination (such as thinking that touching almost

People suffering from OCD may have an irrational fear of germs and “becoming contaminated”. [Image: benchilada, https://goo.gl/qemgDm, CC BY-NC-SA 2.0, https://goo.gl/Toc0ZF]
anything might give you cancer), or aggressive thoughts or images that are unprovoked or nonsensical. Compulsions may be carried out in an attempt to neutralize some of these thoughts, providing temporary relief from the anxiety the obsessions cause, or they may be nonsensical in and of themselves. Either way, compulsions are distinct in that they must be repetitive or excessive, the person feels “driven” to carry out the behavior, and the person feels a great deal of distress if they can't engage in the behavior. Some examples of compulsive behaviors are repetitive washing (often in response to contamination obsessions), repetitive checking (locks, door handles, appliances often in response to doubting obsessions), ordering and arranging things to ensure symmetry, or doing things according to a specific ritual or sequence (such as getting dressed or ready for bed in a specific order). To meet diagnostic criteria for OCD, engaging in obsessions and/or compulsions must take up a significant amount of the person's time, at least an hour per day, and must cause significant distress or impairment in functioning. About 1.6% of the population has met criteria for OCD over the course of a lifetime (Kessler, Berglund, et al., 2005) (see Table 1). Whereas OCD was previously categorized as an Anxiety Disorder, in the most recent version of the DSM (DSM-5; APA, 2013) it has been reclassified under the more specific category of Obsessive-Compulsive and Related Disorders.

People with OCD often confuse having an intrusive thought with their potential for carrying out the thought. Whereas most people when they have a strange or frightening thought are able to let it go, a person with OCD may become “stuck” on the thought and be intensely afraid that they might somehow lose control and act on it. Or worse, they believe that having the thought is just as bad as doing it. This is called thought-action fusion. For example, one patient of ours was plagued by thoughts that she would cause harm to her young daughter. She experienced intrusive images of throwing hot coffee in her daughter’s face or pushing her face underwater when she was giving her a bath. These images were so terrifying to the patient that she would no longer allow herself any physical contact with her daughter and would leave her daughter in the care of a babysitter if her husband or another family was not available to “supervise” her. In reality, the last thing she wanted to do was harm her daughter, and she had no intention or desire to act on the aggressive thoughts and images, nor does anybody with OCD act on these thoughts, but these thoughts were so horrifying to her that she made every attempt to prevent herself from the potential of carrying them out, even if it meant not being able to hold, cradle, or cuddle her daughter. These are the types of struggles people with OCD face every day.

Treatments for Anxiety and Related Disorders

Many successful treatments for anxiety and related disorders have been developed over the years. Medications (anti-anxiety drugs and antidepressants) have been found to be beneficial
for disorders other than specific phobia, but relapse rates are high once medications are stopped (Heimberg et al., 1998; Hollon et al., 2005), and some classes of medications (minor tranquilizers or benzodiazepines) can be habit forming.

Exposure-based cognitive behavioral therapies (CBT) are effective psychosocial treatments for anxiety disorders, and many show greater treatment effects than medication in the long term (Barlow, Allen, & Basden, 2007; Barlow, Gorman, Shear, & Woods, 2000). In CBT, patients are taught skills to help identify and change problematic thought processes, beliefs, and behaviors that tend to worsen symptoms of anxiety, and practice applying these skills to real-life situations through exposure exercises. Patients learn how the automatic “appraisals” or thoughts they have about a situation affect both how they feel and how they behave. Similarly, patients learn how engaging in certain behaviors, such as avoiding situations, tends to strengthen the belief that the situation is something to be feared. A key aspect of CBT is exposure exercises, in which the patient learns to gradually approach situations they find fearful or distressing, in order to challenge their beliefs and learn new, less fearful associations about these situations.

Typically 50% to 80% of patients receiving drugs or CBT will show a good initial response, with the effect of CBT more durable. Newer developments in the treatment of anxiety disorders are focusing on novel interventions, such as the use of certain medications to enhance learning during CBT (Otto et al., 2010), and transdiagnostic treatments targeting core, underlying vulnerabilities (Barlow et al., 2011). As we advance our understanding of anxiety and related disorders, so too will our treatments advance, with the hopes that for the many people suffering from these disorders, anxiety can once again become something useful and adaptive, rather than something debilitating.
Outside Resources

American Psychological Association (APA)

National Institutes of Mental Health (NIMH)

Web: Anxiety and Depression Association of America (ADAA)
http://www.adaa.org/

Web: Center for Anxiety and Related Disorders (CARD)
http://www.bu.edu/card/

Discussion Questions

1. Name and describe the three main vulnerabilities contributing to the development of anxiety and related disorders. Do you think these disorders could develop out of biological factors alone? Could these disorders develop out of learning experiences alone?

2. Many of the symptoms in anxiety and related disorders overlap with experiences most people have. What features differentiate someone with a disorder versus someone without?

3. What is an “alarm reaction?” If someone experiences an alarm reaction when they are about to give a speech in front of a room full of people, would you consider this a “true alarm” or a “false alarm?”

4. Many people are shy. What differentiates someone who is shy from someone with social anxiety disorder? Do you think shyness should be considered an anxiety disorder?

5. Is anxiety ever helpful? What about worry?
Vocabulary

Agoraphobia
A sort of anxiety disorder distinguished by feelings that a place is uncomfortable or may be unsafe because it is significantly open or crowded.

Anxiety
A mood state characterized by negative affect, muscle tension, and physical arousal in which a person apprehensively anticipates future danger or misfortune.

Biological vulnerability
A specific genetic and neurobiological factor that might predispose someone to develop anxiety disorders.

Conditioned response
A learned reaction following classical conditioning, or the process by which an event that automatically elicits a response is repeatedly paired with another neutral stimulus (conditioned stimulus), resulting in the ability of the neutral stimulus to elicit the same response on its own.

External cues
Stimuli in the outside world that serve as triggers for anxiety or as reminders of past traumatic events.

Fight or flight response
A biological reaction to alarming stressors that prepares the body to resist or escape a threat.

Flashback
Sudden, intense re-experiencing of a previous event, usually trauma-related.

Generalized anxiety disorder (GAD)
Excessive worry about everyday things that is at a level that is out of proportion to the specific causes of worry.

Internal bodily or somatic cues
Physical sensations that serve as triggers for anxiety or as reminders of past traumatic events.

Interoceptive avoidance
Avoidance of situations or activities that produce sensations of physical arousal similar to those occurring during a panic attack or intense fear response.

**Obsessive-compulsive disorder (OCD)**
A disorder characterized by the desire to engage in certain behaviors excessively or compulsively in hopes of reducing anxiety. Behaviors include things such as cleaning, repeatedly opening and closing doors, hoarding, and obsessing over certain thoughts.

**Panic disorder (PD)**
A condition marked by regular strong panic attacks, and which may include significant levels of worry about future attacks.

**Posttraumatic stress disorder (PTSD)**
A sense of intense fear, triggered by memories of a past traumatic event, that another traumatic event might occur. PTSD may include feelings of isolation and emotional numbing.

**Psychological vulnerabilities**
Influences that our early experiences have on how we view the world.

**Reinforced response**
Following the process of operant conditioning, the strengthening of a response following either the delivery of a desired consequence (positive reinforcement) or escape from an aversive consequence.

**SAD performance only**
Social anxiety disorder which is limited to certain situations that the sufferer perceives as requiring some type of performance.

**Social anxiety disorder (SAD)**
A condition marked by acute fear of social situations which lead to worry and diminished day to day functioning.

**Specific vulnerabilities**
How our experiences lead us to focus and channel our anxiety.

**Thought-action fusion**
The tendency to overestimate the relationship between a thought and an action, such that one mistakenly believes a “bad” thought is the equivalent of a “bad” action.
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Mood Disorders

Anda Gershon & Renee Thompson

Everyone feels down or euphoric from time to time, but this is different from having a mood disorder such as major depressive disorder or bipolar disorder. Mood disorders are extended periods of depressed, euphoric, or irritable moods that in combination with other symptoms cause the person significant distress and interfere with his or her daily life, often resulting in social and occupational difficulties. In this module, we describe major mood disorders, including their symptom presentations, general prevalence rates, and how and why the rates of these disorders tend to vary by age, gender, and race. In addition, biological and environmental risk factors that have been implicated in the development and course of mood disorders, such as heritability and stressful life events, are reviewed. Finally, we provide an overview of treatments for mood disorders, covering treatments with demonstrated effectiveness, as well as new treatment options showing promise.

Learning Objectives

- Describe the diagnostic criteria for mood disorders.
- Understand age, gender, and ethnic differences in prevalence rates of mood disorders.
- Identify common risk factors for mood disorders.
- Know effective treatments of mood disorders.

The actress Brooke Shields published a memoir titled Down Came the Rain: My Journey through Postpartum Depression in which she described her struggles with depression following the birth of her daughter. Despite the fact that about one in 20 women experience
depression after the birth of a baby (American Psychiatric Association [APA], 2013), postpartum depression—recently renamed “perinatal depression”—continues to be veiled by stigma, owing in part to a widely held expectation that motherhood should be a time of great joy. In an opinion piece in the *New York Times*, Shields revealed that entering motherhood was a profoundly overwhelming experience for her. She vividly describes experiencing a sense of “doom” and “dread” in response to her newborn baby. Because motherhood is conventionally thought of as a joyous event and not associated with sadness and hopelessness, responding to a newborn baby in this way can be shocking to the new mother as well as those close to her. It may also involve a great deal of shame for the mother, making her reluctant to divulge her experience to others, including her doctors and family.

Feelings of shame are not unique to perinatal depression. Stigma applies to other types of depressive and bipolar disorders and contributes to people not always receiving the necessary support and treatment for these disorders. In fact, the World Health Organization ranks both major depressive disorder (MDD) and bipolar disorder (BD) among the top 10 leading causes of disability worldwide. Further, MDD and BD carry a high risk of suicide. It is estimated that 25%–50% of people diagnosed with BD will attempt suicide at least once in their lifetimes (Goodwin & Jamison, 2007).

**What Are Mood Disorders?**

**Mood Episodes**

Everyone experiences brief periods of sadness, irritability, or euphoria. This is different than having a mood disorder, such as MDD or BD, which are characterized by a constellation of symptoms that causes people significant distress or impairs their everyday functioning.
Major Depressive Episode

A major depressive episode (MDE) refers to symptoms that co-occur for at least two weeks and cause significant distress or impairment in functioning, such as interfering with work, school, or relationships. Core symptoms include feeling down or depressed or experiencing anhedonia—loss of interest or pleasure in things that one typically enjoys. According to the fifth edition of the *Diagnostic and Statistical Manual (DSM-5; APA, 2013)*, the criteria for an MDE require five or more of the following nine symptoms, including one or both of the first two symptoms, for most of the day, nearly every day:

1. depressed mood
2. diminished interest or pleasure in almost all activities
3. significant weight loss or gain or an increase or decrease in appetite
4. insomnia or hypersomnia
5. psychomotor agitation or retardation
6. fatigue or loss of energy
7. feeling worthless or excessive or inappropriate guilt
8. diminished ability to concentrate or indecisiveness
9. recurrent thoughts of death, suicidal ideation, or a suicide attempt

These symptoms cannot be caused by physiological effects of a substance or a general medical condition (e.g., hypothyroidism).

Manic or Hypomanic Episode

The core criterion for a manic or hypomanic episode is a distinct period of abnormally and persistently euphoric, expansive, or irritable mood and persistently increased goal-directed activity or energy. The mood disturbance must be present for one week or longer in mania (unless hospitalization is required) or four days or longer in hypomania. Concurrently, at least three of the following symptoms must be present in the context of euphoric mood (or at least four in the context of irritable mood):

1. inflated self-esteem or grandiosity
2. increased goal-directed activity or psychomotor agitation
3. reduced need for sleep
4. racing thoughts or flight of ideas
5. distractibility
6. increased talkativeness
7. excessive involvement in risky behaviors

Manic episodes are distinguished from hypomanic episodes by their duration and associated impairment; whereas manic episodes must last one week and are defined by a significant impairment in functioning, hypomanic episodes are shorter and not necessarily accompanied by impairment in functioning.

Mood Disorders

Unipolar Mood Disorders

Two major types of unipolar disorders described by the *DSM-5* (APA, 2013) are major depressive disorder and persistent depressive disorder (PDD; dysthymia). MDD is defined by one or more MDEs, but no history of manic or hypomanic episodes. Criteria for PDD are feeling depressed most of the day for more days than not, for at least two years. At least two of the following symptoms are also required to meet criteria for PDD:

1. poor appetite or overeating
2. insomnia or hypersomnia
3. low energy or fatigue
4. low self-esteem
5. poor concentration or difficulty making decisions
6. feelings of hopelessness

Like MDD, these symptoms need to cause significant distress or impairment and cannot be due to the effects of a substance or a general medical condition. To meet criteria for PDD, a person cannot be without symptoms for more than two months at a time. PDD has overlapping symptoms with MDD. If someone meets criteria for an MDE during a PDD episode, the person will receive diagnoses of PDD and MDD.
Bipolar Mood Disorders

Three major types of BDs are described by the *DSM-5* (APA, 2013). Bipolar I Disorder (BD I), which was previously known as manic-depression, is characterized by a single (or recurrent) manic episode. A depressive episode is not necessary but commonly present for the diagnosis of BD I. Bipolar II Disorder is characterized by single (or recurrent) hypomanic episodes and depressive episodes. Another type of BD is cyclothymic disorder, characterized by numerous and alternating periods of hypomania and depression, lasting at least two years. To qualify for cyclothymic disorder, the periods of depression cannot meet full diagnostic criteria for an MDE; the person must experience symptoms at least half the time with no more than two consecutive symptom-free months; and the symptoms must cause significant distress or impairment.

It is important to note that the *DSM-5* was published in 2013, and findings based on the updated manual will be forthcoming. Consequently, the research presented below was largely based on a similar, but not identical, conceptualization of mood disorders drawn from the *DSM-IV* (APA, 2000).

How Common Are Mood Disorders? Who Develops Mood Disorders?

**Depressive Disorders**

In a nationally representative sample, lifetime prevalence rate for MDD is 16.6% (Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005). This means that nearly one in five Americans will meet the criteria for MDD during their lifetime. The 12-month prevalence—the proportion of people who meet criteria for a disorder during a 12-month period—for PDD is approximately 0.5% (APA, 2013).
Although the onset of MDD can occur at any time throughout the lifespan, the average age of onset is mid-20s, with the age of onset decreasing with people born more recently (APA, 2000). Prevalence of MDD among older adults is much lower than it is for younger cohorts (Kessler, Birnbaum, Bromet, Hwang, Sampson, & Shahly, 2010). The duration of MDEs varies widely. Recovery begins within three months for 40% of people with MDD and within 12 months for 80% (APA, 2013). MDD tends to be a recurrent disorder with about 40%–50% of those who experience one MDE experiencing a second MDE (Monroe & Harkness, 2011). An earlier age of onset predicts a worse course. About 5%–10% of people who experience an MDE will later experience a manic episode (APA, 2000), thus no longer meeting criteria for MDD but instead meeting them for BD I. Diagnoses of other disorders across the lifetime are common for people with MDD: 59% experience an anxiety disorder; 32% experience an impulse control disorder, and 24% experience a substance use disorder (Kessler, Merikangas, & Wang, 2007).

Women experience two to three times higher rates of MDD than do men (Nolen-Hoeksema & Hilt, 2009). This gender difference emerges during puberty (Conley & Rudolph, 2009). Before puberty, boys exhibit similar or higher prevalence rates of MDD than do girls (Twenge & Nolen-Hoeksema, 2002). MDD is inversely correlated with socioeconomic status (SES), a person’s economic and social position based on income, education, and occupation. Higher prevalence rates of MDD are associated with lower SES (Lorant, Deliege, Eaton, Robert, Philippot, & Ansseau, 2003), particularly for adults over 65 years old (Kessler et al., 2010). Independent of SES, results from a nationally representative sample found that European Americans had a higher prevalence rate of MDD than did African Americans and Hispanic Americans, whose rates were similar (Breslau, Aguilar-Gaxiola, Kendler, Su, Williams, & Kessler, 2006). The course of MDD for African Americans is often more severe and less often treated than it is for European Americans, however (Williams et al., 2007). Native Americans have a higher prevalence rate than do European Americans, African Americans, or Hispanic Americans (Hasin, Goodwin, Stinson & Grant, 2005). Depression is not limited to industrialized or western cultures; it is

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**Box 1. Specifiers**

Both MDEs and manic episodes can be further described using standardized tags based on the timing of, or other symptoms that are occurring during, the mood episode, to increase diagnostic specificity and inform treatment. Psychotic features is specified when the episodes are accompanied by delusions (rigidly held beliefs that are false) or hallucinations (perceptual disturbances that are not based in reality). Seasonal pattern is specified when a mood episode occurs at the same time of the year for two consecutive years—most commonly occurring in the fall and winter. Peripartum onset is specified when a mood episode has an onset during pregnancy or within four weeks of the birth of a child. Approximately 3%–6% of women who have a child experience an MDE with peripartum onset (APA, 2013). This is less frequent and different from the baby blues or when women feel transient mood symptoms usually within 10 days of giving birth, which are experienced by most women (Nolen-Hoeksema & Hilt, 2009).
found in all countries that have been examined, although the symptom presentation as well as prevalence rates vary across cultures (Chentsova-Dutton & Tsai, 2009).

**Bipolar Disorders**

The lifetime prevalence rate of bipolar spectrum disorders in the general U.S. population is estimated at approximately 4.4%, with BD I constituting about 1% of this rate (Merikangas et al., 2007). Prevalence estimates, however, are highly dependent on the diagnostic procedures used (e.g., interviews vs. self-report) and whether or not sub-threshold forms of the disorder are included in the estimate. BD often co-occurs with other psychiatric disorders. Approximately 65% of people with BD meet diagnostic criteria for at least one additional psychiatric disorder, most commonly anxiety disorders and substance use disorders (McElroy et al., 2001). The co-occurrence of BD with other psychiatric disorders is associated with poorer illness course, including higher rates of suicidality (Leverich et al., 2003). A recent cross-national study sample of more than 60,000 adults from 11 countries, estimated the worldwide prevalence of BD at 2.4%, with BD I constituting 0.6% of this rate (Merikangas et al., 2011). In this study, the prevalence of BD varied somewhat by country. Whereas the United States had the highest lifetime prevalence (4.4%), India had the lowest (0.1%). Variation in prevalence rates was not necessarily related to SES, as in the case of Japan, a high-income country with a very low prevalence rate of BD (0.7%).

With regard to ethnicity, data from studies not confounded by SES or inaccuracies in diagnosis are limited, but available reports suggest rates of BD among European Americans are similar to those found among African Americans (Blazer et al., 1985) and Hispanic Americans (Breslau, Kendler, Su, Gaxiola-Aguilar, & Kessler, 2005). Another large community-based study found that although prevalence rates of mood disorders were similar across ethnic groups, Hispanic Americans and African Americans with a mood disorder were more likely to remain...
persistently ill than European Americans (Breslau et al., 2005). Compared with European Americans with BD, African Americans tend to be underdiagnosed for BD (and over-diagnosed for schizophrenia) (Kilbourne, Haas, Mulsant, Bauer, & Pincus, 2004; Minsky, Vega, Miskimen, Gara, & Escobar, 2003), and Hispanic Americans with BD have been shown to receive fewer psychiatric medication prescriptions and specialty treatment visits (Gonzalez et al., 2007). Misdiagnosis of BD can result in the underutilization of treatment or the utilization of inappropriate treatment, and thus profoundly impact the course of illness.

As with MDD, adolescence is known to be a significant risk period for BD; mood symptoms start by adolescence in roughly half of BD cases (Leverich et al., 2007; Perlis et al., 2004). Longitudinal studies show that those diagnosed with BD prior to adulthood experience a more pernicious course of illness relative to those with adult onset, including more episode recurrence, higher rates of suicidality, and profound social, occupational, and economic repercussions (e.g., Lewinsohn, Seeley, Buckley, & Klein, 2002). The prevalence of BD is substantially lower in older adults compared with younger adults (1% vs. 4%) (Merikangas et al., 2007).

What Are Some of the Factors Implicated in the Development and Course of Mood Disorders?

Mood disorders are complex disorders resulting from multiple factors. Causal explanations can be attempted at various levels, including biological and psychosocial levels. Below are several of the key factors that contribute to onset and course of mood disorders are highlighted.

**Depressive Disorders**

Research across family and twin studies has provided support that genetic factors are implicated in the development of MDD. Twin studies suggest that familial influence on MDD is mostly due to genetic effects and that individual-specific environmental effects (e.g., romantic relationships) play
an important role, too. By contrast, the contribution of shared environmental effect by siblings is negligible (Sullivan, Neale & Kendler, 2000). The mode of inheritance is not fully understood although no single genetic variation has been found to increase the risk of MDD significantly. Instead, several genetic variants and environmental factors most likely contribute to the risk for MDD (Lohoff, 2010).

One environmental stressor that has received much support in relation to MDD is stressful life events. In particular, severe stressful life events—those that have long-term consequences and involve loss of a significant relationship (e.g., divorce) or economic stability (e.g., unemployment) are strongly related to depression (Brown & Harris, 1989; Monroe et al., 2009). Stressful life events are more likely to predict the first MDE than subsequent episodes (Lewinsohn, Allen, Seeley, & Gotlib, 1999). In contrast, minor events may play a larger role in subsequent episodes than the initial episodes (Monroe & Harkness, 2005).

Depression research has not been limited to examining reactivity to stressful life events. Much research, particularly brain imagining research using functional magnetic resonance imaging (fMRI), has centered on examining neural circuitry—the interconnections that allow multiple brain regions to perceive, generate, and encode information in concert. A meta-analysis of neuroimaging studies showed that when viewing negative stimuli (e.g., picture of an angry face, picture of a car accident), compared with healthy control participants, participants with MDD have greater activation in brain regions involved in stress response and reduced activation of brain regions involved in positively motivated behaviors (Hamilton, Etkin, Furman, Lemus, Johnson, & Gotlib, 2012).

Other environmental factors related to increased risk for MDD include experiencing early adversity (e.g., childhood abuse or neglect; Widom, DuMont, & Czaja, 2007), chronic stress (e.g., poverty) and interpersonal factors. For example, marital dissatisfaction predicts increases in depressive symptoms in both men and women. On the other hand, depressive symptoms also predict increases in marital dissatisfaction (Whisman & Uebelacker, 2009). Research has found that people with MDD generate some of their interpersonal stress (Hammen, 2005). People with MDD whose relatives or spouses can be described as critical and emotionally overinvolved have higher relapse rates than do those living with people who are less critical and emotionally overinvolved (Butzlaff & Hooley, 1998).

People’s attributional styles or their general ways of thinking, interpreting, and recalling information have also been examined in the etiology of MDD (Gotlib & Joormann, 2010). People with a pessimistic attributional style tend to make internal (versus external), global (versus specific), and stable (versus unstable) attributions to negative events, serving as a vulnerability to developing MDD. For example, someone who when he fails an exam thinks
that it was his fault (internal), that he is stupid (global), and that he will always do poorly (stable) has a pessimistic attribution style. Several influential theories of depression incorporate attributional styles (Abramson, Metalsky, & Alloy, 1989; Abramson Seligman, & Teasdale, 1978).

**Bipolar Disorders**

Although there have been important advances in research on the etiology, course, and treatment of BD, there remains a need to understand the mechanisms that contribute to episode onset and relapse. There is compelling evidence for biological causes of BD, which is known to be highly heritable (McGuffin, Rijsdijk, Andrew, Sham, Katz, & Cardno, 2003). It may be argued that a high rate of heritability demonstrates that BD is fundamentally a biological phenomenon. However, there is much variability in the course of BD both within a person across time and across people (Johnson, 2005). The triggers that determine how and when this genetic vulnerability is expressed are not yet understood; however, there is evidence to suggest that psychosocial triggers may play an important role in BD risk (e.g., Johnson et al., 2008; Malkoff-Schwartz et al., 1998).

In addition to the genetic contribution, biological explanations of BD have also focused on brain function. Many of the studies using fMRI techniques to characterize BD have focused on the processing of emotional stimuli based on the idea that BD is fundamentally a disorder of emotion (APA, 2000). Findings show that regions of the brain thought to be involved in emotional processing and regulation are activated differently in people with BD relative to healthy controls (e.g., Altshuler et al., 2008; Hassel et al., 2008; Lennox, Jacob, Calder, Lupson, & Bullmore, 2004).

However, there is little consensus as to whether a particular brain region becomes more or less active in response to an emotional stimulus among people with BD compared with healthy controls. Mixed findings are in part due to samples consisting of participants who are at various phases of illness at the time of testing (manic, depressed, inter-episode). Sample sizes tend to be relatively small, making comparisons between subgroups difficult. Additionally, the use of a standardized stimulus (e.g., facial expression of anger) may not elicit a sufficiently strong response. Personally engaging stimuli, such as recalling a memory, may be more effective in inducing strong emotions (Isacowitz, Gershon, Allard, & Johnson, 2013).

Within the psychosocial level, research has focused on the environmental contributors to BD. A series of studies show that environmental stressors, particularly severe stressors (e.g., loss of a significant relationship), can adversely impact the course of BD. People with BD have substantially increased risk of relapse (Ellicott, Hammen, Gitlin, Brown, & Jamison, 1990) and
suffer more depressive symptoms (Johnson, Winett, Meyer, Greenhouse, & Miller, 1999) following a severe life stressor. Interestingly, positive life events can also adversely impact the course of BD. People with BD suffer more manic symptoms after life events involving attainment of a desired goal (Johnson et al., 2008). Such findings suggest that people with BD may have a hypersensitivity to rewards.

Evidence from the life stress literature has also suggested that people with mood disorders may have a circadian vulnerability that renders them sensitive to stressors that disrupt their sleep or rhythms. According to social zeitgeber theory (Ehlers, Frank, & Kupfer, 1988; Frank et al., 1994), stressors that disrupt sleep, or that disrupt the daily routines that entrain the biological clock (e.g., meal times) can trigger episode relapse. Consistent with this theory, studies have shown that life events that involve a disruption in sleep and daily routines, such as overnight travel, can increase bipolar symptoms in people with BD (Malkoff-Schwartz et al., 1998).

What Are Some of the Well-Supported Treatments for Mood Disorders?

**Depressive Disorders**

There are many treatment options available for people with MDD. First, a number of antidepressant medications are available, all of which target one or more of the neurotransmitters implicated in depression. The earliest antidepressant medications were monoamine oxidase inhibitors (MAOIs). MAOIs inhibit monoamine oxidase, an enzyme involved in deactivating dopamine, norepinephrine, and serotonin. Although effective in treating depression, MAOIs can have serious side effects. Patients taking MAOIs may develop dangerously high blood pressure if they take certain drugs (e.g., antihistamines) or eat foods containing tyramine, an amino acid commonly found in foods such as aged cheeses, wine, and soy sauce. Tricyclics, the second-oldest class of
antidepressant medications, block the reabsorption of norepinephrine, serotonin, or dopamine at synapses, resulting in their increased availability. Tricyclics are most effective for treating vegetative and somatic symptoms of depression. Like MAOIs, they have serious side effects, the most concerning of which is being cardiotoxic. Selective serotonin reuptake inhibitors (SSRIs; e.g., Fluoxetine) and serotonin and norepinephrine reuptake inhibitors (SNRIs; e.g., Duloxetine) are the most recently introduced antidepressant medications. SSRIs, the most commonly prescribed antidepressant medication, block the reabsorption of serotonin, whereas SNRIs block the reabsorption of serotonin and norepinephrine. SSRIs and SNRIs have fewer serious side effects than do MAOIs and tricyclics. In particular, they are less cardiotoxic, less lethal in overdose, and produce fewer cognitive impairments. They are not, however, without their own side effects, which include but are not limited to difficulty having orgasms, gastrointestinal issues, and insomnia. It should be noted that anti-depressant medication may not work equally for all people. This approach to treatment often involves experimentation with several medications and dosages, and may be more effective when paired with physical exercise and psychotherapy.

Other biological treatments for people with depression include electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), and deep brain stimulation. ECT involves inducing a seizure after a patient takes muscle relaxants and is under general anesthesia. ECT is viable treatment for patients with severe depression or who show resistance to antidepressants although the mechanisms through which it works remain unknown. A common side effect is confusion and memory loss, usually short-term (Schulze-Rauschenbach, Harms, Schlaepfer, Maier, Falkai, & Wagner, 2005). Repetitive TMS is a noninvasive technique administered while a patient is awake. Brief pulsating magnetic fields are delivered to the cortex, inducing electrical activity. TMS has fewer side effects than ECT (Schulze-Rauschenbach et al., 2005), and while outcome studies are mixed, there is evidence that TMS is a promising treatment for patients with MDD who have shown resistance to other treatments (Rosa et al., 2006). Most recently, deep brain stimulation is being examined as a treatment option for patients who did not respond to more traditional treatments like those already described. Deep brain stimulation involves implanting an electrode in the brain. The electrode is connected to an implanted neurostimulator, which electrically stimulates that particular brain region. Although there is some evidence of its effectiveness (Mayberg et al., 2005), additional research is needed.

Several psychosocial treatments have received strong empirical support, meaning that independent investigations have achieved similarly positive results—a high threshold for examining treatment outcomes. These treatments include but are not limited to behavior therapy, cognitive therapy, and interpersonal therapy. Behavior therapies focus on increasing the frequency and quality of experiences that are pleasant or help the patient achieve mastery.
Cognitive therapies primarily focus on helping patients identify and change distorted automatic thoughts and assumptions (e.g., Beck, 1967). Cognitive-behavioral therapies are based on the rationale that thoughts, behaviors, and emotions affect and are affected by each other. Interpersonal Therapy for Depression focuses largely on improving interpersonal relationships by targeting problem areas, specifically unresolved grief, interpersonal role disputes, role transitions, and interpersonal deficits. Finally, there is also some support for the effectiveness of Short-Term Psychodynamic Therapy for Depression (Leichsenring, 2001). The short-term treatment focuses on a limited number of important issues, and the therapist tends to be more actively involved than in more traditional psychodynamic therapy.

**Bipolar Disorders**

Patients with BD are typically treated with pharmacotherapy. Antidepressants such as SSRIs and SNRIs are the primary choice of treatment for depression, whereas for BD, lithium is the first line treatment choice. This is because SSRIs and SNRIs have the potential to induce mania or hypomania in patients with BD. Lithium acts on several neurotransmitter systems in the brain through complex mechanisms, including reduction of excitatory (dopamine and glutamate) neurotransmission, and increasing of inhibitory (GABA) neurotransmission (Lenox & Hahn, 2000). Lithium has strong efficacy for the treatment of BD (Geddes, Burgess, Hawton, Jamison, & Goodwin, 2004). However, a number of side effects can make lithium treatment difficult for patients to tolerate. Side effects include impaired cognitive function (Wingo, Wingo, Harvey, & Baldessarini, 2009), as well as physical symptoms such as nausea, tremor, weight gain, and fatigue (Dunner, 2000). Some of these side effects can improve with continued use; however, medication noncompliance remains an ongoing concern in the treatment of patients with BD. Anticonvulsant medications (e.g., carbamazepine, valproate) are also commonly used to treat patients with BD, either alone or in conjunction with lithium.

There are several adjunctive treatment options for people with BD. Interpersonal and social rhythm therapy (IPSRT; Frank et al., 1994) is a psychosocial intervention focused on addressing the mechanism of action posited in social zeitgeber theory to predispose patients who have BD to relapse, namely sleep disruption. A growing body of literature provides support for the central role of sleep dysregulation in BD (Harvey, 2008). Consistent with this literature, IPSRT aims to increase rhythmicity of patients’ lives and encourage vigilance in maintaining a stable rhythm. The therapist and patient work to develop and maintain a healthy balance of activity and stimulation such that the patient does not become overly active (e.g., by taking on too many projects) or inactive (e.g., by avoiding social contact). The efficacy of IPSRT has been demonstrated in that patients who received this treatment show reduced risk of episode recurrence and are more likely to remain well (Frank et al., 2005).
Conclusion

Everyone feels down or euphoric from time to time. For some people, these feelings can last for long periods of time and can also co-occur with other symptoms that, in combination, interfere with their everyday lives. When people experience an MDE or a manic episode, they see the world differently. During an MDE, people often feel hopeless about the future, and may even experience suicidal thoughts. During a manic episode, people often behave in ways that are risky or place them in danger. They may spend money excessively or have unprotected sex, often expressing deep shame over these decisions after the episode. MDD and BD cause significant problems for people at school, at work, and in their relationships and affect people regardless of gender, age, nationality, race, religion, or sexual orientation. If you or someone you know is suffering from a mood disorder, it is important to seek help. Effective treatments are available and continually improving. If you have an interest in mood disorders, there are many ways to contribute to their understanding, prevention, and treatment, whether by engaging in research or clinical work.
Outside Resources

Books: Recommended memoirs include A Memoir of Madness by William Styron (MDD); Noonday Demon: An Atlas of Depression by Andrew Solomon (MDD); and An Unquiet Mind: A Memoir of Moods and Madness by Kay Redfield (BD).

Web: Visit the Association for Behavioral and Cognitive Therapies to find a list of the recommended therapists and evidence-based treatments.
http://www.abct.org

Web: Visit the Depression and Bipolar Support Alliance for educational information and social support options.
http://www.dbsalliance.org/

Discussion Questions

1. What factors might explain the large gender difference in the prevalence rates of MDD?
2. Why might American ethnic minority groups experience more persistent BD than European Americans?
3. Why might the age of onset for MDD be decreasing over time?
4. Why might overnight travel constitute a potential risk for a person with BD?
5. What are some reasons positive life events may precede the occurrence of manic episode?
Vocabulary

Anhedonia
Loss of interest or pleasure in activities one previously found enjoyable or rewarding.

Attributional style
The tendency by which a person infers the cause or meaning of behaviors or events.

Chronic stress
Discrete or related problematic events and conditions which persist over time and result in prolonged activation of the biological and/or psychological stress response (e.g., unemployment, ongoing health difficulties, marital discord).

Early adversity
Single or multiple acute or chronic stressful events, which may be biological or psychological in nature (e.g., poverty, abuse, childhood illness or injury), occurring during childhood and resulting in a biological and/or psychological stress response.

Grandiosity
Inflated self-esteem or an exaggerated sense of self-importance and self-worth (e.g., believing one has special powers or superior abilities).

Hypersomnia
Excessive daytime sleepiness, including difficulty staying awake or napping, or prolonged sleep episodes.

Psychomotor agitation
Increased motor activity associated with restlessness, including physical actions (e.g., fidgeting, pacing, feet tapping, handwringing).

Psychomotor retardation
A slowing of physical activities in which routine activities (e.g., eating, brushing teeth) are performed in an unusually slow manner.

Social zeitgeber
Zeitgeber is German for “time giver.” Social zeitgebers are environmental cues, such as meal times and interactions with other people, that entrain biological rhythms and thus sleep-wake cycle regularity.
Socioeconomic status (SES)
A person's economic and social position based on income, education, and occupation.

Suicidal ideation
Recurring thoughts about suicide, including considering or planning for suicide, or preoccupation with suicide.
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Schizophrenia and the other psychotic disorders are some of the most impairing forms of psychopathology, frequently associated with a profound negative effect on the individual's educational, occupational, and social function. Sadly, these disorders often manifest right at time of the transition from adolescence to adulthood, just as young people should be evolving into independent young adults. The spectrum of psychotic disorders includes schizophrenia, schizoaffective disorder, delusional disorder, schizotypal personality disorder, schizophreniform disorder, brief psychotic disorder, as well as psychosis associated with substance use or medical conditions. In this module, we summarize the primary clinical features of these disorders, describe the known cognitive and neurobiological changes associated with schizophrenia, describe potential risk factors and/or causes for the development of schizophrenia, and describe currently available treatments for schizophrenia.

Learning Objectives

- Describe the signs and symptoms of schizophrenia and related psychotic disorders.
- Describe the most well-replicated cognitive and neurobiological changes associated with schizophrenia.
- Describe the potential risk factors for the development of schizophrenia.
- Describe the controversies associated with “clinical high risk” approaches to identifying individuals at risk for the development of schizophrenia.
- Describe the treatments that work for some of the symptoms of schizophrenia.
The phenomenology of schizophrenia and related psychotic disorders

Most of you have probably had the experience of walking down the street in a city and seeing a person you thought was acting oddly. They may have been dressed in an unusual way, perhaps disheveled or wearing an unusual collection of clothes, makeup, or jewelry that did not seem to fit any particular group or subculture. They may have been talking to themselves or yelling at someone you could not see. If you tried to speak to them, they may have been difficult to follow or understand, or they may have acted paranoid or started telling a bizarre story about the people who were plotting against them. If so, chances are that you have encountered an individual with schizophrenia or another type of psychotic disorder. If you have watched the movie *A Beautiful Mind* or *The Fisher King*, you have also seen a portrayal of someone thought to have schizophrenia. Sadly, a few of the individuals who have committed some of the recently highly publicized mass murders may have had schizophrenia, though most people who commit such crimes do not have schizophrenia. It is also likely that you have met people with schizophrenia without ever knowing it, as they may suffer in silence or stay isolated to protect themselves from the horrors they see, hear, or believe are operating in the outside world. As these examples begin to illustrate, psychotic disorders involve many different types of symptoms, including delusions, hallucinations, disorganized speech and behavior, abnormal motor behavior (including \textit{catatonia}), and negative symptoms such \textit{anhedonia/amotivation} and blunted affect/reduced speech.

**Delusions** are false beliefs that are often fixed, hard to change even when the person is presented with conflicting information, and are often culturally influenced in their content (e.g., delusions involving Jesus in Judeo-Christian cultures, delusions involving Allah in Muslim cultures). They can be terrifying for the person, who may remain convinced that they are true even when loved ones and friends present them with clear information that they cannot be true. There are many different types or themes to delusions.

The most common delusions are persecutory and involve the belief that individuals or...
groups are trying to hurt, harm, or plot against the person in some way. These can be people that the person knows (people at work, the neighbors, family members), or more abstract groups (the FBI, the CIA, aliens, etc.). Other types of delusions include grandiose delusions, where the person believes that they have some special power or ability (e.g., I am the new Buddha, I am a rock star); referential delusions, where the person believes that events or objects in the environment have special meaning for them (e.g., that song on the radio is being played specifically for me); or other types of delusions where the person may believe that others are controlling their thoughts and actions, their thoughts are being broadcast aloud, or that others can read their mind (or they can read other people's minds).

When you see a person on the street talking to themselves or shouting at other people, they are experiencing hallucinations. These are perceptual experiences that occur even when there is no stimulus in the outside world generating the experiences. They can be auditory, visual, olfactory (smell), gustatory (taste), or somatic (touch). The most common hallucinations in psychosis (at least in adults) are auditory, and can involve one or more voices talking about the person, commenting on the person's behavior, or giving them orders. The content of the hallucinations is frequently negative (“you are a loser,” “that drawing is stupid,” “you should go kill yourself”) and can be the voice of someone the person knows or a complete stranger. Sometimes the voices sound as if they are coming from outside the person's head. Other times the voices seem to be coming from inside the person's head, but are not experienced the same as the person's inner thoughts or inner speech.

Talking to someone with schizophrenia is sometimes difficult, as their speech may be difficult to follow, either because their answers do not clearly flow from your questions, or because one sentence does not logically follow from another. This is referred to as disorganized speech, and it can be present even when the person is writing. Disorganized behavior can include odd dress, odd makeup (e.g., lipstick outlining a mouth for 1 inch), or unusual rituals (e.g., repetitive hand gestures). Abnormal motor behavior can include catatonia, which refers to a variety of behaviors that seem to reflect a reduction in responsiveness to the external environment. This can include
holding unusual postures for long periods of time, failing to respond to verbal or motor prompts from another person, or excessive and seemingly purposeless motor activity.

Some of the most debilitating symptoms of schizophrenia are difficult for others to see. These include what people refer to as “negative symptoms” or the absence of certain things we typically expect most people to have. For example, anhedonia or amotivation reflect a lack of apparent interest in or drive to engage in social or recreational activities. These symptoms can manifest as a great amount of time spent in physical immobility. Importantly, anhedonia and amotivation do not seem to reflect a lack of enjoyment in pleasurable activities or events (Cohen & Minor, 2010; Kring & Moran, 2008; Llerena, Strauss, & Cohen, 2012) but rather a reduced drive or ability to take the steps necessary to obtain the potentially positive outcomes (Barch & Dowd, 2010). Flat affect and reduced speech (alogia) reflect a lack of showing emotions through facial expressions, gestures, and speech intonation, as well as a reduced amount of speech and increased pause frequency and duration.

In many ways, the types of symptoms associated with psychosis are the most difficult for us to understand, as they may seem far outside the range of our normal experiences. Unlike depression or anxiety, many of us may not have had experiences that we think of as on the same continuum as psychosis. However, just like many of the other forms of psychopathology described in this book, the types of psychotic symptoms that characterize disorders like schizophrenia are on a continuum with “normal” mental experiences. For example, work by Jim van Os in the Netherlands has shown that a surprisingly large percentage of the general population (10%+) experience psychotic-like symptoms, though many fewer have multiple experiences and most will not continue to experience these symptoms in the long run (Verdoux & van Os, 2002). Similarly, work in a general population of adolescents and young adults in Kenya has also shown that a relatively high percentage of individuals experience one or more psychotic-like experiences (~19%) at some point in their lives (Mamah et al., 2012; Ndetel et al., 2012), though again most will not go on to develop a full-blown psychotic disorder.

Schizophrenia is the primary disorder that comes to mind when we discuss “psychotic” disorders (see Table 1 for diagnostic criteria), though there are a number of other disorders that share one or more features with schizophrenia. In the remainder of this module, we will use the terms “psychosis” and “schizophrenia” somewhat interchangeably, given that most of the research has focused on schizophrenia. In addition to schizophrenia (see Table 1), other psychotic disorders include schizophreniform disorder (a briefer version of schizophrenia), schizoaffective disorder (a mixture of schizophreniform disorder and depression/mania symptoms), delusional disorder (the experience of only delusions), and brief psychotic disorder (psychotic symptoms that last only a few days or weeks).
The Cognitive Neuroscience of Schizophrenia

As described above, when we think of the core symptoms of psychotic disorders such as schizophrenia, we think of people who hear voices, see visions, and have false beliefs about reality (i.e., delusions). However, problems in cognitive function are also a critical aspect of psychotic disorders and of schizophrenia in particular. This emphasis on cognition in
Schizophrenia is in part due to the growing body of research suggesting that cognitive problems in schizophrenia are a major source of disability and loss of functional capacity (Green, 2006; Nuechterlein et al., 2011). The cognitive deficits that are present in schizophrenia are widespread and can include problems with episodic memory (the ability to learn and retrieve new information or episodes in one’s life), working memory (the ability to maintain information over a short period of time, such as 30 seconds), and other tasks that require one to “control” or regulate one’s behavior (Barch & Ceaser, 2012; Bora, Yucel, & Pantelis, 2009a; Fioravanti, Carlone, Vitale, Cinti, & Clare, 2005; Forbes, Carrick, McIntosh, & Lawrie, 2009; Mesholam-Gately, Giuliano, Goff, Faraone, & Seidman, 2009). Individuals with schizophrenia also have difficulty with what is referred to as “processing speed” and are frequently slower than healthy individuals on almost all tasks. Importantly, these cognitive deficits are present prior to the onset of the illness (Fusar-Poli et al., 2007) and are also present, albeit in a milder form, in the first-degree relatives of people with schizophrenia (Snitz, Macdonald, & Carter, 2006). This suggests that cognitive impairments in schizophrenia reflect part of the risk for the development of psychosis, rather than being an outcome of developing psychosis. Further, people with schizophrenia who have more severe cognitive problems also tend to have more severe negative symptoms and more disorganized speech and behavior (Barch, Carter, & Cohen, 2003; Barch et al., 1999; Dominguez Mde, Viechtbauer, Simons, van Os, & Krabbendam, 2009; Ventura, Hellemann, Thames, Koellner, & Nuechterlein, 2009; Ventura, Thames, Wood, Guzik, & Hellemann, 2010). In addition, people with more cognitive problems have worse function in everyday life (Bowie et al., 2008; Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Fett et al., 2011).

Some people with schizophrenia also show deficits in what is referred to as social cognition, though it is not clear whether such problems are separate from the cognitive problems described above or the result of them (Hoe, Nakagami, Green, & Brekke, 2012; Kerr & Neale, 1993; van Hooren et al., 2008). This includes problems with the recognition of emotional expressions on the faces of other individuals (Kohler, Walker, Martin, Healey, & Moberg, 2010) and problems inferring the intentions of other people (theory of mind) (Bora, Yucel, & Pantelis, 2009b).
Individuals with schizophrenia who have more problems with social cognition also tend to have more negative and disorganized symptoms (Ventura, Wood, & Hellemann, 2011), as well as worse community function (Fett et al., 2011).

The advent of neuroimaging techniques such as structural and functional magnetic resonance imaging and positron emission tomography opened up the ability to try to understand the brain mechanisms of the symptoms of schizophrenia as well as the cognitive impairments found in psychosis. For example, a number of studies have suggested that delusions in psychosis may be associated with problems in “salience” detection mechanisms supported by the ventral striatum (Jensen & Kapur, 2009; Jensen et al., 2008; Kapur, 2003; Kapur, Mizrahi, & Li, 2005; Murray et al., 2008) and the anterior prefrontal cortex (Corlett et al., 2006; Corlett, Honey, & Fletcher, 2007; Corlett, Murray, et al., 2007a, 2007b). These are regions of the brain that normally increase their activity when something important (aka “salient”) happens in the environment. If these brain regions misfire, it may lead individuals with psychosis to mistakenly attribute importance to irrelevant or unconnected events. Further, there is good evidence that problems in working memory and cognitive control in schizophrenia are related to problems in the function of a region of the brain called the dorsolateral prefrontal cortex (DLPFC) (Minzenberg, Laird, Thelen, Carter, & Glahn, 2009; Ragland et al., 2009). These problems include changes in how the DLPFC works when people are doing working-memory or cognitive-control tasks, and problems with how this brain region is connected to other brain regions important for working memory and cognitive control, including the posterior parietal cortex (e.g., Karlsgodt et al., 2008; J. J. Kim et al., 2003; Schlosser et al., 2003), the anterior cingulate (Repovs & Barch, 2012), and temporal cortex (e.g., Fletcher et al., 1995; Meyer-Lindenberg et al., 2001). In terms of understanding episodic memory problems in schizophrenia, many researchers have focused on medial temporal lobe deficits, with a specific focus on the hippocampus (e.g., Heckers & Konradi, 2010). This is because there is much data from humans and animals showing that the hippocampus is important for the creation of new memories (Squire, 1992). However, it has become increasingly clear that problems with the DLPFC also make important contributions to episodic memory deficits in schizophrenia (Ragland et al., 2009), probably because this part of the brain is important for controlling our use of memory.

In addition to problems with regions such as the DLPFC and medial temporal lobes in schizophrenia described above, magnitude resonance neuroimaging studies have also identified changes in cellular architecture, white matter connectivity, and gray matter volume in a variety of regions that include the prefrontal and temporal cortices (Bora et al., 2011). People with schizophrenia also show reduced overall brain volume, and reductions in brain volume as people get older may be larger in those with schizophrenia than in healthy people (Olabi et al., 2011). Taking antipsychotic medications or taking drugs such as marijuana,
alcohol, and tobacco may cause some of these structural changes. However, these structural changes are not completely explained by medications or substance use alone. Further, both functional and structural brain changes are seen, again to a milder degree, in the first-degree relatives of people with schizophrenia (Boos, Aleman, Cahn, Pol, & Kahn, 2007; Brans et al., 2008; Fusar-Poli et al., 2007; MacDonald, Thermenos, Barch, & Seidman, 2009). This again suggests that neural changes associated with schizophrenia are related to a genetic risk for this illness.

### Risk Factors for Developing Schizophrenia

It is clear that there are important genetic contributions to the likelihood that someone will develop schizophrenia, with consistent evidence from family, twin, and adoption studies. (Sullivan, Kendler, & Neale, 2003). However, there is no “schizophrenia gene” and it is likely that the genetic risk for schizophrenia reflects the summation of many different genes that each contribute something to the likelihood of developing psychosis (Gottesman & Shields, 1967; Owen, Craddock, & O’Donovan, 2010). Further, schizophrenia is a very heterogeneous disorder, which means that two different people with “schizophrenia” may each have very different symptoms (e.g., one has hallucinations and delusions, the other has disorganized speech and negative symptoms). This makes it even more challenging to identify specific genes associated with risk for psychosis. Importantly, many studies also now suggest that at least some of the genes potentially associated with schizophrenia are also associated with other mental health conditions, including bipolar disorder, depression, and autism (Gejman, Sanders, & Kendler, 2011; Y. Kim, Zerwas, Trace, & Sullivan, 2011; Owen et al., 2010; Rutter, Kim-Cohen, & Maughan, 2006).

There are also a number of environmental factors that are associated with an increased risk of developing schizophrenia. For example, problems during pregnancy such as increased stress, infection, malnutrition, and/or diabetes have been associated with increased risk of schizophrenia.

There are a number of genetic and environmental risk factors associated with higher likelihood of developing schizophrenia including older fathers, complications during pregnancy/delivery, family history of schizophrenia, and growing up in an urban environment. [Image: CC0 Public Domain]
In addition, complications that occur at the time of birth and which cause hypoxia (lack of oxygen) are also associated with an increased risk for developing schizophrenia (M. Cannon, Jones, & Murray, 2002; Miller et al., 2011). Children born to older fathers are also at a somewhat increased risk of developing schizophrenia. Further, using cannabis increases risk for developing psychosis, especially if you have other risk factors (Casadio, Fernandes, Murray, & Di Forti, 2011; Luzi, Morrison, Powell, di Forti, & Murray, 2008). The likelihood of developing schizophrenia is also higher for kids who grow up in urban settings (March et al., 2008) and for some minority ethnic groups (Bourque, van der Ven, & Malla, 2011). Both of these factors may reflect higher social and environmental stress in these settings. Unfortunately, none of these risk factors is specific enough to be particularly useful in a clinical setting, and most people with these “risk” factors do not develop schizophrenia. However, together they are beginning to give us clues as the neurodevelopmental factors that may lead someone to be at an increased risk for developing this disease.

An important research area on risk for psychosis has been work with individuals who may be at “clinical high risk.” These are individuals who are showing attenuated (milder) symptoms of psychosis that have developed recently and who are experiencing some distress or disability associated with these symptoms. When people with these types of symptoms are followed over time, about 35% of them develop a psychotic disorder (T. D. Cannon et al., 2008), most frequently schizophrenia (Fusar-Poli, McGuire, & Borgwardt, 2012). In order to identify these individuals, a new category of diagnosis, called “Attenuated Psychotic Syndrome,” was added to Section III (the section for disorders in need of further study) of the DSM-5 (see Table 1 for symptoms) (APA, 2013). However, adding this diagnostic category to the DSM-5 created a good deal of controversy (Batstra & Frances, 2012; Fusar-Poli & Yung, 2012). Many scientists and clinicians have been worried that including “risk” states in the DSM-5 would create mental disorders where none exist, that these individuals are often already seeking treatment for other problems, and that it is not clear that we have good treatments to stop these individuals from developing to psychosis. However, the counterarguments have been that there is evidence that individuals with high-risk symptoms develop psychosis at a much higher rate than individuals with other types of psychiatric symptoms, and that the inclusion of Attenuated Psychotic Syndrome in Section III will spur important research that might have clinical benefits. Further, there is some evidence that non-invasive treatments such as omega-3 fatty acids and intensive family intervention may help reduce the development of full-blown psychosis (Preti & Cella, 2010) in people who have high-risk symptoms.

**Treatment of Schizophrenia**

The currently available treatments for schizophrenia leave much to be desired, and the search
for more effective treatments for both the psychotic symptoms of schizophrenia (e.g., hallucinations and delusions) as well as cognitive deficits and negative symptoms is a highly active area of research. The first line of treatment for schizophrenia and other psychotic disorders is the use of antipsychotic medications. There are two primary types of antipsychotic medications, referred to as “typical” and “atypical.” The fact that “typical” antipsychotics helped some symptoms of schizophrenia was discovered serendipitously more than 60 years ago (Carpenter & Davis, 2012; Lopez-Munoz et al., 2005). These are drugs that all share a common feature of being a strong block of the D2 type dopamine receptor. Although these drugs can help reduce hallucinations, delusions, and disorganized speech, they do little to improve cognitive deficits or negative symptoms and can be associated with distressing motor side effects. The newer generation of antipsychotics is referred to as “atypical” antipsychotics. These drugs have more mixed mechanisms of action in terms of the receptor types that they influence, though most of them also influence D2 receptors. These newer antipsychotics are not necessarily more helpful for schizophrenia but have fewer motor side effects. However, many of the atypical antipsychotics are associated with side effects referred to as the “metabolic syndrome,” which includes weight gain and increased risk for cardiovascular illness, Type-2 diabetes, and mortality (Lieberman et al., 2005).

The evidence that cognitive deficits also contribute to functional impairment in schizophrenia has led to an increased search for treatments that might enhance cognitive function in schizophrenia. Unfortunately, as of yet, there are no pharmacological treatments that work consistently to improve cognition in schizophrenia, though many new types of drugs are currently under exploration. However, there is a type of psychological intervention, referred to as cognitive remediation, which has shown some evidence of helping cognition and function in schizophrenia. In particular, a version of this treatment called Cognitive Enhancement Therapy (CET) has been shown to improve cognition, functional outcome, social cognition, and to protect against gray matter loss (Eack et al., 2009; Eack, Greenwald, Hogarty, & Keshavan, 2010; Eack et al., 2010; Eack, Pogue-Geile, Greenwald, Hogarty, & Keshavan, 2010; Hogarty, Greenwald, & Eack, 2006) in young individuals with schizophrenia. The development of new treatments such as Cognitive Enhancement Therapy provides some hope that we will be able to develop new and better approaches to improving the lives of individuals with this serious mental health condition and potentially even prevent it some day.
Outside Resources


Web: National Alliance for the Mentally Ill. This is an excellent site for learning more about advocacy for individuals with major mental illnesses such as schizophrenia. http://www.nami.org/

Web: National Institute of Mental Health. This website has information on NIMH-funded schizophrenia research. http://www.nimh.nih.gov/health/topics/schizophrenia/index.shtml

Web: Schizophrenia Research Forum. This is an excellent website that contains a broad array of information about current research on schizophrenia. http://www.schizophreniaforum.org/

Discussion Questions
1. Describe the major differences between the major psychotic disorders.

2. How would one be able to tell when an individual is “delusional” versus having non-delusional beliefs that differ from the societal normal? How should cultural and sub-cultural variation been taken into account when assessing psychotic symptoms?

3. Why are cognitive impairments important to understanding schizophrenia?

4. Why has the inclusion of a new diagnosis (Attenuated Psychotic Syndrome) in Section III of the DSM-5 created controversy?

5. What are some of the factors associated with increased risk for developing schizophrenia? If we know whether or not someone has these risk factors, how well can we tell whether they will develop schizophrenia?

6. What brain changes are most consistent in schizophrenia?

7. Do antipsychotic medications work well for all symptoms of schizophrenia? If not, which symptoms respond better to antipsychotic medications?

8. Are there any treatments besides antipsychotic medications that help any of the symptoms of schizophrenia? If so, what are they?
Vocabulary

Alogia
A reduction in the amount of speech and/or increased pausing before the initiation of speech.

Anhedonia/amotivation
A reduction in the drive or ability to take the steps or engage in actions necessary to obtain the potentially positive outcome.

Catatonia
Behaviors that seem to reflect a reduction in responsiveness to the external environment. This can include holding unusual postures for long periods of time, failing to respond to verbal or motor prompts from another person, or excessive and seemingly purposeless motor activity.

Delusions
False beliefs that are often fixed, hard to change even in the presence of conflicting information, and often culturally influenced in their content.

Diagnostic criteria
The specific criteria used to determine whether an individual has a specific type of psychiatric disorder. Commonly used diagnostic criteria are included in the Diagnostic and Statistical Manual of Mental Disorder, 5th Edition (DSM-5) and the Internal Classification of Disorders, Version 9 (ICD-9).

Disorganized behavior
Behavior or dress that is outside the norm for almost all subcultures. This would include odd dress, odd makeup (e.g., lipstick outlining a mouth for 1 inch), or unusual rituals (e.g., repetitive hand gestures).

Disorganized speech
Speech that is difficult to follow, either because answers do not clearly follow questions or because one sentence does not logically follow from another.

Dopamine
A neurotransmitter in the brain that is thought to play an important role in regulating the function of other neurotransmitters.
Episodic memory
The ability to learn and retrieve new information or episodes in one's life.

Flat affect
A reduction in the display of emotions through facial expressions, gestures, and speech intonation.

Functional capacity
The ability to engage in self-care (cook, clean, bathe), work, attend school, and/or engage in social relationships.

Hallucinations
Perceptual experiences that occur even when there is no stimulus in the outside world generating the experiences. They can be auditory, visual, olfactory (smell), gustatory (taste), or somatic (touch).

Magnetic resonance imaging
A set of techniques that uses strong magnets to measure either the structure of the brain (e.g., gray matter and white matter) or how the brain functions when a person performs cognitive tasks (e.g., working memory or episodic memory) or other types of tasks.

Neurodevelopmental
Processes that influence how the brain develops either in utero or as the child is growing up.

Positron emission tomography
A technique that uses radio-labelled ligands to measure the distribution of different neurotransmitter receptors in the brain or to measure how much of a certain type of neurotransmitter is released when a person is given a specific type of drug or does a particularly cognitive task.

Processing speed
The speed with which an individual can perceive auditory or visual information and respond to it.

Psychopathology
Illnesses or disorders that involve psychological or psychiatric symptoms.

Working memory
The ability to maintain information over a short period of time, such as 30 seconds or less.
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10
Functions of Emotions
Hyisung Hwang & David Matsumoto

Emotions play a crucial role in our lives because they have important functions. This module describes those functions, dividing the discussion into three areas: the intrapersonal, the interpersonal, and the social and cultural functions of emotions. The section on the intrapersonal functions of emotion describes the roles that emotions play within each of us individually; the section on the interpersonal functions of emotion describes the meanings of emotions to our relationships with others; and the section on the social and cultural functions of emotion describes the roles and meanings that emotions have to the maintenance and effective functioning of our societies and cultures at large. All in all we will see that emotions are a crucially important aspect of our psychological composition, having meaning and function to each of us individually, to our relationships with others in groups, and to our societies as a whole.

Learning Objectives

- Gain an appreciation of the importance of emotion in human life.
- Understand the functions and meanings of emotion in three areas of life: the intrapersonal, interpersonal, and social–cultural.
- Give examples of the role and function of emotion in each of the three areas described.

Introduction

It is impossible to imagine life without emotion. We treasure our feelings—the joy at a ball
game, the pleasure of the touch of a loved one, or the fun with friends on a night out. Even negative emotions are important, such as the sadness when a loved one dies, the anger when violated, the fear that overcomes us in a scary or unknown situation, or the guilt or shame toward others when our sins are made public. Emotions color life experiences and give those experiences meaning and flavor.

In fact, emotions play many important roles in people’s lives and have been the topic of scientific inquiry in psychology for well over a century (Cannon, 1927; Darwin, 1872; James, 1890). This module explores why we have emotions and why they are important. Doing so requires us to understand the function of emotions, and this module does so below by dividing the discussion into three sections. The first concerns the intrapersonal functions of emotion, which refer to the role that emotions play within each of us individually. The second concerns the interpersonal functions of emotion, which refer to the role emotions play between individuals within a group. The third concerns the social and cultural functions of emotion, which refer to the role that emotions play in the maintenance of social order within a society. All in all, we will see that emotions inform us of who we are, what our relationships with others are like, and how to behave in social interactions. Emotions give meaning to events; without emotions, those events would be mere facts. Emotions help coordinate interpersonal relationships. And emotions play an important role in the cultural functioning of keeping human societies together.

Intrapersonal Functions of Emotion

Emotions Help us Act Quickly with Minimal Conscious Awareness

Emotions are rapid information-processing systems that help us act with minimal thinking (Tooby & Cosmides, 2008). Problems associated with birth, battle, death, and seduction have occurred throughout evolutionary history and emotions evolved to aid humans in adapting
to those problems rapidly and with minimal conscious cognitive intervention. If we did not have emotions, we could not make rapid decisions concerning whether to attack, defend, flee, care for others, reject food, or approach something useful, all of which were functionally adaptive in our evolutionary history and helped us to survive. For instance, drinking spoiled milk or eating rotten eggs has negative consequences for our welfare. The emotion of disgust, however, helps us immediately take action by not ingesting them in the first place or by vomiting them out. This response is adaptive because it aids, ultimately, in our survival and allows us to act immediately without much thinking. In some instances, taking the time to sit and rationally think about what to do, calculating cost–benefit ratios in one's mind, is a luxury that might cost one one's life. Emotions evolved so that we can act without that depth of thinking.

Emotions Prepare the Body for Immediate Action

Emotions prepare us for behavior. When triggered, emotions orchestrate systems such as perception, attention, inference, learning, memory, goal choice, motivational priorities, physiological reactions, motor behaviors, and behavioral decision making (Cosmides & Tooby, 2000; Tooby & Cosmides, 2008). Emotions simultaneously activate certain systems and deactivate others in order to prevent the chaos of competing systems operating at the same time, allowing for coordinated responses to environmental stimuli (Levenson, 1999). For instance, when we are afraid, our bodies shut down temporarily unneeded digestive processes, resulting in saliva reduction (a dry mouth); blood flows disproportionately to the lower half of the body; the visual field expands; and air is breathed in, all preparing the body to flee. Emotions initiate a system of components that includes subjective experience, expressive behaviors, physiological reactions, action tendencies, and cognition, all for the purposes of specific actions; the term “emotion” is, in reality, a metaphor for these reactions.

One common misunderstanding many people have when thinking about emotions, however,
is the belief that emotions must always directly produce action. This is not true. Emotion certainly prepares the body for action; but whether people actually engage in action is dependent on many factors, such as the context within which the emotion has occurred, the target of the emotion, the perceived consequences of one's actions, previous experiences, and so forth (Baumeister, Vohs, DeWall, & Zhang, 2007; Matsumoto & Wilson, 2008). Thus, emotions are just one of many determinants of behavior, albeit an important one.

**Emotions Influence Thoughts**

Emotions are also connected to thoughts and memories. Memories are not just facts that are encoded in our brains; they are colored with the emotions felt at those times the facts occurred (Wang & Ross, 2007). Thus, emotions serve as the neural glue that connects those disparate facts in our minds. That is why it is easier to remember happy thoughts when happy, and angry times when angry. Emotions serve as the affective basis of many attitudes, values, and beliefs that we have about the world and the people around us; without emotions those attitudes, values, and beliefs would be just statements without meaning, and emotions give those statements meaning. Emotions influence our thinking processes, sometimes in constructive ways, sometimes not. It is difficult to think critically and clearly when we feel intense emotions, but easier when we are not overwhelmed with emotions (Matsumoto, Hirayama, & LeRoux, 2006).

**Emotions Motivate Future Behaviors**

Because emotions prepare our bodies for immediate action, influence thoughts, and can be felt, they are important motivators of future behavior. Many of us strive to experience the feelings of satisfaction, joy, pride, or triumph in our accomplishments and achievements. At the same time, we also work very hard to avoid strong negative feelings; for example, once we have felt the emotion of disgust when drinking the spoiled milk, we generally work very hard to avoid having those feelings again (e.g., checking the expiration date on the label before buying the milk, smelling the milk before drinking it, watching if the milk curdles in one's coffee before drinking it). Emotions, therefore, not only influence immediate actions but also serve as an important motivational basis for future behaviors.

**Interpersonal Functions of Emotion**

Emotions are expressed both verbally through words and nonverbally through facial expressions, voices, gestures, body postures, and movements. We are constantly expressing
emotions when interacting with others, and others can reliably judge those emotional expressions (Elfenbein & Ambady, 2002; Matsumoto, 2001); thus, emotions have signal value to others and influence others and our social interactions. Emotions and their expressions communicate information to others about our feelings, intentions, relationship with the target of the emotions, and the environment. Because emotions have this communicative signal value, they help solve social problems by evoking responses from others, by signaling the nature of interpersonal relationships, and by providing incentives for desired social behavior (Keltner, 2003).

**Emotional Expressions Facilitate Specific Behaviors in Perceivers**

Because facial expressions of emotion are universal social signals, they contain meaning not only about the expressor’s psychological state but also about that person’s intent and subsequent behavior. This information affects what the perceiver is likely to do. People observing fearful faces, for instance, are more likely to produce approach-related behaviors, whereas people who observe angry faces are more likely to produce avoidance-related behaviors (Marsh, Ambady, & Kleck, 2005). Even subliminal presentation of smiles produces increases in how much beverage people pour and consume and how much they are willing to pay for it; presentation of angry faces decreases these behaviors (Winkielman, Berridge, & Wilbarger, 2005). Also, emotional displays evoke specific, complementary emotional responses from observers; for example, anger evokes fear in others (Dimberg & Ohman, 1996; Esteves, Dimberg, & Ohman, 1994), whereas distress evokes sympathy and aid (Eisenberg et al., 1989).

**Emotional Expressions Signal the Nature of Interpersonal Relationships**

Emotional expressions provide information about the nature of the relationships among
interactants. Some of the most important and provocative set of findings in this area come from studies involving married couples (Gottman & Levenson, 1992; Gottman, Levenson, & Woodin, 2001). In this research, married couples visited a laboratory after having not seen each other for 24 hours, and then engaged in intimate conversations about daily events or issues of conflict. Discrete expressions of contempt, especially by the men, and disgust, especially by the women, predicted later marital dissatisfaction and even divorce.

**Emotional Expressions Provide Incentives for Desired Social Behavior**

Facial expressions of emotion are important regulators of social interaction. In the developmental literature, this concept has been investigated under the concept of social referencing (Klinnert, Campos, & Sorce, 1983); that is, the process whereby infants seek out information from others to clarify a situation and then use that information to act. To date, the strongest demonstration of social referencing comes from work on the visual cliff. In the first study to investigate this concept, Campos and colleagues (Sorce, Emde, Campos, & Klinnert, 1985) placed mothers on the far end of the “cliff” from the infant. Mothers first smiled to the infants and placed a toy on top the safety glass to attract them; infants invariably began crawling to their mothers. When the infants were in the center of the table, however, the mother then posed an expression of fear, sadness, anger, interest, or joy. The results were clearly different for the different faces; no infant crossed the table when the mother showed fear; only 6% did when the mother posed anger, 33% crossed when the mother posed sadness, and approximately 75% of the infants crossed when the mother posed joy or interest.

Other studies provide similar support for facial expressions as regulators of social interaction. In one study (Bradshaw, 1986), experimenters posed facial expressions of neutral, anger, or disgust toward babies as they moved toward an object and measured the amount of inhibition the babies showed in touching the object. The results for 10- and 15-month olds were the same: anger produced the greatest inhibition, followed by disgust, with neutral the least. This study was later replicated (Hertenstein & Campos, 2004) using joy and disgust expressions, altering the method so that the infants were not allowed to touch the toy (compared with a distractor object) until one hour after exposure to the expression. At 14 months of age, significantly more infants touched the toy when they saw joyful expressions, but fewer touched the toy when the infants saw disgust.

**Social and Cultural Functions of Emotion**
If you stop to think about many things we take for granted in our daily lives, we cannot help but come to the conclusion that modern human life is a colorful tapestry of many groups and individual lives woven together in a complex yet functional way. For example, when you’re hungry, you might go to the local grocery store and buy some food. Ever stop to think about how you’re able to do that? You might buy a banana that was grown in a field in southeast Asia being raised by farmers there, where they planted the tree, cared for it, and picked the fruit. They probably handed that fruit off to a distribution chain that allowed multiple people somewhere to use tools such as cranes, trucks, cargo bins, ships or airplanes (that were also created by multiple people somewhere) to bring that banana to your store. The store had people to care for that banana until you came and got it and to barter with you for it (with your money). You may have gotten to the store riding a vehicle that was produced somewhere else in the world by others, and you were probably wearing clothes produced by some other people somewhere else.

Thus, human social life is complex. Individuals are members of multiple groups, with multiple social roles, norms, and expectations, and people move rapidly in and out of the multiple groups of which they are members. Moreover, much of human social life is unique because it revolves around cities, where many people of disparate backgrounds come together. This creates the enormous potential for social chaos, which can easily occur if individuals are not coordinated well and relationships not organized systematically.

One of the important functions of culture is to provide this necessary coordination and organization. Doing so allows individuals and groups to negotiate the social complexity of human social life, thereby maintaining social order and preventing social chaos. Culture does this by providing a meaning and information system to its members, which is shared by a group and transmitted across generations, that allows the group to meet basic needs of survival, pursue happiness and well-being, and derive meaning from life (Matsumoto & Juang, 2013). Culture is what allowed the banana from southeast Asia to appear on your table.
Cultural transmission of the meaning and information system to its members is, therefore, a
neutral aspect of culture. One of the ways this transmission occurs is through the development
of worldviews (including attitudes, values, beliefs, and norms) related to emotions (Matsumoto
& Hwang, 2013; Matsumoto et al., 2008). Worldviews related to emotions provide guidelines
for desirable emotions that facilitate norms for regulating individual behaviors and
interpersonal relationships. Our cultural backgrounds tell us which emotions are ideal to have,
and which are not (Tsai, Knutson, & Fung, 2006). The cultural transmission of information
related to emotions occurs in many ways, from childrearners to children, as well as from the
cultural products available in our world, such as books, movies, ads, and the like (Schönpflug,
2009; Tsai, Louie, Chen, & Uchida, 2007).

Cultures also inform us about what to do with our emotions—that is, how to manage or modify
them—when we experience them. One of the ways in which this is done is through the
management of our emotional expressions through cultural display rules (Friesen, 1972). These
are rules that are learned early in life that specify the management and modification of
our emotional expressions according to social circumstances. Thus, we learn that “big boys
don’t cry” or to laugh at the boss’s jokes even though they’re not funny. By affecting how
individuals express their emotions, culture also influences how people experience them as
Because one of the major functions of culture is to maintain social order in order to ensure group efficiency and thus survival, cultures create worldviews, rules, guidelines, and norms concerning emotions because emotions have important intra- and interpersonal functions, as described above, and are important motivators of behavior. Norms concerning emotion and its regulation in all cultures serve the purpose of maintaining social order. Cultural worldviews and norms help us manage and modify our emotional reactions (and thus behaviors) by helping us to have certain kinds of emotional experiences in the first place and by managing our reactions and subsequent behaviors once we have them. By doing so, our culturally moderated emotions can help us engage in socially appropriate behaviors, as defined by our cultures, and thus reduce social complexity and increase social order, avoiding social chaos. All of this allows us to live relatively harmonious and constructive lives in groups. If cultural worldviews and norms about emotions did not exist, people would just run amok having all kinds of emotional experiences, expressing their emotions and then behaving in all sorts of unpredictable and potentially harmful ways. If that were the case, it would be very difficult for groups and societies to function effectively, and even for humans to survive as a species, if emotions were not regulated in culturally defined ways for the common, social good. Thus, emotions play a critical role in the successful functioning of any society and culture.
Outside Resources

http://top.sagepub.com/content/27/2/102.short

CrashCourse (2014, August 4). Feeling all the feels: Crash course psychology #25. [Video file]. Retrieved from: https://www.youtube.com/watch?v=gAMbkJk6gnE


http://books.wwnorton.com/books/The-Feeling-Brain/

NPR News: Science Of Sadness And Joy: 'Inside Out' Gets Childhood Emotions Right

Online Psychology Laboratory: Motivation and Emotion resources
http://opl.apa.org/Resources.aspx#Motivation

Web: See how well you can read other people’s facial expressions of emotion
http://www.humintell.com/free-demos/

Discussion Questions

1. When emotions occur, why do they simultaneously activate certain physiological and psychological systems in the body and deactivate others?
2. Why is it difficult for people to act rationally and think happy thoughts when they are angry? Conversely, why is it difficult to remember sad memories or have sad thoughts when people are happy?

3. You’re walking down a deserted street when you come across a stranger who looks scared. What would you say? What would you do? Why?

4. You’re walking down a deserted street when you come across a stranger who looks angry. What would you say? What would you do? Why?

5. Think about the messages children receive from their environment (such as from parents, mass media, the Internet, Hollywood movies, billboards, and storybooks). In what ways do these messages influence the kinds of emotions that children should and should not feel?
Vocabulary

Cultural display rules
These are rules that are learned early in life that specify the management and modification of emotional expressions according to social circumstances. Cultural display rules can work in a number of different ways. For example, they can require individuals to express emotions “as is” (i.e., as they feel them), to exaggerate their expressions to show more than what is actually felt, to tone down their expressions to show less than what is actually felt, to conceal their feelings by expressing something else, or to show nothing at all.

Interpersonal
This refers to the relationship or interaction between two or more individuals in a group. Thus, the interpersonal functions of emotion refer to the effects of one’s emotion on others, or to the relationship between oneself and others.

Intrapersonal
This refers to what occurs within oneself. Thus, the intrapersonal functions of emotion refer to the effects of emotion to individuals that occur physically inside their bodies and psychologically inside their minds.

Social and cultural
Society refers to a system of relationships between individuals and groups of individuals; culture refers to the meaning and information afforded to that system that is transmitted across generations. Thus, the social and cultural functions of emotion refer to the effects that emotions have on the functioning and maintenance of societies and cultures.

Social referencing
This refers to the process whereby individuals look for information from others to clarify a situation, and then use that information to act. Thus, individuals will often use the emotional expressions of others as a source of information to make decisions about their own behavior.
References


How do people's cultural ideas and practices shape their emotions (and other types of feelings)? In this module, we will discuss findings from studies comparing North American (United States, Canada) and East Asian (Chinese, Japanese, Korean) contexts. These studies reveal both cultural similarities and differences in various aspects of emotional life. Throughout, we will highlight the scientific and practical importance of these findings and conclude with recommendations for future research.

Learning Objectives

- Review the history of cross-cultural studies of emotion
- Learn about recent empirical findings and theories of culture and emotion
- Understand why cultural differences in emotion matter
- Explore current and future directions in culture and emotion research

Take a moment and imagine you are traveling in a country you've never been to before. Everything—the sights, the smells, the sounds—seems strange. People are speaking a language you don't understand and wearing clothes unlike yours. But they greet you with a smile and you sense that, despite the differences you observe, deep down inside these people have the same feelings as you. But is this true? Do people from opposite ends of the world really feel the same emotions? While most scholars agree that members of different cultures may vary in the foods they eat, the languages they speak, and the holidays they celebrate, there is disagreement about the extent to which culture shapes people's emotions and feelings.
—including what people feel, what they express, and what they do during an emotional event. Understanding how culture shapes people’s emotional lives and what impact emotion has on psychological health and well-being in different cultures will not only advance the study of human behavior but will also benefit multicultural societies. Across a variety of settings—academic, business, medical—people worldwide are coming into more contact with people from foreign cultures. In order to communicate and function effectively in such situations, we must understand the ways cultural ideas and practices shape our emotions.

**Historical Background**

In the 1950s and 1960s, social scientists tended to fall into either one of two camps. The universalist camp claimed that, despite cultural differences in customs and traditions, at a fundamental level all humans feel similarly. These universalists believed that emotions evolved as a response to the environments of our primordial ancestors, so they are the same across all cultures. Indeed, people often describe their emotions as “automatic,” “natural,” “physiological,” and “instinctual,” supporting the view that emotions are hard-wired and universal.

The social constructivist camp, however, claimed that despite a common evolutionary heritage, different groups of humans evolved to adapt to their distinctive environments. And because human environments vary so widely, people’s emotions are also culturally variable. For instance, Lutz (1988) argued that many Western views of emotion assume that emotions are “singular events situated within individuals.” However, people from Ifaluk (a small island near Micronesia) view emotions as “exchanges between individuals” (p. 212). Social constructivists contended that because cultural ideas and practices are all-encompassing, people are often unaware of how their feelings are shaped by their culture. Therefore emotions can feel automatic, natural, physiological, and instinctual, and yet still be primarily culturally shaped.
In the 1970s, Paul Ekman conducted one of the first scientific studies to address the universalist–social constructivist debate. He and Wallace Friesen devised a system to measure people's facial muscle activity, called the Facial Action Coding System (FACS; Ekman & Friesen, 1978). Using FACS, Ekman and Friesen analyzed people's facial expressions and identified specific facial muscle configurations associated with specific emotions, such as happiness, anger, sadness, fear, disgust. Ekman and Friesen then took photos of people posing with these different expressions (Figure 1). With the help of colleagues at different universities around the world, Ekman and Friesen showed these pictures to members of vastly different cultures, gave them a list of emotion words (translated into the relevant languages), and asked them to match the facial expressions in the photos with their corresponding emotion words on the list (Ekman & Friesen, 1971; Ekman et al., 1987).

Across cultures, participants “recognized” the emotional facial expressions, matching each picture with its “correct” emotion word at levels greater than chance. This led Ekman and his colleagues to conclude that there are universally recognized emotional facial expressions. At the same time, though, they found considerable variability across cultures in recognition rates. For instance, whereas 95% of U.S. participants associated a smile with “happiness,” only 69% of Sumatran participants did. Similarly, 86% of U.S. participants associated wrinkling of the nose with “disgust,” but only 60% of Japanese did (Ekman et al., 1987). Ekman and colleagues interpreted this variation as demonstrating cultural differences in “display rules,” or rules about what emotions are appropriate to show in a given situation (Ekman, 1972). Indeed, since this initial work, Matsumoto and his colleagues have demonstrated widespread cultural differences in display rules (Safdar et al., 2009). One prominent example of such differences is biting one's tongue. In India, this signals embarrassment; however, in the U.S. this expression has no such meaning (Haidt & Keltner, 1999).
These findings suggest both cultural similarities and differences in the recognition of emotional facial expressions (although see Russell, 1994, for criticism of this work). Interestingly, since the mid-2000s, increasing research has demonstrated cultural differences not only in display rules, but also the degree to which people focus on the face (versus other aspects of the social context; Masuda, Ellsworth, Mesquita, Leu, Tanida, & Van de Veerdonk, 2008), and on different features of the face (Yuki, Maddux, & Matsuda, 2007) when perceiving others’ emotions. For example, people from the United States tend to focus on the mouth when interpreting others’ emotions, whereas people from Japan tend to focus on the eyes.

But how does culture shape other aspects of emotional life—such as how people emotionally respond to different situations, how they want to feel generally, and what makes them happy? Today, most scholars agree that emotions and other related states are multifaceted, and that cultural similarities and differences exist for each facet. Thus, rather than classifying emotions as either universal or socially-constructed, scholars are now attempting to identify the specific similarities and differences of emotional life across cultures. These endeavors are yielding new insights into the effects of cultural on emotion.

Current and Research Theory

Given the wide range of cultures and facets of emotion in the world, for the remainder of the module we will limit our scope to the two cultural contexts that have received the most empirical attention by social scientists: North America (United States, Canada) and East Asia (China, Japan, and Korea). Social scientists have focused on North American and East Asian contexts because they differ in obvious ways, including their geographical locations, histories, languages, and religions. Moreover, since the 1980s large-scale studies have revealed that North American and East Asian contexts differ in their overall values and attitudes, such as the prioritization of personal vs. group needs (individualism vs. collectivism; Hofstede, 2001). Whereas North American contexts encourage members to prioritize personal over group needs (to be “individualistic”), East Asian contexts encourage members to prioritize group over personal needs (to be “collectivistic”).

Cultural Models of Self in North American and East Asian Contexts

In a landmark paper, cultural psychologists Markus and Kitayama (1991) proposed that previously observed differences in individualism and collectivism translated into different models of the self—or one’s personal concept of who s/he is as a person. Specifically, the researchers argued that in North American contexts, the dominant model of the self is an independent one, in which being a person means being distinct from others and behaving
across situations. In East Asian contexts, however, the dominant model of the self is an interdependent one, in which being a person means being fundamentally connected to others and being responsive to situational demands. For example, in a classic study (Cousins, 1989), American and Japanese students were administered the Twenty Statements Test, in which they were asked to complete the sentence stem, “I am _____,” twenty times. U.S. participants were more likely than Japanese participants to complete the stem with psychological attributes (e.g., friendly, cheerful); Japanese participants, on the other hand, were more likely to complete the stem with references to social roles and responsibilities (e.g., a daughter, a student) (Cousins, 1989). These different models of the self result in different principles for interacting with others. An independent model of self teaches people to express themselves and try to influence others (i.e., change their environments to be consistent with their own beliefs and desires). In contrast, an interdependent model of self teaches people to suppress their own beliefs and desires and adjust to others’ (i.e., fit in with their environment) (Heine, Lehman, Markus, & Kitayama, 1999; Morling, Kitayama, & Miyamoto, 2002; Weisz, Rothbaum, & Blackburn, 1984). Markus and Kitayama (1991) argue that these different models of self have significant implications for how people in Western and East Asian contexts feel.

Cultural Similarities and Differences in Emotion: Comparisons of North American and East Asian Contexts

A considerable body of empirical research suggests that these different models of self shape various aspects of emotional dynamics. Next we will discuss several ways culture shapes emotion, starting with emotional response.

People’s Physiological Responses to Emotional Events Are Similar Across Cultures, but Culture Influences People’s Facial Expressive Behavior

How does culture influence people’s responses to emotional events? Studies of emotional response tend to focus on three components: physiology (e.g., how fast one’s heart beats), subjective experience (e.g., feeling intensely happy or sad), and facial expressive behavior (e.g., smiling or frowning). Although only a few studies have simultaneously measured these different aspects of emotional response, those that do tend to observe more similarities than differences in physiological responses between cultures. That is, regardless of culture, people tend to respond similarly in terms of physiological (or bodily) expression. For instance, in one study, European American and Hmong (pronounced “muhng”) American participants were
asked to relive various emotional episodes in their lives (e.g., when they lost something or someone they loved; when something good happened) (Tsai, Chentsova-Dutton, Freire-Bebeau, & Przymus, 2002). At the level of physiological arousal (e.g., heart rate), there were no differences in how the participants responded. However, their facial expressive behavior told a different story. When reliving events that elicited happiness, pride, and love, European Americans smiled more frequently and more intensely than did their Hmong counterparts—though all participants reported feeling happy, proud, and in love at similar levels of intensity. And similar patterns have emerged in studies comparing European Americans with Chinese Americans during different emotion-eliciting tasks (Tsai et al., 2002; Tsai, Levenson, & McCoy, 2006; Tsai, Levenson, & Carstensen, 2000). Thus, while the physiological aspects of emotional responses appear to be similar across cultures, their accompanying facial expressions are more culturally distinctive.

Again, these differences in facial expressions during positive emotional events are consistent with findings from cross-cultural studies of display rules, and stem from the models of self-description discussed above: In North American contexts that promote an independent self, individuals tend to express their emotions to influence others. Conversely, in East Asian contexts that promote an interdependent self, individuals tend to control and suppress their emotions to adjust to others.

**People Suppress Their Emotions Across Cultures, but Culture Influences the Consequences of Suppression for Psychological Well-Being**

If the cultural ideal in North American contexts is to express oneself, then suppressing emotions (not showing how one feels) should have negative consequences. This is the
assumption underlying hydraulic models of emotion: the idea that emotional suppression and repression impair psychological functioning (Freud, 1910). Indeed, significant empirical research shows that suppressing emotions can have negative consequences for psychological well-being in North American contexts (Gross, 1998). However, Soto and colleagues (2011) find that the relationship between suppression and psychological well-being varies by culture. True, with European Americans, emotional suppression is associated with higher levels of depression and lower levels of life satisfaction. (Remember, in these individualistic societies, the expression of emotion is a fundamental aspect of positive interactions with others.) On the other hand, since for Hong Kong Chinese, emotional suppression is needed to adjust to others (in this interdependent community, suppressing emotions is how to appropriately interact with others), it is simply a part of normal life and therefore not associated with depression or life satisfaction.

These findings are consistent with research suggesting that factors related to clinical depression vary between European Americans and Asian Americans. European Americans diagnosed with depression show dampened or muted emotional responses (Bylsma, Morris, & Rottenberg, 2008). For instance, when shown sad or amusing film clips, depressed European Americans respond less intensely than their nondepressed counterparts. However, other studies have shown that depressed East Asian Americans (i.e., people of East Asian descent who live in the United States) demonstrate similar or increased emotional responses compared with their nondepressed counterparts (Chentsova-Dutton et al., 2007; Chentsova-Dutton, Tsai, & Gotlib, 2010). In other words, depressed European Americans show reduced emotional expressions, but depressed East Asian Americans do not—and, in fact, may express more emotion. Thus, muted responses (which resemble suppression) are associated with depression in European American contexts, but not in East Asian contexts.

People Feel Good During Positive Events, but Culture Influences Whether People
Feel Bad During Positive Events

What about people’s subjective emotional experiences? Do people across cultures feel the same emotions in similar situations, despite how they show them? Recent studies indicate that culture affects whether people are likely to feel bad during good events. In North American contexts, people rarely feel bad after good experiences. However, a number of research teams have observed that, compared with people in North American contexts, people in East Asian contexts are more likely to feel bad and good (“mixed” emotions) during positive events (e.g., feeling worried after winning an important competition; Miyamoto, Uchida, & Ellsworth, 2010). This may be because, compared with North Americans, East Asians engage in more dialectical thinking (i.e., they are more tolerant of contradiction and change). Therefore, they accept that positive and negative feelings can occur simultaneously. In addition, whereas North Americans value maximizing positive states and minimizing negative ones, East Asians value a greater balance between the two (Sims, Tsai, Wang, Fung, & Zhang, 2013). To better understand this, think about how you would feel after getting the top score on a test that’s graded on a curve. In North American contexts, such success is considered an individual achievement and worth celebrating. But what about the other students who will now receive a lower grade because you “raised the curve” with your good grade? In East Asian contexts, not only would students be more thoughtful of the overall group’s success, but they would also be more comfortable acknowledging both the positive (their own success on the test) and the negative (their classmates’ lower grades).

Again, these differences can be linked to cultural differences in models of the self. An interdependent model encourages people to think about how their accomplishments might affect others (e.g., make others feel bad or jealous). Thus, awareness of negative emotions during positive events may discourage people from expressing their excitement and standing out (as in East Asian contexts). Such emotional suppression helps individuals feel in sync with those around them. An independent model, however, encourages people to express themselves and stand out, so when something good happens, they have no reason to feel bad.

So far, we have reviewed research that demonstrates cultural similarities in physiological responses and in the ability to suppress emotions. We have also discussed the cultural differences in facial expressive behavior and the likelihood of experiencing negative feelings during positive events. Next, we will explore how culture shapes people’s ideal or desired states.

People Want to Feel Good Across Cultures, but Culture Influences the Specific Good States People Want to Feel (Their “Ideal Affect”)
Everyone welcomes positive feelings, but cultures vary in the specific types of positive affective states (see Figure 2) their people favor. An affective state is essentially the type of emotional arousal one feels coupled with its intensity—which can vary from pleasant to unpleasant (e.g., happy to sad), with high to low arousal (e.g., energetic to passive). Although people of all cultures experience this range of affective states, they can vary in their preferences for each. For example, people in North American contexts lean toward feeling excited, enthusiastic, energetic, and other “high arousal positive” states. People in East Asian contexts, however, generally prefer feeling calm, peaceful, and other “low arousal positive” states (Tsai, Knutson, & Fung, 2006). These cultural differences have been observed in young children between the ages of 3 and 5, college students, and adults between the ages of 60 and 80 (Tsai, Louie, Chen, & Uchida, 2007; Tsai, Sims, Thomas, & Fung, 2013), and are reflected in widely-distributed cultural products. For example, wherever you look in American contexts—women's magazines, children's storybooks, company websites, and even Facebook profiles (Figure 3)—you will find more open, excited smiles and fewer closed, calm smiles compared to Chinese contexts (Chim, Moon, Ang, Tsai, 2013; Tsai, 2007; Tsai, Louie, et al., 2007).

![Two-Dimensional Map of Affective States](image)

Figure 2: Adapted from Feldman, Barrett, and Russell (1999); Larsen and Diener (1992); Russell (1991); Thayer (1989); Watson and Tellegen (1985)
Again, these differences in ideal affect (i.e., the emotional states that people believe are best) correspond to the independent and interdependent models described earlier: Independent selves want to influence others, which requires action (*doingsomething*), and action involves high arousal states. Conversely, interdependent selves want to adjust to others, which requires suspending action and attending to others—both of which involve low arousal states. Thus, the more that individuals and cultures want to influence others (as in North American contexts), the more they value excitement, enthusiasm, and other high arousal positive states. And, the more that individuals and cultures want to adjust to others (as in East Asian contexts), the more they value calm, peacefulness, and other low arousal positive states (Tsai, Miao, Seppala, Fung, & Yeung, 2007).

Because one’s ideal affect functions as a guide for behavior and a way of evaluating one’s emotional states, cultural differences in ideal affect can result in different emotional lives. For example, several studies have shown that people engage in activities (e.g., recreational pastimes, musical styles) consistent with their cultural ideal affect. That is, people from North American contexts (who value high arousal affective states) tend to prefer thrilling activities like skydiving, whereas people from East Asian contexts (who value low arousal affective states) prefer tranquil activities like lounging on the beach (Tsai, 2007). In addition, people base their conceptions of well-being and happiness on their ideal affect. Therefore, European Americans are more likely to define well-being in terms of excitement, whereas Hong Kong Chinese are more likely to define well-being in terms of calmness. Indeed, among European Americans, the less people experience high arousal positive states, the more depressed they are. But, among Hong Kong Chinese—you guessed it!—the less people experience low arousal positive states, the more depressed they are (Tsai, Knutson, & Fung, 2006).
People Base Their Happiness on Similar Factors Across Cultures, but Culture Influences the Weight Placed on Each Factor

What factors make people happy or satisfied with their lives? We have seen that discrepancies between how people actually feel (actual affect) and how they want to feel (ideal affect)—as well as people's suppression of their ideal affect—are associated with depression. But happiness is based on other factors as well. For instance, Kwan, Bond, & Singelis (1997) found that while European Americans and Hong Kong Chinese subjects both based life satisfaction on how they felt about themselves (self-esteem) and their relationships (relationship harmony), their weighting of each factor was different. That is, European Americans based their life satisfaction primarily on self-esteem, whereas Hong Kong Chinese based their life satisfaction equally on self-esteem and relationship harmony. Consistent with these findings, Oishi and colleagues (1999) found in a study of 39 nations that self-esteem was more strongly correlated with life satisfaction in more individualistic nations compared to more collectivistic ones. Researchers also found that in individualistic cultures people rated life satisfaction based on their emotions more so than on social definitions (or norms). In other words, rather than using social norms as a guideline for what constitutes an ideal life, people in individualistic cultures tend to evaluate their satisfaction according to how they feel emotionally. In collectivistic cultures, however, people's life satisfaction tends to be based on a balance between their emotions and norms (Suh, Diener, Oishi, & Triandis, 1998). Similarly, other researchers have recently found that people in North American contexts are more likely to feel negative when they have poor mental and physical health, while people in Japanese contexts don't have this association (Curhan et al., 2013).

Again, these findings are consistent with cultural differences in models of the self. In North American, independent contexts, feelings about the self matter more, whereas in East Asian, interdependent contexts, feelings about others matter as much as or even more than feelings...
Why Do Cultural Similarities And Differences In Emotion Matter?

Understanding cultural similarities and differences in emotion is obviously critical to understanding emotions in general, and the flexibility of emotional processes more specifically. Given the central role that emotions play in our interaction, understanding cultural similarities and differences is especially critical to preventing potentially harmful miscommunications. Although misunderstandings are unintentional, they can result in negative consequences—as we’ve seen historically for ethnic minorities in many cultures. For instance, across a variety of North American settings, Asian Americans are often characterized as too “quiet” and “reserved,” and these low arousal states are often misinterpreted as expressions of disengagement or boredom—rather than expressions of the ideal of calmness. Consequently, Asian Americans may be perceived as “cold,” “stoic,” and “unfriendly,” fostering stereotypes of Asian Americans as “perpetual foreigners” (Cheryan & Monin, 2005). Indeed, this may be one reason Asian Americans are often overlooked for top leadership positions (Hyun, 2005).

In addition to averting cultural miscommunications, recognizing cultural similarities and differences in emotion may provide insights into other paths to psychological health and well-being. For instance, findings from a recent series of studies suggest that calm states are easier to elicit than excited states, suggesting that one way of increasing happiness in cultures that value excitement may be to increase the value placed on calm states (Chim, Tsai, Hogan, & Fung, 2013).

Current Directions In Culture And Emotion Research

What About Other Cultures?

In this brief review, we’ve focused primarily on comparisons between North American and East Asian contexts because most of the research in cultural psychology has focused on these comparisons. However, there are obviously a multitude of other cultural contexts in which emotional differences likely exist. For example, although Western contexts are similar in many ways, specific Western contexts (e.g., American vs. German) also differ from each other in substantive ways related to emotion (Koopmann-Holm & Matsumoto, 2011). Thus, future research examining other cultural contexts is needed. Such studies may also reveal additional, uninvestigated dimensions or models that have broad implications for emotion. In addition,
because more and more people are being raised within multiple cultural contexts (e.g., for many Chinese Americans, a Chinese immigrant culture at home and mainstream American culture at school), more research is needed to examine how people negotiate and integrate these different cultures in their emotional lives (for examples, see De Leersnyder, Mesquita, & Kim, 2011; Perunovic, Heller, & Rafaeli, 2007).

How Are Cultural Differences in Beliefs About Emotion Transmitted?

According to Kroeber and Kluckhohn (1952), cultural ideas are reflected in and reinforced by practices, institutions, and products. As an example of this phenomenon—and illustrating the point regarding cultural differences in ideal affect—bestselling children's storybooks in the United States often contain more exciting and less calm content (smiles and activities) than do bestselling children's storybooks in Taiwan (Tsai, Louie, et al., 2007). To investigate this further, the researchers randomly assigned European American, Asian American, and Taiwanese Chinese preschoolers to be read either stories with exciting content or stories with calm content. Across all of these cultures, the kids who were read stories with exciting content were afterward more likely to value excited states, whereas those who were read stories with calm content were more likely to value calm states. As a test, after hearing the stories, the kids were shown a list of toys and asked to select their favorites. Those who heard the exciting stories wanted to play with more arousing toys (like a drum that beats loud and fast), whereas those who heard the calm stories wanted to play with less arousing toys (like a drum that beats quiet and slow). These findings suggest that regardless of ethnic background, direct exposure to storybook content alters children's ideal affect. More studies are needed to assess whether a similar process occurs when children and adults are chronically exposed to various types of cultural products. As well, future studies should examine other ways cultural ideas regarding emotion are transmitted (e.g., via interactions with parents and teachers).
Could These Cultural Differences Be Due to Temperament?

An alternative explanation for cultural differences in emotion is that they are due to temperamental factors—that is, biological predispositions to respond in certain ways. (Might European Americans just be more emotional than East Asians because of genetics?) Indeed, most models of emotion acknowledge that both culture and temperament play roles in emotional life, yet few if any models indicate how. Nevertheless, most researchers believe that despite genetic differences in founder populations (i.e., the migrants from a population who leave to create their own societies), culture has a greater impact on emotions. For instance, one theoretical framework, Affect Valuation Theory, proposes that cultural factors shape how people want to feel (“ideal affect”) more than how they actually feel (“actual affect”); conversely, temperamental factors influence how people actually feel more than how they want to feel (Tsai, 2007) (see Figure 4).

To test this hypothesis, European American, Asian American, and Hong Kong Chinese participants completed measures of temperament (i.e., stable dispositions, such as neuroticism or extraversion), actual affect (i.e., how people actually feel in given situations), ideal affect (i.e., how people would like to feel in given situations), and influential cultural values (i.e., personal beliefs transmitted through culture). When researchers analyzed the participants’ responses, they found that differences in ideal affect between cultures were associated more with cultural factors than with temperamental factors (Tsai, Knutson, & Fung, 2006). However, when researchers examined actual affect, they found this to be reversed: actual affect was more strongly associated with temperamental factors than cultural factors. Not all of the studies described above have ruled out a temperamental explanation, though, and more studies are needed to rule out the possibility that the observed group differences

Figure 4: Affect valuation theory. Thicker lines indicate stronger predicted relationships.
are due to genetic factors instead of, or in addition to, cultural factors. Moreover, future studies should examine whether the links between temperament and emotions might vary across cultures, and how cultural and temperamental factors work together to shape emotion.

**Summary**

Based on studies comparing North American and East Asian contexts, there is clear evidence for cultural similarities and differences in emotions, and most of the differences can be traced to different cultural models of the self.

Consider your own concept of self for a moment. What kinds of pastimes do you prefer—activities that make you excited, or ones that make you calm? What kinds of feelings do you strive for? What is your ideal affect? Because emotions seem and feel so instinctual to us, it's hard to imagine that the way we experience them and the ones we desire are anything other than biologically programmed into us. However, as current research has shown (and as future research will continue to explore), there are myriad ways in which culture, both consciously and unconsciously, shapes people's emotional lives.
Outside Resources

Audio Interview: The Really Big Questions “What Are Emotions?” Interview with Paul Ekman, Martha Nussbaum, Dominique Moisi, and William Reddy

Book: Ed Diener and Robert Biswas-Diener: Happiness: Unlocking the Mysteries of Psychological Wealth

Book: Eric Weiner: The Geography of Bliss

Book: Eva Hoffmann: Lost in Translation: Life in a New Language

Book: Hazel Markus: Clash: 8 Cultural Conflicts That Make Us Who We Are

Video: Social Psychology Alive
http://psychology.stanford.edu/~tsailab/PDF/socpsychalive.wmv

Video: The Really Big Questions “Culture and Emotion,” Dr. Jeanne Tsai
http://youtu.be/RQaEaUwNoiw

Video: Tsai's description of cultural differences in emotion
http://youtu.be/T46EZ8LH8Ss

Web: Acculturation and Culture Collaborative at Leuven
http://ppw.kuleuven.be/home/english/research/cscp/acc-research

Web: Culture and Cognition at the University of Michigan
http://culturecognition.isr.umich.edu/

Web: Experts In Emotion Series, Dr. June Gruber, Department of Psychology, Yale University
http://www.yalepeplab.com/teaching/psych131_summer2013/expertseries.php

Web: Georgetown Culture and Emotion Lab
http://georgetownculturerlab.wordpress.com/

Web: Paul Ekman's website
http://www.paulekman.com
Discussion Questions

1. What cultural ideas and practices related to emotion were you exposed to when you were a child? What cultural ideas and practices related to emotion are you currently exposed to as an adult? How do you think they shape your emotional experiences and expressions?

2. How can researchers avoid inserting their own beliefs about emotion in their research?

3. Most of the studies described above are based on self-report measures. What are some of the advantages and disadvantages of using self-report measures to understand the cultural shaping of emotion? How might the use of other behavioral methods (e.g., neuroimaging) address some of these limitations?

4. Do the empirical findings described above change your beliefs about emotion? How?

5. Imagine you are a manager of a large American company that is beginning to do work in China and Japan. How will you apply your current knowledge about culture and emotion to prevent misunderstandings between you and your Chinese and Japanese employees?
Vocabulary

Affect
Feelings that can be described in terms of two dimensions, the dimensions of arousal and valence (Figure 2). For example, high arousal positive states refer to excitement, elation, and enthusiasm. Low arousal positive states refer to calm, peacefulness, and relaxation. Whereas “actual affect” refers to the states that people actually feel, “ideal affect” refers to the states that people ideally want to feel.

Culture
Shared, socially transmitted ideas (e.g., values, beliefs, attitudes) that are reflected in and reinforced by institutions, products, and rituals.

Emotions
Changes in subjective experience, physiological responding, and behavior in response to a meaningful event. Emotions tend to occur on the order of seconds (in contrast to moods which may last for days).

Feelings
A general term used to describe a wide range of states that include emotions, moods, traits and that typically involve changes in subjective experience, physiological responding, and behavior in response to a meaningful event. Emotions typically occur on the order of seconds, whereas moods may last for days, and traits are tendencies to respond a certain way across various situations.

Independent self
A model or view of the self as distinct from others and as stable across different situations. The goal of the independent self is to express and assert the self, and to influence others. This model of self is prevalent in many individualistic, Western contexts (e.g., the United States, Australia, Western Europe).

Interdependent self
A model or view of the self as connected to others and as changing in response to different situations. The goal of the interdependent self is to suppress personal preferences and desires, and to adjust to others. This model of self is prevalent in many collectivistic, East Asian contexts (e.g., China, Japan, Korea).

Social constructivism
Social constructivism proposes that knowledge is first created and learned within a social context and is then adopted by individuals.

Universalism
Universalism proposes that there are single objective standards, independent of culture, in basic domains such as learning, reasoning, and emotion that are a part of all human experience.
References


Basic principles of learning are always operating and always influencing human behavior. This module discusses the two most fundamental forms of learning -- classical (Pavlovian) and instrumental (operant) conditioning. Through them, we respectively learn to associate 1) stimuli in the environment, or 2) our own behaviors, with significant events, such as rewards and punishments. The two types of learning have been intensively studied because they have powerful effects on behavior, and because they provide methods that allow scientists to analyze learning processes rigorously. This module describes some of the most important things you need to know about classical and instrumental conditioning, and it illustrates some of the many ways they help us understand normal and disordered behavior in humans. The module concludes by introducing the concept of observational learning, which is a form of learning that is largely distinct from classical and operant conditioning.

Learning Objectives

- Distinguish between classical (Pavlovian) conditioning and instrumental (operant) conditioning.
- Understand some important facts about each that tell us how they work.
- Understand how they work separately and together to influence human behavior in the world outside the laboratory.
- Students will be able to list the four aspects of observational learning according to Social Learning Theory.
Two Types of Conditioning

Although Ivan Pavlov won a Nobel Prize for studying digestion, he is much more famous for something else: working with a dog, a bell, and a bowl of saliva. Many people are familiar with the classic study of “Pavlov’s dog,” but rarely do they understand the significance of its discovery. In fact, Pavlov’s work helps explain why some people get anxious just looking at a crowded bus, why the sound of a morning alarm is so hated, and even why we swear off certain foods we’ve only tried once. Classical (or Pavlovian) conditioning is one of the fundamental ways we learn about the world around us. But it is far more than just a theory of learning; it is also arguably a theory of identity. For, once you understand classical conditioning, you’ll recognize that your favorite music, clothes, even political candidate, might all be a result of the same process that makes a dog drool at the sound of bell.

Around the turn of the 20th century, scientists who were interested in understanding the behavior of animals and humans began to appreciate the importance of two very basic forms of learning. One, which was first studied by the Russian physiologist Ivan Pavlov, is known as classical, or Pavlovian conditioning. In his famous experiment, Pavlov rang a bell and then gave a dog some food. After repeating this pairing multiple times, the dog eventually treated the bell as a signal for food, and began salivating in anticipation of the treat. This kind of result has been reproduced in the lab using a wide range of signals (e.g., tones, light, tastes, settings) paired with many different events besides food (e.g., drugs, shocks, illness; see below).

We now believe that this same learning process is engaged, for example, when humans associate a drug they’ve taken with the environment in which they’ve taken it; when they associate a stimulus (e.g., a symbol for vacation, like a big beach towel) with an emotional event (like a burst of happiness); and when they associate the flavor of a food with getting food poisoning. Although classical conditioning may seem “old” or “too simple” a theory, it is
still widely studied today for at least two reasons: First, it is a straightforward test of associative
learning that can be used to study other, more complex behaviors. Second, because classical
conditioning is always occurring in our lives, its effects on behavior have important
implications for understanding normal and disordered behavior in humans.

In a general way, classical conditioning occurs whenever neutral stimuli are associated with
psychologically significant events. With food poisoning, for example, although having fish for
dinner may not normally be something to be concerned about (i.e., a “neutral stimuli”), if it
causes you to get sick, you will now likely associate that neutral stimuli (the fish) with the
psychologically significant event of getting sick. These paired events are often described using
terms that can be applied to any situation.

The dog food in Pavlov's experiment is called the **unconditioned stimulus (US)** because it
elicits an **unconditioned response (UR)**. That is, without any kind of “training” or “teaching,”
the stimulus produces a natural or instinctual reaction. In Pavlov's case, the food (US)
automatically makes the dog drool (UR). Other examples of unconditioned stimuli include
loud noises (US) that startle us (UR), or a hot shower (US) that produces pleasure (UR).

On the other hand, a conditioned stimulus produces a conditioned response. A **conditioned
stimulus (CS)** is a signal that has no importance to the organism until it is paired with something
that does have importance. For example, in Pavlov's experiment, the bell is the conditioned
stimulus. Before the dog has learned to associate the bell (CS) with the presence of food (US),
hearing the bell means nothing to the dog. However, after multiple pairings of the bell with
the presentation of food, the dog starts to drool at the sound of the bell. This drooling in
response to the bell is the **conditioned response (CR)**. Although it can be confusing, the
conditioned response is almost always the same as the unconditioned response. However, it
is called the conditioned response because it is conditional on (or, depends on) being paired
with the conditioned stimulus (e.g., the bell). To help make this clearer, consider becoming
really hungry when you see the logo for a fast food restaurant. There's a good chance you'll
start salivating. Although it is the actual eating of the food (US) that normally produces the
salivation (UR), simply seeing the restaurant's logo (CS) can trigger the same reaction (CR).

Another example you are probably very familiar with involves your alarm clock. If you're like
most people, waking up early usually makes you unhappy. In this case, waking up early (US)
produces a natural sensation of grumpiness (UR). Rather than waking up early on your own,
though, you likely have an alarm clock that plays a tone to wake you. Before setting your alarm
to that particular tone, let's imagine you had neutral feelings about it (i.e., the tone had no
prior meaning for you). However, now that you use it to wake up every morning, you
psychologically “pair” that tone (CS) with your feelings of grumpiness in the morning (UR).
After enough pairings, this tone (CS) will automatically produce your natural response of grumpiness (CR). Thus, this linkage between the unconditioned stimulus (US; waking up early) and the conditioned stimulus (CS; the tone) is so strong that the unconditioned response (UR; being grumpy) will become a conditioned response (CR; e.g., hearing the tone at any point in the day—whether waking up or walking down the street—will make you grumpy). Modern studies of classical conditioning use a very wide range of CSs and USs and measure a wide range of conditioned responses.

Although classical conditioning is a powerful explanation for how we learn many different things, there is a second form of conditioning that also helps explain how we learn. First studied by Edward Thorndike, and later extended by B. F. Skinner, this second type of conditioning is known as instrumental or operant conditioning. Operant conditioning occurs when a behavior (as opposed to a stimulus) is associated with the occurrence of a significant event. In the best-known example, a rat in a laboratory learns to press a lever in a cage (called a “Skinner box”) to receive food. Because the rat has no “natural” association between pressing a lever and getting food, the rat has to learn this connection. At first, the rat may simply explore its cage, climbing on top of things, burrowing under things, in search of food. Eventually while poking around its cage, the rat accidentally presses the lever, and a food pellet drops in. This voluntary behavior is called an operant behavior, because it “operates” on the environment (i.e., it is an action that the animal itself makes).

Now, once the rat recognizes that it receives a piece of food every time it presses the lever, the behavior of lever-pressing becomes reinforced. That is, the food pellets serve as reinforcers because they strengthen the rat’s desire to engage with the environment in this particular manner. In a parallel example, imagine that you’re playing a street-racing video game. As you drive through one city course multiple times, you try a number of different streets to get to the finish line. On one of these trials, you discover a shortcut that dramatically improves your overall time. You have learned this new path through operant conditioning.
That is, by engaging with your environment (operant responses), you performed a sequence of behaviors that that was positively reinforced (i.e., you found the shortest distance to the finish line). And now that you've learned how to drive this course, you will perform that same sequence of driving behaviors (just as the rat presses on the lever) to receive your reward of a faster finish.

Operant conditioning research studies how the effects of a behavior influence the probability that it will occur again. For example, the effects of the rat's lever-pressing behavior (i.e., receiving a food pellet) influences the probability that it will keep pressing the lever. For, according to Thorndike's law of effect, when a behavior has a positive (satisfying) effect or consequence, it is likely to be repeated in the future. However, when a behavior has a negative (painful/annoying) consequence, it is less likely to be repeated in the future. Effects that increase behaviors are referred to as reinforcers, and effects that decrease them are referred to as punishers.

An everyday example that helps to illustrate operant conditioning is striving for a good grade in class—which could be considered a reward for students (i.e., it produces a positive emotional response). In order to get that reward (similar to the rat learning to press the lever), the student needs to modify his/her behavior. For example, the student may learn that speaking up in class gets him/her participation points (a reinforcer), so the student speaks up repeatedly. However, the student also learns that s/he shouldn't speak up about just anything; talking about topics unrelated to school actually costs points. Therefore, through the student's freely chosen behaviors, s/he learns which behaviors are reinforced and which are punished.

An important distinction of operant conditioning is that it provides a method for studying how consequences influence “voluntary” behavior. The rat's decision to press the lever is voluntary, in the sense that the rat is free to make and repeat that response whenever it wants. Classical

![Classical or Pavlovan Conditioning](Image courtesy of Bernard W. Balleine)
conditioning, on the other hand, is just the opposite—depending instead on “involuntary” behavior (e.g., the dog doesn’t choose to drool; it just does). So, whereas the rat must actively participate and perform some kind of behavior to attain its reward, the dog in Pavlov’s experiment is a passive participant. One of the lessons of operant conditioning research, then, is that voluntary behavior is strongly influenced by its consequences.

The illustration above summarizes the basic elements of classical and instrumental conditioning. The two types of learning differ in many ways. However, modern thinkers often emphasize the fact that they differ—as illustrated here—in what is learned. In classical conditioning, the animal behaves as if it has learned to associate a stimulus with a significant event. In operant conditioning, the animal behaves as if it has learned to associate a behavior with a significant event. Another difference is that the response in the classical situation (e.g., salivation) is elicited by a stimulus that comes before it, whereas the response in the operant case is not elicited by any particular stimulus. Instead, operant responses are said to be emitted. The word “emitted” further conveys the idea that operant behaviors are essentially voluntary in nature.

Understanding classical and operant conditioning provides psychologists with many tools for understanding learning and behavior in the world outside the lab. This is in part because the two types of learning occur continuously throughout our lives. It has been said that “much like the laws of gravity, the laws of learning are always in effect” (Spreat & Spreat, 1982).

Useful Things to Know about Classical Conditioning

Classical Conditioning Has Many Effects on Behavior

A classical CS (e.g., the bell) does not merely elicit a simple, unitary reflex. Pavlov emphasized salivation because that was the only response he measured. But his bell almost certainly elicited a whole system of responses that functioned to get the organism ready for the upcoming US (food) (see Timberlake, 2001). For example, in addition to salivation, CSs (such as the bell) that signal that food is near also elicit the secretion of gastric acid, pancreatic enzymes, and insulin (which gets blood glucose into cells). All of these responses prepare the body for digestion. Additionally, the CS elicits approach behavior and a state of excitement. And presenting a CS for food can also cause animals whose stomachs are full to eat more food if it is available. In fact, food CSs are so prevalent in modern society, humans are likewise inclined to eat or feel hungry in response to cues associated with food, such as the sound of a bag of potato chips opening, the sight of a well-known logo (e.g., Coca-Cola), or the feel of the couch in front of the television.
Classical conditioning is also involved in other aspects of eating. Flavors associated with certain nutrients (such as sugar or fat) can become preferred without arousing any awareness of the pairing. For example, protein is a US that your body automatically craves more of once you start to consume it (UR): since proteins are highly concentrated in meat, the flavor of meat becomes a CS (or cue, that proteins are on the way), which perpetuates the cycle of craving for yet more meat (this automatic bodily reaction now a CR).

In a similar way, flavors associated with stomach pain or illness become avoided and disliked. For example, a person who gets sick after drinking too much tequila may acquire a profound dislike of the taste and odor of tequila—a phenomenon called taste aversion conditioning. The fact that flavors are often associated with so many consequences of eating is important for animals (including rats and humans) that are frequently exposed to new foods. And it is clinically relevant. For example, drugs used in chemotherapy often make cancer patients sick. As a consequence, patients often acquire aversions to foods eaten just before treatment, or even aversions to such things as the waiting room of the chemotherapy clinic itself (see Bernstein, 1991; Scalera & Bavieri, 2009).

Classical conditioning occurs with a variety of significant events. If an experimenter sounds a tone just before applying a mild shock to a rat’s feet, the tone will elicit fear or anxiety after one or two pairings. Similar fear conditioning plays a role in creating many anxiety disorders in humans, such as phobias and panic disorders, where people associate cues (such as closed spaces, or a shopping mall) with panic or other emotional trauma (see Mineka & Zinbarg, 2006). Here, rather than a physical response (like drooling), the CS triggers an emotion.

Another interesting effect of classical conditioning can occur when we ingest drugs. That is, when a drug is taken, it can be associated with the cues that are present at the same time (e.g., rooms, odors, drug paraphernalia). In this regard, if someone associates a particular smell with the sensation induced by the drug, whenever that person smells the same odor afterward, it may cue responses (physical and/or emotional) related to taking the drug itself. But drug cues have an even more interesting property: They elicit responses that often “compensate” for the upcoming effect of the drug (see Siegel, 1989). For example, morphine itself suppresses pain; however, if someone is used to taking morphine, a cue that signals the “drug is coming soon” can actually make the person more sensitive to pain. Because the person knows a pain suppressant will soon be administered, the body becomes more sensitive, anticipating that “the drug will soon take care of it.” Remarkably, such conditioned compensatory responses in turn decrease the impact of the drug on the body—because the body has become more sensitive to pain.

This conditioned compensatory response has many implications. For instance, a drug user
will be most “tolerant” to the drug in the presence of cues that have been associated with it (because such cues elicit compensatory responses). As a result, overdose is usually not due to an increase in dosage, but to taking the drug in a new place without the familiar cues—which would have otherwise allowed the user to tolerate the drug (see Siegel, Hinson, Krank, & McCully, 1982). Conditioned compensatory responses (which include heightened pain sensitivity and decreased body temperature, among others) might also cause discomfort, thus motivating the drug user to continue usage of the drug to reduce them. This is one of several ways classical conditioning might be a factor in drug addiction and dependence.

A final effect of classical cues is that they motivate ongoing operant behavior (see Balleine, 2005). For example, if a rat has learned via operant conditioning that pressing a lever will give it a drug, in the presence of cues that signal the “drug is coming soon” (like the sound of the lever squeaking), the rat will work harder to press the lever than if those cues weren’t present (i.e., there is no squeaking lever sound). Similarly, in the presence of food-associated cues (e.g., smells), a rat (or an overeater) will work harder for food. And finally, even in the presence of negative cues (like something that signals fear), a rat, a human, or any other organism will work harder to avoid those situations that might lead to trauma. Classical CSs thus have many effects that can contribute to significant behavioral phenomena.

The Learning Process

As mentioned earlier, classical conditioning provides a method for studying basic learning processes. Somewhat counterintuitively, though, studies show that pairing a CS and a US together is not sufficient for an association to be learned between them. Consider an effect called blocking (see Kamin, 1969). In this effect, an animal first learns to associate one CS—call it stimulus A—with a US. In the illustration above, the sound of a bell (stimulus A) is paired
with the presentation of food. Once this association is learned, in a second phase, a second stimulus—stimulus B—is presented alongside stimulus A, such that the two stimuli are paired with the US together. In the illustration, a light is added and turned on at the same time the bell is rung. However, because the animal has already learned the association between stimulus A (the bell) and the food, the animal doesn’t learn an association between stimulus B (the light) and the food. That is, the conditioned response only occurs during the presentation of stimulus A, because the earlier conditioning of A “blocks” the conditioning of B when B is added to A. The reason? Stimulus A already predicts the US, so the US is not surprising when it occurs with Stimulus B.

Learning depends on such a surprise, or a discrepancy between what occurs on a conditioning trial and what is already predicted by cues that are present on the trial. To learn something through classical conditioning, there must first be some prediction error, or the chance that a conditioned stimulus won’t lead to the expected outcome. With the example of the bell and the light, because the bell always leads to the reward of food, there’s no “prediction error” that the addition of the light helps to correct. However, if the researcher suddenly requires that the bell and the light both occur in order to receive the food, the bell alone will produce a prediction error that the animal has to learn.

Blocking and other related effects indicate that the learning process tends to take in the most valid predictors of significant events and ignore the less useful ones. This is common in the real world. For example, imagine that your supermarket puts big star-shaped stickers on products that are on sale. Quickly, you learn that items with the big star-shaped stickers are cheaper. However, imagine you go into a similar supermarket that not only uses these stickers, but also uses bright orange price tags to denote a discount. Because of blocking (i.e., you already know that the star-shaped stickers indicate a discount), you don’t have to learn the color system, too. The star-shaped stickers tell you everything you need to know (i.e. there’s no prediction error for the discount), and thus the color system is irrelevant.

Classical conditioning is strongest if the CS and US are intense or salient. It is also best if the CS and US are relatively new and the organism hasn’t been frequently exposed to them before. And it is especially strong if the organism’s biology has prepared it to associate a particular CS and US. For example, rats and humans are naturally inclined to associate an illness with a flavor, rather than with a light or tone. Because foods are most commonly experienced by taste, if there is a particular food that makes us ill, associating the flavor (rather than the appearance—which may be similar to other foods) with the illness will more greatly ensure we avoid that food in the future, and thus avoid getting sick. This sorting tendency, which is set up by evolution, is called preparedness.
There are many factors that affect the strength of classical conditioning, and these have been the subject of much research and theory (see Rescorla & Wagner, 1972; Pearce & Bouton, 2001). Behavioral neuroscientists have also used classical conditioning to investigate many of the basic brain processes that are involved in learning (see Fanselow & Poulos, 2005; Thompson & Steinmetz, 2009).

**Erasing Classical Learning**

After conditioning, the response to the CS can be eliminated if the CS is presented repeatedly without the US. This effect is called *extinction*, and the response is said to become “extinguished.” For example, if Pavlov kept ringing the bell but never gave the dog any food afterward, eventually the dog's CR (drooling) would no longer happen when it heard the CS (the bell), because the bell would no longer be a predictor of food. Extinction is important for many reasons. For one thing, it is the basis for many therapies that clinical psychologists use to eliminate maladaptive and unwanted behaviors. Take the example of a person who has a debilitating fear of spiders: one approach might include systematic exposure to spiders. Whereas, initially the person has a CR (e.g., extreme fear) every time s/he sees the CS (e.g., the spider), after repeatedly being shown pictures of spiders in neutral conditions, pretty soon the CS no longer predicts the CR (i.e., the person doesn’t have the fear reaction when seeing spiders, having learned that spiders no longer serve as a “cue” for that fear). Here, repeated exposure to spiders without an aversive consequence causes extinction.

Psychologists must accept one important fact about extinction, however: it does not necessarily destroy the original learning (see Bouton, 2004). For example, imagine you strongly associate the smell of chalkboards with the agony of middle school detention. Now imagine that, after years of encountering chalkboards, the smell of them no longer recalls the agony of detention (an example of extinction). However, one day, after entering a new building for the first time, you suddenly catch a whiff of a chalkboard and WHAM!, the agony of detention returns. This is called *spontaneous recovery*: following a lapse in exposure to the CS after extinction has occurred, sometimes re-exposure to the CS (e.g., the smell of chalkboards) can evoke the CR again (e.g., the agony of detention).

Another related phenomenon is the *renewal effect*: After extinction, if the CS is tested in a new context, such as a different room or location, the CR can also return. In the chalkboard example, the action of entering a new building—where you don't expect to smell chalkboards—suddenly renews the sensations associated with detention. These effects have been interpreted to suggest that extinction inhibits rather than erases the learned behavior, and this inhibition is mainly expressed in the context in which it is learned (see “context” in the
This does not mean that extinction is a bad treatment for behavior disorders. Instead, clinicians can increase its effectiveness by using basic research on learning to help defeat these relapse effects (see Craske et al., 2008). For example, conducting extinction therapies in contexts where patients might be most vulnerable to relapsing (e.g., at work), might be a good strategy for enhancing the therapy's success.

Useful Things to Know about Instrumental Conditioning

Most of the things that affect the strength of classical conditioning also affect the strength of instrumental learning—whereby we learn to associate our actions with their outcomes. As noted earlier, the “bigger” the reinforcer (or punisher), the stronger the learning. And, if an instrumental behavior is no longer reinforced, it will also be extinguished. Most of the rules of associative learning that apply to classical conditioning also apply to instrumental learning, but other facts about instrumental learning are also worth knowing.

Instrumental Responses Come Under Stimulus Control

As you know, the classic operant response in the laboratory is lever-pressing in rats, reinforced by food. However, things can be arranged so that lever-pressing only produces pellets when a particular stimulus is present. For example, lever-pressing can be reinforced only when a light in the Skinner box is turned on; when the light is off, no food is released from lever-pressing. The rat soon learns to discriminate between the light-on and light-off conditions, and presses the lever only in the presence of the light (responses in light-off are extinguished). In everyday life, think about waiting in the turn lane at a traffic light. Although you know that green means go, only when you have the green arrow do you turn. In this regard, the operant behavior is now said to be under stimulus control. And, as is the case with the traffic light, in the real world, stimulus control is probably the rule.

The stimulus controlling the operant response is called a discriminative stimulus. It can be associated directly with the response, or the reinforcer (see below). However, it usually does not elicit the response the way a classical CS does. Instead, it is said to “set the occasion for” the operant response. For example, a canvas put in front of an artist does not elicit painting behavior or compel her to paint. It allows, or sets the occasion for, painting to occur.

Stimulus-control techniques are widely used in the laboratory to study perception and other psychological processes in animals. For example, the rat would not be able to respond
appropriately to light-on and light-off conditions if it could not see the light. Following this logic, experiments using stimulus-control methods have tested how well animals see colors, hear ultrasounds, and detect magnetic fields. That is, researchers pair these discriminative stimuli with those they know the animals already understand (such as pressing the lever). In this way, the researchers can test if the animals can learn to press the lever only when an ultrasound is played, for example.

These methods can also be used to study “higher” cognitive processes. For example, pigeons can learn to peck at different buttons in a Skinner box when pictures of flowers, cars, chairs, or people are shown on a miniature TV screen (see Wasserman, 1995). Pecking button 1 (and no other) is reinforced in the presence of a flower image, button 2 in the presence of a chair image, and so on. Pigeons can learn the discrimination readily, and, under the right conditions, will even peck the correct buttons associated with pictures of new flowers, cars, chairs, and people they have never seen before. The birds have learned to categorize the sets of stimuli. Stimulus-control methods can be used to study how such categorization is learned.

**Operant Conditioning Involves Choice**

Another thing to know about operant conditioning is that the response always requires choosing one behavior over others. The student who goes to the bar on Thursday night chooses to drink instead of staying at home and studying. The rat chooses to press the lever instead of sleeping or scratching its ear in the back of the box. The alternative behaviors are each associated with their own reinforcers. And the tendency to perform a particular action depends on both the reinforcers earned for it and the reinforcers earned for its alternatives.

To investigate this idea, choice has been studied in the Skinner box by making two levers available for the rat (or two buttons available for the pigeon), each of which has its own reinforcement or payoff rate. A thorough study of choice in situations like this has led to a rule called the quantitative law of effect (see Herrnstein, 1970), which can be understood without going into quantitative detail: The law
acknowledges the fact that the effects of reinforcing one behavior depend crucially on how much reinforcement is earned for the behavior's alternatives. For example, if a pigeon learns that pecking one light will reward two food pellets, whereas the other light only rewards one, the pigeon will only peck the first light. However, what happens if the first light is more strenuous to reach than the second one? Will the cost of energy outweigh the bonus of food? Or will the extra food be worth the work? In general, a given reinforcer will be less reinforcing if there are many alternative reinforcers in the environment. For this reason, alcohol, sex, or drugs may be less powerful reinforcers if the person's environment is full of other sources of reinforcement, such as achievement at work or love from family members.

Cognition in Instrumental Learning

Modern research also indicates that reinforcers do more than merely strengthen or “stamp in” the behaviors they are a consequence of, as was Thorndike's original view. Instead, animals learn about the specific consequences of each behavior, and will perform a behavior depending on how much they currently want—or “value”—its consequence.

This idea is best illustrated by a phenomenon called the reinforcer devaluation effect (see Colwill & Rescorla, 1986). A rat is first trained to perform two instrumental actions (e.g., pressing a lever on the left, and on the right), each paired with a different reinforcer (e.g., a sweet sucrose solution, and a food pellet). At the end of this training, the rat tends to press both levers, alternating between the sucrose solution and the food pellet. In a second phase, one of the reinforcers (e.g., the sucrose) is then separately paired with illness. This conditions a taste aversion to the sucrose. In a final test, the rat is returned to the Skinner box and allowed to press either lever freely. No reinforcers are presented during this test (i.e., no sucrose or
food comes from pressing the levers), so behavior during testing can only result from the rat's memory of what it has learned earlier. Importantly here, the rat chooses not to perform the response that once produced the reinforcer that it now has an aversion to (e.g., it won't press the sucrose lever). This means that the rat has learned and remembered the reinforcer associated with each response, and can combine that knowledge with the knowledge that the reinforcer is now “bad.” Reinforcers do not merely stamp in responses; the animal learns much more than that. The behavior is said to be “goal-directed” (see Dickinson & Balleine, 1994), because it is influenced by the current value of its associated goal (i.e., how much the rat wants/doesn't want the reinforcer).

Things can get more complicated, however, if the rat performs the instrumental actions frequently and repeatedly. That is, if the rat has spent many months learning the value of pressing each of the levers, the act of pressing them becomes automatic and routine. And here, this once goal-directed action (i.e., the rat pressing the lever for the goal of getting sucrose/food) can become a habit. Thus, if a rat spends many months performing the lever-pressing behavior (turning such behavior into a habit), even when sucrose is again paired with illness, the rat will continue to press that lever (see Holland, 2004). After all the practice, the instrumental response (pressing the lever) is no longer sensitive to reinforcer devaluation. The rat continues to respond automatically, regardless of the fact that the sucrose from this lever makes it sick.

Habits are very common in human experience, and can be useful. You do not need to relearn each day how to make your coffee in the morning or how to brush your teeth. Instrumental behaviors can eventually become habitual, letting us get the job done while being free to think about other things.

**Putting Classical and Instrumental Conditioning Together**

Classical and operant conditioning are usually studied separately. But outside of the laboratory they almost always occur at the same time. For example, a person who is reinforced for drinking alcohol or eating excessively learns these behaviors in the presence of certain stimuli—a pub, a set of friends, a restaurant, or possibly the couch in front of the TV. These stimuli are also available for association with the reinforcer. In this way, classical and operant conditioning are always intertwined.

The figure below summarizes this idea, and helps review what we have discussed in this module. Generally speaking, any reinforced or punished operant response (R) is paired with an outcome (O) in the presence of some stimulus or set of stimuli (S).
The figure illustrates the types of associations that can be learned in this very general scenario. For one thing, the organism will learn to associate the response and the outcome (R – O). This is instrumental conditioning. The learning process here is probably similar to classical conditioning, with all its emphasis on surprise and prediction error. And, as we discussed while considering the reinforcer devaluation effect, once R – O is learned, the organism will be ready to perform the response if the outcome is desired or valued. The value of the reinforcer can also be influenced by other reinforcers earned for other behaviors in the situation. These factors are at the heart of instrumental learning.

Second, the organism can also learn to associate the stimulus with the reinforcing outcome (S – O). This is the classical conditioning component, and as we have seen, it can have many consequences on behavior. For one thing, the stimulus will come to evoke a system of responses that help the organism prepare for the reinforcer (not shown in the figure): The drinker may undergo changes in body temperature; the eater may salivate and have an increase in insulin secretion. In addition, the stimulus will evoke approach (if the outcome is positive) or retreat (if the outcome is negative). Presenting the stimulus will also prompt the instrumental response.

The third association in the diagram is the one between the stimulus and the response (S – R). As discussed earlier, after a lot of practice, the stimulus may begin to elicit the response directly. This is habit learning, whereby the response occurs relatively automatically, without much mental processing of the relation between the action and the outcome and the outcome's current value.

The final link in the figure is between the stimulus and the response-outcome association [S – (R – O)]. More than just entering into a simple association with the R or the O, the stimulus can signal that the R – O relationship is now in effect. This is what we mean when we say that the stimulus can “set the occasion” for the operant response: It sets the occasion for the
response-reinforcer relationship. Through this mechanism, the painter might begin to paint when given the right tools and the opportunity enabled by the canvas. The canvas theoretically signals that the behavior of painting will now be reinforced by positive consequences.

The figure provides a framework that you can use to understand almost any learned behavior you observe in yourself, your family, or your friends. If you would like to understand it more deeply, consider taking a course on learning in the future, which will give you a fuller appreciation of how classical learning, instrumental learning, habit learning, and occasion setting actually work and interact.

Observational Learning

Not all forms of learning are accounted for entirely by classical and operant conditioning. Imagine a child walking up to a group of children playing a game on the playground. The game looks fun, but it is new and unfamiliar. Rather than joining the game immediately, the child opts to sit back and watch the other children play a round or two. Observing the others, the child takes note of the ways in which they behave while playing the game. By watching the behavior of the other kids, the child can figure out the rules of the game and even some strategies for doing well at the game. This is called *observational learning*.

Observational learning is a component of Albert Bandura’s *Social Learning Theory* (Bandura, 1977), which posits that individuals can learn novel responses via observation of key others’ behaviors. Observational learning does not necessarily require reinforcement, but instead hinges on the presence of others, referred to as *social models*. Social models are typically of higher status or authority compared to the observer, examples of which include parents, teachers, and police officers. In the example above, the children who already know how to play the game could be thought of as being authorities—and are therefore social models—even...
though they are the same age as the observer. By observing how the social models behave, an individual is able to learn how to act in a certain situation. Other examples of observational learning might include a child learning to place her napkin in her lap by watching her parents at the dinner table, or a customer learning where to find the ketchup and mustard after observing other customers at a hot dog stand.

Bandura theorizes that the observational learning process consists of four parts. The first is attention—as, quite simply, one must pay attention to what s/he is observing in order to learn. The second part is retention: to learn one must be able to retain the behavior s/he is observing in memory. The third part of observational learning, initiation, acknowledges that the learner must be able to execute (or initiate) the learned behavior. Lastly, the observer must possess the motivation to engage in observational learning. In our vignette, the child must want to learn how to play the game in order to properly engage in observational learning.

Researchers have conducted countless experiments designed to explore observational learning, the most famous of which is Albert Bandura's “Bobo doll experiment.”

In this experiment (Bandura, Ross & Ross 1961), Bandura had children individually observe an adult social model interact with a clown doll (“Bobo”). For one group of children, the adult interacted aggressively with Bobo: punching it, kicking it, throwing it, and even hitting it in the face with a toy mallet. Another group of children watched the adult interact with other toys, displaying no aggression toward Bobo. In both instances the adult left and the children were allowed to interact with Bobo on their own. Bandura found that children exposed to the aggressive social model were significantly more likely to behave aggressively toward Bobo, hitting and kicking him, compared to those exposed to the non-aggressive model. The researchers concluded that the children in the aggressive group used their observations of the adult social model’s behavior to determine that aggressive behavior toward Bobo was acceptable.

While reinforcement was not required to elicit the children's behavior in Bandura's first experiment, it is important to acknowledge that consequences do play a role within observational learning. A future adaptation of this study (Bandura, Ross, & Ross, 1963) demonstrated that children in the
aggression group showed less aggressive behavior if they witnessed the adult model receive punishment for aggressing against Bobo. Bandura referred to this process as vicarious reinforcement, as the children did not experience the reinforcement or punishment directly, yet were still influenced by observing it.

Conclusion

We have covered three primary explanations for how we learn to behave and interact with the world around us. Considering your own experiences, how well do these theories apply to you? Maybe when reflecting on your personal sense of fashion, you realize that you tend to select clothes others have complimented you on (operant conditioning). Or maybe, thinking back on a new restaurant you tried recently, you realize you chose it because its commercials play happy music (classical conditioning). Or maybe you are now always on time with your assignments, because you saw how others were punished when they were late (observational learning). Regardless of the activity, behavior, or response, there’s a good chance your “decision” to do it can be explained based on one of the theories presented in this module.
Outside Resources


Video: Albert Bandura discusses the Bobo Doll Experiment.
https://www.youtube.com/watch?v=eqNaLerMNOE

Discussion Questions

1. Describe three examples of Pavlovian (classical) conditioning that you have seen in your own behavior, or that of your friends or family, in the past few days.

2. Describe three examples of instrumental (operant) conditioning that you have seen in your own behavior, or that of your friends or family, in the past few days.

3. Drugs can be potent reinforcers. Discuss how Pavlovian conditioning and instrumental conditioning can work together to influence drug taking.

4. In the modern world, processed foods are highly available and have been engineered to be highly palatable and reinforcing. Discuss how Pavlovian and instrumental conditioning can work together to explain why people often eat too much.

5. How does blocking challenge the idea that pairings of a CS and US are sufficient to cause Pavlovian conditioning? What is important in creating Pavlovian learning?

6. How does the reinforcer devaluation effect challenge the idea that reinforcers merely "stamp in" the operant response? What does the effect tell us that animals actually learn in operant conditioning?

7. With regards to social learning do you think people learn violence from observing violence
in movies? Why or why not?

8. What do you think you have learned through social learning? Who are your social models?
Vocabulary

Blocking
In classical conditioning, the finding that no conditioning occurs to a stimulus if it is combined with a previously conditioned stimulus during conditioning trials. Suggests that information, surprise value, or prediction error is important in conditioning.

Categorize
To sort or arrange different items into classes or categories.

Classical conditioning
The procedure in which an initially neutral stimulus (the conditioned stimulus, or CS) is paired with an unconditioned stimulus (or US). The result is that the conditioned stimulus begins to elicit a conditioned response (CR). Classical conditioning is nowadays considered important as both a behavioral phenomenon and as a method to study simple associative learning. Same as Pavlovian conditioning.

Conditioned compensatory response
In classical conditioning, a conditioned response that opposes, rather than is the same as, the unconditioned response. It functions to reduce the strength of the unconditioned response. Often seen in conditioning when drugs are used as unconditioned stimuli.

Conditioned response (CR)
The response that is elicited by the conditioned stimulus after classical conditioning has taken place.

Conditioned stimulus (CS)
An initially neutral stimulus (like a bell, light, or tone) that elicits a conditioned response after it has been associated with an unconditioned stimulus.

Context
Stimuli that are in the background whenever learning occurs. For instance, the Skinner box or room in which learning takes place is the classic example of a context. However, “context” can also be provided by internal stimuli, such as the sensory effects of drugs (e.g., being under the influence of alcohol has stimulus properties that provide a context) and mood states (e.g., being happy or sad). It can also be provided by a specific period in time—the passage of time is sometimes said to change the “temporal context.”
Discriminative stimulus
In operant conditioning, a stimulus that signals whether the response will be reinforced. It is said to “set the occasion” for the operant response.

Extinction
Decrease in the strength of a learned behavior that occurs when the conditioned stimulus is presented without the unconditioned stimulus (in classical conditioning) or when the behavior is no longer reinforced (in instrumental conditioning). The term describes both the procedure (the US or reinforcer is no longer presented) as well as the result of the procedure (the learned response declines). Behaviors that have been reduced in strength through extinction are said to be “extinguished.”

Fear conditioning
A type of classical or Pavlovian conditioning in which the conditioned stimulus (CS) is associated with an aversive unconditioned stimulus (US), such as a foot shock. As a consequence of learning, the CS comes to evoke fear. The phenomenon is thought to be involved in the development of anxiety disorders in humans.

Goal-directed behavior
Instrumental behavior that is influenced by the animal's knowledge of the association between the behavior and its consequence and the current value of the consequence. Sensitive to the reinforcer devaluation effect.

Habit
Instrumental behavior that occurs automatically in the presence of a stimulus and is no longer influenced by the animal's knowledge of the value of the reinforcer. Insensitive to the reinforcer devaluation effect.

Instrumental conditioning
Process in which animals learn about the relationship between their behaviors and their consequences. Also known as operant conditioning.

Law of effect
The idea that instrumental or operant responses are influenced by their effects. Responses that are followed by a pleasant state of affairs will be strengthened and those that are followed by discomfort will be weakened. Nowadays, the term refers to the idea that operant or instrumental behaviors are lawfully controlled by their consequences.

Observational learning
Learning by observing the behavior of others.

**Operant**
A behavior that is controlled by its consequences. The simplest example is the rat’s lever-pressing, which is controlled by the presentation of the reinforcer.

**Operant conditioning**
See instrumental conditioning.

**Pavlovian conditioning**
See classical conditioning.

**Prediction error**
When the outcome of a conditioning trial is different from that which is predicted by the conditioned stimuli that are present on the trial (i.e., when the US is surprising). Prediction error is necessary to create Pavlovian conditioning (and associative learning generally). As learning occurs over repeated conditioning trials, the conditioned stimulus increasingly predicts the unconditioned stimulus, and prediction error declines. Conditioning works to correct or reduce prediction error.

**Preparedness**
The idea that an organism’s evolutionary history can make it easy to learn a particular association. Because of preparedness, you are more likely to associate the taste of tequila, and not the circumstances surrounding drinking it, with getting sick. Similarly, humans are more likely to associate images of spiders and snakes than flowers and mushrooms with aversive outcomes like shocks.

**Punisher**
A stimulus that decreases the strength of an operant behavior when it is made a consequence of the behavior.

**Quantitative law of effect**
A mathematical rule that states that the effectiveness of a reinforcer at strengthening an operant response depends on the amount of reinforcement earned for all alternative behaviors. A reinforcer is less effective if there is a lot of reinforcement in the environment for other behaviors.

**Reinforcer**
Any consequence of a behavior that strengthens the behavior or increases the likelihood that
it will be performed it again.

**Reinforcer devaluation effect**
The finding that an animal will stop performing an instrumental response that once led to a reinforcer if the reinforcer is separately made aversive or undesirable.

**Renewal effect**
Recovery of an extinguished response that occurs when the context is changed after extinction. Especially strong when the change of context involves return to the context in which conditioning originally occurred. Can occur after extinction in either classical or instrumental conditioning.

**Social Learning Theory**
The theory that people can learn new responses and behaviors by observing the behavior of others.

**Social models**
Authorities that are the targets for observation and who model behaviors.

**Spontaneous recovery**
Recovery of an extinguished response that occurs with the passage of time after extinction. Can occur after extinction in either classical or instrumental conditioning.

**Stimulus control**
When an operant behavior is controlled by a stimulus that precedes it.

**Taste aversion learning**
The phenomenon in which a taste is paired with sickness, and this causes the organism to reject—and dislike—that taste in the future.

**Unconditioned response (UR)**
In classical conditioning, an innate response that is elicited by a stimulus before (or in the absence of) conditioning.

**Unconditioned stimulus (US)**
In classical conditioning, the stimulus that elicits the response before conditioning occurs.

**Vicarious reinforcement**
Learning that occurs by observing the reinforcement or punishment of another person.
References


Learning is a complex process that defies easy definition and description. This module reviews some of the philosophical issues involved with defining learning and describes in some detail the characteristics of learners and of encoding activities that seem to affect how well people can acquire new memories, knowledge, or skills. At the end, we consider a few basic principles that guide whether a particular attempt at learning will be successful or not.

Learning Objectives

- Consider what kinds of activities constitute learning.
- Name multiple forms of learning.
- List some individual differences that affect learning.
- Describe the effect of various encoding activities on learning.
- Describe three general principles of learning.

Introduction

What do you do when studying for an exam? Do you read your class notes and textbook (hopefully not for the very first time)? Do you try to find a quiet place without distraction? Do you use flash cards to test your knowledge? The choices you make reveal your theory of learning, but there is no reason for you to limit yourself to your own intuitions. There is a vast and vibrant science of learning, in which researchers from psychology, education, and neuroscience study basic principles of learning and memory.
In fact, learning is a much broader domain than you might think. Consider: Is listening to music a form of learning? More often, it seems listening to music is a way of avoiding learning. But we know that your brain’s response to auditory information changes with your experience with that information, a form of learning called auditory perceptual learning (Polley, Steinberg, & Merzenich, 2006). Each time we listen to a song, we hear it differently because of our experience. When we exhibit changes in behavior without having intended to learn something, that is called implicit learning (Seger, 1994), and when we exhibit changes in our behavior that reveal the influence of past experience even though we are not attempting to use that experience, that is called implicit memory (Richardson-Klavehn & Bjork, 1988).

Other well-studied forms of learning include the types of learning that are general across species. We can’t ask a slug to learn a poem or a lemur to learn to bat left-handed, but we can assess learning in other ways. For example, we can look for a change in our responses to things when we are repeatedly stimulated. If you live in a house with a grandfather clock, you know that what was once an annoying and intrusive sound is now probably barely audible to you. Similarly, poking an earthworm again and again is likely to lead to a reduction in its retraction from your touch. These phenomena are forms of nonassociative learning, in which single repeated exposure leads to a change in behavior (Pinsker, Kupfermann, Castelluci, & Kandel, 1970). When our response lessens with exposure, it is called habituation, and when it increases (like it might with a particularly annoying laugh), it is called sensitization. Animals can also learn about relationships between things, such as when an alley cat learns that the sound of janitors working in a restaurant precedes the dumping of delicious new garbage (an example of stimulus-stimulus learning called classical conditioning), or when a dog learns to roll over to get a treat (a form of stimulus-response learning called operant conditioning). These forms of learning will be covered in the module on Conditioning and Learning (http://noba.to/ajxhcqdr).

Here, we’ll review some of the conditions that affect learning, with an eye toward the type of explicit learning we do when trying to learn something. Jenkins (1979) classified experiments
on learning and memory into four groups of factors (renamed here): learners, encoding activities, materials, and retrieval. In this module, we'll focus on the first two categories; the module on Memory (http://noba.to/bdc4uger) will consider other factors more generally.

**Learners**

People bring numerous individual differences with them into memory experiments, and many of these variables affect learning. In the classroom, motivation matters (Pintrich, 2003), though experimental attempts to induce motivation with money yield only modest benefits (Heyer & O’Kelly, 1949). Learners are, however, quite able to allocate more effort to learning prioritized over unimportant materials (Castel, Benjamin, Craik, & Watkins, 2002).

In addition, the organization and planning skills that a learner exhibits matter a lot (Garavalia & Gredler, 2002), suggesting that the efficiency with which one organizes self-guided learning is an important component of learning. We will return to this topic soon.

One well-studied and important variable is **working memory** capacity. Working memory describes the form of memory we use to hold onto information temporarily. Working memory is used, for example, to keep track of where we are in the course of a complicated math problem, and what the relevant outcomes of prior steps in that problem are. Higher scores on working memory measures are predictive of better reasoning skills (Kyllonen & Christal, 1990), reading comprehension (Daneman & Carpenter, 1980), and even better control of attention (Kane, Conway, Hambrick, & Engle, 2008).

Anxiety also affects the quality of learning. For example, people with math anxiety have a smaller capacity for remembering math-related information in working memory, such as the results of carrying a digit in arithmetic (Ashcraft & Kirk, 2001). Having students write about their specific anxiety seems to reduce the worry associated with tests.

Research attests that we can hold between 5 and 9 individual pieces of information in our working memory at once. This is partly why in the 1950s Bell Labs developed a 7-digit phone number system. [Image: Diamondmagna, https://goo.gl/xeUxfw, CC BY-SA 3.0, https://goo.gl/eLCn2O]
and increases performance on math tests (Ramirez & Beilock, 2011).

One good place to end this discussion is to consider the role of expertise. Though there probably is a finite capacity on our ability to store information (Landauer, 1986), in practice, this concept is misleading. In fact, because the usual bottleneck to remembering something is our ability to access information, not our space to store it, having more knowledge or expertise actually enhances our ability to learn new information. A classic example can be seen in comparing a chess master with a chess novice on their ability to learn and remember the positions of pieces on a chessboard (Chase & Simon, 1973). In that experiment, the master remembered the location of many more pieces than the novice, even after only a very short glance. Maybe chess masters are just smarter than the average chess beginner, and have better memory? No: The advantage the expert exhibited only was apparent when the pieces were arranged in a plausible format for an ongoing chess game; when the pieces were placed randomly, both groups did equivalently poorly. Expertise allowed the master to chunk (Simon, 1974) multiple pieces into a smaller number of pieces of information—but only when that information was structured in such a way so as to allow the application of that expertise.

**Encoding Activities**

What we do when we're learning is very important. We've all had the experience of reading something and suddenly coming to the realization that we don't remember a single thing, even the sentence that we just read. How we go about encoding information determines a lot about how much we remember.

You might think that the most important thing is to try to learn. Interestingly, this is not true, at least not completely. Trying to learn a list of words, as compared to just evaluating each word for its part of speech (i.e., noun, verb, adjective) does help you recall the words—that is, it helps you remember and write down more of the words later. But it actually impairs your ability to recognize the words—to judge on a later list which words are the ones that you studied (Eagle & Leiter, 1964). So this is a case in which incidental learning—that is, learning without the intention to learn—is better than intentional learning.

Such examples are not particularly rare and are not limited to recognition. Nairne, Pandeirada, and Thompson (2008) showed, for example, that survival processing—thinking about and rating each word in a list for its relevance in a survival scenario—led to much higher recall than intentional learning (and also higher, in fact, than other encoding activities that are also known to lead to high levels of recall). Clearly, merely intending to learn something is not enough. How a learner actively processes the material plays a large role; for example, reading
words and evaluating their meaning leads to better learning than reading them and evaluating the way that the words look or sound (Craik & Lockhart, 1972). These results suggest that individual differences in motivation will not have a large effect on learning unless learners also have accurate ideas about how to effectively learn material when they care to do so.

So, do learners know how to effectively encode material? People allowed to freely allocate their time to study a list of words do remember those words better than a group that doesn’t have control over their own study time, though the advantage is relatively small and is limited to the subset of learners who choose to spend more time on the more difficult material (Tullis & Benjamin, 2011). In addition, learners who have an opportunity to review materials that they select for restudy often learn more than another group that is asked to restudy the materials that they didn’t select for restudy (Kornell & Metcalfe, 2006). However, this advantage also appears to be relatively modest (Kimball, Smith, & Muntean, 2012) and wasn’t apparent in a group of older learners (Tullis & Benjamin, 2012). Taken together, all of the evidence seems to support the claim that self-control of learning can be effective, but only when learners have good ideas about what an effective learning strategy is.

One factor that appears to have a big effect and that learners do not always appear to understand is the effect of scheduling repetitions of study. If you are studying for a final exam next week and plan to spend a total of five hours, what is the best way to distribute your study? The evidence is clear that spacing one’s repetitions apart in time is superior than massing them all together (Baddeley & Longman, 1978; Bahrick, Bahrick, Bahrick, & Bahrick, 1993; Melton, 1967). Increasing the spacing between consecutive presentations appears to benefit learning yet further (Landauer & Bjork, 1978).

A similar advantage is evident for the practice of interleaving multiple skills to be learned: For example, baseball batters improved more when they faced a mix of different types of pitches than when they faced the same pitches blocked by type (Hall, Domingues, & Cavazos, 1994).
Students also showed better performance on a test when different types of mathematics problems were interleaved rather than blocked during learning (Taylor & Rohrer, 2010).

One final factor that merits discussion is the role of testing. Educators and students often think about testing as a way of assessing knowledge, and this is indeed an important use of tests. But tests themselves affect memory, because retrieval is one of the most powerful ways of enhancing learning (Roediger & Butler, 2013). Self-testing is an underutilized and potent means of making learning more durable.

**General Principles of Learning**

We've only begun to scratch the surface here of the many variables that affect the quality and content of learning (Mullin, Herrmann, & Searleman, 1993). But even within this brief examination of the differences between people and the activities they engage in can we see some basic principles of the learning process.

**The value of effective metacognition**

To be able to guide our own learning effectively, we must be able to evaluate the progress of our learning accurately and choose activities that enhance learning efficiently. It is of little use to study for a long time if a student cannot discern between what material she has or has not mastered, and if additional study activities move her no closer to mastery. **Metacognition** describes the knowledge and skills people have in monitoring and controlling their own learning and memory. We can work to acquire better metacognition by paying attention to our successes and failures in estimating what we do and don't know, and by using testing often to monitor our progress.

**Transfer-appropriate processing**

Sometimes, it doesn't make sense to talk about whether a particular encoding activity is good or bad for learning. Rather, we can talk about whether that activity is good for learning as revealed by a particular test. For example, although reading words for meaning leads to better performance on a test of recall or recognition than paying attention to the pronunciation of the word, it leads to worse performance on a test that taps knowledge of that pronunciation, such as whether a previously studied word rhymes with another word (Morris, Bransford, & Franks, 1977). The principle of **transfer-appropriate processing** states that memory is “better” when the test taps the same type of knowledge as the original encoding activity. When thinking
about how to learn material, we should always be thinking about the situations in which we are likely to need access to that material. An emergency responder who needs access to learned procedures under conditions of great stress should learn differently from a hobbyist learning to use a new digital camera.

**The value of forgetting**

Forgetting is sometimes seen as the enemy of learning, but, in fact, forgetting is a highly desirable part of the learning process. The main bottleneck we face in using our knowledge is being able to access it. We have all had the experience of retrieval failure—that is, not being able to remember a piece of information that we know we have, and that we can access easily once the right set of cues is provided. Because access is difficult, it is important to jettison information that is not needed—that is, to forget it. Without forgetting, our minds would become cluttered with out-of-date or irrelevant information. And, just imagine how complicated life would be if we were unable to forget the names of past acquaintances, teachers, or romantic partners.

But the value of forgetting is even greater than that. There is lots of evidence that *some* forgetting is a prerequisite for *more* learning. For example, the previously discussed benefits of distributing practice opportunities may arise in part because of the greater forgetting that takes places between those spaced learning events. It is for this reason that some encoding activities that are difficult and lead to the appearance of slow learning actually lead to superior learning in the long run (Bjork, 2011). When we opt for learning activities that enhance learning quickly, we must be aware that these are not always the same techniques that lead to durable, long-term learning.

**Conclusion**
To wrap things up, let’s think back to the questions we began the module with. What might you now do differently when preparing for an exam? Hopefully, you will think about testing yourself frequently, developing an accurate sense of what you do and do not know, how you are likely to use the knowledge, and using the scheduling of tasks to your advantage. If you are learning a new skill or new material, using the scientific study of learning as a basis for the study and practice decisions you make is a good bet.
Outside Resources

Video: The First 20 hours – How to Learn Anything - Watch a video by Josh Kaufman about how we can get really good at almost anything with 20 hours of efficient practice. https://www.youtube.com/watch?v=5MgBikgcWnY

Video: The Learning Scientists - Terrific YouTube Channel with videos covering such important topics as interleaving, spaced repetition, and retrieval practice. https://www.youtube.com/channel/UCjbAmxL6GZXiaoXuNE7c1Yg

Video: What we learn before we're born - In this video, science writer Annie Murphy Paul answers the question “When does learning begin?” She covers through new research that shows how much we learn in the womb — from the lilt of our native language to our soon-to-be-favorite foods. https://www.ted.com/talks/annie_murphy_paul_what_we_learn_before_we_re_born

Web: Neuroscience News - This is a science website dedicated to neuroscience research, with this page addressing fascinating new memory research. http://neurosciencenews.com/neuroscience-terms/memory-research/

Web: The Learning Scientists - A website created by three psychologists who wanted to make scientific research on learning more accessible to students, teachers, and other educators. http://www.learningscientists.org/

Discussion Questions

1. How would you best design a computer program to help someone learn a new foreign language? Think about some of the principles of learning outlined in this module and how those principles could be instantiated in “rules” in a computer program.

2. Would you rather have a really good memory or really good metacognition? How might you train someone to develop better metacognition if he or she doesn’t have a very good memory, and what would be the consequences of that training?

3. In what kinds of situations not discussed here might you find a benefit of forgetting on learning?
Vocabulary

Chunk
The process of grouping information together using our knowledge.

Classical conditioning
Describes stimulus-stimulus associative learning.

Encoding
The pact of putting information into memory.

Habituation
Occurs when the response to a stimulus decreases with exposure.

Implicit learning
Occurs when we acquire information without intent that we cannot easily express.

Implicit memory
A type of long-term memory that does not require conscious thought to encode. It's the type of memory one makes without intent.

Incidental learning
Any type of learning that happens without the intention to learn.

Intentional learning
Any type of learning that happens when motivated by intention.

Metacognition
Describes the knowledge and skills people have in monitoring and controlling their own learning and memory.

Nonassociative learning
Occurs when a single repeated exposure leads to a change in behavior.

Operant conditioning
Describes stimulus-response associative learning.

Perceptual learning
Occurs when aspects of our perception changes as a function of experience.

**Sensitization**
Occurs when the response to a stimulus increases with exposure

**Transfer-appropriate processing**
A principle that states that memory performance is superior when a test taps the same cognitive processes as the original encoding activity.

**Working memory**
The form of memory we use to hold onto information temporarily, usually for the purposes of manipulation.
References


NY: Oxford University Press.


“Memory” is a single term that reflects a number of different abilities: holding information briefly while working with it (working memory), remembering episodes of one’s life (episodic memory), and our general knowledge of facts of the world (semantic memory), among other types. Remembering episodes involves three processes: encoding information (learning it, by perceiving it and relating it to past knowledge), storing it (maintaining it over time), and then retrieving it (accessing the information when needed). Failures can occur at any stage, leading to forgetting or to having false memories. The key to improving one’s memory is to improve processes of encoding and to use techniques that guarantee effective retrieval. Good encoding techniques include relating new information to what one already knows, forming mental images, and creating associations among information that needs to be remembered. The key to good retrieval is developing effective cues that will lead the rememberer back to the encoded information. Classic mnemonic systems, known since the time of the ancient Greeks and still used by some today, can greatly improve one’s memory abilities.

Learning Objectives

- Define and note differences between the following forms of memory: working memory, episodic memory, semantic memory, collective memory.
- Describe the three stages in the process of learning and remembering.
- Describe strategies that can be used to enhance the original learning or encoding of information.
- Describe strategies that can improve the process of retrieval.
- Describe why the classic mnemonic device, the method of loci, works so well.
Introduction

In 2013, Simon Reinhard sat in front of 60 people in a room at Washington University, where he memorized an increasingly long series of digits. On the first round, a computer generated 10 random digits—6 1 9 4 8 5 6 3 7 1—on a screen for 10 seconds. After the series disappeared, Simon typed them into his computer. His recollection was perfect. In the next phase, 20 digits appeared on the screen for 20 seconds. Again, Simon got them all correct. No one in the audience (mostly professors, graduate students, and undergraduate students) could recall the 20 digits perfectly. Then came 30 digits, studied for 30 seconds; once again, Simon didn’t misplace even a single digit. For a final trial, 50 digits appeared on the screen for 50 seconds, and again, Simon got them all right. In fact, Simon would have been happy to keep going. His record in this task—called “forward digit span”—is 240 digits!

When most of us witness a performance like that of Simon Reinhard, we think one of two things: First, maybe he’s cheating somehow. (No, he is not.) Second, Simon must have abilities more advanced than the rest of humankind. After all, psychologists established many years ago that the normal memory span for adults is about 7 digits, with some of us able to recall a few more and others a few less (Miller, 1956). That is why the first phone numbers were limited to 7 digits—with some of us able to recall a few more and others a few less (Miller, 1956). That is why the first phone numbers were limited to 7 digits—psychologists determined that many errors occurred (costing the phone company money) when the number was increased to even 8 digits. But in normal testing, no one gets 50 digits correct in a row, much less 240. So, does Simon Reinhard simply have a photographic memory? He does not. Instead, Simon has taught himself simple strategies for remembering that have greatly increased his capacity for remembering virtually any type of material—digits, words, faces and names, poetry, historical dates, and so on. Twelve years earlier, before he started training his memory abilities, he had a digit span of 7, just like most of us. Simon has been training his abilities for about 10 years as of this writing, and has risen...
to be in the top two of “memory athletes.” In 2012, he came in second place in the World Memory Championships (composed of 11 tasks), held in London. He currently ranks second in the world, behind another German competitor, Johannes Mallow. In this module, we reveal what psychologists and others have learned about memory, and we also explain the general principles by which you can improve your own memory for factual material.

## Varieties of Memory

For most of us, remembering digits relies on short-term memory, or working memory—the ability to hold information in our minds for a brief time and work with it (e.g., multiplying 24 x 17 without using paper would rely on working memory). Another type of memory is episodic memory—the ability to remember the episodes of our lives. If you were given the task of recalling everything you did 2 days ago, that would be a test of episodic memory; you would be required to mentally travel through the day in your mind and note the main events. Semantic memory is our storehouse of more-or-less permanent knowledge, such as the meanings of words in a language (e.g., the meaning of “parasol”) and the huge collection of facts about the world (e.g., there are 196 countries in the world, and 206 bones in your body). Collective memory refers to the kind of memory that people in a group share (whether family, community, schoolmates, or citizens of a state or a country). For example, residents of small towns often strongly identify with those towns, remembering the local customs and historical events in a unique way. That is, the community’s collective memory passes stories and recollections between neighbors and to future generations, forming a memory system unto itself.

Psychologists continue to debate the classification of types of memory, as well as which types rely on others (Tulving, 2007), but for this module we will focus on episodic memory. Episodic memory is usually what people think of when they hear the word “memory.” For example,
when people say that an older relative is “losing her memory” due to Alzheimer’s disease, the
type of memory-loss they are referring to is the inability to recall events, or episodic memory.
(Semantic memory is actually preserved in early-stage Alzheimer’s disease.) Although
remembering specific events that have happened over the course of one’s entire life (e.g.,
your experiences in sixth grade) can be referred to as autobiographical memory, we will focus
primarily on the episodic memories of more recent events.

Three Stages of the Learning/Memory Process

Psychologists distinguish between three necessary stages in the learning and memory
process: encoding, storage, and retrieval (Melton, 1963). Encoding is defined as the initial
learning of information; storage refers to maintaining information over time; retrieval is the
ability to access information when you need it. If you meet someone for the first time at a
party, you need to encode her name (Lyn Goff) while you associate her name with her face.
Then you need to maintain the information over time. If you see her a week later, you need
to recognize her face and have it serve as a cue to retrieve her name. Any successful act of
remembering requires that all three stages be intact. However, two types of errors can also
occur. Forgetting is one type: you see the person you met at the party and you cannot recall
her name. The other error is misremembering (false recall or false recognition): you see
someone who looks like Lyn Goff and call the person by that name (false recognition of the
face). Or, you might see the real Lyn Goff, recognize her face, but then call her by the name
of another woman you met at the party (misrecall of her name).

Whenever forgetting or misremembering occurs, we can ask, at which stage in the learning/
memory process was there a failure?—though it is often difficult to answer this question with
precision. One reason for this inaccuracy is that the three stages are not as discrete as our
description implies. Rather, all three stages depend on one another. How we encode
information determines how it will be stored and what cues will be effective when we try to
retrieve it. And too, the act of retrieval itself also changes the way information is subsequently
remembered, usually aiding later recall of the retrieved information. The central point for now
is that the three stages—encoding, storage, and retrieval—affect one another, and are
inextricably bound together.

Encoding

Encoding refers to the initial experience of perceiving and learning information. Psychologists
often study recall by having participants study a list of pictures or words. Encoding in these
situations is fairly straightforward. However, “real life” encoding is much more challenging.
When you walk across campus, for example, you encounter countless sights and sounds—friends passing by, people playing Frisbee, music in the air. The physical and mental environments are much too rich for you to encode all the happenings around you or the internal thoughts you have in response to them. So, an important first principle of encoding is that it is selective: we attend to some events in our environment and we ignore others. A second point about encoding is that it is prolific; we are always encoding the events of our lives—attending to the world, trying to understand it. Normally this presents no problem, as our days are filled with routine occurrences, so we don't need to pay attention to everything. But if something does happen that seems strange—during your daily walk across campus, you see a giraffe—then we pay close attention and try to understand why we are seeing what we are seeing.

Right after your typical walk across campus (one without the appearance of a giraffe), you would be able to remember the events reasonably well if you were asked. You could say whom you bumped into, what song was playing from a radio, and so on. However, suppose someone asked you to recall the same walk a month later. You wouldn't stand a chance. You would likely be able to recount the basics of a typical walk across campus, but not the precise details of that particular walk. Yet, if you had seen a giraffe during that walk, the event would have been fixed in your mind for a long time, probably for the rest of your life. You would tell your friends about it, and, on later occasions when you saw a giraffe, you might be reminded of the day you saw one on campus. Psychologists have long pinpointed distinctiveness—having an event stand out as quite different from a background of similar events—as a key attribute to remembering events (Hunt, 2003).

In addition, when vivid memories are tinged with strong emotional content, they often seem to leave a permanent mark on us. Public tragedies, such as terrorist attacks, often create vivid memories in those who witnessed them. But even those of us not directly involved in such events may have vivid memories of them, including memories of first hearing about them.
For example, many people are able to recall their exact physical location when they first learned about the assassination or accidental death of a national figure. The term flashbulb memory was originally coined by Brown and Kulik (1977) to describe this sort of vivid memory of finding out an important piece of news. The name refers to how some memories seem to be captured in the mind like a flash photograph; because of the distinctiveness and emotionality of the news, they seem to become permanently etched in the mind with exceptional clarity compared to other memories.

Take a moment and think back on your own life. Is there a particular memory that seems sharper than others? A memory where you can recall unusual details, like the colors of mundane things around you, or the exact positions of surrounding objects? Although people have great confidence in flashbulb memories like these, the truth is, our objective accuracy with them is far from perfect (Talarico & Rubin, 2003). That is, even though people may have great confidence in what they recall, their memories are not as accurate (e.g., what the actual colors were; where objects were truly placed) as they tend to imagine. Nonetheless, all other things being equal, distinctive and emotional events are well-remembered.

Details do not leap perfectly from the world into a person’s mind. We might say that we went to a party and remember it, but what we remember is (at best) what we encoded. As noted above, the process of encoding is selective, and in complex situations, relatively few of many possible details are noticed and encoded. The process of encoding always involves recoding—that is, taking the information from the form it is delivered to us and then converting it in a way that we can make sense of it. For example, you might try to remember the colors of a rainbow by using the acronym ROY G BIV (red, orange, yellow, green, blue, indigo, violet). The process of recoding the colors into a name can help us to remember. However, recoding can also introduce errors—when we accidentally add information during encoding, then remember that new material as if it had been part of the actual experience (as discussed below).

Psychologists have studied many
recoding strategies that can be used during study to improve retention. First, research advises that, as we study, we should think of the meaning of the events (Craik & Lockhart, 1972), and we should try to relate new events to information we already know. This helps us form associations that we can use to retrieve information later. Second, imagining events also makes them more memorable; creating vivid images out of information (even verbal information) can greatly improve later recall (Bower & Reitman, 1972). Creating imagery is part of the technique Simon Reinhard uses to remember huge numbers of digits, but we can all use images to encode information more effectively. The basic concept behind good encoding strategies is to form distinctive memories (ones that stand out), and to form links or associations among memories to help later retrieval (Hunt & McDaniel, 1993). Using study strategies such as the ones described here is challenging, but the effort is well worth the benefits of enhanced learning and retention.

We emphasized earlier that encoding is selective: people cannot encode all information they are exposed to. However, recoding can add information that was not even seen or heard during the initial encoding phase. Several of the recoding processes, like forming associations between memories, can happen without our awareness. This is one reason people can sometimes remember events that did not actually happen—because during the process of recoding, details got added. One common way of inducing false memories in the laboratory employs a word-list technique (Deese, 1959; Roediger & McDermott, 1995). Participants hear lists of 15 words, like door, glass, pane, shade, ledge, sill, house, open, curtain, frame, view, breeze, sash, screen, and shutter. Later, participants are given a test in which they are shown a list of words and asked to pick out the ones they'd heard earlier. This second list contains some words from the first list (e.g., door, pane, frame) and some words not from the list (e.g., arm, phone, bottle). In this example, one of the words on the test is window, which—importantly—does not appear in the first list, but which is related to other words in that list. When subjects were tested, they were reasonably accurate with the studied words (door, etc.), recognizing them 72% of the time. However, when window was on the test, they falsely recognized it as having been on the list 84% of the time (Stadler, Roediger, & McDermott, 1999). The same thing happened with many other lists the authors used. This phenomenon is referred to as the DRM (for Deese-Roediger-McDermott) effect. One explanation for such results is that, while students listened to items in the list, the words triggered the students to think about window, even though window was never presented. In this way, people seem to encode events that are not actually part of their experience.

Because humans are creative, we are always going beyond the information we are given: we automatically make associations and infer from them what is happening. But, as with the word association mix-up above, sometimes we make false memories from our inferences—remembering the inferences themselves as if they were actual experiences. To illustrate this,
Brewer (1977) gave people sentences to remember that were designed to elicit pragmatic inferences. Inferences, in general, refer to instances when something is not explicitly stated, but we are still able to guess the undisclosed intention. For example, if your friend told you that she didn’t want to go out to eat, you may infer that she doesn’t have the money to go out, or that she’s too tired. With pragmatic inferences, there is usually one particular inference you’re likely to make. Consider the statement Brewer (1977) gave her participants: “The karate champion hit the cinder block.” After hearing or seeing this sentence, participants who were given a memory test tended to remember the statement as having been, “The karate champion broke the cinder block.” This remembered statement is not necessarily a logical inference (i.e., it is perfectly reasonable that a karate champion could hit a cinder block without breaking it). Nevertheless, the pragmatic conclusion from hearing such a sentence is that the block was likely broken. The participants remembered this inference they made while hearing the sentence in place of the actual words that were in the sentence (see also McDermott & Chan, 2006).

Encoding—the initial registration of information—is essential in the learning and memory process. Unless an event is encoded in some fashion, it will not be successfully remembered later. However, just because an event is encoded (even if it is encoded well), there’s no guarantee that it will be remembered later.

**Storage**

Every experience we have changes our brains. That may seem like a bold, even strange, claim at first, but it’s true. We encode each of our experiences within the structures of the nervous system, making new impressions in the process—and each of those impressions involves changes in the brain. Psychologists (and neurobiologists) say that experiences leave memory traces, or engrams (the two terms are synonyms). Memories have to be stored somewhere in the brain, so in order to do so, the brain biochemically alters itself and its neural tissue. Just like you might write yourself a note to remind you of something, the brain “writes” a memory trace, changing its own

Memory traces, or engrams, are NOT perfectly preserved recordings of past experiences. The traces are combined with current knowledge to reconstruct what we think happened in the past. [Simon Bierdwald, https://goo.gl/JDhdCE, CC BY-NC-SA 2.0, https://goo.gl/jSSrcO]
physical composition to do so. The basic idea is that events (occurrences in our environment) create engrams through a process of **consolidation**: the neural changes that occur after learning to create the memory trace of an experience. Although neurobiologists are concerned with exactly what neural processes change when memories are created, for psychologists, the term *memory trace* simply refers to the physical change in the nervous system (whatever that may be, exactly) that represents our experience.

Although the concept of engram or memory trace is extremely useful, we shouldn’t take the term too literally. It is important to understand that memory traces are not perfect little packets of information that lie dormant in the brain, waiting to be called forward to give an accurate report of past experience. Memory traces are not like video or audio recordings, capturing experience with great accuracy; as discussed earlier, we often have errors in our memory, which would not exist if memory traces were perfect packets of information. Thus, it is wrong to think that remembering involves simply “reading out” a faithful record of past experience. Rather, when we remember past events, we reconstruct them with the aid of our memory traces—but also with our current belief of what happened. For example, if you were trying to recall for the police who started a fight at a bar, you may not have a memory trace of who pushed whom first. However, let’s say you remember that one of the guys held the door open for you. When thinking back to the start of the fight, this knowledge (of how one guy was friendly to you) may unconsciously influence your memory of what happened in favor of the nice guy. Thus, memory is a construction of what you actually recall and what you believe happened. In a phrase, remembering is reconstructive (we reconstruct our past with the aid of memory traces) not reproductive (a perfect reproduction or recreation of the past).

Psychologists refer to the time between learning and testing as the **retention interval**. Memories can consolidate during that time, aiding retention. However, experiences can also occur that undermine the memory. For example, think of what you had for lunch yesterday
—a pretty easy task. However, if you had to recall what you had for lunch 17 days ago, you may well fail (assuming you don’t eat the same thing every day). The 16 lunches you’ve had since that one have created retroactive interference. Retroactive interference refers to new activities (i.e., the subsequent lunches) during the retention interval (i.e., the time between the lunch 17 days ago and now) that interfere with retrieving the specific, older memory (i.e., the lunch details from 17 days ago). But just as newer things can interfere with remembering older things, so can the opposite happen. Proactive interference is when past memories interfere with the encoding of new ones. For example, if you have ever studied a second language, often times the grammar and vocabulary of your native language will pop into your head, impairing your fluency in the foreign language.

Retroactive interference is one of the main causes of forgetting (McGeoch, 1932). In the module Eyewitness Testimony and Memory Biases http://noba.to/uy49tm37 Elizabeth Loftus describes her fascinating work on eyewitness memory, in which she shows how memory for an event can be changed via misinformation supplied during the retention interval. For example, if you witnessed a car crash but subsequently heard people describing it from their own perspective, this new information may interfere with or disrupt your own personal recollection of the crash. In fact, you may even come to remember the event happening exactly as the others described it! This misinformation effect in eyewitness memory represents a type of retroactive interference that can occur during the retention interval (see Loftus [2005] for a review). Of course, if correct information is given during the retention interval, the witness’s memory will usually be improved.

Although interference may arise between the occurrence of an event and the attempt to recall it, the effect itself is always expressed when we retrieve memories, the topic to which we turn next.

Retrieval

Endel Tulving argued that “the key process in memory is retrieval” (1991, p. 91). Why should retrieval be given more prominence than encoding or storage? For one thing, if information were encoded and stored but could not be retrieved, it would be useless. As discussed previously in this module, we encode and store thousands of events—conversations, sights and sounds—every day, creating memory traces. However, we later access only a tiny portion of what we’ve taken in. Most of our memories will never be used—in the sense of being brought back to mind, consciously. This fact seems so obvious that we rarely reflect on it. All those events that happened to you in the fourth grade that seemed so important then? Now, many years later, you would struggle to remember even a few. You may wonder if the traces of those memories still exist in some latent form. Unfortunately, with currently available
Psychologists distinguish information that is available in memory from that which is accessible (Tulving & Pearlstone, 1966). Available information is the information that is stored in memory—but precisely how much and what types are stored cannot be known. That is, all we can know is what information we can retrieve—accessible information. The assumption is that accessible information represents only a tiny slice of the information available in our brains. Most of us have had the experience of trying to remember some fact or event, giving up, and then—all of a sudden!—it comes to us at a later time, even after we’ve stopped trying to remember it. Similarly, we all know the experience of failing to recall a fact, but then, if we are given several choices (as in a multiple-choice test), we are easily able to recognize it.

What factors determine what information can be retrieved from memory? One critical factor is the type of hints, or cues, in the environment. You may hear a song on the radio that suddenly evokes memories of an earlier time in your life, even if you were not trying to remember it when the song came on. Nevertheless, the song is closely associated with that time, so it brings the experience to mind.

The general principle that underlies the effectiveness of retrieval cues is the encoding specificity principle (Tulving & Thomson, 1973): when people encode information, they do so in specific ways. For example, take the song on the radio: perhaps you heard it while you were at a terrific party, having a great, philosophical conversation with a friend. Thus, the song became part of that whole complex experience. Years later, even though you haven’t thought about that party in ages, when you hear the song on the radio, the whole experience rushes back to you. In general, the encoding specificity principle states that, to the extent a retrieval cue (the song) matches or overlaps the memory trace of an experience (the party, the conversation), it will be effective in evoking the memory. A classic experiment on the encoding specificity principle had participants memorize a set of words in a unique setting. Later, the participants were tested on the word sets, either in the same location they learned the words
or a different one. As a result of encoding specificity, the students who took the test in the same place they learned the words were actually able to recall more words (Godden & Baddeley, 1975) than the students who took the test in a new setting.

One caution with this principle, though, is that, for the cue to work, it can't match too many other experiences (Nairne, 2002; Watkins, 1975). Consider a lab experiment. Suppose you study 100 items; 99 are words, and one is a picture—of a penguin, item 50 in the list. Afterwards, the cue “recall the picture” would evoke “penguin” perfectly. No one would miss it. However, if the word “penguin” were placed in the same spot among the other 99 words, its memorability would be exceptionally worse. This outcome shows the power of distinctiveness that we discussed in the section on encoding: one picture is perfectly recalled from among 99 words because it stands out. Now consider what would happen if the experiment were repeated, but there were 25 pictures distributed within the 100-item list. Although the picture of the penguin would still be there, the probability that the cue “recall the picture” (at item 50) would be useful for the penguin would drop correspondingly. Watkins (1975) referred to this outcome as demonstrating the cue overload principle. That is, to be effective, a retrieval cue cannot be overloaded with too many memories. For the cue “recall the picture” to be effective, it should only match one item in the target set (as in the one-picture, 99-word case).

To sum up how memory cues function: for a retrieval cue to be effective, a match must exist between the cue and the desired target memory; furthermore, to produce the best retrieval, the cue-target relationship should be distinctive. Next, we will see how the encoding specificity principle can work in practice.

Psychologists measure memory performance by using production tests (involving recall) or recognition tests (involving the selection of correct from incorrect information, e.g., a multiple-choice test). For example, with our list of 100 words, one group of people might be asked to recall the list in any order (a free recall test), while a different group might be asked to circle the 100 studied words out of a mix with another 100, unstudied words (a recognition test). In this situation, the recognition test would likely produce better performance from participants than the recall test.

We usually think of recognition tests as being quite easy, because the cue for retrieval is a copy of the actual event that was presented for study. After all, what could be a better cue than the exact target (memory) the person is trying to access? In most cases, this line of reasoning is true; nevertheless, recognition tests do not provide perfect indexes of what is stored in memory. That is, you can fail to recognize a target staring you right in the face, yet be able to recall it later with a different set of cues (Watkins & Tulving, 1975). For example, suppose you had the task of recognizing the surnames of famous authors. At first, you might
think that being given the actual last name would always be the best cue. However, research has shown this not necessarily to be true (Muter, 1984). When given names such as Tolstoy, Shaw, Shakespeare, and Lee, subjects might well say that Tolstoy and Shakespeare are famous authors, whereas Shaw and Lee are not. But, when given a cued recall test using first names, people often recall items (produce them) that they had failed to recognize before. For example, in this instance, a cue like George Bernard ______ often leads to a recall of “Shaw,” even though people initially failed to recognize Shaw as a famous author’s name. Yet, when given the cue “William,” people may not come up with Shakespeare, because William is a common name that matches many people (the cue overload principle at work). This strange fact—that recall can sometimes lead to better performance than recognition—can be explained by the encoding specificity principle. As a cue, George Bernard ______ matches the way the famous writer is stored in memory better than does his surname, Shaw, does (even though it is the target). Further, the match is quite distinctive with George Bernard _______, but the cue William ____________ is much more overloaded (Prince William, William Yeats, William Faulkner, will.i.am).

The phenomenon we have been describing is called the recognition failure of recallable words, which highlights the point that a cue will be most effective depending on how the information has been encoded (Tulving & Thomson, 1973). The point is, the cues that work best to evoke retrieval are those that recreate the event or name to be remembered, whereas sometimes even the target itself, such as Shaw in the above example, is not the best cue. Which cue will be most effective depends on how the information has been encoded.

Whenever we think about our past, we engage in the act of retrieval. We usually think that retrieval is an objective act because we tend to imagine that retrieving a memory is like pulling a book from a shelf, and after we are done with it, we return the book to the shelf just as it was. However, research shows this assumption to be false; far from being a static repository of data, the memory is constantly changing. In fact, every time we retrieve a memory, it is altered. For example, the act of retrieval itself (of a fact, concept, or event) makes the retrieved memory much more likely to be retrieved again, a phenomenon called the testing effect or the retrieval practice effect (Pyc & Rawson, 2009; Roediger & Karpicke, 2006). However, retrieving some information can actually cause us to forget other information related to it, a phenomenon called retrieval-induced forgetting (Anderson, Bjork, & Bjork, 1994). Thus the act of retrieval can be a double-edged sword—strengthening the memory just retrieved (usually by a large amount) but harming related information (though this effect is often relatively small).

As discussed earlier, retrieval of distant memories is reconstructive. We weave the concrete bits and pieces of events in with assumptions and preferences to form a coherent story (Bartlett, 1932). For example, if during your 10th birthday, your dog got to your cake before
you did, you would likely tell that story for years afterward. Say, then, in later years you misremember where the dog actually found the cake, but repeat that error over and over during subsequent retellings of the story. Over time, that inaccuracy would become a basic fact of the event in your mind. Just as retrieval practice (repetition) enhances accurate memories, so will it strengthen errors or false memories (McDermott, 2006). Sometimes memories can even be manufactured just from hearing a vivid story. Consider the following episode, recounted by Jean Piaget, the famous developmental psychologist, from his childhood:

One of my first memories would date, if it were true, from my second year. I can still see, most clearly, the following scene, in which I believed until I was about 15. I was sitting in my pram . . . when a man tried to kidnap me. I was held in by the strap fastened round me while my nurse bravely tried to stand between me and the thief. She received various scratches, and I can still vaguely see those on her face. . . . When I was about 15, my parents received a letter from my former nurse saying that she had been converted to the Salvation Army. She wanted to confess her past faults, and in particular to return the watch she had been given as a reward on this occasion. She had made up the whole story, faking the scratches. I therefore must have heard, as a child, this story, which my parents believed, and projected it into the past in the form of a visual memory. . . . Many real memories are doubtless of the same order. (Norman & Schacter, 1997, pp. 187–188)

Piaget’s vivid account represents a case of a pure reconstructive memory. He heard the tale told repeatedly, and doubtless told it (and thought about it) himself. The repeated telling cemented the events as though they had really happened, just as we are all open to the possibility of having “many real memories ... of the same order.” The fact that one can remember precise details (the location, the scratches) does not necessarily indicate that the memory is true, a point that has been confirmed in laboratory studies, too (e.g., Norman & Schacter, 1997).

**Putting It All Together: Improving Your Memory**

A central theme of this module has been the importance of the encoding and retrieval processes, and their interaction. To recap: to improve learning and memory, we need to encode information in conjunction with excellent cues that will bring back the remembered events when we need them. But how do we do this? Keep in mind the two critical principles we have discussed: to maximize retrieval, we should construct meaningful cues that remind us of the original experience, and those cues should be distinctive and not associated with other memories. These two conditions are critical in maximizing cue effectiveness (Nairne, 2002).
So, how can these principles be adapted for use in many situations? Let's go back to how we started the module, with Simon Reinhard's ability to memorize huge numbers of digits. Although it was not obvious, he applied these same general memory principles, but in a more deliberate way. In fact, all mnemonic devices, or memory aids/tricks, rely on these fundamental principles. In a typical case, the person learns a set of cues and then applies these cues to learn and remember information. Consider the set of 20 items below that are easy to learn and remember (Bower & Reitman, 1972).

1. is a gun. 11 is penny-one, hot dog bun.
2. is a shoe. 12 is penny-two, airplane glue.
3. is a tree. 13 is penny-three, bumble bee.
4. is a door. 14 is penny-four, grocery store.
5. is knives. 15 is penny-five, big beehive.
6. is sticks. 16 is penny-six, magic tricks.
7. is oven. 17 is penny-seven, go to heaven.
8. is plate. 18 is penny-eight, golden gate.
9. is wine. 19 is penny-nine, ball of twine.
10. is hen. 20 is penny-ten, ballpoint pen.

It would probably take you less than 10 minutes to learn this list and practice recalling it several times (remember to use retrieval practice!). If you were to do so, you would have a set of peg words on which you could “hang” memories. In fact, this mnemonic device is called the peg word technique. If you then needed to remember some discrete items—say a grocery list, or points you wanted to make in a speech—this method would let you do so in a very precise yet flexible way. Suppose you had to remember bread, peanut butter, bananas, lettuce, and so on. The way to use the method is to form a vivid image of what you want to remember and imagine it interacting with your peg words (as many as you need). For example, for these items, you might imagine a large gun (the first peg word) shooting a loaf of bread, then a jar of peanut butter inside a shoe, then large bunches of bananas hanging from a tree, then a door slamming on a head of lettuce with leaves flying everywhere. The idea is to provide good, distinctive cues (the weirder the better!) for the information you need to remember while you are learning it. If you do this, then retrieving it later is relatively easy. You know your cues perfectly (one is gun, etc.), so you simply go through your cue word list and “look” in your mind's eye at the image stored there (bread, in this case).

This peg word method may sound strange at first, but it works quite well, even with little
One word of warning, though, is that the items to be remembered need to be presented relatively slowly at first, until you have practice associating each with its cue word. People get faster with time. Another interesting aspect of this technique is that it's just as easy to recall the items in backwards order as forwards. This is because the peg words provide direct access to the memorized items, regardless of order.

How did Simon Reinhard remember those digits? Essentially he has a much more complex system based on these same principles. In his case, he uses “memory palaces” (elaborate scenes with discrete places) combined with huge sets of images for digits. For example, imagine mentally walking through the home where you grew up and identifying as many distinct areas and objects as possible. Simon has hundreds of such memory palaces that he uses. Next, for remembering digits, he has memorized a set of 10,000 images. Every four-digit number for him immediately brings forth a mental image. So, for example, 6187 might recall Michael Jackson. When Simon hears all the numbers coming at him, he places an image for every four digits into locations in his memory palace. He can do this at an incredibly rapid rate, faster than 4 digits per 4 seconds when they are flashed visually, as in the demonstration at the beginning of the module. As noted, his record is 240 digits, recalled in exact order. Simon also holds the world record in an event called “speed cards,” which involves memorizing the precise order of a shuffled deck of cards. Simon was able to do this in 21.19 seconds! Again, he uses his memory palaces, and he encodes groups of cards as single images.

Many books exist on how to improve memory using mnemonic devices, but all involve forming distinctive encoding operations and then having an infallible set of memory cues. We should add that to develop and use these memory systems beyond the basic peg system outlined above takes a great amount of time and concentration. The World Memory Championships are held every year and the records keep improving. However, for most common purposes, just keep in mind that to remember well you need to encode information in a distinctive way.
and to have good cues for retrieval. You can adapt a system that will meet most any purpose.
Outside Resources


Student Video 1: Eureka Foong’s - The Misinformation Effect. This is a student-made video illustrating this phenomenon of altered memory. It was one of the winning entries in the 2014 Noba Student Video Award. https://www.youtube.com/watch?v=iMPIWkFtd88

Student Video 2: Kara McCord’s - Flashbulb Memories. This is a student-made video illustrating this phenomenon of autobiographical memory. It was one of the winning entries in the 2014 Noba Student Video Award. https://www.youtube.com/watch?v=mPhW9bUI4F0

Student Video 3: Ang Rui Xia & Ong Jun Hao’s - The Misinformation Effect. Another student-made video exploring the misinformation effect. Also an award winner from 2014. https://www.youtube.com/watch?v=gsn9iKmOJLQ


Web: Retrieval Practice, a website with research, resources, and tips for both educators and learners around the memory-strengthening skill of retrieval practice. http://www.retrievalpractice.org/

Discussion Questions

1. Mnemonists like Simon Reinhard develop mental “journeys,” which enable them to use the method of loci. Develop your own journey, which contains 20 places, in order, that you know well. One example might be: the front walkway to your parents’ apartment; their doorbell; the couch in their living room; etc. Be sure to use a set of places that you know well and that have a natural order to them (e.g., the walkway comes before the doorbell). Now you are more than halfway toward being able to memorize a set of 20 nouns, in order, rather quickly. As an optional second step, have a friend make a list of 20 such nouns and read them to you, slowly (e.g., one every 5 seconds). Use the method to attempt to
remember the 20 items.

2. Recall a recent argument or misunderstanding you have had about memory (e.g., a debate over whether your girlfriend/boyfriend had agreed to something). In light of what you have just learned about memory, how do you think about it? Is it possible that the disagreement can be understood by one of you making a pragmatic inference?

3. Think about what you've learned in this module and about how you study for tests. On the basis of what you have learned, is there something you want to try that might help your study habits?
Vocabulary

**Autobiographical memory**
Memory for the events of one's life.

**Consolidation**
The process occurring after encoding that is believed to stabilize memory traces.

**Cue overload principle**
The principle stating that the more memories that are associated to a particular retrieval cue, the less effective the cue will be in prompting retrieval of any one memory.

**Distinctiveness**
The principle that unusual events (in a context of similar events) will be recalled and recognized better than uniform (nondistinctive) events.

**Encoding**
The initial experience of perceiving and learning events.

**Encoding specificity principle**
The hypothesis that a retrieval cue will be effective to the extent that information encoded from the cue overlaps or matches information in the engram or memory trace.

**Engrams**
A term indicating the change in the nervous system representing an event; also, memory trace.

**Episodic memory**
Memory for events in a particular time and place.

**Flashbulb memory**
Vivid personal memories of receiving the news of some momentous (and usually emotional) event.

**Memory traces**
A term indicating the change in the nervous system representing an event.

**Misinformation effect**
When erroneous information occurring after an event is remembered as having been part of
the original event.

**Mnemonic devices**
A strategy for remembering large amounts of information, usually involving imaging events occurring on a journey or with some other set of memorized cues.

**Recoding**
The ubiquitous process during learning of taking information in one form and converting it to another form, usually one more easily remembered.

**Retrieval**
The process of accessing stored information.

**Retroactive interference**
The phenomenon whereby events that occur after some particular event of interest will usually cause forgetting of the original event.

**Semantic memory**
The more or less permanent store of knowledge that people have.

**Storage**
The stage in the learning/memory process that bridges encoding and retrieval; the persistence of memory over time.
References


Eyewitnesses can provide very compelling legal testimony, but rather than recording experiences flawlessly, their memories are susceptible to a variety of errors and biases. They (like the rest of us) can make errors in remembering specific details and can even remember whole events that did not actually happen. In this module, we discuss several of the common types of errors, and what they can tell us about human memory and its interactions with the legal system.

Learning Objectives

- Describe the kinds of mistakes that eyewitnesses commonly make and some of the ways that this can impede justice.
- Explain some of the errors that are common in human memory.
- Describe some of the important research that has demonstrated human memory errors and their consequences.

What Is Eyewitness Testimony?

Eyewitness testimony is what happens when a person witnesses a crime (or accident, or other legally important event) and later gets up on the stand and recalls for the court all the details of the witnessed event. It involves a more complicated process than might initially be
presumed. It includes what happens during the actual crime to facilitate or hamper witnessing, as well as everything that happens from the time the event is over to the later courtroom appearance. The eyewitness may be interviewed by the police and numerous lawyers, describe the perpetrator to several different people, and make an identification of the perpetrator, among other things.

Why Is Eyewitness Testimony an Important Area of Psychological Research?

When an eyewitness stands up in front of the court and describes what happened from her own perspective, this testimony can be extremely compelling—it is hard for those hearing this testimony to take it “with a grain of salt,” or otherwise adjust its power. But to what extent is this necessary?

There is now a wealth of evidence, from research conducted over several decades, suggesting that eyewitness testimony is probably the most persuasive form of evidence presented in court, but in many cases, its accuracy is dubious. There is also evidence that mistaken eyewitness evidence can lead to wrongful conviction—sending people to prison for years or decades, even to death row, for crimes they did not commit. Faulty eyewitness testimony has been implicated in at least 75% of DNA exoneration cases—more than any other cause (Garrett, 2011). In a particularly famous case, a man named Ronald Cotton was identified by...
a rape victim, Jennifer Thompson, as her rapist, and was found guilty and sentenced to life in prison. After more than 10 years, he was exonerated (and the real rapist identified) based on DNA evidence. For details on this case and other (relatively) lucky individuals whose false convictions were subsequently overturned with DNA evidence, see the Innocence Project website (http://www.innocenceproject.org/).

There is also hope, though, that many of the errors may be avoidable if proper precautions are taken during the investigative and judicial processes. Psychological science has taught us what some of those precautions might involve, and we discuss some of that science now.

**Misinformation**

In an early study of eyewitness memory, undergraduate subjects first watched a slideshow depicting a small red car driving and then hitting a pedestrian (Loftus, Miller, & Burns, 1978). Some subjects were then asked leading questions about what had happened in the slides. For example, subjects were asked, “How fast was the car traveling when it passed the yield sign?” But this question was actually designed to be misleading, because the original slide included a stop sign rather than a yield sign.

Later, subjects were shown pairs of slides. One of the pair was the original slide containing the stop sign; the other was a replacement slide containing a yield sign. Subjects were asked which of the pair they had previously seen. Subjects who had been asked about the yield sign were likely to pick the slide showing the yield sign, even though they had originally seen the slide with the stop sign. In other words, the misinformation in the leading question led to inaccurate memory.

This phenomenon is called the *misinformation effect*, because the misinformation that subjects were exposed to after the event (here in the form of a misleading question) apparently contaminates subjects’ memories of what they witnessed. Hundreds of subsequent studies have demonstrated that memory can be contaminated by erroneous information that people are
exposed to after they witness an event (see Frenna, Nichols, & Loftus, 2011; Loftus, 2005). The misinformation in these studies has led people to incorrectly remember everything from small but crucial details of a perpetrator’s appearance to objects as large as a barn that wasn’t there at all.

These studies have demonstrated that young adults (the typical research subjects in psychology) are often susceptible to misinformation, but that children and older adults can be even more susceptible (Bartlett & Memon, 2007; Ceci & Bruck, 1995). In addition, misinformation effects can occur easily, and without any intention to deceive (Allan & Gabbert, 2008). Even slight differences in the wording of a question can lead to misinformation effects. Subjects in one study were more likely to say yes when asked “Did you see the broken headlight?” than when asked “Did you see a broken headlight?” (Loftus, 1975).

Other studies have shown that misinformation can corrupt memory even more easily when it is encountered in social situations (Gabbert, Memon, Allan, & Wright, 2004). This is a problem particularly in cases where more than one person witnesses a crime. In these cases, witnesses tend to talk to one another in the immediate aftermath of the crime, including as they wait for police to arrive. But because different witnesses are different people with different perspectives, they are likely to see or notice different things, and thus remember different things, even when they witness the same event. So when they communicate about the crime later, they not only reinforce common memories for the event, they also contaminate each other’s memories for the event (Gabbert, Memon, & Allan, 2003; Paterson & Kemp, 2006; Takarangi, Parker, & Garry, 2006).

The misinformation effect has been modeled in the laboratory. Researchers had subjects watch a video in pairs. Both subjects sat in front of the same screen, but because they wore differently polarized glasses, they saw two different versions of a video, projected onto a screen. So, although they were both watching the same screen, and believed (quite reasonably) that they were watching the same video, they were actually watching two different versions of the video (Garry, French, Kinzett, & Mori, 2008).

In the video, Eric the electrician is seen wandering through an unoccupied house and helping himself to the contents thereof. A total of eight details were different between the two videos. After watching the videos, the “co-witnesses” worked together on 12 memory test questions. Four of these questions dealt with details that were different in the two versions of the video, so subjects had the chance to influence one another. Then subjects worked individually on 20 additional memory test questions. Eight of these were for details that were different in the two videos. Subjects’ accuracy was highly dependent on whether they had discussed the details previously. Their accuracy for items they had not previously discussed with their co-
witness was 79%. But for items that they had discussed, their accuracy dropped markedly, to 34%. That is, subjects allowed their co-witnesses to corrupt their memories for what they had seen.

Identifying Perpetrators

In addition to correctly remembering many details of the crimes they witness, eyewitnesses often need to remember the faces and other identifying features of the perpetrators of those crimes. Eyewitnesses are often asked to describe that perpetrator to law enforcement and later to make identifications from books of mug shots or lineups. Here, too, there is a substantial body of research demonstrating that eyewitnesses can make serious, but often understandable and even predictable, errors (Caputo & Dunning, 2007; Cutler & Penrod, 1995).

In most jurisdictions in the United States, lineups are typically conducted with pictures, called photo spreads, rather than with actual people standing behind one-way glass (Wells, Memon, & Penrod, 2006). The eyewitness is given a set of small pictures of perhaps six or eight individuals who are dressed similarly and photographed in similar circumstances. One of these individuals is the police suspect, and the remainder are “foils” or “fillers” (people known to be innocent of the particular crime under investigation). If the eyewitness identifies the suspect, then the investigation of that suspect is likely to progress. If a witness identifies a foil or no one, then the police may choose to move their investigation in another direction.

This process is modeled in laboratory studies of eyewitness identifications. In these studies, research subjects witness a mock crime (often as a short video) and then are asked to make an identification from a photo or a live lineup. Sometimes the lineups are target present, meaning that the perpetrator from the mock crime is actually in the lineup, and sometimes they are target absent, meaning that the lineup is made up entirely of foils. The subjects, or mock witnesses, are given some instructions and asked to pick the
perpetrator out of the lineup. The particular details of the witnessing experience, the instructions, and the lineup members can all influence the extent to which the mock witness is likely to pick the perpetrator out of the lineup, or indeed to make any selection at all. Mock witnesses (and indeed real witnesses) can make errors in two different ways. They can fail to pick the perpetrator out of a target present lineup (by picking a foil or by neglecting to make a selection), or they can pick a foil in a target absent lineup (wherein the only correct choice is to not make a selection).

Some factors have been shown to make eyewitness identification errors particularly likely. These include poor vision or viewing conditions during the crime, particularly stressful witnessing experiences, too little time to view the perpetrator or perpetrators, too much delay between witnessing and identifying, and being asked to identify a perpetrator from a race other than one’s own (Bornstein, Deffenbacher, Penrod, & McGorty, 2012; Brigham, Bennett, Meissner, & Mitchell, 2007; Burton, Wilson, Cowan, & Bruce, 1999; Deffenbacher, Bornstein, Penrod, & McGorty, 2004).

It is hard for the legal system to do much about most of these problems. But there are some things that the justice system can do to help lineup identifications “go right.” For example, investigators can put together high-quality, fair lineups. A fair lineup is one in which the suspect and each of the foils is equally likely to be chosen by someone who has read an eyewitness description of the perpetrator but who did not actually witness the crime (Brigham, Ready, & Spier, 1990). This means that no one in the lineup should “stick out,” and that everyone should match the description given by the eyewitness. Other important recommendations that have come out of this research include better ways to conduct lineups, “double blind” lineups, unbiased instructions for witnesses, and conducting lineups in a sequential fashion (see Technical Working Group for Eyewitness Evidence, 1999; Wells et al., 1998; Wells & Olson, 2003).

**Kinds of Memory Biases**

Memory is also susceptible to a wide variety of other biases and errors. People can forget events that happened to them and people they once knew. They can mix up details across time and place. They can even remember whole complex events that never happened at all. Importantly, these errors, once made, can be very hard to unmake. A memory is no less “memorable” just because it is wrong.

Some small memory errors are commonplace, and you have no doubt experienced many of them. You set down your keys without paying attention, and then cannot find them later when
you go to look for them. You try to come up
with a person’s name but cannot find it,
even though you have the sense that it is
right at the tip of your tongue
(psychologists actually call this the tip-of-the-tongue effect, or TOT) (Brown, 1991).

Other sorts of memory biases are more complicated and longer lasting. For example, it turns out that our expectations and beliefs about how the world works can have huge influences on our memories. Because many aspects of our everyday lives are full of redundancies, our memory systems take advantage of the recurring patterns by forming and using schemata, or memory templates (Alba & Hasher, 1983; Brewer & Treyens, 1981). Thus, we know to expect that a library will have shelves and tables and librarians, and so we don’t have to spend energy noticing these at the time. The result of this lack of attention, however, is that one is likely to remember schema-consistent information (such as tables), and to remember them in a rather generic way, whether or not they were actually present.

False Memory

Some memory errors are so “large” that they almost belong in a class of their own: false memories. Back in the early 1990s a pattern emerged whereby people would go into therapy for depression and other everyday problems, but over the course of the therapy develop memories for violent and horrible victimhood (Loftus & Ketcham, 1994). These patients’ therapists claimed that the patients were recovering genuine memories of real childhood abuse, buried deep in their minds for years or even decades. But some experimental psychologists believed that the memories were instead likely to be false—created in therapy. These researchers then set out to see whether it would indeed be possible for wholly false memories to be created by procedures similar to those used in these patients’ therapy.

In early false memory studies, undergraduate subjects’ family members were recruited to provide events from the students’ lives. The student subjects were told that the researchers
had talked to their family members and learned about four different events from their
childhoods. The researchers asked if the now undergraduate students remembered each of
these four events—introduced via short hints. The subjects were asked to write about each
of the four events in a booklet and then were interviewed two separate times. The trick was
that one of the events came from the researchers rather than the family (and the family had
actually assured the researchers that this event had not happened to the subject). In the first
such study, this researcher-introduced event was a story about being lost in a shopping mall
and rescued by an older adult. In this study, after just being asked whether they remembered
these events occurring on three separate occasions, a quarter of subjects came to believe
that they had indeed been lost in the mall (Loftus & Pickrell, 1995). In subsequent studies,
similar procedures were used to get subjects to believe that they nearly drowned and had
been rescued by a lifeguard, or that they had spilled punch on the bride's parents at a family
wedding, or that they had been attacked by a vicious animal as a child, among other events
(Heaps & Nash, 1999; Hyman, Husband, & Billings, 1995; Porter, Yuille, & Lehman, 1999).

More recent false memory studies have used a variety of different manipulations to produce
false memories in substantial minorities and even occasional majorities of manipulated
subjects (Braun, Ellis, & Loftus, 2002; Lindsay, Hagen, Read, Wade, & Garry, 2004; Mazzoni,
Loftus, Seitz, & Lynn, 1999; Seamon, Philbin, & Harrison, 2006; Wade, Garry, Read, & Lindsay,
2002). For example, one group of researchers used a mock-advertising study, wherein subjects
were asked to review (fake) advertisements for Disney vacations, to convince subjects that
they had once met the character Bugs Bunny at Disneyland—an impossible false memory
because Bugs is a Warner Brothers character (Braun et al., 2002). Another group of researchers
photoshopped childhood photographs of their subjects into a hot air balloon picture and then
asked the subjects to try to remember and describe their hot air balloon experience (Wade
et al., 2002). Other researchers gave subjects unmanipulated class photographs from their
childhoods along with a fake story about a class prank, and thus enhanced the likelihood that
subjects would falsely remember the prank (Lindsay et al., 2004).

Using a false feedback manipulation, we have been able to persuade subjects to falsely
remember having a variety of childhood experiences. In these studies, subjects are told
(falsely) that a powerful computer system has analyzed questionnaires that they completed
previously and has concluded that they had a particular experience years earlier. Subjects
apparently believe what the computer says about them and adjust their memories to match
this new information. A variety of different false memories have been implanted in this way.
In some studies, subjects are told they once got sick on a particular food (Bernstein, Laney,
Morris, & Loftus, 2005). These memories can then spill out into other aspects of subjects’ lives,
such that they often become less interested in eating that food in the future (Bernstein &
Loftus, 2009b). Other false memories implanted with this methodology include having an
unpleasant experience with the character Pluto at Disneyland and witnessing physical violence between one’s parents (Berkowitz, Laney, Morris, Garry, & Loftus, 2008; Laney & Loftus, 2008).

Importantly, once these false memories are implanted—whether through complex methods or simple ones—it is extremely difficult to tell them apart from true memories (Bernstein & Loftus, 2009a; Laney & Loftus, 2008).

**Conclusion**

To conclude, eyewitness testimony is very powerful and convincing to jurors, even though it is not particularly reliable. Identification errors occur, and these errors can lead to people being falsely accused and even convicted. Likewise, eyewitness memory can be corrupted by leading questions, misinterpretations of events, conversations with co-witnesses, and their own expectations for what should have happened. People can even come to remember whole events that never occurred.

The problems with memory in the legal system are real. But what can we do to start to fix them? A number of specific recommendations have already been made, and many of these are in the process of being implemented (e.g., Steblay & Loftus, 2012; Technical Working Group for Eyewitness Evidence, 1999; Wells et al., 1998). Some of these recommendations are aimed at specific legal procedures, including when and how witnesses should be interviewed, and how lineups should be constructed and conducted. Other recommendations call for appropriate education (often in the form of expert witness testimony) to be provided to jury members and others tasked with assessing eyewitness memory. Eyewitness testimony can be of great value to the legal system, but decades of research now argues that this testimony is often given far more weight than its accuracy justifies.
Outside Resources

Video 1: Eureka Foong's - The Misinformation Effect. This is a student-made video illustrating this phenomenon of altered memory. It was one of the winning entries in the 2014 Noba Student Video Award.
https://www.youtube.com/watch?v=iMPIWkFtd88

Video 2: Ang Rui Xia & Ong Jun Hao's - The Misinformation Effect. Another student-made video exploring the misinformation effect. Also an award winner from 2014.
https://www.youtube.com/watch?v=gsn9iKmOJLQ

Discussion Questions

1. Imagine that you are a juror in a murder case where an eyewitness testifies. In what ways might your knowledge of memory errors affect your use of this testimony?

2. How true to life do you think television shows such as CSI or Law & Order are in their portrayals of eyewitnesses?

3. Many jurisdictions in the United States use “show-ups,” where an eyewitness is brought to a suspect (who may be standing on the street or in handcuffs in the back of a police car) and asked, “Is this the perpetrator?” Is this a good or bad idea, from a psychological perspective? Why?
Vocabulary

False memories
Memory for an event that never actually occurred, implanted by experimental manipulation or other means.

Foils
Any member of a lineup (whether live or photograph) other than the suspect.

Misinformation effect
A memory error caused by exposure to incorrect information between the original event (e.g., a crime) and later memory test (e.g., an interview, lineup, or day in court).

Mock witnesses
A research subject who plays the part of a witness in a study.

Photo spreads
A selection of normally small photographs of faces given to a witness for the purpose of identifying a perpetrator.

Schema (plural: schemata)
A memory template, created through repeated exposure to a particular class of objects or events.
References


Psychologists test research questions using a variety of methods. Most research relies on either correlations or experiments. With correlations, researchers measure variables as they naturally occur in people and compute the degree to which two variables go together. With experiments, researchers actively make changes in one variable and watch for changes in another variable. Experiments allow researchers to make causal inferences. Other types of methods include longitudinal and quasi-experimental designs. Many factors, including practical constraints, determine the type of methods researchers use. Often researchers survey people even though it would be better, but more expensive and time consuming, to track them longitudinally.

Learning Objectives

- Articulate the difference between correlational and experimental designs.
- Understand how to interpret correlations.
- Understand how experiments help us to infer causality.
- Understand how surveys relate to correlational and experimental research.
- Explain what a longitudinal study is.
- List a strength and weakness of different research designs.
In the early 1970's, a man named Uri Geller tricked the world: he convinced hundreds of thousands of people that he could bend spoons and slow watches using only the power of his mind. In fact, if you were in the audience, you would have likely believed he had psychic powers. Everything looked authentic—this man had to have paranormal abilities! So, why have you probably never heard of him before? Because when Uri was asked to perform his miracles in line with scientific experimentation, he was no longer able to do them. That is, even though it seemed like he was doing the impossible, when he was tested by science, he proved to be nothing more than a clever magician.

When we look at dinosaur bones to make educated guesses about extinct life, or systematically chart the heavens to learn about the relationships between stars and planets, or study magicians to figure out how they perform their tricks, we are forming observations—the foundation of science. Although we are all familiar with the saying “seeing is believing,” conducting science is more than just what your eyes perceive. Science is the result of systematic and intentional study of the natural world. And psychology is no different. In the movie Jerry Maguire, Cuba Gooding, Jr. became famous for using the phrase, “Show me the money!” In psychology, as in all sciences, we might say, “Show me the data!”

One of the important steps in scientific inquiry is to test our research questions, otherwise known as hypotheses. However, there are many ways to test hypotheses in psychological research. Which method you choose will depend on the type of questions you are asking, as well as what resources are available to you. All methods have limitations, which is why the best research uses a variety of methods.

Most psychological research can be divided into two types: experimental and correlational research.

**Experimental Research**

If somebody gave you $20 that absolutely had to be spent today, how would you choose to spend it? Would you spend it on an item you’ve been eyeing for weeks, or would you donate the money to charity? Which option do you think would bring you the most happiness? If you’re like most people, you’d choose to spend the money on yourself (duh, right?). Our intuition is that we’d be happier if we spent the money on ourselves.

Knowing that our intuition can sometimes be wrong, Professor Elizabeth Dunn (2008) at the University of British Columbia set out to conduct an experiment on spending and happiness. She gave each of the participants in her experiment $20 and then told them they had to spend
the money by the end of the day. Some of the participants were told they must spend the money on themselves, and some were told they must spend the money on others (either charity or a gift for someone). At the end of the day she measured participants' levels of happiness using a self-report questionnaire. (But wait, how do you measure something like happiness when you can't really see it? Psychologists measure many abstract concepts, such as happiness and intelligence, by beginning with operational definitions of the concepts. See the Noba modules on Intelligence and Happiness, respectively, for more information on specific measurement strategies.)

In an experiment, researchers manipulate, or cause changes, in the independent variable, and observe or measure any impact of those changes in the dependent variable. The independent variable is the one under the experimenter's control, or the variable that is intentionally altered between groups. In the case of Dunn's experiment, the independent variable was whether participants spent the money on themselves or on others. The dependent variable is the variable that is not manipulated at all, or the one where the effect happens. One way to help remember this is that the dependent variable “depends” on what happens to the independent variable. In our example, the participants' happiness (the dependent variable in this experiment) depends on how the participants spend their money (the independent variable). Thus, any observed changes or group differences in happiness can be attributed to whom the money was spent on. What Dunn and her colleagues found was that, after all the spending had been done, the people who had spent the money on others were happier than those who had spent the money on themselves. In other words, spending on others causes us to be happier than spending on ourselves. Do you find this surprising?

But wait! Doesn't happiness depend on a lot of different factors—for instance, a person's upbringing or life circumstances? What if some people had happy childhoods and that's why they're happier? Or what if some people dropped their toast that morning and it fell jam-side down and ruined their whole day? It is correct to recognize that these factors and many more
can easily affect a person's level of happiness. So how can we accurately conclude that spending money on others causes happiness, as in the case of Dunn's experiment?

The most important thing about experiments is random assignment. Participants don't get to pick which condition they are in (e.g., participants didn't choose whether they were supposed to spend the money on themselves versus others). The experimenter assigns them to a particular condition based on the flip of a coin or the roll of a die or any other random method. Why do researchers do this? With Dunn's study, there is the obvious reason: you can imagine which condition most people would choose to be in, if given the choice. But another equally important reason is that random assignment makes it so the groups, on average, are similar on all characteristics except what the experimenter manipulates.

By randomly assigning people to conditions (self-spending versus other-spending), some people with happy childhoods should end up in each condition. Likewise, some people who had dropped their toast that morning (or experienced some other disappointment) should end up in each condition. As a result, the distribution of all these factors will generally be consistent across the two groups, and this means that on average the two groups will be relatively equivalent on all these factors. Random assignment is critical to experimentation because if the only difference between the two groups is the independent variable, we can infer that the independent variable is the cause of any observable difference (e.g., in the amount of happiness they feel at the end of the day).

Here's another example of the importance of random assignment: Let's say your class is going to form two basketball teams, and you get to be the captain of one team. The class is to be divided evenly between the two teams. If you get to pick the players for your team first, whom will you pick? You'll probably pick the tallest members of the class or the most athletic. You probably won't pick the short, uncoordinated people, unless there are no other options. As a result, your team will be taller and more athletic than the other team. But what if we want the teams to be fair? How can we do this when we have people of varying height and ability? All we have to do is randomly assign players to the two teams. Most likely, some tall and some short people will end up on your team, and some tall and some short people will end up on the other team. The average height of the teams will be approximately the same. That is the power of random assignment!

Other considerations

In addition to using random assignment, you should avoid introducing confounds into your experiments. Confounds are things that could undermine your ability to draw causal
inferences. For example, if you wanted to test if a new happy pill will make people happier, you could randomly assign participants to take the happy pill or not (the independent variable) and compare these two groups on their self-reported happiness (the dependent variable). However, if some participants know they are getting the happy pill, they might develop expectations that influence their self-reported happiness. This is sometimes known as a placebo effect. Sometimes a person just knowing that he or she is receiving special treatment or something new is enough to actually cause changes in behavior or perception: In other words, even if the participants in the happy pill condition were to report being happier, we wouldn't know if the pill was actually making them happier or if it was the placebo effect—an example of a confound. A related idea is participant demand. This occurs when participants try to behave in a way they think the experimenter wants them to behave. Placebo effects and participant demand often occur unintentionally. Even experimenter expectations can influence the outcome of a study. For example, if the experimenter knows who took the happy pill and who did not, and the dependent variable is the experimenter’s observations of people’s happiness, then the experimenter might perceive improvements in the happy pill group that are not really there.

One way to prevent these confounds from affecting the results of a study is to use a double-blind procedure. In a double-blind procedure, neither the participant nor the experimenter knows which condition the participant is in. For example, when participants are given the happy pill or the fake pill, they don’t know which one they are receiving. This way the participants shouldn’t experience the placebo effect, and will be unable to behave as the researcher expects (participant demand). Likewise, the researcher doesn’t know which pill each participant is taking (at least in the beginning—later, the researcher will get the results for data-analysis purposes), which means the researcher’s expectations can’t influence his or her observations. Therefore, because both parties are “blind” to the condition, neither will be able to behave in a way that introduces a confound. At the end of the day, the only difference between groups will be which pills the participants received, allowing the researcher to determine if the happy pill actually caused people to be happier.

**Correlational Designs**

When scientists passively observe and measure phenomena it is called correlational research. Here, we do not intervene and change behavior, as we do in experiments. In correlational research, we identify patterns of relationships, but we usually cannot infer what causes what. Importantly, with correlational research, you can examine only two variables at a time, no more and no less.
So, what if you wanted to test whether spending on others is related to happiness, but you don’t have $20 to give to each participant? You could use a correlational design—which is exactly what Professor Dunn did, too. She asked people how much of their income they spent on others or donated to charity, and later she asked them how happy they were. Do you think these two variables were related? Yes, they were! The more money people reported spending on others, the happier they were.

More details about the correlation

To find out how well two variables correspond, we can plot the relation between the two scores on what is known as a scatterplot (Figure 1). In the scatterplot, each dot represents a data point. (In this case it’s individuals, but it could be some other unit.) Importantly, each dot provides us with two pieces of information—in this case, information about how good the person rated the past month (x-axis) and how happy the person felt in the past month (y-axis). Which variable is plotted on which axis does not matter.

The association between two variables can be summarized statistically using the correlation coefficient (abbreviated as $r$). A correlation coefficient provides information about the direction and strength of the association between two variables. For the example above, the direction of the association is positive. This means that people who perceived the past month as being good reported feeling more happy, whereas people who perceived the month as being bad reported feeling less happy.

With a positive correlation, the two variables go up or down together. In a scatterplot, the dots form a pattern that extends from the bottom left to the upper right (just as they do in Figure 1). The $r$ value for a positive correlation is indicated by a positive number (although, the positive sign is usually omitted). Here, the $r$ value is .81.
A negative correlation is one in which the two variables move in opposite directions. That is, as one variable goes up, the other goes down. Figure 2 shows the association between the average height of males in a country (y-axis) and the pathogen prevalence (or commonness of disease; x-axis) of that country. In this scatterplot, each dot represents a country. Notice how the dots extend from the top left to the bottom right. What does this mean in real-world terms? It means that people are shorter in parts of the world where there is more disease. The $r$ value for a negative correlation is indicated by a negative number—that is, it has a minus (−) sign in front of it. Here, it is $-0.83$.

The strength of a correlation has to do with how well the two variables align. Recall that in Professor Dunn’s correlational study, spending on others positively correlated with happiness: The more money people reported spending on others, the happier they reported to be. At this point you may be thinking to yourself, I know a very generous person who gave away lots of money to other people but is miserable! Or maybe you know of a very stingy person who is happy as can be. Yes, there might be exceptions. If an association has many exceptions, it is considered a weak correlation. If an association has few or no exceptions, it is considered a strong correlation. A strong correlation is one in which the two variables always, or almost always, go together. In the example of happiness and how good the month has been, the association is strong. The stronger a correlation is, the tighter the dots in the scatterplot will be arranged along a sloped line.

The $r$ value of a strong correlation will have a high absolute value. In other words, you disregard whether there is a negative sign in front of the $r$ value, and just consider the size of the numerical value itself. If the absolute value is large, it is a strong correlation. A weak correlation is one in which the two variables correspond some of the time, but not most of the time. Figure 3 shows the relation between valuing happiness and grade point average (GPA). People who valued happiness more tended to earn slightly lower grades, but there were lots of exceptions to this. The $r$ value for a weak correlation will have a low absolute value. If two variables are so weakly related as to be unrelated, we say they are uncorrelated, and the $r$
value will be zero or very close to zero. In the previous example, is the correlation between height and pathogen prevalence strong? Compared to Figure 3, the dots in Figure 2 are tighter and less dispersed. The absolute value of $-0.83$ is large. Therefore, it is a strong negative correlation.

Can you guess the strength and direction of the correlation between age and year of birth? If you said this is a strong negative correlation, you are correct! Older people always have lower years of birth than younger people (e.g., 1950 vs. 1995), but at the same time, the older people will have a higher age (e.g., 65 vs. 20). In fact, this is a perfect correlation because there are no exceptions to this pattern. I challenge you to find a 10-year-old born before 2003! You can’t.

Problems with the correlation

If generosity and happiness are positively correlated, should we conclude that being generous causes happiness? Similarly, if height and pathogen prevalence are negatively correlated, should we conclude that disease causes shortness? From a correlation alone, we can’t be certain. For example, in the first case it may be that happiness causes generosity, or that generosity causes happiness. Or, a third variable might cause both happiness and generosity, creating the illusion of a direct link between the two. For example, wealth could be the third variable that causes both greater happiness and greater generosity. This is why correlation does not mean causation—an often repeated phrase among psychologists.

Qualitative Designs

Just as correlational research allows us to study topics we can’t experimentally manipulate (e.g., whether you have a large or small income), there are other types of research designs that allow us to investigate these harder-to-study topics. Qualitative designs, including participant observation, case studies, and narrative analysis are examples of such methodologies. Although something as simple as “observation” may seem like it would be a part of all research
methods, participant observation is a distinct methodology that involves the researcher embedding him- or herself into a group in order to study its dynamics. For example, Festinger, Riecken, and Shacter (1956) were very interested in the psychology of a particular cult. However, this cult was very secretive and wouldn’t grant interviews to outside members. So, in order to study these people, Festinger and his colleagues pretended to be cult members, allowing them access to the behavior and psychology of the cult. Despite this example, it should be noted that the people being observed in a participant observation study usually know that the researcher is there to study them.

Another qualitative method for research is the case study, which involves an intensive examination of specific individuals or specific contexts. Sigmund Freud, the father of psychoanalysis, was famous for using this type of methodology; however, more current examples of case studies usually involve brain injuries. For instance, imagine that researchers want to know how a very specific brain injury affects people’s experience of happiness. Obviously, the researchers can’t conduct experimental research that involves inflicting this type of injury on people. At the same time, there are too few people who have this type of injury to conduct correlational research. In such an instance, the researcher may examine only one person with this brain injury, but in doing so, the researcher will put the participant through a very extensive round of tests. Hopefully what is learned from this one person can be applied to others; however, even with thorough tests, there is the chance that something unique about this individual (other than the brain injury) will affect his or her happiness. But with such a limited number of possible participants, a case study is really the only type of methodology suitable for researching this brain injury.

The final qualitative method to be discussed in this section is narrative analysis. Narrative analysis centers around the study of stories and personal accounts of people, groups, or cultures. In this methodology, rather than engaging with participants directly, or quantifying their responses or behaviors, researchers will analyze the themes, structure, and dialogue of each person’s narrative. That is, a researcher will examine people’s personal testimonies in order to learn more about the psychology of those individuals or groups. These stories may be written, audio-recorded, or video-recorded, and allow the researcher not only to study what the participant says but how he or she says it. Every person has a unique perspective on the world, and studying the way he or she conveys a story can provide insight into that perspective.

Quasi-Experimental Designs

What if you want to study the effects of marriage on a variable? For example, does marriage
make people happier? Can you randomly assign some people to get married and others to remain single? Of course not. So how can you study these important variables? You can use a **quasi-experimental design**.

A quasi-experimental design is similar to experimental research, except that random assignment to conditions is not used. Instead, we rely on existing group memberships (e.g., married vs. single). We treat these as the independent variables, even though we don't assign people to the conditions and don't manipulate the variables. As a result, with quasi-experimental designs causal inference is more difficult. For example, married people might differ on a variety of characteristics from unmarried people. If we find that married participants are happier than single participants, it will be hard to say that marriage causes happiness, because the people who got married might have already been happier than the people who have remained single.

Because experimental and quasi-experimental designs can seem pretty similar, let's take another example to distinguish them. Imagine you want to know who is a better professor: Dr. Smith or Dr. Khan. To judge their ability, you're going to look at their students' final grades. Here, the independent variable is the professor (Dr. Smith vs. Dr. Khan) and the dependent variable is the students' grades. In an experimental design, you would randomly assign students to one of the two professors and then compare the students' final grades. However, in real life, researchers can't randomly force students to take one professor over the other; instead, the researchers would just have to use the preexisting classes and study them as-is (quasi-experimental design). Again, the key difference is random assignment to the conditions of the independent variable. Although the quasi-experimental design (where the students choose which professor they want) may seem random, it's most likely not. For example, maybe students heard Dr. Smith sets low expectations, so slackers prefer this class, whereas Dr. Khan sets higher expectations, so smarter students prefer that one. This now introduces a confounding variable (student intelligence) that will almost certainly have an effect on students' final grades, regardless of how skilled the professor is. So, even though a quasi-
experimental design is similar to an experimental design (i.e., both have independent and dependent variables), because there’s no random assignment, you can’t reasonably draw the same conclusions that you would with an experimental design.

Longitudinal Studies

Another powerful research design is the longitudinal study. Longitudinal studies track the same people over time. Some longitudinal studies last a few weeks, some a few months, some a year or more. Some studies that have contributed a lot to psychology followed the same people over decades. For example, one study followed more than 20,000 Germans for two decades. From these longitudinal data, psychologist Rich Lucas (2003) was able to determine that people who end up getting married indeed start off a bit happier than their peers who never marry. Longitudinal studies like this provide valuable evidence for testing many theories in psychology, but they can be quite costly to conduct, especially if they follow many people for many years.

Surveys

A survey is a way of gathering information, using old-fashioned questionnaires or the Internet. Compared to a study conducted in a psychology laboratory, surveys can reach a larger number of participants at a much lower cost. Although surveys are typically used for correlational research, this is not always the case. An experiment can be carried out using surveys as well. For example, King and Napa (1998) presented participants with different types of stimuli on paper: either a survey completed by a happy person or a survey completed by an unhappy person. They wanted to see whether happy people were judged as more likely to get into heaven compared to unhappy people. Can you figure out the independent and dependent variables in this study? Can you guess what the results were? Happy people (vs. unhappy people; the independent variable) were
judged as more likely to go to heaven (the dependent variable) compared to unhappy people!

Likewise, correlational research can be conducted without the use of surveys. For instance, psychologists LeeAnn Harker and Dacher Keltner (2001) examined the smile intensity of women's college yearbook photos. Smiling in the photos was correlated with being married 10 years later!

**Tradeoffs in Research**

Even though there are serious limitations to correlational and quasi-experimental research, they are not poor cousins to experiments and longitudinal designs. In addition to selecting a method that is appropriate to the question, many practical concerns may influence the decision to use one method over another. One of these factors is simply resource availability—how much time and money do you have to invest in the research? (Tip: If you're doing a senior honor's thesis, do not embark on a lengthy longitudinal study unless you are prepared to delay graduation!) Often, we survey people even though it would be more precise—but much more difficult—to track them longitudinally. Especially in the case of exploratory research, it may make sense to opt for a cheaper and faster method first. Then, if results from the initial study are promising, the researcher can follow up with a more intensive method.

Beyond these practical concerns, another consideration in selecting a research design is the ethics of the study. For example, in cases of brain injury or other neurological abnormalities, it would be unethical for researchers to inflict these impairments on healthy participants. Nonetheless, studying people with these injuries can provide great insight into human psychology (e.g., if we learn that damage to a particular region of the brain interferes with emotions, we may be able to develop treatments for emotional irregularities). In addition to brain injuries, there are numerous other areas of research that could be useful in understanding the human mind but which pose challenges to a true experimental design—such as the experiences of war, long-term isolation, abusive parenting, or prolonged drug use. However, none of these are conditions we could ethically experimentally manipulate and randomly assign people to. Therefore, ethical considerations are another crucial factor in determining an appropriate research design.

**Research Methods: Why You Need Them**

Just look at any major news outlet and you'll find research routinely being reported. Sometimes the journalist understands the research methodology, sometimes not (e.g., correlational evidence is often incorrectly represented as causal evidence). Often, the media are quick to
draw a conclusion for you. After reading this module, you should recognize that the strength of a scientific finding lies in the strength of its methodology. Therefore, in order to be a savvy consumer of research, you need to understand the pros and cons of different methods and the distinctions among them. Plus, understanding how psychologists systematically go about answering research questions will help you to solve problems in other domains, both personal and professional, not just in psychology.
Outside Resources

Article: Harker and Keltner study of yearbook photographs and marriage
http://psycnet.apa.org/journals/psp/80/1/112/

Article: Rich Lucas's longitudinal study on the effects of marriage on happiness
http://psycnet.apa.org/journals/psp/84/3/527/

Article: Spending money on others promotes happiness. Elizabeth Dunn’s research
https://www.sciencemag.org/content/319/5870/1687.abstract

Article: What makes a life good?
http://psycnet.apa.org/journals/psp/75/1/156/

Discussion Questions

1. What are some key differences between experimental and correlational research?
2. Why might researchers sometimes use methods other than experiments?
3. How do surveys relate to correlational and experimental designs?
Vocabulary

Confounds
Factors that undermine the ability to draw causal inferences from an experiment.

Correlation
Measures the association between two variables, or how they go together.

Dependent variable
The variable the researcher measures but does not manipulate in an experiment.

Experimenter expectations
When the experimenter's expectations influence the outcome of a study.

Independent variable
The variable the researcher manipulates and controls in an experiment.

Longitudinal study
A study that follows the same group of individuals over time.

Operational definitions
How researchers specifically measure a concept.

Participant demand
When participants behave in a way that they think the experimenter wants them to behave.

Placebo effect
When receiving special treatment or something new affects human behavior.

Quasi-experimental design
An experiment that does not require random assignment to conditions.

Random assignment
Assigning participants to receive different conditions of an experiment by chance.
References


As our society increasingly calls for evidence-based decision making, it is important to consider how and when we can draw valid inferences from data. This module will use four recent research studies to highlight key elements of a statistical investigation.

Learning Objectives

- Define basic elements of a statistical investigation.
- Describe the role of p-values and confidence intervals in statistical inference.
- Describe the role of random sampling in generalizing conclusions from a sample to a population.
- Describe the role of random assignment in drawing cause-and-effect conclusions.
- Critique statistical studies.

Introduction

Does drinking coffee actually increase your life expectancy? A recent study (Freedman, Park, Abnet, Hollenbeck, & Sinha, 2012) found that men who drank at least six cups of coffee a day had a 10% lower chance of dying (women 15% lower) than those who drank none. Does this mean you should pick up or increase your own coffee habit?

Modern society has become awash in studies such as this; you can read about several such studies in the news every day. Moreover, data abound everywhere in modern life. Conducting
such a study well, and interpreting the results of such studies well for making informed decisions or setting policies, requires understanding basic ideas of statistics, the science of gaining insight from data. Rather than relying on anecdote and intuition, statistics allows us to systematically study phenomena of interest.

Key components to a statistical investigation are:

• Planning the study: Start by asking a testable research question and deciding how to collect data. For example, how long was the study period of the coffee study? How many people were recruited for the study, how were they recruited, and from where? How old were they? What other variables were recorded about the individuals, such as smoking habits, on the comprehensive lifestyle questionnaires? Were changes made to the participants’ coffee habits during the course of the study?

• Examining the data: What are appropriate ways to examine the data? What graphs are relevant, and what do they reveal? What descriptive statistics can be calculated to summarize relevant aspects of the data, and what do they reveal? What patterns do you see in the data? Are there any individual observations that deviate from the overall pattern, and what do they reveal? For example, in the coffee study, did the proportions differ when we compared the smokers to the non-smokers?

• Inferring from the data: What are valid statistical methods for drawing inferences “beyond” the data you collected? In the coffee study, is the 10%-15% reduction in risk of death
something that could have happened just by chance?

- Drawing conclusions: Based on what you learned from your data, what conclusions can you draw? Who do you think these conclusions apply to? (Were the people in the coffee study older? Healthy? Living in cities?) Can you draw a cause-and-effect conclusion about your treatments? (Are scientists now saying that the coffee drinking is the cause of the decreased risk of death?)

Notice that the numerical analysis ("crunching numbers" on the computer) comprises only a small part of overall statistical investigation. In this module, you will see how we can answer some of these questions and what questions you should be asking about any statistical investigation you read about.

**Distributional Thinking**

When data are collected to address a particular question, an important first step is to think of meaningful ways to organize and examine the data. The most fundamental principle of statistics is that data vary. The pattern of that variation is crucial to capture and to understand. Often, careful presentation of the data will address many of the research questions without requiring more sophisticated analyses. It may, however, point to additional questions that need to be examined in more detail.

Example 1: Researchers investigated whether cancer pamphlets are written at an appropriate level to be read and understood by cancer patients (Short, Moriarty, & Cooley, 1995). Tests of reading ability were given to 63 patients. In addition, readability level was determined for a sample of 30 pamphlets, based on characteristics such as the lengths of words and sentences in the pamphlet. The results, reported in terms of grade levels, are displayed in Table 1.

<table>
<thead>
<tr>
<th>Patients’ reading levels</th>
<th>&lt;3</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>&gt;12</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count (number of patients)</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>17</td>
<td>63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pamphlet’s readability levels</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count (number of pamphlets)</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 1. Frequency tables of patient reading levels and pamphlet readability levels.

These two variables reveal two fundamental aspects of statistical thinking:
• Data vary. More specifically, values of a variable (such as reading level of a cancer patient or readability level of a cancer pamphlet) vary.

• Analyzing the pattern of variation, called the **distribution** of the variable, often reveals insights.

Addressing the research question of whether the cancer pamphlets are written at appropriate levels for the cancer patients requires comparing the two distributions. A naïve comparison might focus only on the centers of the distributions. Both medians turn out to be ninth grade, but considering only medians ignores the variability and the overall distributions of these data. A more illuminating approach is to compare the entire distributions, for example with a graph, as in Figure 1.

![Figure 1: Comparison of patient reading levels and pamphlet readability levels.](image)

Figure 1 makes clear that the two distributions are not well aligned at all. The most glaring discrepancy is that many patients (17/63, or 27%, to be precise) have a reading level below that of the most readable pamphlet. These patients will need help to understand the information provided in the cancer pamphlets. Notice that this conclusion follows from considering the distributions as a whole, not simply measures of center or variability, and that the graph contrasts those distributions more immediately than the frequency tables.

**Statistical Significance**
Even when we find patterns in data, often there is still uncertainty in various aspects of the data. For example, there may be potential for measurement errors (even your own body temperature can fluctuate by almost 1 °F over the course of the day). Or we may only have a “snapshot” of observations from a more long-term process or only a small subset of individuals from the population of interest. In such cases, how can we determine whether patterns we see in our small set of data is convincing evidence of a systematic phenomenon in the larger process or population?

Example 2: In a study reported in the November 2007 issue of *Nature*, researchers investigated whether pre-verbal infants take into account an individual’s actions toward others in evaluating that individual as appealing or aversive (Hamlin, Wynn, & Bloom, 2007). In one component of the study, 10-month-old infants were shown a “climber” character (a piece of wood with “googly” eyes glued onto it) that could not make it up a hill in two tries. Then the infants were shown two scenarios for the climber’s next try, one where the climber was pushed to the top of the hill by another character (“helper”), and one where the climber was pushed back down the hill by another character (“hinderer”). The infant was alternately shown these two scenarios several times. Then the infant was presented with two pieces of wood (representing the helper and the hinderer characters) and asked to pick one to play with. The researchers found that of the 16 infants who made a clear choice, 14 chose to play with the helper toy.

One possible explanation for this clear majority result is that the helping behavior of the one toy increases the infants’ likelihood of choosing that toy. But are there other possible explanations? What about the color of the toy? Well, prior to collecting the data, the researchers arranged so that each color and shape (red square and blue circle) would be seen by the same number of infants. Or maybe the infants had right-handed tendencies and so picked whichever toy was closer to their right hand? Well, prior to collecting the data, the researchers arranged it so half the infants saw the helper toy on the right and half on the left. Or, maybe the shapes of these wooden characters (square, triangle, circle) had an effect? Perhaps, but again, the researchers controlled for this
by rotating which shape was the helper toy, the hinderer toy, and the climber. When designing experiments, it is important to control for as many variables as might affect the responses as possible.

It is beginning to appear that the researchers accounted for all the other plausible explanations. But there is one more important consideration that cannot be controlled—if we did the study again with these 16 infants, they might not make the same choices. In other words, there is some randomness inherent in their selection process. Maybe each infant had no genuine preference at all, and it was simply “random luck” that led to 14 infants picking the helper toy. Although this random component cannot be controlled, we can apply a probability model to investigate the pattern of results that would occur in the long run if random chance were the only factor.

If the infants were equally likely to pick between the two toys, then each infant had a 50% chance of picking the helper toy. It’s like each infant tossed a coin, and if it landed heads, the infant picked the helper toy. So if we tossed a coin 16 times, could it land heads 14 times? Sure, it’s possible, but it turns out to be very unlikely. Getting 14 (or more) heads in 16 tosses is about as likely as tossing a coin and getting 9 heads in a row. This probability is referred to as a p-value. The p-value tells you how often a random process would give a result at least as extreme as what was found in the actual study, assuming there was nothing other than random chance at play. So, if we assume that each infant was choosing equally, then the probability that 14 or more out of 16 infants would choose the helper toy is found to be 0.0021. We have only two logical possibilities: either the infants have a genuine preference for the helper toy, or the infants have no preference (50/50) and an outcome that would occur only 2 times in 1,000 iterations happened in this study. Because this p-value of 0.0021 is quite small, we conclude that the study provides very strong evidence that these infants have a genuine preference for the helper toy. We often compare the p-value to some cut-off value (called the level of significance, typically around 0.05). If the p-value is smaller than that cut-off value, then we reject the hypothesis that only random chance was at play here. In this case, these researchers would conclude that significantly more than half of the infants in the study chose the helper toy, giving strong evidence of a genuine preference for the toy with the helping behavior.

Generalizability

One limitation to the previous study is that the conclusion only applies to the 16 infants in the study. We don’t know much about how those 16 infants were selected. Suppose we want to select a subset of individuals (a sample) from a much larger group of individuals (the
population) in such a way that conclusions from the sample can be generalized to the larger population. This is the question faced by pollsters every day.

Example 3: The General Social Survey (GSS) is a survey on societal trends conducted every other year in the United States. Based on a sample of about 2,000 adult Americans, researchers make claims about what percentage of the U.S. population consider themselves to be “liberal,” what percentage consider themselves “happy,” what percentage feel “rushed” in their daily lives, and many other issues. The key to making these claims about the larger population of all American adults lies in how the sample is selected. The goal is to select a sample that is representative of the population, and a common way to achieve this goal is to select a random sample that gives every member of the population an equal chance of being selected for the sample. In its simplest form, random sampling involves numbering every member of the population and then using a computer to randomly select the subset to be surveyed. Most polls don’t operate exactly like this, but they do use probability-based sampling methods to select individuals from nationally representative panels.

In 2004, the GSS reported that 817 of 977 respondents (or 83.6%) indicated that they always or sometimes feel rushed. This is a clear majority, but we again need to consider variation due to random sampling. Fortunately, we can use the same probability model we did in the previous example to investigate the probable size of this error. (Note, we can use the coin-tossing model when the actual population size is much, much larger than the sample size, as then we can still consider the probability to be the same for every individual in the sample.) This probability model predicts that the sample result will be within 3 percentage points of the population value (roughly 1 over the square root of the sample size, the margin of error). A statistician would conclude, with 95% confidence, that between 80.6% and 86.6% of all adult Americans in 2004 would have responded that they sometimes or always feel rushed.

The key to the margin of error is that when we use a probability sampling method, we can make claims about how often (in the long run, with repeated random sampling) the sample...
result would fall within a certain distance from the unknown population value by chance (meaning by random sampling variation) alone. Conversely, non-random samples are often suspect to bias, meaning the sampling method systematically over-represents some segments of the population and under-represents others. We also still need to consider other sources of bias, such as individuals not responding honestly. These sources of error are not measured by the margin of error.

**Cause and Effect Conclusions**

In many research studies, the primary question of interest concerns differences between groups. Then the question becomes how were the groups formed (e.g., selecting people who already drink coffee vs. those who don’t). In some studies, the researchers actively form the groups themselves. But then we have a similar question—could any differences we observe in the groups be an artifact of that group-formation process? Or maybe the difference we observe in the groups is so large that we can discount a “fluke” in the group-formation process as a reasonable explanation for what we find?

Example 4: A psychology study investigated whether people tend to display more creativity when they are thinking about intrinsic or extrinsic motivations (Ramsey & Schafer, 2002, based on a study by Amabile, 1985). The subjects were 47 people with extensive experience with creative writing. Subjects began by answering survey questions about either intrinsic motivations for writing (such as the pleasure of self-expression) or extrinsic motivations (such as public recognition). Then all subjects were instructed to write a haiku, and those poems were evaluated for creativity by a panel of judges. The researchers conjectured beforehand that subjects who were thinking about intrinsic motivations would display more creativity than subjects who were thinking about extrinsic motivations. The creativity scores from the 47 subjects in this study are displayed in Figure 2, where higher scores indicate more creativity.

![Figure 2. Creativity scores separated by type of motivation.](image-url)
In this example, the key question is whether the type of motivation affects creativity scores. In particular, do subjects who were asked about intrinsic motivations tend to have higher creativity scores than subjects who were asked about extrinsic motivations?

Figure 2 reveals that both motivation groups saw considerable variability in creativity scores, and these scores have considerable overlap between the groups. In other words, it’s certainly not always the case that those with extrinsic motivations have higher creativity than those with intrinsic motivations, but there may still be a statistical tendency in this direction. (Psychologist Keith Stanovich (2013) refers to people’s difficulties with thinking about such probabilistic tendencies as “the Achilles heel of human cognition.”)

The mean creativity score is 19.88 for the intrinsic group, compared to 15.74 for the extrinsic group, which supports the researchers’ conjecture. Yet comparing only the means of the two groups fails to consider the variability of creativity scores in the groups. We can measure variability with statistics using, for instance, the standard deviation: 5.25 for the extrinsic group and 4.40 for the intrinsic group. The standard deviations tell us that most of the creativity scores are within about 5 points of the mean score in each group. We see that the mean score for the intrinsic group lies within one standard deviation of the mean score for extrinsic group. So, although there is a tendency for the creativity scores to be higher in the intrinsic group, on average, the difference is not extremely large.

We again want to consider possible explanations for this difference. The study only involved individuals with extensive creative writing experience. Although this limits the population to which we can generalize, it does not explain why the mean creativity score was a bit larger for the intrinsic group than for the extrinsic group. Maybe women tend to receive higher creativity scores? Here is where we need to focus on how the individuals were assigned to the motivation groups. If only women were in the intrinsic motivation group and only men in the extrinsic group, then this would present a problem because we wouldn't know if the intrinsic group did better because of the different type of motivation or because they were women. However, the researchers guarded against such a problem by randomly assigning the individuals to the motivation groups. Like flipping a coin, each individual was just as likely to be assigned to either type of motivation. Why is this helpful? Because this random assignment tends to balance out all the variables related to creativity we can think of, and even those we don't think of in advance, between the two groups. So we should have a similar male/female split between the two groups; we should have a similar age distribution between the two groups; we should have a similar distribution of educational background between the two groups; and so on. Random assignment should produce groups that are as similar as possible except for the type of motivation, which presumably eliminates all those other variables as possible explanations for the observed tendency for higher scores in the intrinsic group.
But does this always work? No, so by “luck of the draw” the groups may be a little different prior to answering the motivation survey. So then the question is, is it possible that an unlucky random assignment is responsible for the observed difference in creativity scores between the groups? In other words, suppose each individual’s poem was going to get the same creativity score no matter which group they were assigned to, that the type of motivation in no way impacted their score. Then how often would the random-assignment process alone lead to a difference in mean creativity scores as large (or larger) than $19.88 - 15.74 = 4.14$ points?

We again want to apply to a probability model to approximate a p-value, but this time the model will be a bit different. Think of writing everyone’s creativity scores on an index card, shuffling up the index cards, and then dealing out 23 to the extrinsic motivation group and 24 to the intrinsic motivation group, and finding the difference in the group means. We (better yet, the computer) can repeat this process over and over to see how often, when the scores don’t change, random assignment leads to a difference in means at least as large as 4.41. Figure 3 shows the results from 1,000 such hypothetical random assignments for these scores. Only 2 of the 1,000 simulated random assignments produced a difference in group means of 4.41 or larger. In other words, the approximate p-value is $2/1000 = 0.002$. This small p-value indicates that it would be very surprising for the random assignment process alone to produce such a large difference in group means. Therefore, as with Example 2, we have strong evidence that focusing on intrinsic motivations tends to increase creativity scores, as compared to thinking about extrinsic motivations.

Notice that the previous statement implies a cause-and-effect relationship between motivation and creativity score; is such a strong conclusion justified? Yes, because of the random assignment used in the study. That should have balanced out any other variables between the two groups, so now that the small p-value convinces us that the higher mean in the intrinsic group wasn’t just a coincidence, the only reasonable explanation left is the difference in the type of motivation. Can we generalize this conclusion to everyone?
Not necessarily—we could cautiously generalize this conclusion to individuals with extensive experience in creative writing similar the individuals in this study, but we would still want to know more about how these individuals were selected to participate.

**Conclusion**

Statistical thinking involves the careful design of a study to collect meaningful data to answer a focused research question, detailed analysis of patterns in the data, and drawing conclusions that go beyond the observed data. Random sampling is paramount to generalizing results from our sample to a larger population, and random assignment is key to drawing cause-and-effect conclusions. With both kinds of randomness, probability models help us assess how much random variation we can expect in our results, in order to determine whether our results could happen by chance alone and to estimate a margin of error.

So where does this leave us with regard to the coffee study mentioned at the beginning of this module? We can answer many of the questions:

- This was a 14-year study conducted by researchers at the National Cancer Institute.
- The results were published in the June issue of the *New England Journal of Medicine*, a respected, peer-reviewed journal.
- The study reviewed coffee habits of more than 402,000 people ages 50 to 71 from six states and two metropolitan areas. Those with cancer, heart disease, and stroke were excluded at the start of the study. Coffee consumption was assessed once at the start of the study.
- About 52,000 people died during the course of the study.
- People who drank between two and five cups of coffee daily showed a lower risk as well, but the amount of reduction increased for those drinking six or more cups.
• The sample sizes were fairly large and so the p-values are quite small, even though percent reduction in risk was not extremely large (dropping from a 12% chance to about 10%-11%).

• Whether coffee was caffeinated or decaffeinated did not appear to affect the results.

• This was an observational study, so no cause-and-effect conclusions can be drawn between coffee drinking and increased longevity, contrary to the impression conveyed by many news headlines about this study. In particular, it’s possible that those with chronic diseases don’t tend to drink coffee.

This study needs to be reviewed in the larger context of similar studies and consistency of results across studies, with the constant caution that this was not a randomized experiment. Whereas a statistical analysis can still “adjust” for other potential confounding variables, we are not yet convinced that researchers have identified them all or completely isolated why this decrease in death risk is evident. Researchers can now take the findings of this study and develop more focused studies that address new questions.
Outside Resources

Apps: Interactive web applets for teaching and learning statistics include the collection at http://www.rossmanchance.com/applets/

P-Value extravaganza
https://www.youtube.com/watch?v=bVMVGHkt2cg&feature=youtube_gdata_player

Web: Inter-university Consortium for Political and Social Research
http://www.icpsr.umich.edu/index.html

Web: The Consortium for the Advancement of Undergraduate Statistics
https://www.causeweb.org/

Discussion Questions

1. Find a recent research article in your field and answer the following: What was the primary research question? How were individuals selected to participate in the study? Were summary results provided? How strong is the evidence presented in favor or against the research question? Was random assignment used? Summarize the main conclusions from the study, addressing the issues of statistical significance, statistical confidence, generalizability, and cause and effect. Do you agree with the conclusions drawn from this study, based on the study design and the results presented?

2. Is it reasonable to use a random sample of 1,000 individuals to draw conclusions about all U.S. adults? Explain why or why not.
Vocabulary

Cause-and-effect
Related to whether we say one variable is causing changes in the other variable, versus other variables that may be related to these two variables.

Confidence interval
An interval of plausible values for a population parameter; the interval of values within the margin of error of a statistic.

Distribution
The pattern of variation in data.

Generalizability
Related to whether the results from the sample can be generalized to a larger population.

Margin of error
The expected amount of random variation in a statistic; often defined for 95% confidence level.

Parameter
A numerical result summarizing a population (e.g., mean, proportion).

Population
A larger collection of individuals that we would like to generalize our results to.

P-value
The probability of observing a particular outcome in a sample, or more extreme, under a conjecture about the larger population or process.

Random assignment
Using a probability-based method to divide a sample into treatment groups.

Random sampling
Using a probability-based method to select a subset of individuals for the sample from the population.

Sample
The collection of individuals on which we collect data.
Statistic
A numerical result computed from a sample (e.g., mean, proportion).

Statistical significance
A result is statistically significant if it is unlikely to arise by chance alone.
References


Intelligence is among the oldest and longest studied topics in all of psychology. The development of assessments to measure this concept is at the core of the development of psychological science itself. This module introduces key historical figures, major theories of intelligence, and common assessment strategies related to intelligence. This module will also discuss controversies related to the study of group differences in intelligence.

Learning Objectives

- List at least two common strategies for measuring intelligence.
- Name at least one “type” of intelligence.
- Define intelligence in simple terms.
- Explain the controversy relating to differences in intelligence between groups.

Introduction

Every year hundreds of grade school students converge on Washington, D.C., for the annual Scripps National Spelling Bee. The “bee” is an elite event in which children as young as 8 square off to spell words like “cymotrichous” and “appoggiatura.” Most people who watch the bee think of these kids as being “smart” and you likely agree with this description.

What makes a person intelligent? Is it heredity (two of the 2014 contestants in the bee have siblings who have previously won)(National Spelling Bee, 2014a)? Is it interest (the most
Defining and Measuring Intelligence

When you think of “smart people” you likely have an intuitive sense of the qualities that make them intelligent. Maybe you think they have a good memory, or that they can think quickly, or that they simply know a whole lot of information. Indeed, people who exhibit such qualities appear very intelligent. That said, it seems that intelligence must be more than simply knowing facts and being able to remember them. One point in favor of this argument is the idea of animal intelligence. It will come as no surprise to you that a dog, which can learn commands and tricks seems smarter than a snake that cannot. In fact, researchers and lay people generally agree with one another that primates—monkeys and apes (including humans)—are among the most intelligent animals. Apes such as chimpanzees are capable of complex problem solving and sophisticated communication (Kohler, 1924).

Scientists point to the social nature of primates as one evolutionary source of their intelligence. Primates live together in troops or family groups and are, therefore, highly social creatures. As such, primates tend to have brains that are better developed for communication and long term thinking than most other animals. For instance, the complex social environment has led primates to develop deception, altruism, numerical concepts, and “theory of mind” (a sense of the self as a unique individual separate from others in the group; Gallup, 1982; Hauser, MacNeilage & Ware, 1996). [Also see Noba module Theory of Mind http://noba.to/a8wpytg3]

The question of what constitutes human intelligence is one of the oldest inquiries in psychology. When we talk about intelligence we typically mean intellectual ability. This broadly encompasses the ability to learn, remember and use new information, to solve problems and
to adapt to novel situations. An early scholar of intelligence, Charles Spearman, proposed the idea that intelligence was one thing, a “general factor” sometimes known as simply “g.” He based this conclusion on the observation that people who perform well in one intellectual area such as verbal ability also tend to perform well in other areas such as logic and reasoning (Spearman, 1904).

A contemporary of Spearman’s named Francis Galton—himself a cousin of Charles Darwin—was among those who pioneered psychological measurement (Hunt, 2009). For three pence Galton would measure various physical characteristics such as grip strength but also some psychological attributes such as the ability to judge distance or discriminate between colors. This is an example of one of the earliest systematic measures of individual ability. Galton was particularly interested in intelligence, which he thought was heritable in much the same way that height and eye color are. He conceived of several rudimentary methods for assessing whether his hypothesis was true. For example, he carefully tracked the family tree of the top-scoring Cambridge students over the previous 40 years. Although he found specific families disproportionately produced top scholars, intellectual achievement could still be the product of economic status, family culture or other non-genetic factors. Galton was also, possibly, the first to popularize the idea that the heritability of psychological traits could be studied by looking at identical and fraternal twins. Although his methods were crude by modern standards, Galton established intelligence as a variable that could be measured (Hunt, 2009).

The person best known for formally pioneering the measurement of intellectual ability is Alfred Binet. Like Galton, Binet was fascinated by individual differences in intelligence. For instance, he blindfolded chess players and saw that some of them had the ability to continue playing using only their memory to keep the many positions of the pieces in mind (Binet, 1894). Binet was particularly interested in the development of intelligence, a fascination that led him to observe children carefully in the classroom setting.

Along with his colleague Theodore Simon, Binet created a test of children’s intellectual capacity. They created individual test items that should be answerable by children of given ages. For instance, a child who is three should be able to point to her mouth and eyes, a child who is nine should be able to name the months of the year in order, and a twelve year old ought to be able to name sixty words in three minutes. Their assessment became the first “IQ
“IQ” or “intelligence quotient” is a name given to the score of the Binet-Simon test. The score is derived by dividing a child’s mental age (the score from the test) by their chronological age.
to create an overall quotient. These days, the phrase “IQ” does not apply specifically to the Binet-Simon test and is used to generally denote intelligence or a score on any intelligence test. In the early 1900s the Binet-Simon test was adapted by a Stanford professor named Lewis Terman to create what is, perhaps, the most famous intelligence test in the world, the Stanford-Binet (Terman, 1916). The major advantage of this new test was that it was standardized. Based on a large sample of children Terman was able to plot the scores in a normal distribution, shaped like a “bell curve” (see Fig. 1). To understand a normal distribution think about the height of people. Most people are average in height with relatively fewer being tall or short, and fewer still being extremely tall or extremely short. Terman (1916) laid out intelligence scores in exactly the same way, allowing for easy and reliable categorizations and comparisons between individuals.

Looking at another modern intelligence test—the Wechsler Adult Intelligence Scale (WAIS)—can provide clues to a definition of intelligence itself. Motivated by several criticisms of the Stanford-Binet test, psychologist David Wechsler sought to create a superior measure of intelligence. He was critical of the way that the Stanford-Binet relied so heavily on verbal ability and was also suspicious of using a single score to capture all of intelligence. To address these issues Wechsler created a test that tapped a wide range of intellectual abilities. This understanding of intelligence—that it is made up of a pool of specific abilities—is a notable departure from Spearman’s concept of general intelligence. The WAIS assesses people's ability
to remember, compute, understand language, reason well, and process information quickly (Wechsler, 1955).

One interesting by-product of measuring intelligence for so many years is that we can chart changes over time. It might seem strange to you that intelligence can change over the decades but that appears to have happened over the last 80 years we have been measuring this topic. Here’s how we know: IQ tests have an average score of 100. When new waves of people are asked to take older tests they tend to outperform the original sample from years ago on which the test was normed. This gain is known as the “Flynn Effect,” named after James Flynn, the researcher who first identified it (Flynn, 1987). Several hypotheses have been put forth to explain the Flynn Effect including better nutrition (healthier brains!), greater familiarity with testing in general, and more exposure to visual stimuli. Today, there is no perfect agreement among psychological researchers with regards to the causes of increases in average scores on intelligence tests. Perhaps if you choose a career in psychology you will be the one to discover the answer!

Types of Intelligence

David Wechsler’s approach to testing intellectual ability was based on the fundamental idea that there are, in essence, many aspects to intelligence. Other scholars have echoed this idea by going so far as to suggest that there are actually even different types of intelligence. You likely have heard distinctions made between “street smarts” and “book learning.” The former refers to practical wisdom accumulated through experience while the latter indicates formal education. A person high in street smarts might have a superior ability to catch a person in a lie, to persuade others, or to think quickly under pressure. A person high in book learning, by contrast, might have a large vocabulary and be able to remember a large number of references to classic novels. Although psychologists don’t use street smarts or book smarts as professional terms they do believe that intelligence comes in different types.

There are many ways to parse apart the concept of intelligence. Many scholars believe that Carroll’s (1993) review of more than 400 data sets provides the best currently existing single source for organizing various concepts related to intelligence. Carroll divided intelligence into three levels, or strata, descending from the most abstract down to the most specific (see Fig. 2). To understand this way of categorizing simply think of a “car.” Car is a general word that denotes all types of motorized vehicles. At the more specific level under “car” might be various types of cars such as sedans, sports cars, SUVs, pick-up trucks, station wagons, and so forth. More specific still would be certain models of each such as a Honda Civic or Ferrari Enzo. In the same manner, Carroll called the highest level (stratum III) the general intelligence factor
“g.” Under this were more specific stratum II categories such as fluid intelligence and visual perception and processing speed. Each of these, in turn, can be sub-divided into very specific components such as spatial scanning, reaction time, and word fluency.

Thinking of intelligence as Carroll (1993) does, as a collection of specific mental abilities, has helped researchers conceptualize this topic in new ways. For example, Horn and Cattell (1966) distinguish between “fluid” and “crystalized” intelligence, both of which show up on stratum II of Carroll's model. Fluid intelligence is the ability to “think on your feet;” that is, to solve problems. Crystalized intelligence, on the other hand, is the ability to use language, skills and experience to address problems. The former is associated more with youth while the latter increases with age. You may have noticed the way in which younger people can adapt to new situations and use trial and error to quickly figure out solutions. By contrast, older people tend to rely on their relatively superior store of knowledge to solve problems.

Harvard professor Howard Gardner is another figure in psychology who is well-known for championing the notion that there are different types of intelligence. Gardner's theory is appropriately, called “multiple intelligences.” Gardner’s theory is based on the idea that people process information through different “channels” and these are relatively independent of one
Another. He has identified 8 common intelligences including 1) logic-math, 2) visual-spatial, 3) music-rhythm, 4) verbal-linguistic, 5) bodily-kinesthetic, 6) interpersonal, 7) intrapersonal, and 8) naturalistic (Gardner, 1985). Many people are attracted to Gardner’s theory because it suggests that people each learn in unique ways. There are now many Gardner- influenced schools in the world.

Another type of intelligence is Emotional intelligence. Unlike traditional models of intelligence that emphasize cognition (thinking) the idea of emotional intelligence emphasizes the experience and expression of emotion. Some researchers argue that emotional intelligence is a set of skills in which an individual can accurately understand the emotions of others, can identify and label their own emotions, and can use emotions. (Mayer & Salovey, 1997). Other researchers believe that emotional intelligence is a mixture of abilities, such as stress management, and personality, such as a person’s predisposition for certain moods (Bar-On, 2006). Regardless of the specific definition of emotional intelligence, studies have shown a link between this concept and job performance (Lopes, Grewal, Kadis, Gall, & Salovey, 2006). In fact, emotional intelligence is similar to more traditional notions of cognitive intelligence with regards to workplace benefits. Schmidt and Hunter (1998), for example, reviewed research on intelligence in the workplace context and show that intelligence is the single best predictor of doing well in job training programs, of learning on the job. They also report that general intelligence is moderately correlated with all types of jobs but especially with managerial and complex, technical jobs.

There is one last point that is important to bear in mind about intelligence. It turns out that the way an individual thinks about his or her own intelligence is also important because it predicts performance. Researcher Carol Dweck has made a career out of looking at the differences between high IQ children who perform well and those who do not, so-called “under achievers.” Among her most interesting findings is that it is not gender or social class that sets apart the high and low performers. Instead, it is their mindset. The children who believe that their abilities in general—and their intelligence specifically—is a fixed trait tend to underperform. By contrast, kids who believe that intelligence is changeable and evolving tend to handle failure better and perform better (Dweck, 1986). Dweck refers to this as a person’s “mindset” and having a growth mindset appears to be healthier.

**Correlates of Intelligence**

The research on mindset is interesting but there can also be a temptation to interpret it as suggesting that every human has an unlimited potential for intelligence and that becoming smarter is only a matter of positive thinking. There is some evidence that genetics is an
important factor in the intelligence equation. For instance, a number of studies on genetics in adults have yielded the result that intelligence is largely, but not totally, inherited (Bouchard, 2004). Having a healthy attitude about the nature of smarts and working hard can both definitely help intellectual performance but it also helps to have the genetic leaning toward intelligence.

Carol Dweck’s research on the mindset of children also brings one of the most interesting and controversial issues surrounding intelligence research to the fore: group differences. From the very beginning of the study of intelligence researchers have wondered about differences between groups of people such as men and women. With regards to potential differences between the sexes some people have noticed that women are under-represented in certain fields. In 1976, for example, women comprised just 1% of all faculty members in engineering (Ceci, Williams & Barnett, 2009).

Even today women make up between 3% and 15% of all faculty in math-intensive fields at the 50 top universities. This phenomenon could be explained in many ways: it might be the result of inequalities in the educational system, it might be due to differences in socialization wherein young girls are encouraged to develop other interests, it might be the result of that women are—on average—responsible for a larger portion of childcare obligations and therefore make different types of professional decisions, or it might be due to innate differences between these groups, to name just a few possibilities. The possibility of innate differences is the most controversial because many people see it as either the product of or the foundation for sexism. In today’s political landscape it is easy to see that asking certain questions such as “are men smarter than women?” would be inflammatory. In a comprehensive review of research on intellectual abilities and sex Ceci and colleagues (2009) argue against the hypothesis that biological and genetic differences account for much of the sex differences in intellectual ability. Instead, they believe that a complex web of influences ranging from societal expectations to test taking strategies to individual interests account for
many of the sex differences found in math and similar intellectual abilities.

A more interesting question, and perhaps a more sensitive one, might be to inquire in which ways men and women might differ in intellectual ability, if at all. That is, researchers should not seek to prove that one group or another is better but might examine the ways that they might differ and offer explanations for any differences that are found. Researchers have investigated sex differences in intellectual ability. In a review of the research literature Halpern (1997) found that women appear, on average, superior to men on measures of fine motor skill, acquired knowledge, reading comprehension, decoding non-verbal expression, and generally have higher grades in school. Men, by contrast, appear, on average, superior to women on measures of fluid reasoning related to math and science, perceptual tasks that involve moving objects, and tasks that require transformations in working memory such as mental rotations of physical spaces. Halpern also notes that men are disproportionately represented on the low end of cognitive functioning including in intellectual disability, dyslexia, and attention deficit disorders (Halpern, 1997).

Other researchers have examined various explanatory hypotheses for why sex differences in intellectual ability occur. Some studies have provided mixed evidence for genetic factors while others point to evidence for social factors (Neisser, et al, 1996; Nisbett, et al., 2012). One interesting phenomenon that has received research scrutiny is the idea of stereotype threat. Stereotype threat is the idea that mental access to a particular stereotype can have real-world impact on a member of the stereotyped group. In one study (Spencer, Steele, & Quinn, 1999), for example, women who were informed that women tend to fare poorly on math exams just before taking a math test actually performed worse relative to a control group who did not hear the stereotype. Research on stereotype has yielded mixed results and we are currently uncertain about exactly how and when this effect might occur. One possible antidote to stereotype threat, at least in the case of women, is to make a self-affirmation (such as listing positive personal qualities) before the threat occurs. In one study, for instance, Martens and her colleagues (2006) had women write about personal qualities that they valued before taking a math test. The affirmation largely erased the effect of stereotype by improving math scores for women relative to a control group but similar affirmations had little effect for men (Martens, Johns, Greenberg, & Schimel, 2006).

These types of controversies compel many lay people to wonder if there might be a problem with intelligence measures. It is natural to wonder if they are somehow biased against certain groups. Psychologists typically answer such questions by pointing out that bias in the testing sense of the word is different than how people use the word in everyday speech. Common use of bias denotes a prejudice based on group membership. Scientific bias, on the other hand, is related to the psychometric properties of the test such as validity and reliability.
Validity is the idea that an assessment measures what it claims to measure and that it can predict future behaviors or performance. To this end, intelligence tests are not biased because they are fairly accurate measures and predictors. There are, however, real biases, prejudices, and inequalities in the social world that might benefit some advantaged group while hindering some disadvantaged others.

Conclusion

Although you might not be able to spell “esquamulose” or “staphylococci” – indeed, you might not even know what they mean—you don’t need to count yourself out in the intelligence department. Now that we have examined intelligence in depth we can return to our intuitive view of those students who compete in the National Spelling Bee. Are they smart? Certainly, they seem to have high verbal intelligence. There is also the possibility that they benefit from either a genetic boost in intelligence, a supportive social environment, or both. Watching them spell difficult words there is also much we do not know about them. We cannot tell, for instance, how emotionally intelligent they are or how they might use bodily-kinesthetic intelligence. This highlights the fact that intelligence is a complicated issue. Fortunately, psychologists continue to research this fascinating topic and their studies continue to yield new insights.
Outside Resources

Blog: Dr. Jonathan Wai has an excellent blog on Psychology Today discussing many of the most interesting issue related to intelligence.
http://www.psychologytoday.com/blog/finding-the-next-einstein

Video: Hank Green gives a fun and interesting overview of the concept of intelligence in this installment of the Crash Course series.
https://www.youtube.com/watch?v=9xTz3Qjclol

Discussion Questions

1. Do you think that people get smarter as they get older? In what ways might people gain or lose intellectual abilities as they age?

2. When you meet someone who strikes you as being smart what types of cues or information do you typically attend to in order to arrive at this judgment?

3. How do you think socio-economic status affects an individual taking an intellectual abilities test?

4. Should psychologists be asking about group differences in intellectual ability? What do you think?

5. Which of Howard Gardner’s 8 types of intelligence do you think describes the way you learn best?
Vocabulary

G
Short for “general factor” and is often used to be synonymous with intelligence itself.

Intelligence
An individual's cognitive capability. This includes the ability to acquire, process, recall and apply information.

IQ
Short for “intelligence quotient.” This is a score, typically obtained from a widely used measure of intelligence that is meant to rank a person’s intellectual ability against that of others.

Norm
Assessments are given to a representative sample of a population to determine the range of scores for that population. These “norms” are then used to place an individual who takes that assessment on a range of scores in which he or she is compared to the population at large.

Standardize
Assessments that are given in the exact same manner to all people. With regards to intelligence tests standardized scores are individual scores that are computed to be referenced against normative scores for a population (see “norm”).

Stereotype threat
The phenomenon in which people are concerned that they will conform to a stereotype or that their performance does conform to that stereotype, especially in instances in which the stereotype is brought to their conscious awareness.
References


Psychologists interested in the study of human individuality have found that accomplishments in education, the world of work, and creativity are a joint function of talent, passion, and commitment — or how much effort and time one is willing to invest in personal development when the opportunity is provided. This module reviews models and measures that psychologists have designed to assess intellect, interests, and energy for personal development. The module begins with a model for organizing these three psychological domains, which is useful for understanding talent development. This model is not only helpful for understanding the many different ways that positive development may unfold among people, but it is also useful for conceptualizing personal development and ways of selecting opportunities in learning and work settings that are more personally meaningful. Data supporting this model are reviewed.

Learning Objectives

• Compare and contrast satisfaction and satisfactoriness.
• Discuss why the model of talent development offered in this module places equal emphasis on assessing the person and assessing the environment.
• Articulate the relationship between ability and learning and performance.
• Understand the issue of an "ability threshold" beyond which more ability may or may not matter.
• List personal attributes other than interests and abilities that are important to individual accomplishment.
An amalgam of intelligence, interests, and mastery are appropriate topics for an essay on the cross-cutting themes running through these vast domains of psychological diversity. For effective performance and valued accomplishments, these three classes of determinants are needed for comprehensive treatments of psychological phenomena supporting learning, occupational performance, and for advancing knowledge through innovative solutions. Historically, these personal attributes go back to at least Plato’s triarchic view of the human psyche, described in *Phaedra*, wherein he depicts the *intellect* as a charioteer, and *affect* (interests) and *will* (to master) as horses that draw the chariot. Ever since that time, cognitive, affective, and conative factors have all been found in comprehensive models of human development, or “The Trilogy of Mind” (Hilgard, 1980). To predict the magnitude, nature, and sophistication of intellectual development toward learning, working, and creating, all three classes are indispensable and deficits on any one can markedly hobble the effectiveness of the others in meeting standards for typical as well as extraordinary performance. These three aspects of human individuality all operate in parallel confluences of behaviors, perceptions, and stimuli to engender stream of consciousness experiences as well as effective functioning. Hilgard (1980) was indeed justified to criticize formulations in cognitive psychology, which neglect affection and conation; technically, such truncated frameworks of human psychological phenomena are known as under-determined or misspecified causal models (Lubinski, 2000; Lubinski & Humphreys, 1997).

**A Framework for Understanding Talent Development**

Figure 1 is an adaptation of the Theory of Work Adjustment (TWA; Dawis & Lofquist, 1984; Lubinski & Benbow, 2000). It provides a useful organizational scheme for this treatment by outlining critical dimensions of human individuality for performance in learning and work settings (and in transitioning between such settings). Here, the dominant models of intellectual abilities and educational–occupational interests are assembled. Because this review will be...
restricted to measures of individual differences that harbor real-world significance, these two models are linked to corresponding features of learning and work environments, ability requirements and incentive or reward structures, which set standards for meeting expectations (performance) and rewarding valued performance (compensation). Correspondence between abilities and ability requirements constitutes satisfactoriness ("competence"), whereas correspondence between an interests and reward structures constitutes satisfaction ("fulfillment"). To the extent that satisfactoriness and satisfaction co-occur, the individual is motivated to maintain contact with the environment and the environment is motivated to retain the individual; if one of these dimensions is dis-corrrespondent, the individual is motivated to leave the environment or the environment is motivated to dismiss.

Figure 1. The above is an adaptation of the Theory of Work Adjustment (Dawis & Lofquist, 1984), following Lubinski and Benbow (2000) to highlight its general role in talent development over the life span. The radex scaling of cognitive abilities (upper left) and the RIASEC hexagon of interests (lower left) outline personal attributes relevant to learning and work. The letters within the cognitive ability arrangement denote different regions of concentration, whereas their accompanying numbers increase as a function of complexity. Contained within the RIASEC is a simplification of this hexagon. Following Prediger (1982), it amounts to a two-dimensional structure of independent dimensions: people/things and data/ideas, which underlie RIASEC. The dotted line running down the individual and environment sectors underscores the idea that equal emphasis is placed on assessing personal attributes (abilities and interests) and assessing the environment (abilities requirements and reward structure). Correspondence between abilities and ability requirements constitutes satisfactoriness whereas correspondence between interests and reinforce systems constitutes satisfaction. Jointly, these two dimensions predict tenure or a longstanding relationship between the individual and the environment.
This model of talent development places equal emphasis on assessing the individual (abilities and interests) and the environment (response requirements and reward structures). Comprehensive reviews of outcomes within education (Lubinski, 1996; Lubinski & Benbow, 2000), counseling (Dawis, 1992; Gottfredson, 2003; Rounds & Tracey, 1990), and industrial/organizational psychology all emphasize this person/environment tandem (Dawis, 1991; Katzell, 1994; Lubinski & Dawis, 1992; Strong, 1943): aligning competency/motivational proclivities to performance standards and reward structures for learning and work (Bouchard, 1997; Scarr, 1996; Scarr & McCartney, 1983). And indeed, educational, counseling, and industrial psychology can be contiguously sequenced by this framework. They all share a common feature: the scientific study of implementing interventions or opportunities, based on individual differences, for maximizing positive psychological growth across different stages of life span development (Lubinski, 1996). For making individual decisions about personal development, or institutional decisions about organizational development, it is frequently useful to go beyond a minimum requisite approach of “do you like it” (satisfaction) and “can you do it” (satisfactoriness), and instead consider what individuals like the most and can do the best (Lubinski & Benbow, 2000, 2001). This framework is useful for identifying “optimal promise” for personal as well as organizational development. For now, however, cognitive abilities and interests will be reviewed and, ultimately, linked to conative determinants that mobilize, and in part account for, individual differences in how capabilities and motives are expressed.

Cognitive Abilities

Over the past several decades—the past 20 years in particular—a remarkable consensus has emerged that cognitive abilities are organized hierarchically (Carroll, 1993). A general outline of this hierarchy is represented graphically by a radex (Guttman, 1954), depicted in the upper left region of Figure 1. This illustrates the reliable finding that cognitive ability assessments covary as a function of their content or complexity (Corno, Cronbach et al., 2002; Lubinski & Dawis, 1992; Snow & Lohman, 1989). Cognitive ability tests can be scaled in this space based on how highly they covary with one another. The more that two tests share complexity and content, the more they covary and the closer they are to one another as points within the radex. Test complexity is scaled from the center of the radex (“g”) out, and, along lines emanating from the origin, complexity decreases but test content remains the same. Test content is scaled around the circular bands with equal distance from the center of the radex and, progressing around these bands, the relative density of test content changes from spatial/mechanical to verbal/linguistic to quantitative/numerical, but test complexity remains constant. Therefore, test content varies within each band (but complexity remains constant), whereas test complexity varies between bands (but on lines from the origin to the periphery, content remains
constant). Because the extent to which tests covary is represented by how close together they are within this space (Lubinski & Dawis, 1992; Snow & Lohman, 1989; Wai, Lubinski, & Benbow, 2009), this model is helpful in organizing the many different kinds of specific ability tests.

As Piaget astutely pointed out, “Intelligence is what you use when you don’t know what to do,” and this model affords an excellent overview of the content and sophistication of thought applied to familiar and novel problem-solving tasks. Mathematical, spatial, and verbal reasoning constitute the chief specific abilities with implications for different choices and performance after those choices in learning and work settings (Corno et al., 2002; Dawis, 1992; Gottfredson, 2003; Lubinski, 2004; Wai et al., 2009). The content of measures or tests of these specific abilities index individual differences in different modalities of thought: reasoning with numbers, words, and figures or shapes. Yet, despite this disparate content and focus, contrasting specific ability tests are all positively correlated, because they all index an underlying general property of intellectual thought.

This general (common) dimension, identified over 100 years ago (Spearman, 1904) and corroborated by a massive quantity of subsequent research (Carroll, 1993; Jensen, 1998), is general mental ability, the general factor, or simply g (Gottfredson, 1997). General mental ability represents the complexity/sophistication of a person’s intellectual repertoire (Jensen, 1998; Lubinski & Dawis, 1992). The more complex a test is, regardless of its content, the better a measure of g it is. Further, because g underlies all cognitive reasoning processes, any test that assesses a specific ability is also, to some extent, a measure of g (Lubinski, 2004). In school, work, and a variety of everyday life circumstances, assessments of this general dimension covary more broadly and deeper than any other measure of human individuality (Hunt, 2011; Jensen, 1998; Lubinski, 2000, 2004).

Measures of g manifest their life importance by going beyond educational settings (where...
they covary with educational achievement assessments in the .70–.80 range), by playing a role in shaping phenomena within Freud’s two important life domains, arbeiten and lieben, working and loving (or, resource acquisition and mating). Measures of \( g \) covary .20–.60 with work performance as a function of job complexity, .30–.40 with income, and −.20 with criminal behavior, .40 with SES of origin, and .50−.70 with achieved SES; assortative mating correlations on \( g \) are around .50 (Jensen, 1998; Lubinski, 2004; Schmidt & Hunter, 1998). Furthermore, Malcolm Gladwell (2008) notwithstanding, there does not appear to be an ability threshold; that is, the idea that after a certain point more ability does not matter. More ability does matter.

Although other determinants are certainly needed (interests, persistence, opportunity), more ability does make a difference in learning, working, and creating, even among the top 1% of ability, or IQ equivalents ranging from approximately 137 to over 200 (see Figure 2). When appropriate assessment and criterion measures are utilized to capture the breadth of ability and accomplishment differences among the profoundly talented, individual differences within the top 1% of ability are shown to matter a great deal. In the past this has been difficult to demonstrate, because intellectual assessments and criterion measures lacked sufficient scope in gifted or intellectually talented populations, which resulted in no variation in assessments among the able and exceptionally able (ceiling effects). Without variation there cannot be co-variation, but modern methods have now corrected for this (Kell, Lubinski, & Benbow, 2013a; Lubinski, 2009; Park, Lubinski, & Benbow, 2007, 2008). Yet, even when \( g \) is measured in its full scope, and validated with large samples and appropriate low-base-rate-criteria over protracted longitudinal intervals, there is much more to intellectual functioning than measures of \( g \) or general ability.

To reveal how general and specific abilities operate over the course of development, Figure 3 contains data from over 400,000 high schools students assessed between grades 9 through 12, and tracked for 11 years. Specifically, Figure 3 graphs the general and specific ability profiles of students earning terminal degrees in nine disciplines (Wai et al., 2009). Given that highly congruent findings were observed for all four cohorts (grades 9 through 12), the cohorts were combined. High general intelligence and an intellectual orientation dominated by high mathematical and spatial abilities, relative to verbal ability, were salient characteristics of individuals who pursued advanced education credentials in science, technology, engineering, and mathematics (STEM). These participants occupy a region in the intellectual space defined by the dimensions of ability level and ability pattern different from participants who earn undergraduate and graduate degrees in other domains.

Two major differences distinguish the STEM from the non-STEM educational groups. First, students who ultimately secure educational credentials in STEM domains are more capable than those earning degrees in other areas, especially in nonverbal intellectual abilities. Within
all educational domains, more advanced degrees are associated with more general and specific abilities. Second, for all three STEM educational groupings (and the advanced degrees within these groupings), spatial ability > verbal ability—whereas for all others, ranging from education to biology, spatial ability < verbal ability (with business being an exception). Young adolescents who subsequently secured advanced educational credentials in STEM manifested a spatial–verbal ability pattern opposite that of those who ultimately earned educational

Accomplishments Across Individual Differences within the Top 1% of General Cognitive Ability: 25+ Years After Identified at Age 13

Figure 2. Frey and Detterman (2004) have shown that the SAT composite is an excellent measure of general intelligence for high ability samples; here, intellectually precocious youth were assessed on this composite at age 13 and separated into quartiles (Lubinski, 2009). The mean age 13 SAT composite scores for each quartile are displayed in parentheses along the x-axis. Odds ratios comparing the likelihood of each outcome in the top (Q4) and bottom (Q1) SAT quartiles are displayed at the end of every respective criterion line. An asterisk indicates that the 95% confidence interval for the odds ratio did not include 1.0, meaning that the likelihood of the outcome in Q4 was significantly greater than in Q1. These SAT assessments by age 13 were conducted before the re-centering of the SAT in the mid-1990s (i.e., during the 1970s and early 1980s); at that time, cutting scores for the top 1 in 200 were SAT-M ≥ 500, SAT-V ≥ 430; for the top 1 in 10,000, cutting scores were SAT-M ≥ 700, SAT-V ≥ 630 by age 13.
credentials in other areas. These same patterns play out in occupational arenas in predictable ways (Kell, Lubinski, Benbow, & Steiger, 2013b). In the past decade, individual differences within the top 1% of ability have revealed that these patterns portend important outcomes for technical innovation and creativity, with respect to both ability level (Lubinski, 2009; Park et al., 2008) and pattern (Kell et al. 2013a, Kell et al., 2013b; Park et al., 2007). Level of general ability has predictive validity for the magnitude of accomplishment (how extraordinary they are), whereas ability pattern has predictive validity for the nature of accomplishments (the domains they occur in).

Figure 3. Average z scores of participants on verbal, spatial, and mathematical ability for terminal bachelor's degrees, terminal master's degrees, and doctoral degrees are plotted by field. The groups are plotted in rank order of their normative standing on g (verbal [V] + spatial [S] + mathematical [M]) along the x-axis, and the line with the arrows from each field pointing to it indicates on the continuous scale where they are in general mental ability in z-score units. This figure is standardized in relation to all participants with complete ability data at the time of initial testing. Respective Ns for each group (men + women) were as follows for bachelor's, master's, and doctorates, respectively: engineering (1,143, 339, 71), physical science (633, 182, 202), math/computer science (877, 266, 57), biological science (740, 182, 79), humanities (3,226, 695, 82), social science (2,609, 484, 158), arts (615, 171 [master's only]), business (2,386, 191 [master's + doctorate]), and education (3,403, 1,505 [master's + doctorate]). For education and business, master's degrees and doctorates were combined because the doctorate samples for these groups were too small to obtain stability (N = 30). For the specific N for each degree by sex that composed the major groupings, see Appendix A in Wai et al. (2009).
Interests

Just because people can do something well doesn’t mean they like doing it. Psychological information on motivational differences (personal passions) is needed to understand attractions and aversions, different ways to create a meaningful life, and how differential development unfolds. Even people with the same intellectual equipment vary widely in their motivational proclivities. Paraphrasing Plato, different horses drive intellectual development down different life paths. The lower left region of Figure 1 provides the dominant model of vocational interests, one developed from decades of large-scale longitudinal and cross-cultural research. It shows a hexagonal structure consisting of six general themes: Realistic (R) = working with gadgets and things, the outdoors, need for structure; Investigative (I) = scientific pursuits, especially mathematics and the physical science, an interest in theory; Artistic (A) = creative expression in art and writing, little need for structure; Social (S) = people interests, the helping professions, teaching, nursing, counseling; Enterprising (E) = likes leadership roles directed toward economic objectives; and Conventional (C) = liking of well-structured environments and clear chains of command, such as office practices.

These six themes covary inversely with the distance between them, hence, the hexagonal structure circling around R-I-A-S-E-C. John Holland (1959, 1996) justifiably receives most of the credit for this model (Day & Rounds, 1998), although Guilford et al. (1954) uncovered a similar framework based on military data and labeled them Mechanical, Scientific, Aesthetic Expression, Social Welfare, Business, and Clerical. Although each theme contains multiple subcomponents, Holland’s hexagon, like the radex of cognitive abilities, captures the general outlines of the educational/occupational interest domain, but there are molecular strands of intellective and interest dimensions that add nuance to these general outlines (for abilities, see Carroll, 1993; for interests, see Dawis, 1991; Savickas & Spokane, 1999). There are also super-ordinal themes such as people.
versus things (Su, Rounds, & Armstrong, 2009), which manifest arguably the largest sex-difference on a psychological dimension of human individuality.

At superordinate levels of people versus things or data versus ideas (Prediger, 1982), or at the RIASEC level of analysis, interest dimensions covary in different ways with mathematical, spatial, and verbal abilities (Ackerman, 1996; Ackerman & Heggestad, 1997; Schmidt, Lubinski, & Benbow, 1998); and intense selection, when exclusively restricted to a specific ability, will eventuate in distinctive interest profiles across the three abilities with implications for differential development (Humphreys, Lubinski, & Yao, 1993; Webb, Lubinski, & Benbow, 2007). Although correlations between abilities and interests are “only” in the .20–.30 range, when selection is extreme, distinct profiles emerge and reflect different “types” (Lubinski & Benbow, 2000, 2006). For basic science, this shows how ostensibly different kinds of intelligence at the extreme do not stem from different qualities, but rather from endpoint extremes within a multivariate space of systematic sources of individual differences, which “pull” with them constellations of nonintellectual personal attributes. For applied practice, skilled educational–vocational counselors routinely combine information on abilities and interests to distill learning and work environments that individuals are likely to thrive in competence and experience fulfillment (Dawis, 1992; Rounds & Tracy, 1990). For further insights, a final class of important psychological determinants is needed, however.

Mastery

As all parents of more than one child know, there are huge individual differences in the extent to which individuals embrace opportunities for positive development. Seasoned faculty at top institutions for graduate training have observed the same phenomenon—among highly select graduate students, task commitment varies tremendously. Even among the intellectual elite, individual differences in accomplishments stem from more than abilities, interests, and opportunity; conative determinants are critical catalysts. Galton (1869) called it “zeal,” Hull (1928) called it “industriousness,” and Webb (1915) called it “will.” Such labels as “grit” or “strivers” are sometimes used

According to some researchers, it takes about 10,000 hours of practicing a skill to become an “expert” in it. Of course, one’s natural ability would vary this amount. However, either way, get to practicing! [Image: CC0 Public Domain, https://goo.gl/m25gce]
to define resources that people call upon to mobilize their abilities and interests over protracted intervals. Conative factors are distinct from abilities and preferences, having more to do with individual differences in energy or psychological tempo rather than the content of what people can do or how rapidly they learn. Indeed, characteristic across scientific studies of expertise and world-class accomplishment are attributes specifically indicative of indefatigable capacities for study and work. This is an underappreciated class of individual differences, although Ackerman (1996) has discussed typical intellectual engagement (TIE) and Dawis and Lofquist (1984) have discussed pace and endurance. This class of attributes simply has not received the attention it deserves.

Nevertheless, in the field of talent development and identification, the greatest consensus appears to be found on the topic of conation, rather than cognition or affect. Exceptional performers are deeply committed to what they do, and they devote a great deal of time to doing it. Regardless of the theorist, Howard Gardner, Dean Simonton, Arthur Jensen, Anders Erikson, and Harriet Zuckerman all agree that this is a uniform characteristic of world class performers at the top of their game. In the words of Dean Simonton and E. O. Wilson, respectively:

[M]aking it big [becoming a star] is a career. People who wish to do so must organize their whole lives around a single enterprise. They must be monomaniacs, even megalomaniacs, about their pursuits. They must start early, labor continuously, and never give up the cause. Success is not for the lazy, procrastinating, or mercurial. (Simonton, 1994, p. 181)

I have been presumptuous enough to counsel new Ph.D.’s in biology as follows: If you choose an academic career you will need forty hours a week to perform teaching and administrative duties, another twenty hours on top of that to conduct respectable research, and still another twenty hours to accomplish really important research. This formula is not boot-camp rhetoric. (Wilson, 1998, pp. 55–56)

Figure 4 contains data from two extraordinary populations of individuals (Lubinski, Benbow, Webb, Bleske-Rechek, 2006). One group consists of a sample of profoundly gifted adolescents identified at age 12 as in the top 1 in 10,000 in mathematical or verbal reasoning ability; they were subsequently tracked for 20 years. Members of the second group were identified in their early twenties, as first- or second-year STEM graduate students enrolled in a top-15 U.S. university; they were subsequently tracked for 10 years. Now in their mid-thirties, subjects were asked how much they would be willing to work in their “ideal job” and, second, how much they actually do work. The data are clear. There are huge individual differences associated with how much time people are willing to invest in their career development and work. The STEM graduate students are particularly interesting inasmuch as in their mid-twenties they
were assessed on abilities, interests, and personality, and both sexes were found to be highly similar on these psychological dimensions (Lubinski, Benbow, Shea, Eftekhar-Sanjani, & Halvorson, 2001). But subsequently, over the life span, they markedly diverged in time allocation and life priorities (Ceci & Williams, 2011; Ferriman, Lubinski, & Benbow, 2009).

These figures reveal huge noncognitive individual differences among individuals with exceptional intellectual talent. One only needs to imagine the ticking of a tenure clock and the differences likely to accrue over a 5-year interval between two faculty working 45- versus 65-hour weeks (other things being equal). Making partner in a prestigious law firm is no different, nor is achieving genuine excellence in most intellectually demanding areas.
Conclusion

Since Spearman (1904) advanced the idea of general intelligence, a steady stream of systematic scientific knowledge has accrued in the psychological study of human individuality. We have learned that the intellect is organized hierarchically, that interests are multidimensional and only covary slightly with abilities, and that individual differences are huge in terms of investing in personal development. When these aspects of human psychological diversity are combined with commensurate attention devoted to opportunities for learning, work, and personal growth, a framework for understanding human development begins to take shape. Because frameworks may be found that emphasize only one set of these determinants, this essay closes with the recommendation—based on the empirical evidence—to stress all three.
Outside Resources

Book: Human Cognitive Abilities, by John Carroll constitutes a definitive treatment of the nature and hierarchical organization of cognitive abilities, based on a conceptual and empirical analysis of the past century's factor analytic research.
/ref=sr_1_1?ie=UTF8&qid=1390944516&sr=1-1&keywords=human+cognitive+abilities

Book: Human Intelligence, by Earl Hunt, provides a superb overview of empirical research on cognitive abilities. Collectively, these three sources capture the psychological significance of what this important domain of human psychological diversity affords.
http://www.amazon.com/Human-Intelligence-Earl-Hunt/dp/0521707811

Book: The g Factor, by Arthur Jensen, explicates the depth and breadth of the central dimension running through all cognitive abilities, the summit of Carroll's (1993) hierarchical organization: general intelligence (or “g”). Revealed here is the practical and scientific significance for coming to terms with a rich array of critical human outcomes found in schools, work, and everyday life.

Book: For additional reading on the history of intellectual assessment, read Century of Ability Testing, by Robert Thorndike and David F. Lohman

Discussion Questions

1. Why are abilities and interests insufficient for conceptualizing educational and occupational development?

2. Why does the model of talent development discussed in this module place equal emphasis on assessing the individual and assessing the environment.

3. What is the most widely agreed on empirical finding, among investigators who study the development of truly outstanding careers?

4. Besides what you can do and what you like, what other factors are important to consider when making choices about your personal development in learning and work settings?
Vocabulary

**g or general mental ability**
The general factor common to all cognitive ability measures, "a very general mental capacity that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—‘catching on,’ ‘making sense of things,’ or ‘figuring out’ what to do” (Gottfredson, 1997, p. 13).

**Satisfaction**
Correspondence between an individual’s needs or preferences and the rewards offered by the environment.

**Satisfactoriness**
Correspondence between an individual’s abilities and the ability requirements of the environment.

**Specific abilities**
Cognitive abilities that contain an appreciable component of g or general ability, but also contain a large component of a more content-focused talent such as mathematical, spatial, or verbal ability; patterns of specific abilities channel development down different paths as a function of an individual’s relative strengths and weaknesses.

**Under-determined or misspecified causal models**
Psychological frameworks that miss or neglect to include one or more of the critical determinants of the phenomenon under analysis.
References


The brain is the most complex part of the human body. It is the center of consciousness and also controls all voluntary and involuntary movement and bodily functions. It communicates with each part of the body through the nervous system, a network of channels that carry electrochemical signals.

Learning Objectives

- Name the various parts of the nervous system and their respective functions
- Explain how neurons communicate with each other
- Identify the location and function of the limbic system
- Articulate how the primary motor cortex is an example of brain region specialization
- Name at least three neuroimaging techniques and describe how they work

In the 1800s a German scientist by the name of Ernst Weber conducted several experiments meant to investigate how people perceive the world via their own bodies (Hernstein & Boring, 1966). It is obvious that we use our sensory organs—our eyes, and ears, and nose—to take in and understand the world around us. Weber was particularly interested in the sense of touch. Using a drafting compass he placed the two points far apart and set them on the skin of a volunteer. When the points were far apart the research participants could easily distinguish between them. As Weber repeated the process with ever closer points, however, most people lost the ability to tell the difference between them. Weber discovered that the ability to recognize these “just noticeable differences” depended on where on the body the
compans was positioned. Your back, for example, is far less sensitive to touch than is the skin on your face. Similarly, the tip of your tongue is extremely sensitive! In this way, Weber began to shed light on the way that nerves, the nervous system, and the brain form the biological foundation of psychological processes.

In this module we will explore the biological side of psychology by paying particular attention to the brain and to the nervous system. Understanding the nervous system is vital to understanding psychology in general. It is through the nervous system that we experience pleasure and pain, feel emotions, learn and use language, and plan goals, just to name a few examples. In the pages that follow we will begin by examining how the human nervous system develops and then we will learn about the parts of the brain and how they function. We will conclude with a section on how modern psychologists study the brain.

It is worth mentioning here, at the start, that an introduction to the biological aspects of psychology can be both the most interesting and most frustrating of all topics for new students of psychology. This is, in large part, due to the fact that there is so much new information to learn and new vocabulary associated with all the various parts of the brain and nervous system. In fact, there are 30 key vocabulary words presented in this module! We encourage you not to get bogged down in difficult words. Instead, pay attention to the broader concepts, perhaps even skipping over the vocabulary on your first reading. It is helpful to pass back through with a second reading, once you are already familiar with the topic, with attention to learning the vocabulary.

**Nervous System development across the human lifespan**

As a species, humans have evolved a complex nervous system and brain over millions of years. Comparisons of our nervous systems with those of other animals, such as chimpanzees, show some similarities (Darwin, 1859). Researchers can also use fossils to study the relationship between brain volume and human behavior over the course of evolutionary history. *Homo*
*habilis*, for instance, a human ancestor living about 2 million years ago shows a larger brain volume than its own ancestors but far less than modern *homo sapiens*. The main difference between humans and other animals— in terms of brain development— is that humans have a much more developed frontal cortex (the front part of the brain associated with planning).

Interestingly, a person’s unique nervous system develops over the course of their lifespan in a way that resembles the evolution of nervous systems in animals across vast stretches of time. For example, the human nervous system begins developing even before a person is born. It begins as a simple bundle of tissue that forms into a tube and extends along the head-to-tail plane becoming the spinal cord and brain. 25 days into its development, the embryo has a distinct spinal cord, as well as hindbrain, midbrain and forebrain (Stiles & Jernigan, 2010). What, exactly, is this nervous system that is developing and what does it do?

The nervous system can be thought of as the body’s communication network that consists of all nerve cells. There are many ways in which we can divide the nervous system to understand it more clearly. One common way to do so is by parsing it into the central nervous system and the peripheral nervous system. Each of these can be sub-divided, in turn. Let’s take a closer, more in-depth look at each. And, don’t worry, the nervous system is complicated with many parts and many new vocabulary words. It might seem overwhelming at first but through the figures and a little study you can get it.

**The Central Nervous System (CNS): The Neurons inside the Brain**

The Central Nervous System, or CNS for short, is made up of the brain and spinal cord (see Figure 1). The CNS is the portion of the nervous system that is encased in bone (the brain is protected by the skull and the spinal cord is protected by the spinal column). It is referred to as “central” because it is the brain and spinal cord that are primarily responsible for processing sensory information— touching a hot stove or seeing a rainbow, for example— and sending signals to the peripheral nervous system for action. It communicates largely by sending electrical signals through individual nerve cells that make up the fundamental building blocks of the nervous system, called neurons. There are approximately 100 billion...
neurons in the human brain and each has many contacts with other neurons, called synapses (Brodal, 1992).

If we were able to magnify a view of individual neurons we would see that they are cells made from distinct parts (see Figure 2). The three main components of a neuron are the dendrites, the soma, and the axon. Neurons communicate with one another by receiving information through the dendrites, which act as an antenna. When the dendrites channel this information to the soma, or cell body, it builds up as an electro-chemical signal. This electrical part of the signal, called an action potential, shoots down the axon, a long tail that leads away from the soma and toward the next neuron. When people talk about “nerves” in the nervous system, it typically refers to bundles of axons that form long neural wires along which electrical signals can travel. Cell-to-cell communication is helped by the fact that the axon is covered by a myelin sheath—a layer of fatty cells that allow the signal to travel very rapidly from neuron to neuron (Kandel, Schwartz & Jessell, 2000).

If we were to zoom in still further we could take a closer look at the synapse, the space between neurons (see Figure 3). Here, we would see that there is a space between neurons, called the synaptic gap. To give you a sense of scale we can compare the synaptic gap to the thickness of a dime, the thinnest of all American coins (about 1.35 mm). You could stack approximately 70,000 synaptic gaps in the thickness of a single coin!

As the action potential, the electrical signal reaches the end of the axon, tiny packets of chemicals, called neurotransmitters, are released. This is the chemical part of the electro-chemical signal. These neurotransmitters are the chemical signals that travel from one neuron
to another, enabling them to communicate with one another. There are many different types of neurotransmitters and each has a specialized function. For example, serotonin affects sleep, hunger and mood. Dopamine is associated with attention, learning and pleasure (Kandel & Schwartz, 1982)

It is amazing to realize that when you think—when you reach out to grab a glass of water, when you realize that your best friend is happy, when you try to remember the name of the parts of a neuron—what you are experiencing is actually electro-chemical impulses shooting between nerves!

The Central Nervous System: Looking at the Brain as a Whole

If we were to zoom back out and look at the central nervous system again we would see that the brain is the largest single part of the central nervous system. The brain is the headquarters of the entire nervous system and it is here that most of your sensing, perception, thinking, awareness, emotions, and planning take place. For many people the brain is so important that there is a sense that it is there—inside the brain—that a person's sense of self is located (as opposed to being primarily in your toes, by contrast). The brain is so important, in fact, that it consumes 20% of the total oxygen and calories we consume even though it is only, on average, about 2% of our overall weight.

It is helpful to examine the various parts of the brain and to understand their unique functions to get a better sense of the role the brain plays. We will start by looking at very general areas of the brain and then we will zoom in and look at more specific parts. Anatomists and neuroscientists often divide the brain into portions based on the location and function of various brain parts. Among the simplest ways to organize the brain is to describe it as having three basic portions: the hindbrain, midbrain and forebrain. Another way to look at the brain is to consider the brain stem, the Cerebellum, and the Cerebrum. There is another part, called the Limbic System that is less well defined. It is made up of a number of structures that are “sub-cortical” (existing in the hindbrain) as well as cortical regions of the brain (see Figure 4).

The brain stem is the most basic structure of the brain and is located at the top of the spine and bottom of the brain. It is sometimes considered the “oldest” part of the brain because we can see similar structures in other, less evolved animals such as crocodiles. It is in charge of
a wide range of very basic “life support” functions for the human body including breathing, digestion, and the beating of the heart. Amazingly, the brain stem sends the signals to keep these processes running smoothly without any conscious effort on our behalf.

The **limbic system** is a collection of highly specialized neural structures that sit at the top of the brain stem, which are involved in regulating our emotions. Collectively, the limbic system is a term that doesn’t have clearly defined areas as it includes forebrain regions as well as hindbrain regions. These include the amygdala, the thalamus, the hippocampus, the insula cortex, the anterior cingulate cortex, and the prefrontal cortex. These structures influence hunger, the sleep-wake cycle, sexual desire, fear and aggression, and even memory.

The **cerebellum** is a structure at the very back of the brain. Aristotle referred to it as the “small brain” based on its appearance and it is principally involved with movement and posture although it is also associated with a variety of other thinking processes. The cerebellum, like the brain stem, coordinates actions without the need for any conscious awareness.

The **cerebrum** (also called the “cerebral cortex”) is the “newest,” most advanced portion of the brain. The cerebral hemispheres (the left and right hemispheres that make up each side of the top of the brain) are in charge of the types of processes that are associated with more awareness and voluntary control such as speaking and planning as well as contain our primary sensory areas (such as seeing, hearing, feeling, and moving). These two hemispheres are connected to one another by a thick bundle of axons called the **corpus callosum**. There are instances in which people—either because of a genetic abnormality or as the result of surgery—have had their corpus callosum severed so that the two halves of the brain cannot easily communicate with one another. The rare **split-brain** patients offer helpful insights into how the brain works. For example, we now understand that the brain is **contralateral**, or opposite-sided. This means that the left side of the brain is responsible for controlling a number of sensory and motor functions of the right side of the body, and vice versa.
Consider this striking example: A split brain patient is seated at a table and an object such as a car key can be placed where a split-brain patient can only see it through the right visual field. Right visual field images will be processed on the left side of the brain and left visual field images will be processed on the right side of the brain. Because language is largely associated with the left side of the brain the patient who sees car key in the right visual field when asked “What do you see?” would answer, “I see a car key.” In contrast, a split-brain patient who only saw the car key in the left visual field, thus the information went to the non-language right side of the brain, might have a difficult time speaking the word “car key.” In fact in this case, the patient is likely to respond “I didn't see anything at all.” However, if asked to draw the item with their left hand—a process associated with the right side of the brain—the patient will be able to do so! See the outside resources below for a video demonstration of this striking phenomenon.

Besides looking at the brain as an organ that is made up of two halves we can also examine it by looking at its four various lobes of the cerebral cortex, the outer part of the brain (see Figure 5). Each of these is associated with a specific function. The **occipital lobe**, located at the back of the cerebral cortex, is the house of the visual area of the brain. You can see the road in front of you when you are driving, track the motion of a ball in the air thanks to the occipital lobe. The **temporal lobe**, located on the underside of the cerebral cortex, is where sounds and smells are processed. The **parietal lobe**, at the upper back of the cerebral cortex, is where touch and taste are processed. Finally, the **frontal lobe**, located at the forward part of the cerebral cortex is where behavioral motor plans are processed as well as a number of highly complicated processes occur including speech and language use, creative problem solving, and planning and organization.

One particularly fascinating area in the frontal lobe is called the “primary motor cortex”. This strip running along the side of the brain is in charge of voluntary movements like waving goodbye, wiggling your eyebrows, and kissing. It is an excellent example of the way that the various regions of the brain are highly specialized. Interestingly, each of our various body parts has a unique portion of the primary motor cortex devoted to it (see Figure 6). Each individual finger has about as much dedicated brain space as your entire leg. Your lips, in turn, require about
as much dedicated brain processing as all of your fingers and your hand combined!

Because the cerebral cortex in general, and the frontal lobe in particular, are associated with such sophisticated functions as planning and being self-aware they are often thought of as a higher, less primal portion of the brain. Indeed, other animals such as rats and kangaroos while they do have frontal regions of their brain do not have the same level of development in the cerebral cortices. The closer an animal is to humans on the evolutionary tree—think chimpanzees and gorillas, the more developed is this portion of their brain.

The Peripheral Nervous System

In addition to the central nervous system (the brain and spinal cord) there is also a complex network of nerves that travel to every part of the body. This is called the **peripheral nervous system** (PNS) and it carries the signals necessary for the body to survive (see Figure 7). Some of the signals carried by the PNS are related to voluntary actions. If you want to type a message to a friend, for instance, you make conscious choices about which letters go in what order and your brain sends the appropriate signals to your fingers to do the work. Other processes, by contrast, are not voluntary. Without your awareness your brain is also sending signals to your organs, your digestive system, and the muscles that are holding you up right now with instructions about what they should be doing. All of this occurs through the pathways of your peripheral nervous system.
How we study the brain

The brain is difficult to study because it is housed inside the thick bone of the skull. What’s more, it is difficult to access the brain without hurting or killing the owner of the brain. As a result, many of the earliest studies of the brain (and indeed this is still true today) focused on unfortunate people who happened to have damage to some particular area of their brain. For instance, in the 1880s a surgeon named Paul Broca conducted an autopsy on a former patient who had lost his powers of speech. Examining his patient’s brain, Broca identified a damaged area—now called the “Broca’s Area”—on the left side of the brain (see Figure 8) (AAAS, 1880). Over the years a number of researchers have been able to gain insights into the function of specific regions of the brain from these types of patients.

An alternative to examining the brains or behaviors of humans with brain damage or surgical lesions can be found in the instance of animals. Some researchers examine the brains of other animals such as rats, dogs and monkeys. Although animals brains differ from human brains in both size and structure there are many similarities as well. The use of animals for study can yield important insights into human brain function.

In modern times, however, we do not have to exclusively rely on the study of people
with brain lesions. Advances in technology have led to ever more sophisticated imaging techniques. Just as X-ray technology allows us to peer inside the body, neuroimaging techniques allow us glimpses of the working brain (Raichle, 1994). Each type of imaging uses a different technique and each has its own advantages and disadvantages.

**Positron Emission Tomography (PET)** records metabolic activity in the brain by detecting the amount of radioactive substances, which are injected into a person's bloodstream, the brain is consuming. This technique allows us to see how much an individual uses a particular part of the brain while at rest, or not performing a task. Another technique, known as **Functional Magnetic Resonance Imaging (fMRI)** relies on blood flow. This method measures changes in the levels of naturally occurring oxygen in the blood. As a brain region becomes active, it requires more oxygen. This technique measures brain activity based on this increase oxygen level. This means fMRI does not require a foreign substance to be injected into the body. Both PET and fMRI scans have poor **temporal resolution**, meaning that they cannot tell us exactly when brain activity occurred. This is because it takes several seconds for blood to arrive at a portion of the brain working on a task.

One imaging technique that has better temporal resolution is **Electroencephalography (EEG)**, which measures electrical brain activity instead of blood flow. Electrodes are place on the scalp of participants and they are nearly instantaneous in picking up electrical activity. Because this activity could be coming from any portion of the brain, however, EEG is known to have poor **spatial resolution**, meaning that it is not accurate with regards to specific location.

Another technique, known as **Diffuse Optical Imaging** (DOI) can offer high temporal and spatial resolution. DOI works by shining infrared light into the brain. It might seem strange that light can pass through the head and brain. Light properties change as they pass through oxygenated blood and through active neurons. As a result, researchers can make inferences regarding where and when brain activity is happening.
Conclusion

It has often been said that the brain studies itself. This means that humans are uniquely capable of using our most sophisticated organ to understand our most sophisticated organ. Breakthroughs in the study of the brain and nervous system are among the most exciting discoveries in all of psychology. In the future, research linking neural activity to complex, real world attitudes and behavior will help us to understand human psychology and better intervene in it to help people.
Outside Resources

Video: Animation of Neurons
http://www.youtube.com/watch?v=-SHBnExxub8

Video: Split Brain Patient
http://www.youtube.com/watch?v=ZMLzP1VCANo

Web: Animation of the Magnetic Resonance Imaging (MRI)
http://sites.sinauer.com/neuroscience5e/animations01.01.html

Web: Animation of the Positron Emission Tomography (PET)
http://sites.sinauer.com/neuroscience5e/animations01.02.html

Web: Teaching resources and videos for teaching about the brain, from Colorado State University:
http://www.learner.org/resources/series142.html

Web: The Brain Museum
http://brainmuseum.org/

Discussion Questions

1. In your opinion is learning about the functions of various parts of the brain by studying
the abilities of brain damaged patients ethical. What, in your opinion, are the potential
benefits and considerations?

2. Are research results on the brain more compelling to you than are research results from
survey studies on attitudes? Why or why not? How does biological research such as studies
of the brain influence public opinion regarding the science of psychology?

3. If humans continue to evolve what changes might you predict in our brains and cognitive
abilities?

4. Which brain scanning techniques, or combination of techniques, do you find to be the
best? Why? Why do you think scientists may or may not employ exactly your recommended
techniques?
Vocabulary

**Action Potential**
A transient all-or-nothing electrical current that is conducted down the axon when the membrane potential reaches the threshold of excitation.

**Axon**
Part of the neuron that extends off the soma, splitting several times to connect with other neurons; main output of the neuron.

**Brain Stem**
The “trunk” of the brain comprised of the medulla, pons, midbrain, and diencephalon.

**Broca’s Area**
An area in the frontal lobe of the left hemisphere. Implicated in language production.

**Central Nervous System**
The portion of the nervous system that includes the brain and spinal cord.

**Cerebellum**
The distinctive structure at the back of the brain, Latin for “small brain.”

**Cerebrum**
Usually refers to the cerebral cortex and associated white matter, but in some texts includes the subcortical structures.

**Contralateral**
Literally “opposite side”; used to refer to the fact that the two hemispheres of the brain process sensory information and motor commands for the opposite side of the body (e.g., the left hemisphere controls the right side of the body).

**Corpus Callosum**
The thick bundle of nerve cells that connect the two hemispheres of the brain and allow them to communicate.

**Dendrites**
Part of a neuron that extends away from the cell body and is the main input to the neuron.
Diffuse Optical Imaging (DOI)
A neuroimaging technique that infers brain activity by measuring changes in light as it is passed through the skull and surface of the brain.

Electroencephalography (EEG)
A neuroimaging technique that measures electrical brain activity via multiple electrodes on the scalp.

Frontal Lobe
The front most (anterior) part of the cerebrum; anterior to the central sulcus and responsible for motor output and planning, language, judgment, and decision-making.

Functional Magnetic Resonance Imaging (fMRI)
Functional magnetic resonance imaging (fMRI): A neuroimaging technique that infers brain activity by measuring changes in oxygen levels in the blood.

Limbic System
Includes the subcortical structures of the amygdala and hippocampal formation as well as some cortical structures; responsible for aversion and gratification.

Myelin Sheath
Fatty tissue, that insulates the axons of the neurons; myelin is necessary for normal conduction of electrical impulses among neurons.

Nervous System
The body’s network for electrochemical communication. This system includes all the nerves cells in the body.

Neurons
Individual brain cells

Neurotransmitters
Chemical substance released by the presynaptic terminal button that acts on the postsynaptic cell.

Occipital Lobe
The back most (posterior) part of the cerebrum; involved in vision.

Parietal Lobe
The part of the cerebrum between the frontal and occipital lobes; involved in bodily sensations, visual attention, and integrating the senses.

**Peripheral Nervous System**
All of the nerve cells that connect the central nervous system to all the other parts of the body.

**Positron Emission Tomography (PET)**
A neuroimaging technique that measures brain activity by detecting the presence of a radioactive substance in the brain that is initially injected into the bloodstream and then pulled in by active brain tissue.

**Soma**
Cell body of a neuron that contains the nucleus and genetic information, and directs protein synthesis.

**Spatial Resolution**
A term that refers to how small the elements of an image are; high spatial resolution means the device or technique can resolve very small elements; in neuroscience it describes how small of a structure in the brain can be imaged.

**Split-brain Patient**
A patient who has had most or all of his or her corpus callosum severed.

**Synapses**
Junction between the presynaptic terminal button of one neuron and the dendrite, axon, or soma of another postsynaptic neuron.

**Synaptic Gap**
Also known as the synaptic cleft; the small space between the presynaptic terminal button and the postsynaptic dendritic spine, axon, or soma.

**Temporal Lobe**
The part of the cerebrum in front of (anterior to) the occipital lobe and below the lateral fissure; involved in vision, auditory processing, memory, and integrating vision and audition.

**Temporal Resolution**
A term that refers to how small a unit of time can be measured; high temporal resolution means capable of resolving very small units of time; in neuroscience it describes how precisely in time a process can be measured in the brain.
References

American Association for the Advancement of Science (AAAS). (1880). Dr. Paul Broca. Science, 1, 93.


This module on the biological basis of behavior provides an overview of the basic structure of neurons and their means of communication. Neurons, cells in the central nervous system, receive information from our sensory systems (vision, audition, olfaction, gustation, and somatosensation) about the world around us; in turn, they plan and execute appropriate behavioral responses, including attending to a stimulus, learning new information, speaking, eating, mating, and evaluating potential threats. The goal of this module is to become familiar with the anatomical structure of neurons and to understand how neurons communicate by electrochemical signals to process sensory information and produce complex behaviors through networks of neurons. Having a basic knowledge of the fundamental structure and function of neurons is a necessary foundation as you move forward in the field of psychology.

Learning Objectives

- Differentiate the functional roles between the two main cell classes in the brain, neurons and glia.
- Describe how the forces of diffusion and electrostatic pressure work collectively to facilitate electrochemical communication.
- Define resting membrane potential, excitatory postsynaptic potentials, inhibitory postsynaptic potentials, and action potentials.
- Explain features of axonal and synaptic communication in neurons.

Introduction
Imagine trying to string words together into a meaningful sentence without knowing the meaning of each word or its function (i.e., is it a verb, a noun, or an adjective?). In a similar fashion, to appreciate how groups of cells work together in a meaningful way in the brain as a whole, we must first understand how individual cells in the brain function. Much like words, brain cells, called neurons, have an underlying structure that provides the foundation for their functional purpose. Have you ever seen a neuron? Did you know that the basic structure of a neuron is similar whether it is from the brain of a rat or a human? How do the billions of neurons in our brain allow us to do all the fun things we enjoy, such as texting a friend, cheering on our favorite sports team, or laughing?

Our journey in answering these questions begins more than 100 years ago with a scientist named Santiago Ramón y Cajal. Ramón y Cajal (1911) boldly concluded that discrete individual neurons are the structural and functional units of the nervous system. He based his conclusion on the numerous drawings he made of Golgi-stained tissue, a stain named after the scientist who discovered it, Camillo Golgi. Scientists use several types of stains to visualize cells. Each stain works in a unique way, which causes them to look differently when viewed under a microscope. For example, a very common Nissl stain labels only the main part of the cell (i.e., the cell body; see left and middle panels of Figure 1). In contrast, a Golgi stain fills the cell body and all the processes that extend outward from it (see right panel of Figure 1). A more notable characteristic of a Golgi stain is that it only stains approximately 1–2% of neurons (Pasternak & Woolsey, 1975; Smit & Colon, 1969), permitting the observer to distinguish one cell from another. These qualities allowed Cajal to examine the full anatomical structure of individual neurons for the first time. This significantly enhanced our appreciation of the intricate networks their processes form. Based on his observation of Golgi-stained tissue, Cajal suggested neurons were distinguishable processing units rather than continuous structures. This was in opposition to the dominant theory at the time.
proposed by Joseph von Gerlach, which stated that the nervous system was composed of a continuous network of nerves (for review see, Lopez-Munoz, Boya, & Alamo, 2006). Camillo Golgi himself had been an avid supporter of Gerlach’s theory. Despite their scientific disagreement, Cajal and Camillo Golgi shared the Nobel Prize for Medicine in 1906 for their combined contribution to the advancement of science and our understanding of the structure of the nervous system. This seminal work paved the pathway to our current understanding of the basic structure of the nervous system described in this module (for review see: De Carlos & Borrell, 2007; Grant, 2007).

Before moving forward, there will be an introduction to some basic terminology regarding the anatomy of neurons in the section called “The Structure of the Neuron,” below. Once we have reviewed this fundamental framework, the remainder of the module will focus on the electrochemical signals through which neurons communicate. While the electrochemical process might sound intimidating, it will be broken down into digestible sections. The first subsection, “Resting Membrane Potential,” describes what occurs in a neuron at rest, when it is theoretically not receiving or sending signals. Building upon this knowledge, we will examine the electrical conductance that occurs within a single neuron when it receives signals. Finally, the module will conclude with a description of the electrical conductance, which results in communication between neurons through a release of chemicals. At the end of the module, you should have a broad concept of how each cell and large groups of cells send and receive information by electrical and chemical signals.

A note of encouragement: This module introduces a vast amount of technical terminology that at times may feel overwhelming. Do not get discouraged or bogged down in the details. Utilize the glossary at the end of the module as a quick reference guide; tab the glossary page so that you can easily refer to it while reading the module. The glossary contains all terms in bold typing. Terms in italics are additional significant terms that may appear in other modules but are not contained within the glossary. On your first read of this module, I suggest focusing on the broader concepts and functional aspects of the terms instead of trying to commit all the terminology to memory. That is right, I said read first! I highly suggest reading this module at least twice, once prior to and again following the course lecture on this material. Repetition is the best way to gain clarity and commit to memory the challenging concepts and detailed vocabulary presented here.

The Structure of the Neuron

Basic Nomenclature
There are approximately 100 billion neurons in the human brain (Williams & Herrup, 1988). Each neuron has three main components: dendrites, the soma, and the axon (see Figure 2). **Dendrites** are processes that extend outward from the **soma**, or cell body, of a neuron and typically branch several times. Dendrites receive information from thousands of other neurons and are the main source of input of the neuron. The **nucleus**, which is located within the soma, contains genetic information, directs protein synthesis, and supplies the energy and the resources the neuron needs to function. The main source of output of the neuron is the **axon**. The axon is a process that extends far away from the soma and carries an important signal called an action potential to another neuron. The place at which the axon of one neuron comes in close contact to the dendrite of another neuron is a **synapse** (see Figures 2–3). Typically, the axon of a neuron is covered with an insulating substance called a **myelin sheath** that allows the signal and communication of one neuron to travel rapidly to another neuron.

The axon splits many times, so that it can communicate, or synapse, with several other neurons (see Figure 2). At the end of the axon is a **terminal button**, which forms synapses with **spines**, or protrusions, on the dendrites of neurons. Synapses form between the **presynaptic** terminal button (neuron sending the signal) and the **postsynaptic** membrane (neuron receiving the signal; see Figure 3). Here we will focus specifically on synapses between the terminal button of an axon and a dendritic spine; however, synapses can also form between the terminal button of an axon and the soma or the axon of another neuron.

A very small space called a **synaptic gap** or a synaptic cleft, approximately 5 nm (nanometers), exists between the presynaptic terminal button and the postsynaptic dendritic spine. To give you a better idea of the size, a dime is 1.35 mm (millimeter) thick. There are 1,350,000 nm in
the thickness of a dime. In the presynaptic terminal button, there are synaptic vesicles that package together groups of chemicals called neurotransmitters (see Figure 3). Neurotransmitters are released from the presynaptic terminal button, travel across the synaptic gap, and activate ion channels on the postsynaptic spine by binding to receptor sites. We will discuss the role of receptors in more detail later in the module.

Types of Cells in the Brain

Not all neurons are created equal! There are neurons that help us receive information about the world around us, sensory neurons. There are motor neurons that allow us to initiate movement and behavior, ultimately allowing us to interact with the world around us. Finally, there are interneurons, which process the sensory input from our environment into meaningful representations, plan the appropriate behavioral response, and connect to the motor neurons to execute these behavioral plans.

There are three main categories of neurons, each defined by its specific structure. The structures of these three different types of neurons support their unique functions. Unipolar neurons are structured in such a way that is ideal for relaying information forward, so they have one neurite (axon) and no dendrites. They are involved in transmission of physiological information from the body's periphery such as communicating body temperature through the spinal cord up to the brain. Bipolar neurons are involved in sensory perception such as perception of light in the retina of the eye. They have one axon and one dendrite which help acquire and pass sensory information to various centers in the brain. Finally, multipolar neurons are the most common and they communicate sensory and motor information in the brain. For example, their firing causes muscles in the body to contract. Multipolar neurons have one axon and many dendrites which allows them to communicate with other neurons. One of the most prominent neurons is a pyramidal neuron, which falls under the multipolar category. It gets its name from the triangular or pyramidal shape of its soma (for examples see, Furtak, Moyer, & Brown, 2007).

In addition to neurons, there is a second type of cell in the brain called glia cells. Glia cells have several functions, just a few of which we will discuss here. One type of glia cell, called oligodendroglia, forms the
myelin sheaths mentioned above (Simons & Trotter, 2007; see Fig. 2). Oligodendroglia wrap their dendritic processes around the axons of neurons many times to form the myelin sheath. One cell will form the myelin sheath on several axons. Other types of glia cells, such as microglia and astrocytes, digest debris of dead neurons, carry nutritional support from blood vessels to the neurons, and help to regulate the ionic composition of the extracellular fluid. While glial cells play a vital role in neuronal support, they do not participate in the communication between cells in the same fashion as neurons do.

Communication Within and Between Neurons

Thus far, we have described the main characteristics of neurons, including how their processes come in close contact with one another to form synapses. In this section, we consider the conduction of communication within a neuron and how this signal is transmitted to the next neuron. There are two stages of this electrochemical action in neurons. The first stage is the electrical conduction of dendritic input to the initiation of an action potential within a neuron. The second stage is a chemical transmission across the synaptic gap between the presynaptic neuron and the postsynaptic neuron of the synapse. To understand these processes, we first need to consider what occurs within a neuron when it is at a steady state, called resting membrane potential.

Resting Membrane Potential

The intracellular (inside the cell) fluid and extracellular (outside the cell) fluid of neurons is composed of a combination of ions (electrically charged molecules; see Figure 4). Cations are positively charged ions, and anions are negatively charged ions. The composition of intracellular and extracellular fluid is similar to salt water, containing sodium (Na\(^+\)), potassium (K\(^+\)), chloride (Cl\(^-\)), and anions (A\(^-\)).

The cell membrane, which is composed of a lipid bilayer of fat molecules, separates the cell from the surrounding extracellular fluid. There are proteins that span the membrane, forming ion channels that allow particular ions to pass between the intracellular and extracellular fluid (see Figure 4). These ions are in different concentrations inside the cell relative to outside the cell, and the ions have different electrical charges. Due to this difference in concentration and charge, two forces act to maintain a steady state when the cell is at rest: diffusion and electrostatic pressure. Diffusion is the force on molecules to move from areas of high concentration to areas of low concentration. Electrostatic pressure is the force on two ions with similar charge to repel each other and the force of two ions with opposite charge to attract to one another. Remember the saying, opposites attract?
Regardless of the ion, there exists a membrane potential at which the force of diffusion is equal and opposite of the force of electrostatic pressure. This voltage, called the \textit{equilibrium potential}, is the voltage at which no ions flow. Since there are several ions that can permeate the cell's membrane, the baseline electrical charge inside the cell compared with outside the cell, referred to as \textit{resting membrane potential}, is based on the collective drive of force on several ions. Relative to the extracellular fluid, the membrane potential of a neuron at rest is negatively charged at approximately \(-70\) mV (see Figure 5). These are very small voltages compared with the voltages of batteries and electrical outlets, which we encounter daily, that range from 1.5 to 240 V.

Let us see how these two forces, diffusion and electrostatic pressure, act on the four groups of ions mentioned above.

1. \textit{Anions (A-)}: Anions are highly concentrated inside the cell and contribute to the negative charge of the resting membrane potential. Diffusion and electrostatic pressure are not forces that determine A- concentration because A- is impermeable to the cell membrane. There are no ion channels that allow for A- to move between the intracellular and extracellular fluid.

2. \textit{Potassium (K+)}: The cell membrane is very permeable to potassium at rest, but potassium remains in high concentrations inside the cell. Diffusion pushes K+ outside the cell because it is in high concentration inside the cell. However, electrostatic pressure pushes K+ inside the cell because the positive charge of K+ is attracted to the negative charge inside the cell. In combination, these forces oppose one another with respect to K+.

3. \textit{Chloride (Cl-)}: The cell membrane is also very permeable to chloride at rest, but chloride remains in high concentration outside the cell. Diffusion pushes Cl- inside the cell because it is in high concentration outside the cell. However, electrostatic pressure pushes Cl- outside the cell because the negative charge of Cl- is attracted to the positive charge outside the cell. Similar to K+, these forces oppose one another with respect to Cl-.
4. **Sodium (Na+):** The cell membrane is not very permeable to sodium at rest. Diffusion pushes Na+ inside the cell because it is in high concentration outside the cell. Electrostatic pressure also pushes Na+ inside the cell because the positive charge of Na+ is attracted to the negative charge inside the cell. Both of these forces push Na+ inside the cell; however, Na+ cannot permeate the cell membrane and remains in high concentration outside the cell. The small amounts of Na+ inside the cell are removed by a sodium-potassium pump, which uses the neuron's energy (adenosine triphosphate, ATP) to pump 3 Na+ ions out of the cell in exchange for bringing 2 K+ ions inside the cell.

**Action Potential**

Now that we have considered what occurs in a neuron at rest, let us consider what changes occur to the resting membrane potential when a neuron receives input, or information, from the presynaptic terminal button of another neuron. Our understanding of the electrical signals or potentials that occurs within a neuron results from the seminal work of Hodgkin and Huxley that began in the 1930s at a well-known marine biology lab in Woodshole, MA. Their work, for which they won the Nobel Prize in Medicine in 1963, has resulted in the general model of electrochemical transduction that is described here (Hodgkin & Huxley, 1952). Hodgkin and Huxley studied a very large axon in the squid, a common species for that region of the United States. The giant axon of the squid is roughly 100 times larger than that of axons in the mammalian brain, making it much easier to see. Activation of the giant axon is responsible for a withdrawal response the squid uses when trying to escape from a predator, such as large fish, birds, sharks, and even humans. When was the last time you had calamari? The large axon size is no mistake in nature's design; it allows for very rapid transmission of an electrical signal, enabling a swift escape motion in the squid from its predators.

While studying this species, Hodgkin and Huxley noticed that if they applied an electrical stimulus to the axon, a large, transient electrical current conducted down the axon. This transient electrical current is known as an action potential (see Figure 5). An action potential is an all-or-nothing response that occurs when there is a change in the charge or potential of the cell from its resting membrane potential (-70 mV) in a more positive direction, which is a depolarization (see Figure 5). What is meant by an all-or-nothing response? I find that this concept is best compared to the binary code used in computers, where there are only two possibilities, 0 or 1. There is no halfway or in-between these possible values; for example, 0.5 does not exist in binary code. There are only two possibilities, either the value of 0 or the value of 1. The action potential is the same in this respect. There is no halfway; it occurs, or it does not occur. There is a specific membrane potential that the neuron must reach to initiate an action potential. This membrane potential, called the threshold of excitation, is typically...
around -50 mV. If the threshold of excitation is reached, then an action potential is triggered.

How is an action potential initiated? At any one time, each neuron is receiving hundreds of inputs from the cells that synapse with it. These inputs can cause several types of fluctuations in the neuron's membrane potentials (see Figure 5):

1. **excitatory postsynaptic potentials** (EPSPs): a *depolarizing* current that causes the membrane potential to become more positive and closer to the threshold of excitation; or

2. **inhibitory postsynaptic potentials** (IPSPs): a *hyperpolarizing* current that causes the membrane potential to become more negative and further away from the threshold of excitation.

These postsynaptic potentials, EPSPs and IPSPs, *summate* or add together in time and space. The IPSPs make the membrane potential more negative, but how much so depends on the strength of the IPSPs. The EPSPs make the membrane potential more positive; again, how much more positive depends on the strength of the EPSPs. If you have two small EPSPs at the same time and the same synapse then the result will be a large EPSP. If you have a small EPSP and a small IPSP at the same time and the same synapse then they will cancel each other out. Unlike the action potential, which is an all-or-nothing response, IPSPs and EPSPs are smaller and *graded* potentials, varying in strength. The change in voltage during an action potential is approximately 100 mV. In comparison, EPSPs and IPSPs are changes in voltage between 0.1 to 40 mV. They can be different strengths, or gradients, and they are measured by how far the membrane potentials diverge from the resting membrane potential.

I know the concept of summation can be confusing. As a child, I use to play a game in elementary school with a very large parachute where you would try to knock balls out of the center of the parachute. This game illustrates the properties of summation rather well. In this game, a group of children next to one another would work in unison to produce waves in the parachute in order to cause a wave large enough to knock the ball out of the parachute. The children would initiate the waves at the same time and in the same direction. The additive result was a larger wave in the parachute, and the balls would bounce out of the parachute.
However, if the waves they initiated occurred in the opposite direction or with the wrong timing, the waves would cancel each other out, and the balls would remain in the center of the parachute. EPSPs or IPSPs in a neuron work in the same fashion to the properties of the waves in the parachute; they either add or cancel each other out. If you have two EPSPs, then they sum together and become a larger depolarization. Similarly, if two IPSPs come into the cell at the same time, they will sum and become a larger hyperpolarization in membrane potential. However, if two inputs were opposing one another, moving the potential in opposite directions, such as an EPSP and an IPSP, their sum would cancel each other out.

At any moment in time, each cell is receiving mixed messages, both EPSPs and IPSPs. If the summation of EPSPs is strong enough to depolarize the membrane potential to reach the threshold of excitation, then it initiates an action potential. The action potential then travels down the axon, away from the soma, until it reaches the ends of the axon (the terminal button). In the terminal button, the action potential triggers the release of neurotransmitters from the presynaptic terminal button into the synaptic gap. These neurotransmitters, in turn, cause EPSPs and IPSPs in the postsynaptic dendritic spines of the next cell (see Figures 4 & 6). The neurotransmitter released from the presynaptic terminal button binds with ionotropic receptors in a lock-and-key fashion on the post-synaptic dendritic spine. Ionotropic receptors are receptors on ion channels that open, allowing some ions to enter or exit the cell, depending upon the presence of a particular neurotransmitter. The type of neurotransmitter and the permeability of the ion channel it activates will determine if an EPSP or IPSP occurs in the dendrite of the post-synaptic cell. These EPSPs and IPSPs summate in the same fashion described above and the entire process occurs again in another cell.

The Change in Membrane Potential During an Action Potential

We discussed previously which ions are involved in maintaining the resting membrane potential. Not surprisingly, some of these same ions are involved in the action potential. When the cell becomes depolarized (more positively charged) and reaches the threshold of excitation, this causes a voltage-dependent Na+ channel to open. A voltage-dependent ion channel is a channel that opens, allowing some ions to enter or exit the cell, depending upon when the cell reaches a particular membrane potential. When the cell is at resting membrane potential, these voltage-dependent Na+ channels are closed. As we learned earlier, both diffusion and electrostatic pressure are pushing Na+ inside the cells. However, Na+ cannot permeate the membrane when the cell is at rest. Now that these channels are open, Na+ rushes inside the cell, causing the cell to become very positively charged relative to the outside of the cell. This is responsible for the rising or depolarizing phase of the action potential (see Figure 5). The inside of the cell becomes very positively charged, +40mV. At this point, the Na+
channels close and become \textit{refractory}. This means the Na+ channels cannot reopen again until after the cell returns to the resting membrane potential. Thus, a new action potential cannot occur during the refractory period. The refractory period also ensures the action potential can only move in one direction down the axon, away from the soma. As the cell becomes more depolarized, a second type of voltage-dependent channel opens; this channel is permeable to K+. With the cell very positive relative to the outside of the cell (depolarized) and the high concentration of K+ within the cell, both the force of diffusion and the force of electrostatic pressure drive K+ outside of the cell. The movement of K+ out of the cell causes the cell potential to return back to the resting membrane potential, the falling or hyperpolarizing phase of the action potential (see Figure 5). A short hyperpolarization occurs partially due to the gradual closing of the K+ channels. With the Na+ closed, electrostatic pressure continues to push K+ out of the cell. In addition, the sodium-potassium pump is pushing Na+ out of the cell. The cell returns to the resting membrane potential, and the excess extracellular K+ diffuses away. This exchange of Na+ and K+ ions happens very rapidly, in less than 1 msec. The action potential occurs in a wave-like motion down the axon until it reaches the terminal button. Only the ion channels in very close proximity to the action potential are affected.

Earlier you learned that axons are covered in myelin. Let us consider how myelin speeds up the process of the action potential. There are gaps in the myelin sheaths called \textit{nodes of Ranvier}. The myelin insulates the axon and does not allow any fluid to exist between the myelin and cell membrane. Under the myelin, when the Na+ and K+ channels open, no ions flow between the intracellular and extracellular fluid. This saves the cell from having to expend the energy necessary to rectify or regain the resting membrane potential. (Remember, the pumps need ATP to run.) Under the myelin, the action potential degrades some, but is still large enough in potential to trigger a new action potential at the next node of Ranvier. Thus, the action potential actively jumps from node to node; this process is known as \textit{saltatory conduction}.

In the presynaptic terminal button, the action potential triggers the release of neurotransmitters (see Figure 3). Neurotransmitters cross the synaptic gap and open subtypes
of receptors in a lock-and-key fashion (see Figure 3). Depending on the type of neurotransmitter, an EPSP or IPSP occurs in the dendrite of the post-synaptic cell. Neurotransmitters that open Na+ or calcium (Ca+) channels cause an EPSP; an example is the NMDA receptors, which are activated by glutamate (the main excitatory neurotransmitter in the brain). In contrast, neurotransmitters that open Cl- or K+ channels cause an IPSP; an example is gamma-aminobutyric acid (GABA) receptors, which are activated by GABA, the main inhibitory neurotransmitter in the brain. Once the EPSPs and IPSPs occur in the postsynaptic site, the process of communication within and between neurons cycles on (see Figure 6). A neurotransmitter that does not bind to receptors is broken down and inactivated by enzymes or glial cells, or it is taken back into the presynaptic terminal button in a process called reuptake, which will be discussed further in the module on psychopharmacology.
Outside Resources

http://www.sumanasinc.com/webcontent/animations/neurobiology.html

Video: An animation and an explanation of an action potential
https://youtu.be/OZG8M_IdA1M

Video: An animation of neurotransmitter actions at the synapse
http://www.youtube.com/watch?v=90cj4NX87Yk

Video: An interactive animation that allows students to observe the results of manipulations to excitatory and inhibitory post-synaptic potentials. Also includes animations and explanations of transmission and neural circuits.
https://apps.childrenshospital.org/clinical/animation/neuron/

Video: Another animation of an action potential
http://www.youtube.com/watch?v=-SHBnExxub8&list=PL968773A54EF13D21

Video: Another animation of neurotransmitter actions at the synapse
http://www.youtube.com/watch?v=LT3VKAr4roo&list=PL968773A54EF13D21

Video: Domino Action Potential: This hands-on activity helps students grasp the complex process of the action potential, as well as become familiar with the characteristics of transmission (e.g., all-or-none response, refractory period).
https://www.youtube.com/watch?v=xzvZ11EutBY

Video: For perspective on techniques in neuroscience to look inside the brain
https://www.youtube.com/watch?v=s4smjT1qwZU

Video: The Behaving Brain is the third program in the DISCOVERING PSYCHOLOGY series. This program looks at the structure and composition of the human brain: how neurons function, how information is collected and transmitted, and how chemical reactions relate to thought and behavior.
http://www.learner.org/series/discoveringpsychology/03/e03expand.html

Video: You can grow new brain cells. Here’s how. -Can we, as adults, grow new neurons?
Neuroscientist Sandrine Thuret says that we can, and she offers research and practical advice on how we can help our brains better perform neurogenesis—improving mood, increasing memory formation and preventing the decline associated with aging along the way.
https://www.youtube.com/watch?v=B_tjKYvEziI

Web: For more information on the Nobel Prize shared by Ramón y Cajal and Golgi
http://www.nobelprize.org/nobel_prizes/medicine/laureates/1906/

Discussion Questions

1. What structures of a neuron are the main input and output of that neuron?
2. What does the statement mean that communication within and between cells is an electrochemical process?
3. How does myelin increase speed and efficiency of the action potential?
4. How does diffusion and electrostatic pressure contribute to the resting membrane potential and the action potential?
5. Describe the cycle of communication within and between neurons.
Vocabulary

**Action potential**
A transient all-or-nothing electrical current that is conducted down the axon when the membrane potential reaches the threshold of excitation.

**Axon**
Part of the neuron that extends off the soma, splitting several times to connect with other neurons; main output of the neuron.

**Cell membrane**
A bi-lipid layer of molecules that separates the cell from the surrounding extracellular fluid.

**Dendrite**
Part of a neuron that extends away from the cell body and is the main input to the neuron.

**Diffusion**
The force on molecules to move from areas of high concentration to areas of low concentration.

**Electrostatic pressure**
The force on two ions with similar charge to repel each other; the force of two ions with opposite charge to attract to one another.

**Excitatory postsynaptic potentials**
A depolarizing postsynaptic current that causes the membrane potential to become more positive and move towards the threshold of excitation.

**Inhibitory postsynaptic potentials**
A hyperpolarizing postsynaptic current that causes the membrane potential to become more negative and move away from the threshold of excitation.

**Ion channels**
Proteins that span the cell membrane, forming channels that specific ions can flow through between the intracellular and extracellular space.

**Ionotropic receptor**
Ion channel that opens to allow ions to permeate the cell membrane under specific conditions,
such as the presence of a neurotransmitter or a specific membrane potential.

**Myelin sheath**
Substance around the axon of a neuron that serves as insulation to allow the action potential to conduct rapidly toward the terminal buttons.

**Neurotransmitters**
Chemical substance released by the presynaptic terminal button that acts on the postsynaptic cell.

**Nucleus**
Collection of nerve cells found in the brain which typically serve a specific function.

**Resting membrane potential**
The voltage inside the cell relative to the voltage outside the cell while the cell is a rest (approximately -70 mV).

**Sodium-potassium pump**
An ion channel that uses the neuron's energy (adenosine triphosphate, ATP) to pump three Na+ ions outside the cell in exchange for bringing two K+ ions inside the cell.

**Soma**
Cell body of a neuron that contains the nucleus and genetic information, and directs protein synthesis.

**Spines**
Protrusions on the dendrite of a neuron that form synapses with terminal buttons of the presynaptic axon.

**Synapse**
Junction between the presynaptic terminal button of one neuron and the dendrite, axon, or soma of another postsynaptic neuron.

**Synaptic gap**
Also known as the synaptic cleft; the small space between the presynaptic terminal button and the postsynaptic dendritic spine, axon, or soma.

**Synaptic vesicles**
Groups of neurotransmitters packaged together and located within the terminal button.
Terminal button
The part of the end of the axon that form synapses with postsynaptic dendrite, axon, or soma.

Threshold of excitation
Specific membrane potential that the neuron must reach to initiate an action potential.
References


Early life experiences exert a profound and long-lasting influence on physical and mental health throughout life. The efforts to identify the primary causes of this have significantly benefited from studies of the epigenome—a dynamic layer of information associated with DNA that differs between individuals and can be altered through various experiences and environments. The epigenome has been heralded as a key “missing piece” of the etiological puzzle for understanding how development of psychological disorders may be influenced by the surrounding environment, in concordance with the genome. Understanding the mechanisms involved in the initiation, maintenance, and heritability of epigenetic states is thus an important aspect of research in current biology, particularly in the study of learning and memory, emotion, and social behavior in humans. Moreover, epigenetics in psychology provides a framework for understanding how the expression of genes is influenced by experiences and the environment to produce individual differences in behavior, cognition, personality, and mental health. In this module, we survey recent developments revealing epigenetic aspects of mental health and review some of the challenges of epigenetic approaches in psychology to help explain how nurture shapes nature.

Learning Objectives

- Explain what the term epigenetics means and the molecular machinery involved.
- Name and discuss important neural and developmental pathways that are regulated by epigenetic factors, and provide examples of epigenetic effects on personality traits and cognitive behavior.
- Understand how misregulation of epigenetic mechanisms can lead to disease states, and be able to discuss examples.
- Recognize how epigenetic machinery can be targets for therapeutic agents, and discuss
Introduction

Early childhood is not only a period of physical growth; it is also a time of mental development related to changes in the anatomy, physiology, and chemistry of the nervous system that influence mental health throughout life. Cognitive abilities associated with learning and memory, reasoning, problem solving, and developing relationships continue to emerge during childhood. Brain development is more rapid during this critical or sensitive period than at any other, with more than 700 neural connections created each second. Herein, complex gene–environment interactions (or genotype–environment interactions, G×E) serve to increase the number of possible contacts between neurons, as they hone their adult synaptic properties and excitability. Many weak connections form to different neuronal targets; subsequently, they undergo remodeling in which most connections vanish and a few stable connections remain. These structural changes (or plasticity) may be crucial for the development of mature neural networks that support emotional, cognitive, and social behavior. The generation of different morphology, physiology, and behavioral outcomes from a single genome in response to changes in the environment forms the basis for “phenotypic plasticity,” which is fundamental to the way organisms cope with environmental variation, navigate the present world, and solve future problems.

The challenge for psychology has been to integrate findings from genetics and environmental (social, biological, chemical) factors, including the quality of infant–mother attachments, into the study of personality and our understanding of the emergence of mental illness. These studies have demonstrated that common DNA sequence variation and rare mutations account
for only a small fraction (1%–2%) of the total risk for inheritance of personality traits and mental disorders (Dick, Riley, & Kendler, 2010; Gershon, Alliey-Rodriguez, & Liu, 2011). Additionally, studies that have attempted to examine the mechanisms and conditions under which DNA sequence variation influences brain development and function have been confounded by complex cause-and-effect relationships (Petronis, 2010). The large unaccounted heritability of personality traits and mental health suggests that additional molecular and cellular mechanisms are involved.

**Epigenetics** has the potential to provide answers to these important questions and refers to the transmission of **phenotype** in terms of gene expression in the absence of changes in DNA sequence—hence the name epi- (Greek: επί- over, above) genetics (Waddington, 1942; Wolffe & Matzke, 1999). The advent of high-throughput techniques such as sequencing-based approaches to study the distributions of regulators of gene expression throughout the genome led to the collective description of the “epigenome.” In contrast to the genome sequence, which is static and the same in almost all cells, the **epigenome** is highly dynamic, differing among cell types, tissues, and brain regions (Gregg et al., 2010). Recent studies have provided insights into epigenetic regulation of developmental pathways in response to a range of external environmental factors (Dolinoy, Weidman, & Jirtle, 2007). These environmental factors during early childhood and adolescence can cause changes in expression of genes conferring risk of mental health and chronic physical conditions. Thus, the examination of genetic–epigenetic–environment interactions from a developmental perspective may determine the nature of gene misregulation in psychological disorders.

This module will provide an overview of the main components of the epigenome and review themes in recent epigenetic research that have relevance for psychology, to form the biological basis for the interplay between environmental signals and the genome in the regulation of individual differences in physiology, emotion, cognition, and behavior.

**Molecular control of gene expression: the dynamic epigenome**

Almost all the cells in our body are genetically identical, yet our body generates many different cell types, organized into different tissues and organs, and expresses different proteins. Within each type of mammalian cell, about 2 meters of genomic DNA is divided into nuclear chromosomes. Yet the nucleus of a human cell, which contains the chromosomes, is only about 2 μm in diameter. To achieve this 1,000,000-fold compaction, DNA is wrapped around a group of 8 proteins called histones. This combination of DNA and histone proteins forms a special structure called a “nucleosome,” the basic unit of chromatin, which represents a structural solution for maintaining and accessing the tightly compacted genome. These factors
alter the likelihood that a gene will be expressed or silenced. Cellular functions such as gene expression, DNA replication, and the generation of specific cell types are therefore influenced by distinct patterns of chromatin structure, involving covalent modification of both histones (Kadonaga, 1998) and DNA (Razin, 1998).

Importantly, epigenetic variation also emerges across the lifespan. For example, although identical twins share a common genotype and are genetically identical and epigenetically similar when they are young, as they age they become more dissimilar in their epigenetic patterns and often display behavioral, personality, or even physical differences, and have different risk levels for serious illness. Thus, understanding the structure of the nucleosome is key to understanding the precise and stable control of gene expression and regulation, providing a molecular interface between genes and environmentally induced changes in cellular activity.

The primary epigenetic mark: DNA modification

DNA methylation is the best-understood epigenetic modification influencing gene expression. DNA is composed of four types of naturally occurring nitrogenous bases: adenine (A), thymine (T), guanine (G), and cytosine (C). In mammalian genomes, DNA methylation occurs primarily at cytosine residues in the context of cytosines that are followed by guanines (CpG dinucleotides), to form 5-methylcytosine in a cell-specific pattern (Goll & Bestor, 2005; Law & Jacobsen, 2010; Suzuki & Bird, 2008). The enzymes that perform DNA methylation are called DNA methyltransferases (DNMTs), which catalyze the transfer of a methyl group to the cytosine (Adams, McKay, Craig, & Burdon, 1979). These enzymes are all expressed in the central nervous system and are dynamically regulated during development (Feng, Chang, Li, & Fan, 2005; Goto et al., 1994). The effect of DNA methylation on gene function varies depending on the period of development during which the methylation occurs and location of the methylated cytosine. Methylation of DNA in gene regulatory regions (promoter and enhancer
regions) usually results in gene silencing and reduced gene expression (Ooi, O'Donnell, & Bestor, 2009; Suzuki & Bird, 2008; Sutter and Doerfler, 1980; Vardimon et al., 1982). This is a powerful regulatory mechanism that ensures that genes are expressed only when needed. Thus DNA methylation may broadly impact human brain development, and age-related misregulation of DNA methylation is associated with the molecular pathogenesis of neurodevelopmental disorders.

Histone modification and the histone code

The modification of histone proteins comprises an important epigenetic mark related to gene expression. One of the most thoroughly studied modifications is histone acetylation, which is associated with gene activation and increased gene expression (Wade, Pruss, & Wolffe, 1997). Acetylation on histone tails is mediated by the opposing enzymatic activities of histone acetyltransferases (HATs) and histone deacetylases (HDACs) (Kuo & Allis, 1998). For example, acetylation of histone in gene regulatory regions by HAT enzymes is generally associated with DNA demethylation, gene activation, and increased gene expression (Hong, Schroth, Matthews, Yau, & Bradbury, 1993; Sealy & Chalkley, 1978). On the other hand, removal of the acetyl group (deacetylation) by HDAC enzymes is generally associated with DNA methylation, gene silencing, and decreased gene expression (Davie & Chadee, 1998). The relationship between patterns of histone modifications and gene activity provides evidence for the existence of a “histone code” for determining cell-specific gene expression programs (Jenuwein & Allis, 2001). Interestingly, recent research using animal models has demonstrated that histone modifications and DNA methylation of certain genes mediates the long-term behavioral effects of the level of care experienced during infancy.

Early childhood experience

Life experiences, like a stressful event in childhood, can cause the modification of histone proteins (pictured) to help adapt to one’s environment. For example, in response to a stressful event, histone modification of one’s DNA might occur to encourage a more cautious personality—in order to avoid future, stressful encounters. [Image: Zephyris, https://goo.gl/gGrSQd, CC BY-SA 3.0, https://goo.gl/kB1Ogc]
The development of an individual is an active process of adaptation that occurs within a social and economic context. For example, the closeness or degree of positive attachment of the parent (typically mother)–infant bond and parental investment (including nutrient supply provided by the parent) that define early childhood experience also program the development of individual differences in stress responses in the brain, which then affect memory, attention, and emotion. In terms of evolution, this process provides the offspring with the ability to physiologically adjust gene expression profiles contributing to the organization and function of neural circuits and molecular pathways that support (1) biological defensive systems for survival (e.g., stress resilience), (2) reproductive success to promote establishment and persistence in the present environment, and (3) adequate parenting in the next generation (Bradshaw, 1965).

**Parental investment and programming of stress responses in the offspring**

The most comprehensive study to date of variations in parental investment and epigenetic inheritance in mammals is that of the maternally transmitted responses to stress in rats. In rat pups, maternal nurturing (licking and grooming) during the first week of life is associated with long-term programming of individual differences in stress responsiveness, emotionality, cognitive performance, and reproductive behavior (Caldji et al., 1998; Francis, Diorio, Liu, & Meaney, 1999; Liu et al., 1997; Myers, Brunelli, Shair, Squire, & Hofer, 1989; Stern, 1997). In adulthood, the offspring of mothers that exhibit increased levels of pup licking and grooming over the first week of life show increased expression of the glucocorticoid receptor in the hippocampus (a brain structure associated with stress responsivity as well as learning and memory) and a lower hormonal response to stress compared with adult animals reared by low licking and grooming mothers (Francis et al., 1999; Liu et al., 1997). Moreover, rat pups that received low levels of maternal licking and grooming during the first week of life showed decreased histone acetylation and increased DNA methylation of a neuron-specific promoter of the glucocorticoid receptor gene (Weaver et al., 2004). The expression of this gene is then reduced, the number of glucocorticoid receptors in the brain is decreased, and the animals show a higher hormonal response to stress throughout their life. The effects of maternal care on stress hormone responses and behaviour in the offspring can be eliminated in adulthood by pharmacological treatment (HDAC inhibitor trichostatin A, TSA) or dietary amino acid supplementation (methyl donor L-methionine), treatments that influence histone acetylation, DNA methylation, and expression of the glucocorticoid receptor gene (Weaver et al., 2004; Weaver et al., 2005). This series of experiments shows that histone acetylation and DNA methylation of the glucocorticoid receptor gene promoter is a necessary link in the process leading to the long-term physiological and behavioral sequelae of poor maternal care. This
points to a possible molecular target for treatments that may reverse or ameliorate the traces of childhood maltreatment.

Several studies have attempted to determine to what extent the findings from model animals are transferable to humans. Examination of post-mortem brain tissue from healthy human subjects found that the human equivalent of the glucocorticoid receptor gene promoter (NR3C1 exon 1F promoter) is also unique to the individual (Turner, Pelascini, Macedo, & Muller, 2008). A similar study examining newborns showed that methylation of the glucocorticoid receptor gene promoter maybe an early epigenetic marker of maternal mood and risk of increased hormonal responses to stress in infants 3 months of age (Oberlander et al., 2008). Although further studies are required to examine the functional consequence of this DNA methylation, these findings are consistent with our studies in the neonate and adult offspring of low licking and grooming mothers that show increased DNA methylation of the promoter of the glucocorticoid receptor gene, decreased glucocorticoid receptor gene expression, and increased hormonal responses to stress (Weaver et al., 2004). Examination of brain tissue from suicide victims found that the human glucocorticoid receptor gene promoter is also more methylated in the brains of individuals who had experienced maltreatment during childhood (McGowan et al., 2009). These finding suggests that DNA methylation mediates the effects of early environment in both rodents and humans and points to the possibility of new therapeutic approaches stemming from translational epigenetic research. Indeed, similar processes at comparable epigenetic labile regions could explain why the adult offspring of high and low licking/grooming mothers exhibit widespread differences in hippocampal gene expression and cognitive function (Weaver, Meaney, & Szyf, 2006).

However, this type of research is limited by the inaccessibility of human brain samples. The translational potential of this finding would be greatly enhanced if the relevant epigenetic modification can be measured in an accessible tissue. Examination of blood samples from
adult patients with bipolar disorder, who also retrospectively reported on their experiences of childhood abuse and neglect, found that the degree of DNA methylation of the human glucocorticoid receptor gene promoter was strongly positively related to the reported experience of childhood maltreatment decades earlier. For a relationship between a molecular measure and reported historical exposure, the effects size is extraordinarily large. This opens a range of new possibilities: given the large effect size and consistency of this association, measurement of the GR promoter methylation may effectively become a blood test measuring the physiological traces left on the genome by early experiences. Although this blood test cannot replace current methods of diagnosis, this unique and addition information adds to our knowledge of how disease may arise and be manifested throughout life. Near-future research will examine whether this measure adds value over and above simple reporting of early adversities when it comes to predicting important outcomes, such as response to treatment or suicide.

**Child nutrition and the epigenome**

The old adage “you are what you eat” might be true on more than just a physical level: The food you choose (and even what your parents and grandparents chose) is reflected in your own personal development and risk for disease in adult life (Wells, 2003). Nutrients can reverse or change DNA methylation and histone modifications, thereby modifying the expression of critical genes associated with physiologic and pathologic processes, including embryonic development, aging, and carcinogenesis. It appears that nutrients can influence the epigenome either by directly inhibiting enzymes that catalyze DNA methylation or histone modifications, or by altering the availability of substrates necessary for those enzymatic reactions. For example, rat mothers fed a diet low in methyl group donors during pregnancy produce offspring with reduced DNMT-1 expression, decreased DNA methylation, and increased histone acetylation at promoter regions of specific genes, including the glucocorticoid receptor, and...
increased gene expression in the liver of juvenile offspring (Lillycrop, Phillips, Jackson, Hanson, & Burdge, 2005) and adult offspring (Lillycrop et al., 2007). These data suggest that early life nutrition has the potential to influence epigenetic programming in the brain not only during early development but also in adult life, thereby modulating health throughout life. In this regard, nutritional epigenetics has been viewed as an attractive tool to prevent pediatric developmental diseases and cancer, as well as to delay aging-associated processes.

The best evidence relating to the impact of adverse environmental conditions development and health comes from studies of the children of women who were pregnant during two civilian famines of World War II: the Siege of Leningrad (1941–44) (Bateson, 2001) and the Dutch Hunger Winter (1944–1945) (Stanner et al., 1997). In the Netherlands famine, women who were previously well nourished were subjected to low caloric intake and associated environmental stressors. Women who endured the famine in the late stages of pregnancy gave birth to smaller babies (Lumey & Stein, 1997) and these children had an increased risk of insulin resistance later in life (Painter, Roseboom, & Bleker, 2005). In addition, offspring who were starved prenatally later experienced impaired glucose tolerance in adulthood, even when food was more abundant (Stanner et al., 1997). Famine exposure at various stages of gestation was associated with a wide range of risks such as increased obesity, higher rates of coronary heart disease, and lower birth weight (Lumey & Stein, 1997). Interestingly, when examined 60 years later, people exposed to famine prenatally showed reduced DNA methylation compared with their unexposed same-sex siblings (Heijmans et al., 2008).

**Epigenetic regulation of learning and memory**

Memories are recollections of actual events stored within our brains. But how is our brain able to form and store these memories? Epigenetic mechanisms influence genomic activities in the brain to produce long-term changes in synaptic signaling, organization, and morphology, which in turn support learning and memory (Day & Sweatt, 2011).

Neuronal activity in the hippocampus of mice is associated with changes in DNA methylation.
methylation (Guo et al., 2011), and disruption to genes encoding the DNA methylation machinery cause learning and memory impairments (Feng et al., 2010). DNA methylation has also been implicated in the maintenance of long-term memories, as pharmacological inhibition of DNA methylation and impaired memory (Day & Sweatt, 2011; Miller et al., 2010). These findings indicate the importance of DNA methylation in mediating synaptic plasticity and cognitive functions, both of which are disturbed in psychological illness.

Changes in histone modifications can also influence long-term memory formation by altering chromatin accessibility and the expression of genes relevant to learning and memory. Memory formation and the associated enhancements in synaptic transmission are accompanied by increases in histone acetylation (Guan et al., 2002) and alterations in histone methylation (Schaefer et al., 2009), which promote gene expression. Conversely, a neuronal increase in histone deacetylase activity, which promotes gene silencing, results in reduced synaptic plasticity and impairs memory (Guan et al., 2009). Pharmacological inhibition of histone deacetylases augments memory formation (Guan et al., 2009; Levenson et al., 2004), further suggesting that histone (de)acetylation regulates this process.

In humans genetic defects in genes encoding the DNA methylation and chromatin machinery exhibit profound effects on cognitive function and mental health (Jiang, Bressler, & Beaudet, 2004). The two best-characterized examples are Rett syndrome (Amir et al., 1999) and Rubinstein-Taybi syndrome (RTS) (Alarcon et al., 2004), which are profound intellectual disability disorders. Both MECP2 and CBP are highly expressed in neurons and are involved in regulating neural gene expression (Chen et al., 2003; Martinowich et al., 2003).

Rett syndrome patients have a mutation in their DNA sequence in a gene called MECP2. MECP2 plays many important roles within the cell: One of these roles is to read the DNA sequence, checking for DNA methylation, and to bind to areas that contain methylation, thereby preventing the wrong proteins from being present. Other roles for MECP2 include promoting the presence of particular, necessary, proteins, ensuring that DNA is packaged properly within the cell and assisting with the production of proteins. MECP2 function also influences gene expression that supports dendritic and synaptic development and hippocampus-dependent memory (Li, Zhong, Chau, Williams, & Chang, 2011; Skene et al., 2010). Mice with altered MECP2 expression exhibit genome-wide increases in histone acetylation, neuron cell death, increased anxiety, cognitive deficits, and social withdrawal (Shahbazian et al., 2002). These findings support a model in which DNA methylation and MECP2 constitute a cell-specific epigenetic mechanism for regulation of histone modification and gene expression, which may be disrupted in Rett syndrome.

RTS patients have a mutation in their DNA sequence in a gene called CBP. One of these roles
of CBP is to bind to specific histones and promote histone acetylation, thereby promoting gene expression. Consistent with this function, RTS patients exhibit a genome-wide decrease in histone acetylation and cognitive dysfunction in adulthood (Kalkhoven et al., 2003). The learning and memory deficits are attributed to disrupted neural plasticity (Korzus, Rosenfeld, & Mayford, 2004). Similar to RTS in humans, mice with a mutation of CBP perform poorly in cognitive tasks and show decreased genome-wide histone acetylation (for review, see Josselyn, 2005). In the mouse brain CBP was found to act as an epigenetic switch to promote the birth of new neurons in the brain. Interestingly, this epigenetic mechanism is disrupted in the fetal brains of mice with a mutation of CBP, which, as pups, exhibit early behavioral deficits following removal and separation from their mother (Wang et al., 2010). These findings provide a novel mechanism whereby environmental cues, acting through histone modifying enzymes, can regulate epigenetic status and thereby directly promote neurogenesis, which regulates neurobehavioral development.

Together, these studies demonstrate that misregulation of epigenetic modifications and their regulatory enzymes is capable of orchestrating prominent deficits in neuronal plasticity and cognitive function. Knowledge from these studies may provide greater insight into other mental disorders such as depression and suicidal behaviors.

Epigenetic mechanisms in psychological disorders

Epigenome-wide studies have identified several dozen sites with DNA methylation alterations in genes involved in brain development and neurotransmitter pathways, which had previously been associated with mental illness (Mill et al., 2008). These disorders are complex and typically start at a young age and cause lifelong disability. Often, limited benefits from treatment make these diseases some of the most burdensome disorders for individuals, families, and society. It has become evident that the efforts to identify the primary causes of complex psychiatric disorders may significantly benefit from studies linking environmental effects with changes observed within the individual cells.
Epigenetic events that alter chromatin structure to regulate programs of gene expression have been associated with depression-related behavior and action of antidepressant medications, with increasing evidence for similar mechanisms occurring in post-mortem brains of depressed individuals. In mice, social avoidance resulted in decreased expression of hippocampal genes important in mediating depressive responses (Tsankova et al., 2006). Similarly, chronic social defeat stress was found to decrease expression of genes implicated in normal emotion processing (Lutter et al., 2008). Consistent with these findings, levels of histone markers of increased gene expression were down regulated in human post-mortem brain samples from individuals with a history of clinical depression (Covington et al., 2009).

Administration of antidepressants increased histone markers of increased gene expression and reversed the gene repression induced by defeat stress (Lee, Wynder, Schmidt, McCafferty, & Shiekhattar, 2006; Tsankova et al., 2006; Wilkinson et al., 2009). These results provide support for the use of HDAC inhibitors against depression. Accordingly, several HDAC inhibitors have been found to exert antidepressant effects by each modifying distinct cellular targets (Cassel et al., 2006; Schroeder, Lin, Crusio, & Akbarian, 2007).

There is also increasing evidence that aberrant gene expression resulting from altered epigenetic regulation is associated with the pathophysiology of suicide (McGowan et al., 2008; Poulter et al., 2008). Thus, it is tempting to speculate that there is an epigenetically determined reduced capacity for gene expression, which is required for learning and memory, in the brains of suicide victims.

**Epigenetic strategy to understanding gene-environment interactions**

While the cellular and molecular mechanisms that influence on physical and mental health have long been a central focus of neuroscience, only in recent years has attention turned to the epigenetic mechanisms behind the dynamic changes in gene expression responsible for normal cognitive function and increased risk for
mental illness. The links between early environment and epigenetic modifications suggest a mechanism underlying gene-environment interactions. Early environmental adversity alone is not a sufficient cause of mental illness, because many individuals with a history of severe childhood maltreatment or trauma remain healthy. It is increasingly becoming evident that inherited differences in the segments of specific genes may moderate the effects of adversity and determine who is sensitive and who is resilient through a gene-environment interplay. Genes such as the glucocorticoid receptor appear to moderate the effects of childhood adversity on mental illness. Remarkably, epigenetic DNA modifications have been identified that may underlie the long-lasting effects of environment on biological functions. This new epigenetic research is pointing to a new strategy to understanding gene-environment interactions.

The next decade of research will show if this potential can be exploited in the development of new therapeutic options that may alter the traces that early environment leaves on the genome. However, as discussed in this module, the epigenome is not static and can be molded by developmental signals, environmental perturbations, and disease states, which present an experimental challenge in the search for epigenetic risk factors in psychological disorders (Rakyan, Down, Balding, & Beck, 2011). The sample size and epigenomic assay required is dependent on the number of tissues affected, as well as the type and distribution of epigenetic modifications. The combination of genetic association maps studies with epigenome-wide developmental studies may help identify novel molecular mechanisms to explain features of inheritance of personality traits and transform our understanding of the biological basis of psychology. Importantly, these epigenetic studies may lead to identification of novel therapeutic targets and enable the development of improved strategies for early diagnosis, prevention, and better treatment of psychological and behavioral disorders.
Outside Resources

Reference: The “Encyclopedia of DNA Elements” (ENCODE) project
http://encodeproject.org/ENCODE/

Reference: THREADS - A new way to explore the ENCODE Project
http://www.nature.com/encode/#/threads

Web: Explore, view, and download genome-wide maps of DNA and histone modifications from the NCBI Epigenomics Portal

Web: NOVA ScienceNOW - Introduction to Epigenetics
http://www.pbs.org/wgbh/nova/genes

Web: The University of Utah's Genetic Science Learning Center
http://learn.genetics.utah.edu/content/epigenetics/

Discussion Questions

1. Describe the physical state of the genome when genes are active and inactive.

2. Often, the physical characteristics of genetically identical twins become increasingly different as they age, even at the molecular level. Explain why this is so (use the terms “environment” and “epigenome”).

3. Name 3–4 environmental factors that influence the epigenome and describe their effects.

4. The rat nurturing example shows us how parental behavior can shape the behavior of offspring on a biochemical level. Discuss how this relates to humans and include the personal and social implications.

5. Explain how the food we eat affects gene expression.

6. Can the diets of parents affect their offspring's epigenome?

7. Why is converging evidence the best kind of evidence in the study of brain function?

8. If you were interested in whether a particular brain area was involved in a specific behavior, what neuroscience methods could you use?

9. If you were interested in the precise time in which a particular brain process occurred,
which neuroscience methods could you use?
Vocabulary

DNA methylation
Covalent modifications of mammalian DNA occurring via the methylation of cytosine, typically in the context of the CpG dinucleotide.

DNA methyltransferases (DNMTs)
Enzymes that establish and maintain DNA methylation using methyl-group donor compounds or cofactors. The main mammalian DNMTs are DNMT1, which maintains methylation state across DNA replication, and DNMT3a and DNMT3b, which perform de novo methylation.

Epigenetics
The study of heritable changes in gene expression or cellular phenotype caused by mechanisms other than changes in the underlying DNA sequence. Epigenetic marks include covalent DNA modifications and posttranslational histone modifications.

Epigenome
The genome-wide distribution of epigenetic marks.

Gene
A specific deoxyribonucleic acid (DNA) sequence that codes for a specific polypeptide or protein or an observable inherited trait.

Genome-wide association study (GWAS)
A study that maps DNA polymorphisms in affected individuals and controls matched for age, sex, and ethnic background with the aim of identifying causal genetic variants.

Genotype
The DNA content of a cell's nucleus, whether a trait is externally observable or not.

Histone acetyltransferases (HATs) and histone deacetylases (HDACs)
HATs are enzymes that transfer acetyl groups to specific positions on histone tails, promoting an “open” chromatin state and transcriptional activation. HDACs remove these acetyl groups, resulting in a “closed” chromatin state and transcriptional repression.

Histone modifications
Posttranslational modifications of the N-terminal “tails” of histone proteins that serve as a major mode of epigenetic regulation. These modifications include acetylation,
phosphorylation, methylation, sumoylation, ubiquitination, and ADP-ribosylation.

**Identical twins**
Two individual organisms that originated from the same zygote and therefore are genetically identical or very similar. The epigenetic profiling of identical twins discordant for disease is a unique experimental design as it eliminates the DNA sequence-, age-, and sex-differences from consideration.

**Phenotype**
The pattern of expression of the genotype or the magnitude or extent to which it is observably expressed—an observable characteristic or trait of an organism, such as its morphology, development, biochemical or physiological properties, or behavior.
References


The purpose of this module is to provide a brief review of attachment theory—a theory designed to explain the significance of the close, emotional bonds that children develop with their caregivers and the implications of those bonds for understanding personality development. The module discusses the origins of the theory, research on individual differences in attachment security in infancy and childhood, and the role of attachment in adult relationships.

Learning Objectives

- Explain the way the attachment system works and its evolutionary significance.
- Identify three commonly studied attachment patterns and what is known about the development of those patterns.
- Describe what is known about the consequences of secure versus insecure attachment in adult relationships.

Introduction

Some of the most rewarding experiences in people's lives involve the development and maintenance of close relationships. For example, some of the greatest sources of joy involve falling in love, starting a family, being reunited with distant loved ones, and sharing experiences with close others. And, not surprisingly, some of the most painful experiences in people's lives involve the disruption of important social bonds, such as separation from a spouse, losing a
Attachment Theory: A Brief History and Core Concepts

Attachment theory was originally developed in the 1940s by John Bowlby, a British psychoanalyst who was attempting to understand the intense distress experienced by infants who had been separated from their parents. Bowlby (1969) observed that infants would go to extraordinary lengths to prevent separation from their parents or to reestablish proximity to a missing parent. For example, he noted that children who had been separated from their parents would often cry, call for their parents, refuse to eat or play, and stand at the door in desperate anticipation of their parents’ return. At the time of Bowlby’s initial writings, psychoanalytic writers held that these expressions were manifestations of immature defense mechanisms that were operating to repress emotional pain. However, Bowlby observed that such expressions are common to a wide variety of mammalian species and speculated that these responses to separation may serve an evolutionary function (see Focus Topic 1).
Focus Topic 1: Harlow’s research on contact comfort

When Bowlby was originally developing his theory of attachment, there were alternative theoretical perspectives on why infants were emotionally attached to their primary caregivers (most often, their biological mothers). Bowlby and other theorists, for example, believed that there was something important about the responsiveness and contact provided by mothers. Other theorists, in contrast, argued that young infants feel emotionally connected to their mothers because mothers satisfy more basic needs, such as the need for food. That is, the child comes to feel emotionally connected to the mother because she is associated with the reduction of primary drives, such as hunger, rather than the reduction of drives that might be relational in nature.

In a classic set of studies, psychologist Harry Harlow placed young monkeys in cages that contained two artificial, surrogate “mothers” (Harlow, 1958). One of those surrogates was a simple wire contraption; the other was a wire contraption covered in cloth. Both of the surrogate mothers were equipped with a feeding tube so that Harrow and his colleagues had the option to allow the surrogate to deliver or not deliver milk. Harlow found that the young macaques spent a disproportionate amount of time with the cloth surrogate as opposed to the wire surrogate. Moreover, this was true even when the infants were fed by the wire surrogate rather than the cloth surrogate. This suggests that the strong emotional bond that infants form with their primary caregivers is rooted in something more than whether the caregiver provides food per se. Harlow’s research is now regarded as one of the first experimental demonstrations of the importance of “contact comfort” in the establishment of infant–caregiver bonds.

Drawing on evolutionary theory, Bowlby (1969) argued that these behaviors are adaptive responses to separation from a primary attachment figure—a caregiver who provides support, protection, and care. Because human infants, like other mammalian infants, cannot feed or protect themselves, they are dependent upon the care and protection of “older and wiser” adults for survival. Bowlby argued that, over the course of evolutionary history, infants who were able to maintain proximity to an attachment figure would be more likely to survive to a reproductive age.

According to Bowlby, a motivational system, what he called the attachment behavioral system, was gradually “designed” by natural selection to regulate proximity to an attachment figure. The attachment system functions much like a thermostat that continuously monitors the ambient temperature of a room, comparing that temperature against a desired state and
adjusting behavior (e.g., activating the furnace) accordingly. In the case of the attachment system, Bowlby argued that the system continuously monitors the accessibility of the primary attachment figure. If the child perceives the attachment figure to be nearby, accessible, and attentive, then the child feels loved, secure, and confident and, behaviorally, is likely to explore his or her environment, play with others, and be sociable. If, however, the child perceives the attachment figure to be inaccessible, the child experiences anxiety and, behaviorally, is likely to exhibit attachment behaviors ranging from simple visual searching on the low extreme to active searching, following, and vocal signaling on the other. These attachment behaviors continue either until the child is able to reestablish a desirable level of physical or psychological proximity to the attachment figure or until the child exhausts himself or herself or gives up, as may happen in the context of a prolonged separation or loss.

Individual Differences in Infant Attachment

Although Bowlby believed that these basic dynamics captured the way the attachment system works in most children, he recognized that there are individual differences in the way children appraise the accessibility of the attachment figure and how they regulate their attachment behavior in response to threats. However, it was not until his colleague, Mary Ainsworth, began to systematically study infant–parent separations that a formal understanding of these individual differences emerged. Ainsworth and her students developed a technique called the strange situation—a laboratory task for studying infant–parent attachment (Ainsworth, Blehar, Waters, & Wall, 1978). In the strange situation, 12-month-old infants and their parents are brought to the laboratory and, over a period of approximately 20 minutes, are systematically separated from and reunited with one another. In the strange situation, most children (about 60%) behave in the way implied by Bowlby’s normative theory. Specifically, they become upset when the parent leaves the room, but, when he or she returns, they actively seek the parent and are easily comforted by him or her. Children who exhibit this pattern of behavior are often called...
secure. Other children (about 20% or less) are ill at ease initially and, upon separation, become extremely distressed. Importantly, when reunited with their parents, these children have a difficult time being soothed and often exhibit conflicting behaviors that suggest they want to be comforted, but that they also want to “punish” the parent for leaving. These children are often called anxious-resistant. The third pattern of attachment that Ainsworth and her colleagues documented is often labeled avoidant. Avoidant children (about 20%) do not consistently behave as if they are stressed by the separation but, upon reunion, actively avoid seeking contact with their parent, sometimes turning their attention to play objects on the laboratory floor.

Ainsworth’s work was important for at least three reasons. First, she provided one of the first empirical demonstrations of how attachment behavior is organized in unfamiliar contexts. Second, she provided the first empirical taxonomy of individual differences in infant attachment patterns. According to her research, at least three types of children exist: those who are secure in their relationship with their parents, those who are anxious-resistant, and those who are anxious-avoidant. Finally, she demonstrated that these individual differences were correlated with infant-parent interactions in the home during the first year of life. Children who appear secure in the strange situation, for example, tend to have parents who are responsive to their needs. Children who appear insecure in the strange situation (i.e., anxious-resistant or avoidant) often have parents who are insensitive to their needs, or inconsistent or rejecting in the care they provide.

**Antecedents of Attachment Patterns**

In the years that have followed Ainsworth’s ground-breaking research, researchers have investigated a variety of factors that may help determine whether children develop secure or insecure relationships with their primary attachment figures. As mentioned above, one of the key determinants of attachment patterns is the history of sensitive and responsive interactions between the caregiver and the child. In short, when the child is uncertain or stressed, the ability of the caregiver to...
provide support to the child is critical for his or her psychological development. It is assumed that such supportive interactions help the child learn to regulate his or her emotions, give the child the confidence to explore the environment, and provide the child with a safe haven during stressful circumstances.

Evidence for the role of sensitive caregiving in shaping attachment patterns comes from longitudinal and experimental studies. For example, Grossmann, Grossmann, Spangler, Suess, and Unzner (1985) studied parent–child interactions in the homes of 54 families, up to three times during the first year of the child’s life. At 12 months of age, infants and their mothers participated in the strange situation. Grossmann and her colleagues found that children who were classified as secure in the strange situation at 12 months of age were more likely than children classified as insecure to have mothers who provided responsive care to their children in the home environment.

Van den Boom (1994) developed an intervention that was designed to enhance maternal sensitive responsiveness. When the infants were 9 months of age, the mothers in the intervention group were rated as more responsive and attentive in their interaction with their infants compared to mothers in the control group. In addition, their infants were rated as more sociable, self-soothing, and more likely to explore the environment. At 12 months of age, children in the intervention group were more likely to be classified as secure than insecure in the strange situation.

**Attachment Patterns and Child Outcomes**

Attachment researchers have studied the association between children’s attachment patterns and their adaptation over time. Researchers have learned, for example, that children who are classified as secure in the strange situation are more likely to have high functioning relationships with peers, to be evaluated favorably by teachers, and to persist with more diligence in challenging tasks. In contrast, insecure-avoidant children are more likely to be construed as “bullies” or to have a difficult time building and maintaining friendships (Weinfield, Sroufe, Egeland, & Carlson, 2008).

**Attachment in Adulthood**

Although Bowlby was primarily focused on understanding the nature of the infant–caregiver relationship, he believed that attachment characterized human experience across the life course. It was not until the mid-1980s, however, that researchers began to take seriously the possibility that attachment processes may be relevant to adulthood. Hazan and Shaver (1987)
were two of the first researchers to explore Bowlby’s ideas in the context of romantic relationships. According to Hazan and Shaver, the emotional bond that develops between adult romantic partners is partly a function of the same motivational system—the attachment behavioral system—that gives rise to the emotional bond between infants and their caregivers. Hazan and Shaver noted that in both kinds of relationship, people (a) feel safe and secure when the other person is present; (b) turn to the other person during times of sickness, distress, or fear; (c) use the other person as a “secure base” from which to explore the world; and (d) speak to one another in a unique language, often called “motherese” or “baby talk.” (See Focus Topic 2)

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**Focus Topic 2: Attachment and social media**

Social media websites and mobile communication services are coming to play an increasing role in people’s lives. Many people use Facebook, for example, to keep in touch with family and friends, to update their loved ones regarding things going on in their lives, and to meet people who share similar interests. Moreover, modern cellular technology allows people to get in touch with their loved ones much easier than was possible a mere 20 years ago.

From an attachment perspective, these innovations in communications technology are important because they allow people to stay connected virtually to their attachment figures—regardless of the physical distance that might exist between them. Recent research has begun to examine how attachment processes play out in the use of social media. Oldmeadow, Quinn, and Kowert (2013), for example, studied a diverse sample of individuals and assessed their attachment security and their use of Facebook. Oldmeadow and colleagues found that the use of Facebook may serve attachment functions. For example, people were more likely to report using Facebook to connect with others when they were experiencing negative emotions. In addition, the researchers found that people who were more anxious in their attachment orientation were more likely to use Facebook frequently, but people who were more avoidant used Facebook less and were less open on the site.

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On the basis of these parallels, Hazan and Shaver (1987) argued that adult romantic relationships, such as infant–caregiver relationships, are attachments. According to Hazan and Shaver, individuals gradually transfer attachment-related functions from parents to peers as they develop. Thus, although young children tend to use their parents as their primary attachment figures, as they reach adolescence and young adulthood, they come to rely more
upon close friends and/or romantic partners for basic attachment-related functions. Thus, although a young child may turn to his or her mother for comfort, support, and guidance when distressed, scared, or ill, young adults may be more likely to turn to their romantic partners for these purposes under similar situations.

Hazan and Shaver (1987) asked a diverse sample of adults to read the three paragraphs below and indicate which paragraph best characterized the way they think, feel, and behave in close relationships:

1. I am somewhat uncomfortable being close to others; I find it difficult to trust them completely, difficult to allow myself to depend on them. I am nervous when anyone gets too close, and often, others want me to be more intimate than I feel comfortable being.

2. I find it relatively easy to get close to others and am comfortable depending on them and having them depend on me. I don't worry about being abandoned or about someone getting too close to me.

3. I find that others are reluctant to get as close as I would like. I often worry that my partner doesn't really love me or won't want to stay with me. I want to get very close to my partner, and this sometimes scares people away.

Conceptually, these descriptions were designed to represent what Hazan and Shaver considered to be adult analogues of the kinds of attachment patterns Ainsworth described in the strange situation (avoidant, secure, and anxious, respectively). Hazan and Shaver (1987) found that the distribution of the three patterns was similar to that observed in infancy. In other words, about 60% of adults classified themselves as secure (paragraph B), about 20% described themselves as avoidant (paragraph A), and about 20% described themselves as anxious-resistant (paragraph C). Moreover, they found that people who described themselves as secure, for example, were more likely to report having had warm and trusting relationships with their parents when they were growing up. In addition, they were more likely to have positive views of romantic relationships. Based on these findings, Hazan and Shaver (1987) concluded that the same kinds of individual differences that exist in infant attachment also exist in adulthood.

**Research on Attachment in Adulthood**

Attachment theory has inspired a large amount of literature in social, personality, and clinical psychology. In the sections below, I provide a brief overview of some of the major research questions and what researchers have learned about attachment in adulthood.
Who Ends Up with Whom?

When people are asked what kinds of psychological or behavioral qualities they are seeking in a romantic partner, a large majority of people indicate that they are seeking someone who is kind, caring, trustworthy, and understanding—the kinds of attributes that characterize a “secure” caregiver (Chappell & Davis, 1998). But we know that people do not always end up with others who meet their ideals. Are secure people more likely to end up with secure partners—and, vice versa, are insecure people more likely to end up with insecure partners? The majority of the research that has been conducted to date suggests that the answer is “yes.” Frazier, Byer, Fischer, Wright, and DeBord (1996), for example, studied the attachment patterns of more than 83 heterosexual couples and found that, if the man was relatively secure, the woman was also likely to be secure.

One important question is whether these findings exist because (a) secure people are more likely to be attracted to other secure people, (b) secure people are likely to create security in their partners over time, or (c) some combination of these possibilities. Existing empirical research strongly supports the first alternative. For example, when people have the opportunity to interact with individuals who vary in security in a speed-dating context, they express a greater interest in those who are higher in security than those who are more insecure (McClure, Lydon, Baccus, & Baldwin, 2010). However, there is also some evidence that people’s attachment styles mutually shape one another in close relationships. For example, in a longitudinal study, Hudson, Fraley, Vicary, and Brumbaugh (2012) found that, if one person in a relationship experienced a change in security, his or her partner was likely to experience a change in the same direction.

Relationship Functioning

Research has consistently demonstrated that individuals who are relatively secure are more
likely than insecure individuals to have high functioning relationships—relationships that are more satisfying, more enduring, and less characterized by conflict. For example, Feeney and Noller (1992) found that insecure individuals were more likely than secure individuals to experience a breakup of their relationship. In addition, secure individuals are more likely to report satisfying relationships (e.g., Collins & Read, 1990) and are more likely to provide support to their partners when their partners were feeling distressed (Simpson, Rholes, & Nelligan, 1992).

Do Early Experiences Shape Adult Attachment?

The majority of research on this issue is retrospective—that is, it relies on adults’ reports of what they recall about their childhood experiences. This kind of work suggests that secure adults are more likely to describe their early childhood experiences with their parents as being supportive, loving, and kind (Hazan & Shaver, 1987). A number of longitudinal studies are emerging that demonstrate prospective associations between early attachment experiences and adult attachment styles and/or interpersonal functioning in adulthood. For example, Fraley, Roisman, Booth-LaForce, Owen, and Holland (2013) found in a sample of more than 700 individuals studied from infancy to adulthood that maternal sensitivity across development prospectively predicted security at age 18. Simpson, Collins, Tran, and Haydon (2007) found that attachment security, assessed in infancy in the strange situation, predicted peer competence in grades 1 to 3, which, in turn, predicted the quality of friendship relationships at age 16, which, in turn, predicted the expression of positive and negative emotions in their adult romantic relationships at ages 20 to 23.

It is easy to come away from such findings with the mistaken assumption that early experiences “determine” later outcomes. To be clear: Attachment theorists assume that the relationship between early experiences and subsequent outcomes is probabilistic, not deterministic.
Having supportive and responsive experiences with caregivers early in life is assumed to set the stage for positive social development. But that does not mean that attachment patterns are set in stone. In short, even if an individual has far from optimal experiences in early life, attachment theory suggests that it is possible for that individual to develop well-functioning adult relationships through a number of corrective experiences—including relationships with siblings, other family members, teachers, and close friends. Security is best viewed as a culmination of a person's attachment history rather than a reflection of his or her early experiences alone. Those early experiences are considered important not because they determine a person's fate, but because they provide the foundation for subsequent experiences.
Outside Resources


Strange Situation Video
https://www.youtube.com/watch?v=QTsewNrHUHU

Survey: Learn more about your attachment patterns via this online survey http://www.yourpersonality.net/relstructures/

Video on Harry Harlow’s Research with Rhesus Monkeys
https://www.youtube.com/watch?v=OrNBEhzjg8I

Discussion Questions

1. What kind of relationship did you have with your parents or primary caregivers when you were young? Do you think that had any bearing on the way you related to others (e.g., friends, relationship partners) as you grew older?

2. There is variation across cultures in the extent to which people value independence. Do you think this might have implications for the development of attachment patterns?

3. As parents age, it is not uncommon for them to have to depend on their adult children. Do you think that people’s history of experiences in their relationships with their parents might shape people’s willingness to provide care for their aging parents? In other words, are secure adults more likely to provide responsive care to their aging parents?

4. Some people, despite reporting insecure relationships with their parents, report secure, well-functioning relationships with their spouses. What kinds of experiences do you think might enable someone to develop a secure relationship with their partners despite having an insecure relationship with other central figures in their lives?

5. Most attachment research on adults focuses on attachment to peers (e.g., romantic
partners). What other kinds of things may serve as attachment figures? Do you think siblings, pets, or gods can serve as attachment figures?
**Vocabulary**

**Attachment behavioral system**
A motivational system selected over the course of evolution to maintain proximity between a young child and his or her primary attachment figure.

**Attachment behaviors**
Behaviors and signals that attract the attention of a primary attachment figure and function to prevent separation from that individual or to reestablish proximity to that individual (e.g., crying, clinging).

**Attachment figure**
Someone who functions as the primary safe haven and secure base for an individual. In childhood, an individual's attachment figure is often a parent. In adulthood, an individual's attachment figure is often a romantic partner.

**Attachment patterns**
(also called “attachment styles” or “attachment orientations”) Individual differences in how securely (vs. insecurely) people think, feel, and behave in attachment relationships.

**Strange situation**
A laboratory task that involves briefly separating and reuniting infants and their primary caregivers as a way of studying individual differences in attachment behavior.
References


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Cognitive Development in Childhood
Robert Siegler

This module examines what cognitive development is, major theories about how it occurs, the roles of nature and nurture, whether it is continuous or discontinuous, and how research in the area is being used to improve education.

Learning Objectives

• Be able to identify and describe the main areas of cognitive development.
• Be able to describe major theories of cognitive development and what distinguishes them.
• Understand how nature and nurture work together to produce cognitive development.
• Understand why cognitive development is sometimes viewed as discontinuous and sometimes as continuous.
• Know some ways in which research on cognitive development is being used to improve education.

Introduction

By the time you reach adulthood you have learned a few things about how the world works. You know, for instance, that you can’t walk through walls or leap into the tops of trees. You know that although you cannot see your car keys they’ve got to be around here someplace. What’s more, you know that if you want to communicate complex ideas like ordering a triple-shot soy vanilla latte with chocolate sprinkles it’s better to use words with meanings attached to them rather than simply gesturing and grunting. People accumulate all this useful
knowledge through the process of cognitive development, which involves a multitude of factors, both inherent and learned.

Cognitive development refers to the development of thinking across the lifespan. Defining thinking can be problematic, because no clear boundaries separate thinking from other mental activities. Thinking obviously involves the higher mental processes: problem solving, reasoning, creating, conceptualizing, categorizing, remembering, planning, and so on. However, thinking also involves other mental processes that seem more basic and at which even toddlers are skilled—such as perceiving objects and events in the environment, acting skillfully on objects to obtain goals, and understanding and producing language. Yet other areas of human development that involve thinking are not usually associated with cognitive development, because thinking isn't a prominent feature of them—such as personality and temperament.

As the name suggests, cognitive development is about change. Children's thinking changes in dramatic and surprising ways. Consider DeVries's (1969) study of whether young children understand the difference between appearance and reality. To find out, she brought an unusually even-tempered cat named Maynard to a psychology laboratory and allowed the 3- to 6-year-old participants in the study to pet and play with him. DeVries then put a mask of a fierce dog on Maynard's head, and asked the children what Maynard was. Despite all of the children having identified Maynard previously as a cat, now most 3-year-olds said that he was a dog and claimed that he had a dog's bones and a dog's stomach. In contrast, the 6-year-olds weren't fooled; they had no doubt that Maynard remained a cat. Understanding how children's thinking changes so dramatically in just a few years is one of the fascinating challenges in studying cognitive development.

There are several main types of theories of child development. Stage theories, such as Piaget's stage theory, focus on whether children progress through qualitatively different stages of
development. **Sociocultural theories**, such as that of Lev Vygotsky, emphasize how other people and the attitudes, values, and beliefs of the surrounding culture, influence children's development. **Information processing theories**, such as that of David Klahr, examine the mental processes that produce thinking at any one time and the transition processes that lead to growth in that thinking.

At the heart of all of these theories, and indeed of all research on cognitive development, are two main questions: (1) How do nature and nurture interact to produce cognitive development? (2) Does cognitive development progress through qualitatively distinct stages? In the remainder of this module, we examine the answers that are emerging regarding these questions, as well as ways in which cognitive developmental research is being used to improve education.

**Nature and Nurture**

The most basic question about child development is how nature and nurture together shape development. **Nature** refers to our biological endowment, the genes we receive from our parents. **Nurture** refers to the environments, social as well as physical, that influence our development, everything from the womb in which we develop before birth to the homes in which we grow up, the schools we attend, and the many people with whom we interact.

The nature-nurture issue is often presented as an either-or question: Is our intelligence (for example) due to our genes or to the environments in which we live? In fact, however, every aspect of development is produced by the interaction of genes and environment. At the most basic level, without genes, there would be no child, and without an environment to provide nurture, there also would be no child.

The way in which nature and nurture work together can be seen in findings on visual development. Many people view vision as something that people either are born with or that is purely a matter of biological maturation, but it also depends on the right kind of experience at the right time. For example, development of **depth perception**, the ability to actively perceive the distance from oneself to objects in the environment, depends on seeing patterned light and having normal brain activity in response to the patterned light, in infancy (Held, 1993). If no patterned light is received, for example when a baby has severe cataracts or blindness that is not surgically corrected until later in development, depth perception remains abnormal even after the surgery.

Adding to the complexity of the nature-nurture interaction, children’s genes lead to their
eliciting different treatment from other people, which influences their cognitive development. For example, infants’ physical attractiveness and temperament are influenced considerably by their genetic inheritance, but it is also the case that parents provide more sensitive and affectionate care to easygoing and attractive infants than to difficult and less attractive ones, which can contribute to the infants’ later cognitive development (Langlois et al., 1995; van den Boom & Hoeksma, 1994).

Also contributing to the complex interplay of nature and nurture is the role of children in shaping their own cognitive development. From the first days out of the womb, children actively choose to attend more to some things and less to others. For example, even 1-month-olds choose to look at their mother’s face more than at the faces of other women of the same age and general level of attractiveness (Bartrip, Morton, & de Schonen, 2001). Children’s contributions to their own cognitive development grow larger as they grow older (Scarr & McCartney, 1983). When children are young, their parents largely determine their experiences: whether they will attend day care, the children with whom they will have play dates, the books to which they have access, and so on. In contrast, older children and adolescents choose their environments to a larger degree. Their parents’ preferences largely determine how 5-year-olds spend time, but 15-year-olds’ own preferences largely determine when, if ever, they set foot in a library. Children’s choices often have large consequences. To cite one example, the more that children choose to read, the more that their reading improves in future years (Baker, Dreher, & Guthrie, 2000). Thus, the issue is not whether cognitive development is a product of nature or nurture; rather, the issue is how nature and nurture work together to produce cognitive development.

### Does Cognitive Development Progress Through Distinct Stages?

Some aspects of the development of living organisms, such as the growth of the width of a pine tree, involve **quantitative changes**, with the tree getting a little wider each year. Other changes, such as the life cycle of a ladybug, involve **qualitative changes**, with the creature
becoming a totally different type of entity after a transition than before (Figure 1). The existence of both gradual, quantitative changes and relatively sudden, qualitative changes in the world has led researchers who study cognitive development to ask whether changes in children's thinking are gradual and **continuous** or sudden and **discontinuous**.

The great Swiss psychologist Jean Piaget proposed that children's thinking progresses through a series of four discrete stages. By “stages,” he meant periods during which children reasoned similarly about many superficially different problems, with the stages occurring in a fixed order and the thinking within different stages differing in fundamental ways. The four stages that Piaget hypothesized were the **sensorimotor stage** (birth to 2 years), the **preoperational reasoning stage** (2 to 6 or 7 years), the **concrete operational reasoning stage** (6 or 7 to 11 or 12 years), and the **formal operational reasoning stage** (11 or 12 years and throughout the rest of life).

During the sensorimotor stage, children's thinking is largely realized through their perceptions of the world and their physical interactions with it. Their mental representations are very limited. Consider Piaget's **object permanence task**, which is one of his most famous problems. If an infant younger than 9 months of age is playing with a favorite toy, and another person removes the toy from view, for example by putting it under an opaque cover and not letting the infant immediately reach for it, the infant is very likely to make no effort to retrieve it and to show no emotional distress (Piaget, 1954). This is not due to their being uninterested in the toy or unable to reach for it; if the same toy is put under a clear cover, infants below 9
months readily retrieve it (Munakata, McClelland, Johnson, & Siegler, 1997). Instead, Piaget claimed that infants less than 9 months do not understand that objects continue to exist even when out of sight.

During the preoperational stage, according to Piaget, children can solve not only this simple problem (which they actually can solve after 9 months) but show a wide variety of other symbolic-representation capabilities, such as those involved in drawing and using language. However, such 2- to 7-year-olds tend to focus on a single dimension, even when solving problems would require them to consider multiple dimensions. This is evident in Piaget’s (1952) conservation problems. For example, if a glass of water is poured into a taller, thinner glass, children below age 7 generally say that there now is more water than before. Similarly, if a clay ball is reshaped into a long, thin sausage, they claim that there is now more clay, and if a row of coins is spread out, they claim that there are now more coins. In all cases, the children are focusing on one dimension, while ignoring the changes in other dimensions (for example, the greater width of the glass and the clay ball).
Children overcome this tendency to focus on a single dimension during the **concrete operations stage**, and think logically in most situations. However, according to Piaget, they still cannot think in systematic scientific ways, even when such thinking would be useful. Thus, if asked to find out which variables influence the period that a pendulum takes to complete its arc, and given weights that they can attach to strings in order to do experiments with the pendulum to find out, most children younger than age 12, perform biased experiments from which no conclusion can be drawn, and then conclude that whatever they originally believed is correct. For example, if a boy believed that weight was the only variable that mattered, he might put the heaviest weight on the shortest string and push it the hardest, and then conclude that just as he thought, weight is the only variable that matters (Inhelder & Piaget, 1958).

Finally, in the formal operations period, children attain the reasoning power of mature adults, which allows them to solve the pendulum problem and a wide range of other problems. However, this **formal operations stage** tends not to occur without exposure to formal education in scientific reasoning, and appears to be largely or completely absent from some societies that do not provide this type of education.

Although Piaget’s theory has been very influential, it has not gone unchallenged. Many more recent researchers have obtained findings indicating that cognitive development is

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**Piaget’s Concrete and Formal Operations stages**

- **Concrete Operational**: 6-7 Years to 11-12 Years
  - Logical reasoning only applied to objects that are real or can be seen

- **Formal Operational**: 11-12 Years to Lifetime
  - Individual can think logically about potential events or abstract ideas; advanced reasoning
considerably more continuous than Piaget claimed. For example, Diamond (1985) found that on the object permanence task described above, infants show earlier knowledge if the waiting period is shorter. At age 6 months, they retrieve the hidden object if the wait is no longer than 2 seconds; at 7 months, they retrieve it if the wait is no longer than 4 seconds; and so on. Even earlier, at 3 or 4 months, infants show surprise in the form of longer looking times if objects suddenly appear to vanish with no obvious cause (Baillargeon, 1987). Similarly, children’s specific experiences can greatly influence when developmental changes occur. Children of pottery makers in Mexican villages, for example, know that reshaping clay does not change the amount of clay at much younger ages than children who do not have similar experiences (Price-Williams, Gordon, & Ramirez, 1969).

So, is cognitive development fundamentally continuous or fundamentally discontinuous? A reasonable answer seems to be, “It depends on how you look at it and how often you look.” For example, under relatively facilitative circumstances, infants show early forms of object permanence by 3 or 4 months, and they gradually extend the range of times for which they can remember hidden objects as they grow older. However, on Piaget’s original object permanence task, infants do quite quickly change toward the end of their first year from not reaching for hidden toys to reaching for them, even after they’ve experienced a substantial delay before being allowed to reach. Thus, the debate between those who emphasize discontinuous, stage-like changes in cognitive development and those who emphasize gradual continuous changes remains a lively one.

Applications to Education

Understanding how children think and learn has proven useful for improving education. One example comes from the area of reading. Cognitive developmental research has shown that phonemic awareness—that is, awareness of the component sounds within words—is a crucial skill in learning to read. To measure awareness of the component sounds within words, researchers ask children to decide whether two words rhyme, to decide whether the words start with the same sound, to identify the component sounds within words, and to indicate what would be left if a given sound were removed from a word. Kindergartners’ performance on these tasks is the strongest predictor of reading achievement in third and fourth grade, even stronger than IQ or social class background (Nation, 2008). Moreover, teaching these skills to randomly chosen 4- and 5-year-olds results in their being better readers years later (National Reading Panel, 2000).

Another educational application of cognitive developmental research involves the area of mathematics. Even before they enter kindergarten, the mathematical knowledge of children
from low-income backgrounds lags far behind that of children from more affluent backgrounds. Ramani and Siegler (2008) hypothesized that this difference is due to the children in middle- and upper-income families engaging more frequently in numerical activities, for example playing numerical board games such as Chutes and Ladders. Chutes and Ladders is a game with a number in each square; children start at the number one and spin a spinner or throw a dice to determine how far to move their token. Playing this game seemed likely to teach children about numbers, because in it, larger numbers are associated with greater values on a variety of dimensions. In particular, the higher the number that a child's token reaches, the greater the distance the token will have traveled from the starting point, the greater the number of physical movements the child will have made in moving the token from one square to another, the greater the number of number-words the child will have said and heard, and the more time will have passed since the beginning of the game. These spatial, kinesthetic, verbal, and time-based cues provide a broad-based, multisensory foundation for knowledge of numerical magnitudes (the sizes of numbers), a type of knowledge that is closely related to mathematics achievement test scores (Booth & Siegler, 2006).

Playing this numerical board game for roughly 1 hour, distributed over a 2-week period, improved low-income children's knowledge of numerical magnitudes, ability to read printed numbers, and skill at learning novel arithmetic problems. The gains lasted for months after the game-playing experience (Ramani & Siegler, 2008; Siegler & Ramani, 2009). An advantage of this type of educational intervention is that it has minimal if any cost—a parent could just draw a game on a piece of paper.

Understanding of cognitive development is advancing on many different fronts. One exciting area is linking changes in brain activity to changes in children's thinking (Nelson et al., 2006). Although many people believe that brain maturation is something that occurs before birth, the brain actually continues to change in large ways for many years thereafter. For example,
a part of the brain called the prefrontal cortex, which is located at the front of the brain and is particularly involved with planning and flexible problem solving, continues to develop throughout adolescence (Blakemore & Choudhury, 2006). Such new research domains, as well as enduring issues such as nature and nurture, continuity and discontinuity, and how to apply cognitive development research to education, insure that cognitive development will continue to be an exciting area of research in the coming years.

Conclusion

Research into cognitive development has shown us that minds don’t just form according to a uniform blueprint or innate intellect, but through a combination of influencing factors. For instance, if we want our kids to have a strong grasp of language we could concentrate on phonemic awareness early on. If we want them to be good at math and science we could engage them in numerical games and activities early on. Perhaps most importantly, we no longer think of brains as empty vessels waiting to be filled up with knowledge but as adaptable organs that develop all the way through early adulthood.
Outside Resources


Discussion Questions

1. Why are there different theories of cognitive development? Why don't researchers agree on which theory is the right one?
2. Do children's natures differ, or do differences among children only reflect differences in their experiences?
3. Do you see development as more continuous or more discontinuous?
4. Can you think of ways other than those described in the module in which research on cognitive development could be used to improve education?
Vocabulary

Chutes and Ladders
A numerical board game that seems to be useful for building numerical knowledge.

Concrete operations stage
Piagetian stage between ages 7 and 12 when children can think logically about concrete situations but not engage in systematic scientific reasoning.

Conservation problems
Problems pioneered by Piaget in which physical transformation of an object or set of objects changes a perceptually salient dimension but not the quantity that is being asked about.

Continuous development
Ways in which development occurs in a gradual incremental manner, rather than through sudden jumps.

Depth perception
The ability to actively perceive the distance from oneself of objects in the environment.

Discontinuous development
Discontinuous development

Formal operations stage
Piagetian stage starting at age 12 years and continuing for the rest of life, in which adolescents may gain the reasoning powers of educated adults.

Information processing theories
Theories that focus on describing the cognitive processes that underlie thinking at any one age and cognitive growth over time.

Nature
The genes that children bring with them to life and that influence all aspects of their development.

Numerical magnitudes
The sizes of numbers.
**Nurture**
The environments, starting with the womb, that influence all aspects of children's development.

**Object permanence task**
The Piagetian task in which infants below about 9 months of age fail to search for an object that is removed from their sight and, if not allowed to search immediately for the object, act as if they do not know that it continues to exist.

**Phonemic awareness**
Awareness of the component sounds within words.

**Piaget's theory**
Theory that development occurs through a sequence of discontinuous stages: the sensorimotor, preoperational, concrete operational, and formal operational stages.

**Preoperational reasoning stage**
Period within Piagetian theory from age 2 to 7 years, in which children can represent objects through drawing and language but cannot solve logical reasoning problems, such as the conservation problems.

**Qualitative changes**
Large, fundamental change, as when a caterpillar changes into a butterfly; stage theories such as Piaget's posit that each stage reflects qualitative change relative to previous stages.

**Quantitative changes**
Gradual, incremental change, as in the growth of a pine tree's girth.

**Sensorimotor stage**
Period within Piagetian theory from birth to age 2 years, during which children come to represent the enduring reality of objects.

**Sociocultural theories**
Theory founded in large part by Lev Vygotsky that emphasizes how other people and the attitudes, values, and beliefs of the surrounding culture influence children's development.
References


Emerging adulthood has been proposed as a new life stage between adolescence and young adulthood, lasting roughly from ages 18 to 25. Five features make emerging adulthood distinctive: identity explorations, instability, self-focus, feeling in-between adolescence and adulthood, and a sense of broad possibilities for the future. Emerging adulthood is found mainly in industrialized countries, where most young people obtain tertiary education and median ages of entering marriage and parenthood are around 30. There are variations in emerging adulthood within industrialized countries. It lasts longest in Europe, and in Asian industrialized countries, the self-focused freedom of emerging adulthood is balanced by obligations to parents and by conservative views of sexuality. In non-industrialized countries, although today emerging adulthood exists only among the middle-class elite, it can be expected to grow in the 21st century as these countries become more affluent.

Learning Objectives

- Explain where, when, and why a new life stage of emerging adulthood appeared over the past half-century.
- Identify the five features that distinguish emerging adulthood from other life stages.
- Describe the variations in emerging adulthood in countries around the world.

Introduction

Think for a moment about the lives of your grandparents and great-grandparents when they
were in their twenties. How do their lives at that age compare to your life? If they were like most other people of their time, their lives were quite different than yours. What happened to change the twenties so much between their time and our own? And how should we understand the 18–25 age period today?

The theory of emerging adulthood proposes that a new life stage has arisen between adolescence and young adulthood over the past half-century in industrialized countries. Fifty years ago, most young people in these countries had entered stable adult roles in love and work by their late teens or early twenties. Relatively few people pursued education or training beyond secondary school, and, consequently, most young men were full-time workers by the end of their teens. Relatively few women worked in occupations outside the home, and the median marriage age for women in the United States and in most other industrialized countries in 1960 was around 20 (Arnett & Taber, 1994; Douglass, 2005). The median marriage age for men was around 22, and married couples usually had their first child about one year after their wedding day. All told, for most young people half a century ago, their teenage adolescence led quickly and directly to stable adult roles in love and work by their late teens or early twenties. These roles would form the structure of their adult lives for decades to come.

Now all that has changed. A higher proportion of young people than ever before—about 70% in the United States—pursue education and training beyond secondary school (National Center for Education Statistics, 2012). The early twenties are not a time of entering stable adult work but a time of immense job instability: In the United States, the average number of job changes from ages 20 to 29 is seven. The median age of entering marriage in the United States is now 27 for women and 29 for men (U.S. Bureau of the Census, 2011). Consequently, a new stage of the life span, emerging adulthood, has been created, lasting from the late teens through the mid-twenties, roughly ages 18 to 25.
The Five Features of Emerging Adulthood

Five characteristics distinguish emerging adulthood from other life stages (Arnett, 2004). Emerging adulthood is:

1. the age of identity explorations;
2. the age of instability;
3. the self-focused age;
4. the age of feeling in-between; and
5. the age of possibilities.

Perhaps the most distinctive characteristic of emerging adulthood is that it is the age of identity explorations. That is, it is an age when people explore various possibilities in love and work as they move toward making enduring choices. Through trying out these different possibilities, they develop a more definite identity, including an understanding of who they are, what their capabilities and limitations are, what their beliefs and values are, and how they fit into the society around them. Erik Erikson (1950), who was the first to develop the idea of identity, proposed that it is mainly an issue in adolescence; but that was more than 50 years ago, and today it is mainly in emerging adulthood that identity explorations take place (Côté, 2006).

The explorations of emerging adulthood also make it the age of instability. As emerging adults explore different possibilities in love and work, their lives are often unstable. A good illustration of this instability is their frequent moves from one residence to another. Rates of residential change in American society are much higher at ages 18 to 29 than at any other period of life (Arnett, 2004). This reflects the explorations going on in emerging adults' lives. Some move out of their parents' household for the first time in their late teens to attend a residential
college, whereas others move out simply to be independent (Goldscheider & Goldscheider, 1999). They may move again when they drop out of college or when they graduate. They may move to cohabit with a romantic partner, and then move out when the relationship ends. Some move to another part of the country or the world to study or work. For nearly half of American emerging adults, residential change includes moving back in with their parents at least once (Goldscheider & Goldscheider, 1999). In some countries, such as in southern Europe, emerging adults remain in their parents’ home rather than move out; nevertheless, they may still experience instability in education, work, and love relationships (Douglass, 2005, 2007).

Emerging adulthood is also a self-focused age. Most American emerging adults move out of their parents’ home at age 18 or 19 and do not marry or have their first child until at least their late twenties (Arnett, 2004). Even in countries where emerging adults remain in their parents’ home through their early twenties, as in southern Europe and in Asian countries such as Japan, they establish a more independent lifestyle than they had as adolescents (Rosenberger, 2007). Emerging adulthood is a time between adolescents’ reliance on parents and adults’ long-term commitments in love and work, and during these years, emerging adults focus on themselves as they develop the knowledge, skills, and self-understanding they will need for adult life. In the course of emerging adulthood, they learn to make independent decisions about everything from what to have for dinner to whether or not to get married.

Another distinctive feature of emerging adulthood is that it is an age of feeling in-between, not adolescent but not fully adult, either. When asked, “Do you feel that you have reached adulthood?” the majority of emerging adults respond neither yes nor no but with the ambiguous “in some ways yes, in some ways no” (Arnett, 2003, 2012). It is only when people reach their late twenties and early thirties that a clear majority feels adult. Most emerging adults have the subjective feeling of being in a transitional period of life, on the way to adulthood but not there yet. This “in-between” feeling in emerging adulthood has been found in a wide range of countries, including Argentina (Facio & Micocci, 2003), Austria (Sirsch, Dreher, Mayr, & Willinger, 2009), Israel (Mayseless & Scharf, 2003), the Czech Republic (Macek, Bejček, & Vaničková, 2007), and China (Nelson & Chen, 2007).

Finally, emerging adulthood is the age of possibilities, when many different futures remain possible, and when little about a person’s direction in life has been decided for certain. It tends to be an age of high hopes and great expectations, in part because few of their dreams have been tested in the fires of real life. In one national survey of 18- to 24-year-olds in the United States, nearly all—89%—agreed with the statement, “I am confident that one day I will get to where I want to be in life” (Arnett & Schwab, 2012). This optimism in emerging adulthood has been found in other countries as well (Nelson & Chen, 2007).
International Variations

The five features proposed in the theory of emerging adulthood originally were based on research involving about 300 Americans between ages 18 and 29 from various ethnic groups, social classes, and geographical regions (Arnett, 2004). To what extent does the theory of emerging adulthood apply internationally?

The answer to this question depends greatly on what part of the world is considered. Demographers make a useful distinction between the non-industrialized countries that comprise the majority of the world’s population and the industrialized countries that are part of the Organization for Economic Co-operation and Development (OECD), including the United States, Canada, western Europe, Japan, South Korea, Australia, and New Zealand. The current population of OECD countries (also called industrialized countries) is 1.2 billion, about 18% of the total world population (UNDP, 2011). The rest of the human population resides in non-industrialized countries, which have much lower median incomes; much lower median educational attainment; and much higher incidence of illness, disease, and early death. Let us consider emerging adulthood in OECD countries first, then in non-industrialized countries.

![Map of OECD countries](https://goo.gl/Mlvm0Y, CC BY-SA 2.0, https://goo.gl/eH69he)

EA in OECD Countries: The Advantages of Affluence

The same demographic changes as described above for the United States have taken place
in other OECD countries as well. This is true of participation in postsecondary education as well as median ages for entering marriage and parenthood (UNdata, 2010). However, there is also substantial variability in how emerging adulthood is experienced across OECD countries. Europe is the region where emerging adulthood is longest and most leisurely. The median ages for entering marriage and parenthood are near 30 in most European countries (Douglass, 2007). Europe today is the location of the most affluent, generous, and egalitarian societies in the world—in fact, in human history (Arnett, 2007). Governments pay for tertiary education, assist young people in finding jobs, and provide generous unemployment benefits for those who cannot find work. In northern Europe, many governments also provide housing support. Emerging adults in European societies make the most of these advantages, gradually making their way to adulthood during their twenties while enjoying travel and leisure with friends.

The lives of Asian emerging adults in industrialized countries such as Japan and South Korea are in some ways similar to the lives of emerging adults in Europe and in some ways strikingly different. Like European emerging adults, Asian emerging adults tend to enter marriage and parenthood around age 30 (Arnett, 2011). Like European emerging adults, Asian emerging adults in Japan and South Korea enjoy the benefits of living in affluent societies with generous social welfare systems that provide support for them in making the transition to adulthood—for example, free university education and substantial unemployment benefits.

However, in other ways, the experience of emerging adulthood in Asian OECD countries is markedly different than in Europe. Europe has a long history of individualism, and today's emerging adults carry that legacy with them in their focus on self-development and leisure during emerging adulthood. In contrast, Asian cultures have a shared cultural history emphasizing collectivism and family obligations. Although Asian cultures have become more individualistic in recent decades as a consequence of globalization, the legacy of collectivism persists in the lives of emerging adults. They pursue identity explorations and self-development during emerging adulthood, like their American and European counterparts, but within narrower boundaries set by their sense of obligations to others, especially their parents (Phinney & Baldeolomar, 2011). For example, in their views of the most important criteria for becoming an adult, emerging adults in the United States and Europe consistently rank financial independence among the most important markers of adulthood. In contrast, emerging adults with an Asian cultural background especially emphasize becoming capable of supporting parents financially as among the most important criteria (Arnett, 2003; Nelson, Badger, & Wu, 2004). This sense of family obligation may curtail their identity explorations in emerging adulthood to some extent, as they pay more heed to their parents' wishes about what they should study, what job they should take, and where they should live than emerging adults do in the West (Rosenberger, 2007).
Another notable contrast between Western and Asian emerging adults is in their sexuality. In the West, premarital sex is normative by the late teens, more than a decade before most people enter marriage. In the United States and Canada, and in northern and eastern Europe, cohabitation is also normative; most people have at least one cohabiting partnership before marriage. In southern Europe, cohabiting is still taboo, but premarital sex is tolerated in emerging adulthood. In contrast, both premarital sex and cohabitation remain rare and forbidden throughout Asia. Even dating is discouraged until the late twenties, when it would be a prelude to a serious relationship leading to marriage. In cross-cultural comparisons, about three fourths of emerging adults in the United States and Europe report having had premarital sexual relations by age 20, versus less than one fifth in Japan and South Korea (Hatfield and Rapson, 2006).

**EA in Non-Industrialized Countries: Low But Rising**

Emerging adulthood is well established as a normative life stage in the industrialized countries described thus far, but it is still growing in non-industrialized countries. Demographically, in non-industrialized countries as in OECD countries, the median ages for entering marriage and parenthood have been rising in recent decades, and an increasing proportion of young
people have obtained post-secondary education. Nevertheless, currently it is only a minority of young people in non-industrialized countries who experience anything resembling emerging adulthood. The majority of the population still marries around age 20 and has long finished education by the late teens. As you can see in Figure 1, rates of enrollment in tertiary education are much lower in non-industrialized countries (represented by the five countries on the right) than in OECD countries (represented by the five countries on the left).

For young people in non-industrialized countries, emerging adulthood exists only for the wealthier segment of society, mainly the urban middle class, whereas the rural and urban poor— the majority of the population— have no emerging adulthood and may even have no adolescence because they enter adult-like work at an early age and also begin marriage and parenthood relatively early. What Saraswathi and Larson (2002) observed about adolescence applies to emerging adulthood as well: “In many ways, the lives of middle-class youth in India, South East Asia, and Europe have more in common with each other than they do with those of poor youth in their own countries.” However, as globalization proceeds, and economic development along with it, the proportion of young people who experience emerging adulthood will increase as the middle class expands. By the end of the 21st century, emerging adulthood is likely to be normative worldwide.

Conclusion

The new life stage of emerging adulthood has spread rapidly in the past half-century and is continuing to spread. Now that the transition to adulthood is later than in the past, is this change positive or negative for emerging adults and their societies? Certainly there are some negatives. It means that young people are dependent on their parents for longer than in the past, and they take longer to become full contributing members of their societies. A substantial proportion of them have trouble sorting through the opportunities available to them and struggle with anxiety and depression, even though most are optimistic. However, there are advantages to having this new life stage as well. By
waiting until at least their late twenties to take on the full range of adult responsibilities, emerging adults are able to focus on obtaining enough education and training to prepare themselves for the demands of today's information- and technology-based economy. Also, it seems likely that if young people make crucial decisions about love and work in their late twenties or early thirties rather than their late teens and early twenties, their judgment will be more mature and they will have a better chance of making choices that will work out well for them in the long run.

What can societies do to enhance the likelihood that emerging adults will make a successful transition to adulthood? One important step would be to expand the opportunities for obtaining tertiary education. The tertiary education systems of OECD countries were constructed at a time when the economy was much different, and they have not expanded at the rate needed to serve all the emerging adults who need such education. Furthermore, in some countries, such as the United States, the cost of tertiary education has risen steeply and is often unaffordable to many young people. In non-industrialized countries, tertiary education systems are even smaller and less able to accommodate their emerging adults. Across the world, societies would be wise to strive to make it possible for every emerging adult to receive tertiary education, free of charge. There could be no better investment for preparing young people for the economy of the future.
Outside Resources

Article: “Average Age of First-Time Moms Keeps Climbing In The U.S” - This NPR story was released in January of 2016 and discusses the rising age of first time pregnancies in US women. The rising average age is reflective of emerging adulthood.
http://www.npr.org/sections/health-shots/2016/01/14/462816458/average-age-of-first-time-moms-keeps-climbing-in-the-u-s

http://jeffreyarnett.com/articles/ARNETT_Emerging_Adulthood_theory.pdf

Article: “Why are so many people in their 20s taking so long to grow up?” - This article presents an interesting perspective that discusses the changing lifestyle of US individuals in there 20's.

Video: “Jeffrey Jensen Arnett: Emerging Adulthood” - This video shows an interview with the author of the module, Jeffrey Jensen Arnett. Dr. Arnett talks about his book “Emerging Adulthood” as well as emerging adulthood as a lifespan.
https://www.youtube.com/watch?v=Y_f8DmU-gQQ

Web: Jeffrey Jensen Arnett website
http://www.jeffreyarnett.com

Web: Society for the Study of Emerging Adulthood. SSEA is “a multidisciplinary, international organization with a focus on theory and research related to emerging adulthood, which includes the age range of approximately 18 through 29 years. The website includes information on topics, events, and publications pertaining to emerging adults from diverse backgrounds, cultures, and countries.”
http://www.ssea.org

Discussion Questions

1. What kind of variations in emerging adulthood would you predict within your country? Would there be social class differences? Gender differences? Ethnic differences?
2. Looking at Figure 1, what contrasts do you observe between OECD countries and non-industrialized countries? Between males and females? What economic and cultural differences might explain these contrasts?

3. Do you agree or disagree with the author’s prediction that emerging adulthood is likely to become a life stage experienced worldwide in the decades to come? What factors are likely to determine whether this turns out to be true?
Vocabulary

Collectivism
Belief system that emphasizes the duties and obligations that each person has toward others.

Emerging adulthood
A new life stage extending from approximately ages 18 to 25, during which the foundation of an adult life is gradually constructed in love and work. Primary features include identity explorations, instability, focus on self-development, feeling incompletely adult, and a broad sense of possibilities.

Individualism
Belief system that exalts freedom, independence, and individual choice as high values.

Industrialized countries
The economically advanced countries of the world, in which most of the world's wealth is concentrated.

Non-industrialized countries
The less economically advanced countries that comprise the majority of the world's population. Most are currently developing at a rapid rate.

OECD countries
Members of the Organization for Economic Co-operation and Development, comprised of the world's wealthiest countries.

Tertiary education
Education or training beyond secondary school, usually taking place in a college, university, or vocational training program.
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