Learning

An enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience

Learning by Association - Classical Conditioning

Learning by Consequences - Instrumental/ Operant Conditioning

Learning by Observation - Social Learning Theory

Classical Conditioning

Stage 1: Before Conditioning:

In this stage, the unconditioned stimulus (UCS) produces an unconditioned response (UCR) in an organism.

In basic terms, this means that a stimulus in the environment has produced a behavior / response which is unlearned (i.e., unconditioned) and therefore is a natural response which has not been taught. In this respect, no new behavior has been learned yet.

For example, a stomach virus (UCS) would produce a response of nausea (UCR). In another example, a perfume (UCS) could create a response of happiness or desire (UCR).

This stage also involves another stimulus which has no effect on a person and is called the neutral stimulus (NS). The NS could be a person, object, place, etc.

The neutral stimulus in classical conditioning does not produce a response until it is paired with the unconditioned stimulus.

Stage 2: During Conditioning:

During this stage, a stimulus which produces no response (i.e., neutral) is associated with the unconditioned stimulus at which point it now becomes known as the conditioned stimulus (CS).

For example, a stomach virus (UCS) might be associated with eating a certain food such as chocolate (CS). Also, perfume (UCS) might be associated with a specific person (CS).

For classical conditioning to be effective, the conditioned stimulus should occur before the unconditioned stimulus, rather than after it, or during the same time. Thus, the conditioned stimulus acts as a type of signal or cue for the unconditioned stimulus.

Often during this stage, the UCS must be associated with the CS on a number of occasions, or trials, for learning to take place. However, one trail learning can happen on certain occasions when it is not necessary for an association to be strengthened over time (such as being sick after food poisoning or drinking too much alcohol).

Stage 3: After Conditioning:

Now the conditioned stimulus (CS) has been associated with the unconditioned stimulus (UCS) to create a new conditioned response (CR).

For example, a person (CS) who has been associated with nice perfume (UCS) is now found attractive (CR). Also, chocolate (CS) which was eaten before a person was sick with a virus (UCS) now produces a response of nausea (CR).

Limitations of Classical Conditioning
CR often resembles the normal response to UCS
Learning a novel behaviour?

Operant or Instrumental conditioning

Certain Responses are learned because they operate on, or affect, the environment

Skinner

A type of learning in which behavior is 'strengthened' if followed by reinforcement or 'diminished' if followed by punishment
The frequency will increase if the consequence is reinforcing to the subject.
The frequency will decrease if the consequence is not reinforcing or punishing to the subject

Reinforcement - Any consequence that increases the likelihood of the behavior it follows
IS ALWAYS GOOD ???
Punishment - Any consequence that decreases the likelihood of the behavior it follows
The subject determines if a consequence is reinforcing or punishing

Types of Reinforcement

1. **Positive reinforcement** (Reinforcement): occurs when a behavior (response) is followed by a stimulus that is rewarding, increasing the frequency of that behavior. In the Skinner box experiment, a stimulus such as food or sugar solution can be delivered when the rat engages in a target behavior, such as pressing a lever.
2. **Negative reinforcement** (Escape): occurs when a behavior (response) is followed by the removal of an aversive stimulus, thereby increasing that behavior's frequency. In the Skinner box experiment, negative reinforcement can be a loud noise continuously sounding inside the rat's

cage until it engages in the target behavior, such as pressing a lever, upon which the loud noise is removed.

3. **Positive punishment** (Punishment) (also called "Punishment by contingent stimulation"): occurs when a behavior (response) is followed by a stimulus, such as introducing a shock or loud noise, resulting in a decrease in that behavior.

4. **Negative punishment** (Penalty) (also called "Punishment by contingent withdrawal"): occurs when a behavior (response) is followed by the removal of a stimulus, such as taking away a child's toy following an undesired behavior, resulting in a decrease in that behavior

Examples

Goal of Reinforcement: Increase a Desired Behavior

Positive Reinforcement (giving someone something pleasant):

- The paycheck you get from work
- When a teacher gives a child a candy or smile for answering a question correctly

Negative Reinforcement (taking something unpleasant away):

- A teacher promises to take away homework if the students work together quietly.
- Going to a driver safety class to get points taken off your license
- Giving extra effort to your presentation preparation in order to avoid boss's criticim

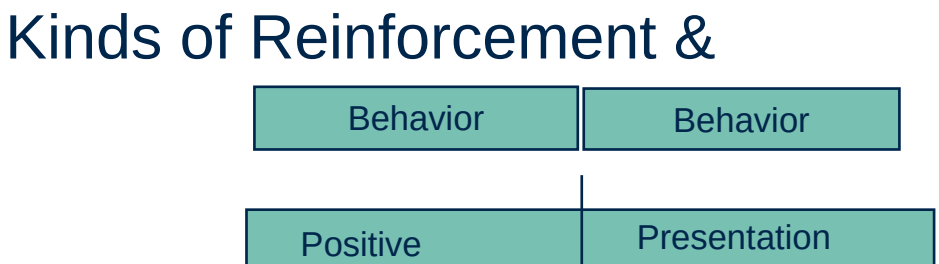
Goal of Punsihment: Decrease an Undesired Behavior

Positive Punishment (giving someone something unpleasant):

- Spanking a child when he/she lies
- Warning for misconduct in the college

Negative Punishment (taking something pleasant away):

- Time out (you're taking the child away from some enjoyable activity)
- Not letting a child have a nightly snack because he/she lied
- Taking a child's toy away for a time because he/she didn't share with other children



Reinforcement Schedules

Know that we understand the four types of reinforcement, we need to understand how and when these are applied (Ferster & Skinner, 1957). For example, do we apply the positive reinforcement every time a child does something positive? Do we punish a child every time he does something negative? To answer these questions, you need to understand the schedules of reinforcement.

Applying one of the four types of reinforcement every time the behavior occurs (getting a raise after every successful project or getting spanked after every negative behavior) is called a Continuous Schedule. Its continuous because the application occurs after every project, behavior, etc. This is the best approach when using punishment. Inconsistencies in the punishment of often results in confusion and resentment. A problem with this schedule is that we are not always present when a behavior occurs or may not be able to apply the punishment.

There are two types of continuous schedules:

Fixed Ratio. A fixed ratio schedule refers to applying the reinforcement after a specific number of behaviors. Spanking a child if you have to ask him three times to clean his room is an example. The problem is that the child (or anyone for that matter) will begin to realize that he can get away with two requests before he has to act. Therefore, the behavior does not tend to change until right before the preset number.

Fixed Interval. Applying the reinforcer after a specific amount of time is referred to as a fixed interval schedule. An example might be getting a raise every year and not in between. A major problem with this schedule is that people tend to improve their performance right before the time period expires so as to "look good" when the review comes around.

When reinforcement is applied on an irregular basis, they are called variable schedules.

Variable Ratio. This refers to applying a reinforcer after a variable number of responses. Variable ratio schedules have been found to work best under many circumstances and knowing an example will explain why. Imagine walking into a casino and heading for the slot machines. After the third coin you put in, you get two back. Two more and you get three back. Another five coins and you receive two more back. How difficult is it to stop playing?

Variable Interval. Reinforcing someone after a variable amount of time is the final schedule. If you have a boss who checks your work periodically, you understand the power of this schedule. Because you don't know when the next 'check-up' might come, you have to be working hard at all times in order to be ready.

In this sense, the variable schedules are more powerful and result in more consistent behaviors. This may not be as true for punishment since consistency in the application is so important, but for all other types of reinforcement they tend to result in stronger responses.

FIGURE 8.11
Excerpt from an Education Textbook

Maslow's Hierarchy of Needs

In Chapter 2 you saw that people become actualized to accomplish higher motives only after they have fulfilled certain basic needs.

Psychologist Abraham Maslow identified seven categories of basic needs common to all people. Maslow represented these needs as a hierarchy in the shape of a pyramid (Figure 3.1). A **hierarchy** is an arrangement that ranks people or concepts from lowest to highest. According to Maslow, individuals must meet the needs at the lower levels of the pyramid before they can successfully be motivated to tackle the next levels. The lowest four levels represent **deficiency needs,** and the upper three levels represent **growth needs.**

Physiological Needs

Notice that the physiological needs are the foundation of the pyramid. Why do you suppose these needs occupy this position?

Maslow suggested that the first and most basic need people have is the need for survival: their physiological requirements for food, water, and shelter. People must have food to eat, water to drink, and a place to call home before they can think about anything else. If any of these physiological necessities is missing, people are motivated above all else to meet the missing need. Have you ever had a hard time paying attention to what the professor is saying when you are hungry? Some of your future students may not have had breakfast—or even dinner the night before. Free and reduced breakfast and lunch programs have been implemented in schools to help students meet some of their physiological needs.

FIGURE 3.1
Maslow's hierarchy of needs.

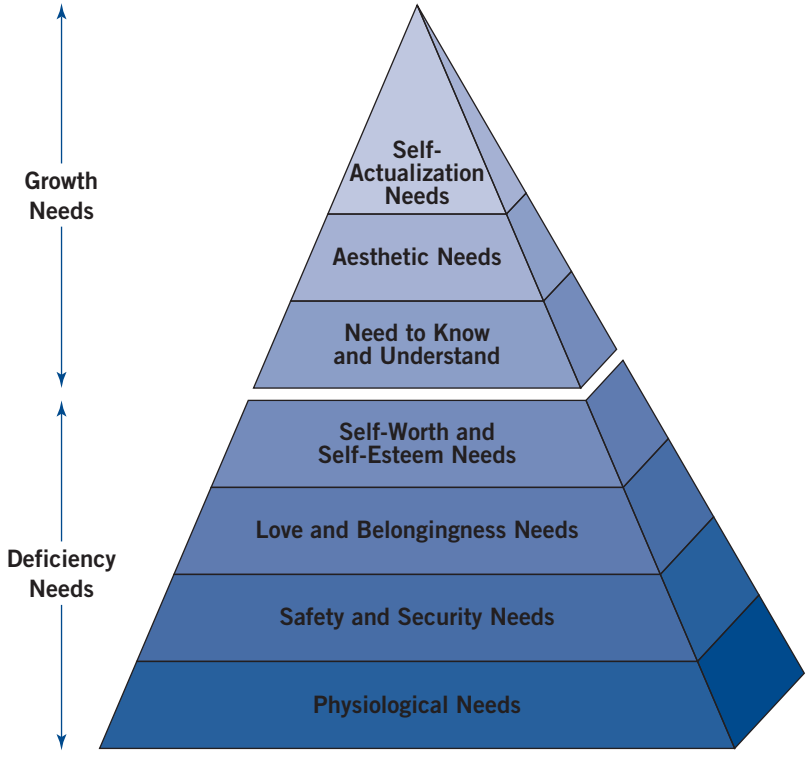


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FIGURE 8.11 *(continued)*

Safety and Security Needs

After their physiological needs have been satisfied, people can work to meet their needs for safety and security. (But the physiological needs must be met first.) Safety is the feeling people get when they know no harm will befall them, physically, mentally, or emotionally; security is the feeling people get when their fears and anxieties are low. How does this relate to students in school? What threats to their physical, mental, or emotional security might students perceive in school? (You will investigate safety and security in the classroom more thoroughly in Chapter 8.)

Love and Belongingness Needs

After the physiological needs and the needs for survival and for safety and security have been met, an individual can be motivated to meet the needs represented at higher levels of the pyramid. The third level of the pyramid are needs associated with love and belonging. These needs are met through satisfactory relationships—relationships with family members, friends, peers, classmates, teachers, and other people with whom individuals interact. Satisfactory relationships imply acceptance by others. Having satisfied their physiological and security needs, people can venture out and seek relationships from which their need for love and belonging can be met.

Think about students of the age that you desire to teach. What do they need from their teacher and the people with whom they establish relationships that will assure them they are accepted?

Self-Worth and Self-Esteem Needs

Once individuals have satisfactorily met their need for love and belonging, they can begin to develop positive feelings of self-worth and self-esteem, and act to foster pride in their work and in themselves as people. Before they can work toward self-esteem, however, they must feel safe, secure, and part of a group such as a class in school. In a study by Yamamoto et al. (1996), more than 1,700 children in grades 2 through 9 reported that the most stressful events in their lives were those that threatened their security and those that threatened to embarrass them, thereby challenging their developing sense of love and belonging. As a teacher, you need to find ways you can help students in your classes develop positive feelings about themselves and thus begin to satisfy their needs for self-worth and self-esteem.

The Deficiency Needs

The first four levels of Maslow's hierarchy of needs are essential for a person's well-being and must be satisfied before the person is motivated to seek experiences that pertain to the upper levels. If a student cannot meet any of these needs, that student will not be motivated to pursue any of the needs in the succeeding levels. Because of this, the first four levels of needs are called **deficiency needs.** After a deficiency need has been satisfied, a person's motivation to satisfy it lessens. Fortunately, many students come to school with the deficiency needs of physiology, safety and security, love and belongingness, and self-esteem already met—at home; in peer groups; in church, scouting, athletic, or music groups; in other groups; or in some combination of these. However, some students who come to school are not having these needs met elsewhere and look for ways to satisfy these needs in school. And *all* students must meet these deficiency needs before they can successfully work at learning.

The Need to Know and Understand

The fifth level of Maslow's pyramid represents an individual's need to know and understand. According to Maslow's hierarchy, this motivation cannot occur until the deficiency needs have been met to the individual's satisfaction. As you can

(Continued)

FIGURE 8.11 *(continued)*

imagine, the need to know and understand is a primary area of focus for education and is a topic on which we will concentrate. One of our primary jobs as educators is to motivate students so they will want to know and understand.

Aesthetic Needs

Aesthetics refers to the quality of being creatively, beautifully, or artistically pleasing; aesthetic needs are the needs to express oneself in pleasing ways. Decorating your living room, wrapping birthday presents attractively, washing and waxing your car, and keeping up with the latest styles in clothing are all ways of expressing your aesthetic sense. People are motivated to meet this need only after the previous five needs have been met. *In what (desirable) ways might your students express themselves aesthetically in your classroom? In what ways might you express yourself aesthetically in your classroom?*

The Need for Self-Actualization

At the top of the pyramid is the need for **self-actualization,** which is a person's desire to become everything he or she is capable of becoming—to realize and use his or her full potential, capacities, and talents. This need can be addressed only when the previous six have been satisfied. It is rarely met completely; Maslow (1968) estimated that less than 1% of adults achieve total self-actualization.

The Growth Needs

The upper three levels of the pyramid constitute a person's **growth needs.** Growth needs can never be satisfied completely. Contrary to the deficiency needs, for which motivation diminishes when a need is satisfied, as growth needs are met, people's motivation to meet them increases. The more these needs are satisfied, the more people want to pursue them. For example, the more one comes to understand, the more one's motivation to learn more increases. Have you experienced this yourself? In what situation? We hope you are experiencing this increased motivation to learn in your introduction to education course.

Source: Text material adapted from D. Martin and K. Joomis, *Building Teachers: A Constructivist Approach to Introducing Education,* (Belmont, CA: Wadsworth, 2007), pp. 72–75.

for Jews, especially ones as famous as Freud. Not long afterward, he died of the cancer of the mouth and jaw that he had suffered from for the last 20 years of his life.

Theory

Freud didn't exactly invent the idea of the conscious versus unconscious mind, but he certainly was responsible for making it popular. The **conscious mind** is what you are aware of at any particular moment, your present perceptions, memories, thoughts, fantasies, feelings, what have you. Working closely with the conscious mind is what Freud called the **preconscious**, what we might today call "available memory:" anything that can easily be made conscious, the memories you are not at the moment thinking about but can readily bring to mind. Now no-one has a problem with these two layers of mind. But Freud suggested that these are the smallest parts!

The largest part by far is the **unconscious**. It includes all the things that are not easily available to awareness, including many things that have their origins there, such as our drives or instincts, and things that are put there because we can't bear to look at them, such as the memories and emotions associated with trauma.

According to Freud, the unconscious is the source of our motivations, whether they be simple desires for food or sex, neurotic compulsions, or the motives of an artist or scientist. And yet, we are often driven to deny or resist becoming conscious of these motives, and they are often available to us only in disguised form. We will come back to this.

The id, the ego, and the superego

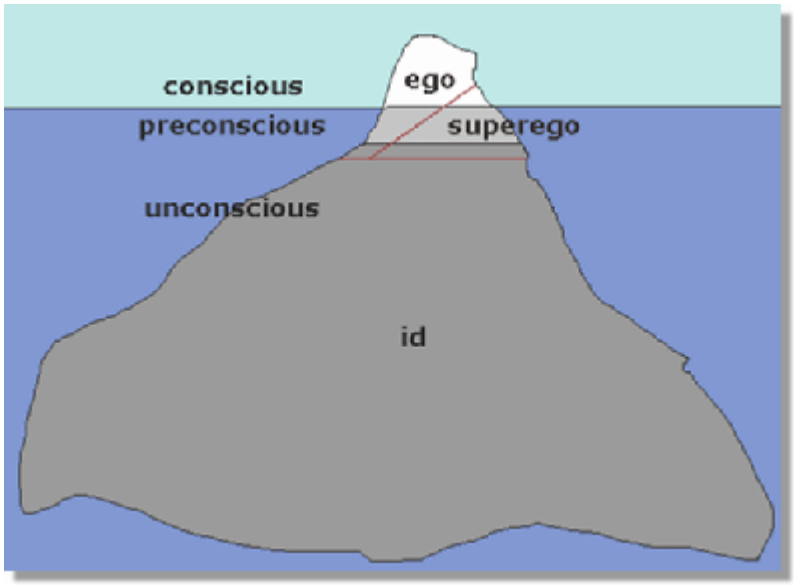
Freudian psychological reality begins with the world, full of objects. Among them is a very special object, the organism. The organism is special in that it acts to survive and reproduce, and it is guided toward those ends by its needs – hunger, thirst, the avoidance of pain, and sex.

A part – a very important part – of the organism is the nervous system, which has as one its characteristics a sensitivity to the organism's needs. At birth, that nervous system is little more than that of any other animal, an "it" or **id**. The nervous system, as id, translates the organism's needs into motivational forces called, in German, **Triebe**, which has been translated as **instincts** or **drives**. Freud also called them **wishes**. This translation from need to wish is called the **primary process**.

The id works in keeping with the **pleasure principle**, which can be understood as a demand to take care of needs immediately. Just picture the hungry infant, screaming itself blue. It doesn't "know" what it wants in any adult sense; it just knows that it wants it and it wants it now. The infant, in the Freudian view, is pure, or nearly pure id. And the id is nothing if not the psychic representative of biology.

Unfortunately, although a wish for food, such as the image of a juicy steak, might be enough to satisfy the id, it isn't enough to satisfy the organism. The need only gets stronger, and the wishes just keep coming. You may have noticed that, when you haven't satisfied some need, such as the need for food, it begins to demand more and more of your attention, until there comes a point where you can't think of anything else. This is the wish or drive breaking into consciousness.

Luckily for the organism, there is that small portion of the mind we discussed before, the conscious, that is hooked up to the world through the senses. Around this little bit of consciousness, during the first year of a child's life, some of the "it" becomes "I," some of the id becomes **ego**. The ego relates the organism to reality by means of its consciousness, and it searches for objects to satisfy the wishes that id creates to represent the organisms needs. This problem-solving activity is called the **secondary process**.



The ego, unlike the id, functions according to the **reality principle**, which says "take care of a need as soon as an appropriate object is found." It represents reality and, to a considerable extent, reason.

However, as the ego struggles to keep the id (and, ultimately, the organism) happy, it meets with obstacles in the world. It occasionally meets with objects that actually assist it in attaining its goals. And it keeps a record of these obstacles and aides. In particular, it keeps track of the rewards and punishments meted out by two of the most influential objects in the world of the child – mom and dad. This record of things to avoid and strategies to take becomes the **superego**. It is not completed until about seven years of age. In some people, it never is completed.

There are two aspects to the superego: One is the **conscience**, which is an internalization of punishments and warnings. The other is called the **ego ideal**. It derives from rewards and positive models presented to the child. The conscience and ego ideal communicate their requirements to the ego with feelings like pride, shame, and guilt.

It is as if we acquired, in childhood, a new set of needs and accompanying wishes, this time of social rather than biological origins. Unfortunately, these new wishes can easily conflict with the ones from the id. You see, the superego represents society, and society often wants nothing better than to have you never satisfy your needs at all!

Life instincts and the death instinct

Freud saw all human behavior as motivated by the drives or instincts, which in turn are the neurological representations of physical needs. At first, he referred to them as the **life instincts**. These instincts perpetuate (a) the life of the individual, by motivating him or her to seek food and water, and (b) the life of the species, by motivating him or her to have sex. The motivational energy of these life instincts, the "oomph" that powers our psyches, he called **libido**, from the Latin word for "I desire."

Freud's clinical experience led him to view sex as much more important in the dynamics of the psyche than other needs. We are, after all, social creatures, and sex is the most social of needs. Plus, we have to remember that Freud included much more than intercourse in the term sex! Anyway, libido has come to mean, not any old drive, but the sex drive.

Later in his life, Freud began to believe that the life instincts didn't tell the whole story. Libido is a lively

thing; the pleasure principle keeps us in perpetual motion. And yet the goal of all this motion is to be still, to be satisfied, to be at peace, to have no more needs. The goal of life, you might say, is death! Freud began to believe that "under" and "beside" the life instincts there was a **death instinct**. He began to believe that every person has an unconscious wish to die.

This seems like a strange idea at first, and it was rejected by many of his students, but I think it has some basis in experience: Life can be a painful and exhausting process. There is easily, for the great majority of people in the world, more pain than pleasure in life – something we are extremely reluctant to admit! Death promises release from the struggle.

Freud referred to a **nirvana principle**. Nirvana is a Buddhist idea, often translated as heaven, but actually meaning "blowing out," as in the blowing out of a candle. It refers to non-existence, nothingness, the void, which is the goal of all life in Buddhist philosophy.

The day-to-day evidence of the death instinct and its nirvana principle is in our desire for peace, for escape from stimulation, our attraction to alcohol and narcotics, our penchant for escapist activity, such as losing ourselves in books or movies, our craving for rest and sleep. Sometimes it presents itself openly as suicide and suicidal wishes. And, Freud theorized, sometimes we direct it out away from ourselves, in the form of aggression, cruelty, murder, and destructiveness.

Anxiety

Freud once said "life is not easy!"

The ego – the "I" – sits at the center of some pretty powerful forces: reality; society, as represented by the superego; biology, as represented by the id. When these make conflicting demands upon the poor ego, it is understandable if it – if you – feel threatened, fell overwhelmed, feel as if it were about to collapse under the weight of it all. This feeling is called **anxiety**, and it serves as a signal to the ego that its survival, and with it the survival of the whole organism, is in jeopardy.

Freud mentions three different kind of anxieties: The first is **realistic anxiety**, which you and I would call fear. Actually Freud did, too, in German. But his translators thought "fear" too mundane! Nevertheless, if I throw you into a pit of poisonous snakes, you might experience realistic anxiety.

The second is **moral anxiety**. This is what we feel when the threat comes not from the outer, physical world, but from the internalized social world of the superego. It is, in fact, just another word for feelings like shame and guilt and the fear of punishment.

The last is **neurotic anxiety**. This is the fear of being overwhelmed by impulses from the id. If you have ever felt like you were about to "lose it," lose control, your temper, your rationality, or even your mind, you have felt neurotic anxiety. Neurotic is actually the Latin word for nervous, so this is nervous anxiety. It is this kind of anxiety that intrigued Freud most, and we usually just call it anxiety, plain and simple.

The defense mechanisms

The ego deals with the demands of reality, the id, and the superego as best as it can. But when the anxiety becomes overwhelming, the ego must defend itself. It does so by unconsciously blocking the impulses or distorting them into a more acceptable, less threatening form. The techniques are called the **ego defense mechanisms**, and Freud, his daughter Anna, and other disciples have discovered quite a few.

Denial involves blocking external events from awareness. If some situation is just too much to handle, the

person just refuses to experience it. As you might imagine, this is a primitive and dangerous defense – no one disregards reality and gets away with it for long! It can operate by itself or, more commonly, in combination with other, more subtle mechanisms that support it.

I was once reading while my five year old daughter was watching a cartoon (The Smurfs, I think). She was, as was her habit, quite close to the television, when a commercial came on. Apparently, no-one at the television station was paying much attention, because this was a commercial for a horror movie, complete with bloody knife, hockey mask, and screams of terror. Now I wasn't able to save my child from this horror, so I did what any good psychologist father would do: I talked about it. I said to her "Boy, that was a scary commercial, wasn't it?" She said "Huh?" I said "That commercial...it sure was scary wasn't it?" She said "What commercial?" I said "The commercial that was just on, with the blood and the mask and the screaming...!" She had apparently shut out the whole thing.

Since then, I've noticed little kids sort of glazing over when confronted by things they'd rather not be confronted by. I've also seen people faint at autopsies, people deny the reality of the death of a loved one, and students fail to pick up their test results. That's denial.

Anna Freud also mentions **denial in fantasy**: This is when children, in their imaginations, transform an "evil" father into a loving teddy bear, or a helpless child into a powerful superhero.

Repression, which Anna Freud also called "motivated forgetting," is just that: not being able to recall a threatening situation, person, or event. This, too, is dangerous, and is a part of most other defenses.

As an adolescent, I developed a rather strong fear of spiders, especially long-legged ones. I didn't know where it came from, but it was starting to get rather embarrassing by the time I entered college. At college, a counselor helped me to get over it (with a technique called systematic desensitization), but I still had no idea where it came from. Years later, I had a dream, a particularly clear one, that involved getting locked up by my cousin in a shed behind my grandparents' house when I was very young. The shed was small, dark, and had a dirt floor covered with – you guessed it! – long-legged spiders.

The Freudian understanding of this phobia is pretty simple: I repressed a traumatic event – the shed incident – but seeing spiders aroused the anxiety of the event without arousing the memory.

Other examples abound. Anna Freud provides one that now strikes us as quaint: A young girl, guilty about her rather strong sexual desires, tends to forget her boy-friend's name, even when trying to introduce him to her relations! Or an alcoholic can't remember his suicide attempt, claiming he must have "blacked out." Or a someone almost drowns as a child, but can't remember the event even when people try to remind him – but he does have this fear of open water!

Note that, to be a true example of a defense, it should function unconsciously. My brother had a fear of dogs as a child, but there was no defense involved: He had been bitten by one, and wanted very badly never to repeat the experience! Usually, it is the irrational fears we call phobias that derive from repression of traumas.

Asceticism, or the renunciation of needs, is one most people haven't heard of, but it has become relevant again today with the emergence of the disorder called anorexia. Preadolescents, when they feel threatened by their emerging sexual desires, may unconsciously try to protect themselves by denying, not only their sexual desires, but all desires. They get involved in some kind of ascetic (monk-like) lifestyle wherein they renounce their interest in what other people enjoy.

In boys nowadays, there is a great deal of interest in the self-discipline of the martial arts. Fortunately, the martial arts not only don't hurt you (much), they may actually help you. Unfortunately, girls in our society often develop a great deal of interest in attaining an excessively and artificially thin standard of beauty. In Freudian theory, their denial of their need for food is actually a cover for their denial of their sexual

development. Our society conspires with them: After all, what most societies consider a normal figure for a mature woman is in ours considered 20 pounds overweight!

Anna Freud also discusses a milder version of this called **restriction of ego**. Here, a person loses interest in some aspect of life and focuses it elsewhere, in order to avoid facing reality. A young girl who has been rejected by the object of her affections may turn away from feminine things and become a "sex-less intellectual," or a boy who is afraid that he may be humiliated on the football team may unaccountably become deeply interested in poetry.

Isolation (sometimes called intellectualization) involves stripping the emotion from a difficult memory or threatening impulse. A person may, in a very cavalier manner, acknowledge that they had been abused as a child, or may show a purely intellectual curiosity in their newly discovered sexual orientation. Something that should be a big deal is treated as if it were not.

In emergency situations, many people find themselves completely calm and collected until the emergency is over, at which point they fall to pieces. Something tells you that, during the emergency, you can't afford to fall apart. It is common to find someone totally immersed in the social obligations surrounding the death of a loved one. Doctors and nurses must learn to separate their natural reactions to blood, wounds, needles, and scalpels, and treat the patient, temporarily, as something less than a warm, wonderful human being with friends and family. Adolescents often go through a stage where they are obsessed with horror movies, perhaps to come to grips with their own fears. Nothing demonstrates isolation more clearly than a theater full of people laughing hysterically while someone is shown being dismembered.

Displacement is the redirection of an impulse onto a substitute target. If the impulse, the desire, is okay with you, but the person you direct that desire towards is too threatening, you can displace to someone or something that can serve as a symbolic substitute.

Someone who hates his or her mother may repress that hatred, but direct it instead towards, say, women in general. Someone who has not had the chance to love someone may substitute cats or dogs for human beings. Someone who feels uncomfortable with their sexual desire for a real person may substitute a fetish. Someone who is frustrated by his or her superiors may go home and kick the dog, beat up a family member, or engage in cross-burnings.

Turning against the self is a very special form of displacement, where the person becomes their own substitute target. It is normally used in reference to hatred, anger, and aggression, rather than more positive impulses, and it is the Freudian explanation for many of our feelings of inferiority, guilt, and depression. The idea that depression is often the result of the anger we refuse to acknowledge is accepted by many people, Freudians and non-Freudians alike.

Once upon a time, at a time when I was not feeling my best, my daughter, five years old, spilled an entire glass of chocolate milk in the living room. I lashed out at her verbally, telling her she was clumsy and had to learn to be more careful and how often hadn't I told her and...well, you know. She stood there stiffly with a sort of smoldering look in her eyes, and, of all things, pounded herself on her own head several times! Obviously, she would rather have pounded my head, but, well, you just don't do that, do you? Needless to say, I've felt guilty ever since.

Projection, which Anna Freud also called displacement outward, is almost the complete opposite of turning against the self. It involves the tendency to see your own unacceptable desires in other people. In other words, the desires are still there, but they're not your desires anymore. I confess that whenever I hear

someone going on and on about how aggressive everybody is, or how perverted they all are, I tend to wonder if this person doesn't have an aggressive or sexual streak in themselves that they'd rather not acknowledge.

Let me give you a couple of examples: A husband, a good and faithful one, finds himself terribly attracted to the charming and flirtatious lady next door. But rather than acknowledge his own, hardly abnormal, lusts, he becomes increasingly jealous of his wife, constantly worried about her faithfulness, and so on. Or a woman finds herself having vaguely sexual feelings about her girlfriends. Instead of acknowledging those feelings as quite normal, she becomes increasingly concerned with the presence of lesbians in her community.

Altruistic surrender is a form of projection that at first glance looks like its opposite: Here, the person attempts to fulfill his or her own needs vicariously, through other people.

A common example of this is the friend (we've all had one) who, while not seeking any relationship himself, is constantly pushing other people into them, and is particularly curious as to "what happened last night" and "how are things going?" The extreme example of altruistic surrender is the person who lives their whole life for and through another.

Reaction formation, which Anna Freud called "believing the opposite," is changing an unacceptable impulse into its opposite. So a child, angry at his or her mother, may become overly concerned with her and rather dramatically shower her with affection. An abused child may run to the abusing parent. Or someone who can't accept a homosexual impulse may claim to despise homosexuals.

Perhaps the most common and clearest example of reaction formation is found in children between seven and eleven or so: Most boys will tell you in no uncertain terms how disgusting girls are, and girls will tell you with equal vigor how gross boys are. Adults watching their interactions, however, can tell quite easily what their true feelings are!

Undoing involves "magical" gestures or rituals that are meant to cancel out unpleasant thoughts or feelings after they've already occurred. Anna Freud mentions, for example, a boy who would recite the alphabet backwards whenever he had a sexual thought, or turn around and spit whenever meeting another boy who shared his passion for masturbation.

In "normal" people, the undoing is, of course, more conscious, and we might engage in an act of atonement for some behavior, or formally ask for forgiveness. But in some people, the act of atonement isn't conscious at all. Consider the alcoholic father who, after a year of verbal and perhaps physical abuse, puts on the best and biggest Christmas ever for his kids. When the season is over, and the kids haven't quite been fooled by his magical gesture, he returns to his bartender with complaints about how ungrateful his family is, and how they drive him to drink.

One of the classic examples of undoing concerns personal hygiene following sex: It is perfectly reasonable to wash up after sex. After all, it can get messy! But if you feel the need to take three or four complete showers using gritty soap – perhaps sex doesn't quite agree with you.

Introjection, sometimes called identification, involves taking into your own personality characteristics of someone else, because doing so solves some emotional difficulty. For example, a child who is left alone frequently, may in some way try to become "mom" in order to lessen his or her fears. You can sometimes catch them telling their dolls or animals not to be afraid. And we find the older child or teenager imitating his or her favorite star, musician, or sports hero in an effort to establish an identity.

A more unusual example is a woman who lived next to my grandparents. Her husband had died and she began to dress in his clothes, albeit neatly tailored to her figure. She began to take up various of his habits,

such as smoking a pipe. Although the neighbors found it strange and referred to her as "the man-woman," she was not suffering from any confusion about her sexual identity. In fact, she later remarried, retaining to the end her men's suits and pipe!

I must add here that identification is very important to Freudian theory as the mechanism by which we develop our superegos.

Identification with the aggressor is a version of introjection that focuses on the adoption, not of general or positive traits, but of negative or feared traits. If you are afraid of someone, you can partially conquer that fear by becoming more like them. Two of my daughters, growing up with a particularly moody cat, could often be seen meowing, hissing, spitting, and arching their backs in an effort to keep that cat from springing out of a closet or dark corner and trying to eat their ankles.

A more dramatic example is one called the Stockholm Syndrome. After a hostage crisis in Stockholm, psychologists were surprised to find that the hostages were not only not terribly angry at their captors, but often downright sympathetic. A more recent case involved a young woman named Patty Hearst, of the wealthy and influential Hearst family. She was captured by a very small group of self-proclaimed revolutionaries called the Symbionese Liberation Army. She was kept in closets, raped, and otherwise mistreated. Yet she apparently decided to join them, making little propaganda videos for them and even waving a machine gun around during a bank robbery. When she was later tried, psychologists strongly suggested she was a victim, not a criminal. She was nevertheless convicted of bank robbery and sentenced to 7 years in prison. Her sentence was commuted by President Carter after 2 years.

Regression is a movement back in psychological time when one is faced with stress. When we are troubled or frightened, our behaviors often become more childish or primitive. A child may begin to suck their thumb again or wet the bed when they need to spend some time in the hospital. Teenagers may giggle uncontrollably when introduced into a social situation involving the opposite sex. A freshman college student may need to bring an old toy from home. A gathering of civilized people may become a violent mob when they are led to believe their livelihoods are at stake. Or an older man, after spending twenty years at a company and now finding himself laid off, may retire to his recliner and become childishly dependent on his wife.

Where do we retreat when faced with stress? To the last time in life when we felt safe and secure, according to Freudian theory.

Rationalization is the cognitive distortion of "the facts" to make an event or an impulse less threatening. We do it often enough on a fairly conscious level when we provide ourselves with excuses. But for many people, with sensitive egos, making excuses comes so easy that they never are truly aware of it. In other words, many of us are quite prepared to believe our lies.

A useful way of understanding the defenses is to see them as a combination of denial or repression with various kinds of rationalizations.

All defenses are, of course, lies, even if we are not conscious of making them. But that doesn't make them less dangerous – in fact it makes them more so. As your grandma may have told you, "Oh what a tangled web we weave..." Lies breed lies, and take us further and further from the truth, from reality. After a while, the ego can no longer take care of the id's demands, or pay attention to the superego's. The anxieties come rushing back, and you break down.

And yet Freud saw defenses as necessary. You can hardly expect a person, especially a child, to take the pain

and sorrow of life full on! While some of his followers suggested that all of the defenses could be used positively, Freud himself suggested that there was one positive defense, which he called sublimation.

Sublimation is the transforming of an unacceptable impulse, whether it be sex, anger, fear, or whatever, into a socially acceptable, even productive form. So someone with a great deal of hostility may become a hunter, a butcher, a football player, or a mercenary. Someone suffering from a great deal of anxiety in a confusing world may become an organizer, a businessperson, or a scientist. Someone with powerful sexual desires may become an artist, a photographer, or a novelist, and so on. For Freud, in fact, all positive, creative activities were sublimations, and predominantly of the sex drive.

The stages

As I said earlier, for Freud, the sex drive is the most important motivating force. In fact, Freud felt it was the primary motivating force not only for adults but for children and even infants. When he introduced his ideas about infantile sexuality to the Viennese public of his day, they were hardly prepared to talk about sexuality in adults, much less in infants!

It is true that the capacity for orgasm is there neurologically from birth. But Freud was not just talking about orgasm. Sexuality meant not only intercourse, but all pleasurable sensation from the skin. It is clear even to the most prudish among us that babies, children, and, of course, adults, enjoy tactile experiences such as caresses, kisses, and so on.

Freud noted that, at different times in our lives, different parts of our skin give us greatest pleasure. Later theorists would call these areas **erogenous zones**. It appeared to Freud that the infant found its greatest pleasure in sucking, especially at the breast. In fact, babies have a penchant for bringing nearly everything in their environment into contact with their mouths. A bit later in life, the child focuses on the anal pleasures of holding it in and letting go. By three or four, the child may have discovered the pleasure of touching or rubbing against his or her genitalia. Only later, in our sexual maturity, do we find our greatest pleasure in sexual intercourse. In these observations, Freud had the makings of a psychosexual stage theory.

The **oral stage** lasts from birth to about 18 months. The focus of pleasure is, of course, the mouth. Sucking and biting are favorite activities.

The **anal stage** lasts from about 18 months to three or four years old. The focus of pleasure is the anus. Holding it in and letting it go are greatly enjoyed.

The **phallic stage** lasts from three or four to five, six, or seven years old. The focus of pleasure is the genitalia. Masturbation is common.

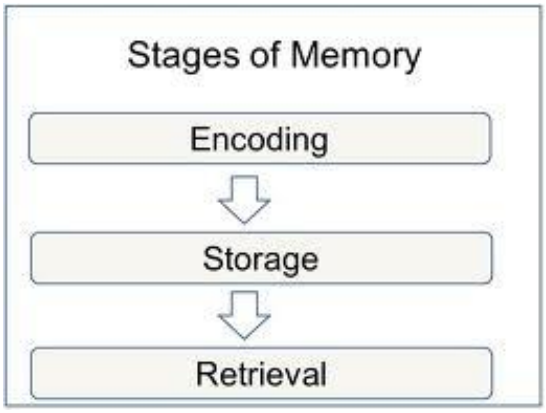
The **latent stage** lasts from five, six, or seven to puberty, that is, somewhere around 12 years old. During this stage, Freud believed that the sexual impulse was suppressed in the service of learning. I must note that, while most children seem to be fairly calm, sexually, during their grammar school years, perhaps up to a quarter of them are quite busy masturbating and playing "doctor." In Freud's repressive era, these children were, at least, quieter than their modern counterparts.

The **genital stage** begins at puberty, and represents the resurgence of the sex drive in adolescence, and the more specific focusing of pleasure in sexual intercourse. Freud felt that masturbation, oral sex, homosexuality, and many other things we find acceptable in adulthood today, were immature.

This is a true stage theory, meaning that Freudians believe that we all go through these stages, in this order, and pretty close to these ages.

MEMORY

Memory is the ability to take in information, store it, and recall it at a later time. In psychology, memory is broken into three stages: encoding, storage, and retrieval.



Stages of memory: The three stages of memory: encoding, storage, and retrieval. Problems can occur at any stage of the process.

The Memory Process

1. Encoding (or registration): the process of receiving, processing, and combining information. Encoding allows information from the outside world to reach our senses in the forms of chemical and physical stimuli. In this first stage we must change the information so that we may put the memory into the encoding process.
2. Storage: the creation of a permanent record of the encoded information. Storage is the second memory stage or process in which we maintain information over periods of time.
3. Retrieval (or recall, or recognition): the calling back of stored information in response to some cue for use in a process or activity. The third process is the retrieval of information that we have stored. We must locate it and return it to our consciousness. Some retrieval attempts may be effortless due to the type of information.

Problems can occur at any stage of the process, leading to anything from forgetfulness to amnesia. Distraction can prevent us from encoding information initially; information might not be stored properly, or might not move from short-term to long-term storage; and/or we might not be able to retrieve the information once it's stored.

Types of Memory

Sensory Memory

Sensory memory allows individuals to retain impressions of sensory information after the original stimulus has ceased. One of the most common examples of sensory memory is fast-moving lights in darkness: if you've ever lit a sparkler on the Fourth of July or watched traffic

rush by at night, the light appears to leave a trail. This is because of "iconic memory," the visual sensory store. Two other types of sensory memory have been extensively studied: echoic memory (the auditory sensory store) and haptic memory (the tactile sensory store). Sensory memory is not involved in higher cognitive functions like short- and long-term memory; it is not consciously controlled. The role of sensory memory is to provide a detailed representation of our entire sensory experience for which relevant pieces of information are extracted by short-term memory and processed by working memory.

Short-Term Memory

Short-term memory is also known as *working memory*. It holds only a few items (research shows a range of 7 +/- 2 items) and only lasts for about 20 seconds. However, items can be moved from short-term memory to long-term memory via processes like *rehearsal*. An example of rehearsal is when someone gives you a phone number verbally and you say it to yourself repeatedly until you can write it down. If someone interrupts your rehearsal by asking a question, you can easily forget the number, since it is only being held in your short-term memory.

Long-Term Memory

Long-term memories are all the memories we hold for periods of time longer than a few seconds; long-term memory encompasses everything from what we learned in first grade to our old addresses to what we wore to work yesterday. Long-term memory has an incredibly vast storage capacity, and some memories can last from the time they are created until we die.

There are many types of long-term memory. *Explicit* or *declarative* memory requires conscious recall; it consists of information that is consciously stored or retrieved. Explicit memory can be further subdivided into *semantic* memory (facts taken out of context, such as "Paris is the capital of France") and *episodic* memory (personal experiences, such as "When I was in Paris, I saw the *Mona Lisa*").

In contrast to explicit/declarative memory, there is also a system for procedural/implicit memory. These memories are not based on consciously storing and retrieving information, but on implicit learning. Often this type of memory is employed in learning new motor skills. An example of implicit learning is learning to ride a bike: you do not need to consciously remember how to ride a bike, you simply do. This is because of implicit memory.

Sensory Memory

Sensory memory allows an individual to remember an input in great detail but for only a few milliseconds.

Sensory memory allows individuals to retain impressions of sensory information for a brief time after the original stimulus has ceased. It allows individuals to remember great sensory detail about a complex stimulus immediately following its presentation. Sensory memory is an automatic response considered to be outside of cognitive control. The information represented in this type of memory is the "raw data" which provides a snapshot of a person's overall sensory experience. Information from sensory memory has the shortest retention time, ranging from mere

milliseconds to five seconds. It is retained just long enough for it to be transferred to short-term (working) memory.

In sensory memory, no manipulation of the incoming information occurs as it is transferred quickly to working memory. The amount of information is greatly reduced during this transfer because the capacity of working memory is not large enough to cope with all the input coming from our sense organs.

Types of Sensory Memory

It is assumed that there is a subtype of sensory memory for each of the five major senses (touch, taste, sight, hearing, and smell); however, only three of these types have been extensively studied: echoic memory, iconic memory, and haptic memory.

Iconic Memory

Sensory input to the visual system goes into iconic memory, so named because the mental representations of visual stimuli are referred to as icons. Iconic memory has a duration of about 100 ms. One of the times that iconic memory is noticeable is when we see “light trails.” This is the phenomenon when bright lights move rapidly at night and you perceive them as forming a trail; this is the image that is represented in iconic memory.

Echoic Memory

Echoic memory is the branch of sensory memory used by the auditory system. Echoic memory is capable of holding a large amount of auditory information, but only for 3–4 seconds. This echoic sound is replayed in the mind for this brief amount of time immediately after the presentation of the auditory stimulus.

Haptic Memory

Haptic memory is the branch of sensory memory used by the sense of touch. Sensory receptors all over the body detect sensations like pressure, itching, and pain, which are briefly held in haptic memory before vanishing or being transported to short-term memory. This type of memory seems to be used when assessing the necessary forces for gripping and interacting with familiar objects. Haptic memory seems to decay after about two seconds. Evidence of haptic memory has only recently been identified and not as much is known about its characteristics compared to iconic memory.

Short-Term and Working Memory

Short-term memory, which includes working memory, stores information for a brief period of recall for things that happened recently.

Short-term memory is the capacity for holding a small amount of information in an active, readily available state for a brief period of time. It is separate from our long-term memory, where lots of information is stored for us to recall at a later time. Unlike sensory memory, it is capable of temporary storage. How long this storage lasts depends on conscious effort from the

individual; without rehearsal or active maintenance, the duration of short-term memory is believed to be on the order of seconds.

Capacity of Short-Term Memory

Short-term memory acts as a scratchpad for temporary recall of information. For instance, in order to understand this sentence you need to hold in your mind the beginning of the sentence as you read the rest. Short-term memory decays rapidly and has a limited capacity.

The psychologist George Miller suggested that human short-term memory has a forward memory span of approximately seven items plus or minus two. More recent research has shown that this number is roughly accurate for college students recalling lists of digits, but memory span varies widely with populations tested and with material used.

For example, the ability to recall words in order depends on a number of characteristics of these words: fewer words can be recalled when the words have longer spoken duration (this is known as the *word-length effect)* or when their speech sounds are similar to each other (this is called the *phonological similarity effect*). More words can be recalled when the words are highly familiar or occur frequently in the language. Chunking of information can also lead to an increase in short-term memory capacity. For example, it is easier to remember a hyphenated phone number than a single long number because it is broken into three chunks instead of existing as ten digits.

Rehearsal is the process in which information is kept in short-term memory by mentally repeating it. When the information is repeated each time, that information is re-entered into the short-term memory, thus keeping that information for another 10 to 20 seconds, the average storage time for short-term memory. Distractions from rehearsal often cause disturbances in short-term memory retention. This accounts for the desire to complete a task held in short-term memory as soon as possible.

Working Memory

Though the term “working memory” is often used synonymously with “short-term memory,” working memory is related to but actually distinct from short-term memory. It holds temporary data in the mind where it can be manipulated. Baddeley and Hitch’s 1974 model of working memory is the most commonly accepted theory of working memory today. According to Baddeley, working memory has a phonological loop to preserve verbal data, a visuospatial scratchpad to control visual data, and a central executive to disperse attention between them.

Phonological Loop

The phonological loop is responsible for dealing with auditory and verbal information, such as phone numbers, people’s names, or general understanding of what other people are talking about. We could roughly say that it is a system specialized for language. It consists of two parts: a short-term *phonological store* with auditory memory traces that are subject to rapid decay, and an *articulatory loop* that can revive these memory traces. The phonological store can only store

sounds for about two seconds without rehearsal, but the auditory loop can “replay them” internally to keep them in working memory. The repetition of information deepens the memory.

Visuospatial Sketchpad

Visual and spatial information is handled in the visuospatial sketchpad. This means that information about the position and properties of objects can be stored. The phonological loop and visuospatial sketchpad are semi-independent systems; because of this, you can increase the amount you can remember by engaging both systems at once. For instance, you might be better able to remember an entire phone number if you visualize part of it (using the visuospatial sketchpad) and then say the rest of it out loud (using the phonological loop).

Central Executive

The central executive connects the phonological loop and the visuospatial sketchpad and coordinates their activities. It also links the working memory to the long-term memory, controls the storage of long-term memory, and manages memory retrieval from storage. The process of storage is influenced by the duration in which information is held in working memory and the amount that the information is manipulated. Information is stored for a longer time if it is semantically interpreted and viewed with relation to other information already stored in long-term memory.

Transport to Long-Term Memory

The process of transferring information from short-term to long-term memory involves encoding and consolidation of information. This is a function of time; that is, the longer the memory stays in the short-term memory the more likely it is to be placed in the long-term memory. In this process, the meaningfulness or emotional content of an item may play a greater role in its retention in the long-term memory.

This greater retention is owed to an enhanced synaptic response within the hippocampus, which is essential for memory storage. The limbic system of the brain (including the hippocampus and amygdala) is not necessarily directly involved in long-term memory, but it selects particular information from short-term memory and consolidates these memories by playing them like a continuous tape.

Long-Term Memory

Long-term memory is used for the storage of information over long periods of time, ranging from a few hours to a lifetime.

If we want to remember something tomorrow, we have to consolidate it into long-term memory today. Long-term memory is the final, semi-permanent stage of memory. Unlike sensory and short-term memory, long-term memory has a theoretically infinite capacity, and information can remain there indefinitely. Long-term memory has also been called reference memory, because an individual must refer to the information in long-term memory when performing almost any task. Long-term memory can be broken down into two categories: explicit and implicit memory.

Explicit Memory

Explicit memory, also known as conscious or declarative memory, involves memory of facts, concepts, and events that require conscious recall of the information. In other words, the individual must actively think about retrieving the information from memory. This type of information is *explicitly* stored and retrieved—hence its name. Explicit memory can be further subdivided into semantic memory, which concerns facts, and episodic memory, which concerns primarily personal or autobiographical information.

Semantic Memory

Semantic memory involves abstract factual knowledge, such as "Albany is the capital of New York." It is for the type of information that we learn from books and school: faces, places, facts, and concepts. You use semantic memory when you take a test. Another type of semantic memory is called a script. Scripts are like blueprints of what tends to happen in certain situations. For example, what usually happens if you visit a restaurant? You get the menu, you order your meal, you eat it, and then you pay the bill. Through practice, you learn these scripts and encode them into semantic memory.

Episodic Memory

Episodic memory is used for more contextualized memories. They are generally memories of specific moments, or episodes, in one's life. As such, they include sensations and emotions associated with the event, in addition to the who, what, where, and when of what happened. An example of an episodic memory would be recalling your family's trip to the beach. Autobiographical memory (memory for particular events in one's own life) is generally viewed as either equivalent to, or a subset of, episodic memory. One specific type of autobiographical memory is a flashbulb memory, which is a highly detailed, exceptionally vivid "snapshot" of the moment and circumstances in which a piece of surprising and consequential (or emotionally arousing) news was heard. For example, many people remember exactly where they were and what they were doing when they heard of the terrorist attacks on September 11, 2001. This is because it is a flashbulb memory.

Semantic and episodic memory are closely related; memory for facts can be enhanced with episodic memories associated with the fact, and vice versa. For example, the answer to the factual question "Are all apples red?" might be recalled by remembering the time you saw someone eating a green apple. Likewise, semantic memories about certain topics, such as football, can contribute to more detailed episodic memories of a particular personal event, like watching a football game. A person that barely knows the rules of football will remember the various plays and outcomes of the game in much less detail than a football expert.

Implicit Memory

In contrast to explicit (conscious) memory, implicit (also called "unconscious" or "procedural") memory involves procedures for completing actions. These actions develop with practice over time. Athletic skills are one example of implicit memory. You learn the fundamentals of a sport, practice them over and over, and then they flow naturally during a game. Rehearsing for a dance

or musical performance is another example of implicit memory. Everyday examples include remembering how to tie your shoes, drive a car, or ride a bicycle. These memories are accessed without conscious awareness—they are automatically translated into actions without us even realizing it. As such, they can often be difficult to teach or explain to other people. Implicit memories differ from the semantic scripts described above in that they are usually actions that involve movement and motor coordination, whereas scripts tend to emphasize social norms or behaviors.

Introduction to Memory Encoding

Memory encoding allows an item of interest to be converted into a construct that is stored in the brain, which can later be recalled.

Memory encoding allows information to be converted into a construct that is stored in the brain indefinitely. Once it is encoded, it can be recalled from either short- or long-term memory. At a very basic level, memory encoding is like hitting "Save" on a computer file. Once a file is saved, it can be retrieved as long as the hard drive is undamaged. "Recall" refers to retrieving previously encoded information.

The process of encoding begins with perception, which is the identification, organization, and interpretation of any sensory information in order to understand it within the context of a particular environment. Stimuli are perceived by the senses, and related signals travel to the thalamus of the human brain, where they are synthesized into one experience. The hippocampus then analyzes this experience and decides if it is worth committing to long-term memory.

Encoding is achieved using chemicals and electric impulses within the brain. Neural pathways, or connections between neurons (brain cells), are actually formed or strengthened through a process called long-term potentiation, which alters the flow of information within the brain. In other words, as a person experiences novel events or sensations, the brain "rewires" itself in order to store those new experiences in memory.

Types of Encoding

The four primary types of encoding are visual, acoustic, elaborative, and semantic.

Visual

Visual encoding is the process of encoding images and visual sensory information. The creation of mental pictures is one way people use visual encoding. This type of information is temporarily stored in iconic memory, and then is moved to long-term memory for storage. The amygdala plays a large role in the visual encoding of memories.

Acoustic

Acoustic encoding is the use of auditory stimuli or hearing to implant memories. This is aided by what is known as the phonological loop. The phonological loop is a process by which sounds are sub-vocally rehearsed (or "said in your mind over and over") in order to be remembered.

Elaborative

Elaborative encoding uses information that is already known and relates it to the new information being experienced. The nature of a new memory becomes dependent as much on previous information as it does on the new information. Studies have shown that the long-term retention of information is greatly improved through the use of elaborative encoding.

Semantic

Semantic encoding involves the use of sensory input that has a specific meaning or can be applied to a context. Chunking and mnemonics (discussed below) aid in semantic encoding; sometimes, deep processing and optimal retrieval occurs. For example, you might remember a particular phone number based on a person's name or a particular food by its color.

Optimizing Encoding through Organization

Not all information is encoded equally well. Think again about hitting "Save" on a computer file. Did you save it into the right folder? Was the file complete when you saved it? Will you be able to find it later? At a basic level, the process of encoding faces similar challenges: if information is improperly coded, recall will later be more challenging. The process of encoding memories in the brain can be optimized in a variety of ways, including mnemonics, chunking, and state-dependent learning.

Mnemonics

Mnemonic devices, sometimes simply called mnemonics, are one way to help encode simple material into memory. A mnemonic is any organization technique that can be used to help remember something. One example is a *peg-word* system, in which the person "pegs" or associates the items to be remembered with other easy-to-remember items. An example of this is "King Phillip Came Over For Good Soup," a peg-word sentence for remembering the order of taxonomic categories in biology that uses the same initial letters as the words to be remembered: *kingdom, phylum, class, order, family, genus, species.* Another type of mnemonic is an *acronym,* in which a person shortens a list of words to their initial letters to reduce their memory load.

Chunking

Chunking is the process of organizing parts of objects into meaningful wholes. The whole is then remembered as a unit instead of individual parts. Examples of chunking include remembering phone numbers (a series of individual numbers separated by dashes) or words (a series of individual letters).

State-Dependent Learning

State-dependent learning is when a person remembers information based on the state of mind (or mood) they are in when they learn it. Retrieval cues are a large part of state-dependent learning. For example, if a person listened to a particular song while learning certain concepts, playing that song is likely to cue up the concepts learned. Smells, sounds, or place of learning can also be part of state-dependent learning.

Memory Consolidation

Memory consolidation is a category of processes that stabilize a memory trace after its initial acquisition. Like encoding, consolidation influences whether the memory of an event is accessible after the fact. However, encoding is more influenced by attention and conscious effort to remember things, while the processes involved in consolidation tend to be unconscious and happen at the cellular or neurological level. Generally, encoding takes focus, while consolidation is more of a biological process. Consolidation even happens while we sleep.

Sleep and Memory

Research indicates that sleep is of paramount importance for the brain to consolidate information into accessible memories. While we sleep, the brain analyzes, categorizes, and discards recent memories. One useful memory-enhancement technique is to use an audio recording of the information you want to remember and play it while you are trying to go to sleep. Once you are actually in the first stage of sleep, there is no learning occurring because it is hard to consolidate memories during sleep (which is one reason why we tend to forget most of our dreams). However, the things you hear on the recording just before you fall asleep are more likely to be retained because of your relaxed and focused state of mind.

Introduction to Memory Storage

Memory storage allows us to hold onto information for a very long duration of time—even a lifetime.

Parallel Distributed Processing Model

The parallel distributed processing (PDP) model is an example of a network model of memory, and it is the prevailing connectionist approach today. PDP posits that memory is made up of neural networks that interact to store information. It is more of a metaphor than an actual biological theory, but it is very useful for understanding how neurons fire and wire with each other.

Taking its metaphors from the field of computer science, this model stresses the parallel nature of neural processing. “Parallel processing” is a computing term; unlike serial processing (performing one operation at a time), parallel processing allows hundreds of operations to be completed at once—in parallel. Under PDP, neural networks are thought to work in parallel to change neural connections to store memories. This theory also states that memory is stored by modifying the strength of connections between neural units. Neurons that fire together frequently (which occurs when a particular behavior or mental process is engaged many times) have stronger connections between them. If these neurons stop interacting, the memory’s strength weakens. This model emphasizes learning and other cognitive phenomena in the creation and storage of memory.

Memory Retrieval: Recognition and Recall

Memory retrieval, including recall and recognition, is the process of remembering information stored in long-term memory.

Memory retrieval is the process of remembering information stored in long-term memory. Some theorists suggests that there are three stores of memory: sensory memory, long-term memory (LTM), and short-term memory (STM). Only data that is processed through STM and encoded into LTM can later be retrieved. Overall, the mechanisms of memory are not completely understood. However, there are many theories concerning memory retrieval.

There are two main types of memory retrieval: recall and recognition. In recall, the information must be retrieved from memories. In recognition, the presentation of a familiar outside stimulus provides a cue that the information has been seen before. A cue might be an object or a scene—any stimulus that reminds a person of something related. Recall may be assisted when retrieval cues are presented that enable the subject to quickly access the information in memory.

Interference with Memory Retrieval

Interference occurs in memory when there is an interaction between the new material being learned and previously learned material. There are two main kinds of interference: proactive and retroactive.

Proactive Interference

Proactive interference is the forgetting of information due to interference from previous knowledge in LTM. Past memories can inhibit the encoding of new memories. This is particularly true if they are learned in similar contexts and the new information is similar to previous information. This is what is happening when you have trouble remembering your new phone number because your old one is stuck in your head.

Retroactive Interference

Retroactive interference occurs when newly learned information interferes with the encoding or recall of previously learned information. If a participant was asked to recall a list of words, and was then immediately presented with new information, it could interfere with remembering the initial list. If you learn to use a new kind of computer and then later have to use the old model again, you might find you have forgotten how to use it. This is due to retroactive interference.

Memory Distortions and Biases

Memories are not stored as exact replicas of reality; rather, they are modified and reconstructed during recall.

Memory Errors

Memories are fallible. They are reconstructions of reality filtered through people's minds, not perfect snapshots of events. Because memories are reconstructed, they are susceptible to being manipulated with false information. Memory errors occur when memories are recalled incorrectly; a memory gap is the complete loss of a memory.

Schemas

In a 1932 study, Frederic Bartlett demonstrated how telling and retelling a story distorted information recall. He told participants a complicated Native American story and had them repeat it over a series of intervals. With each repetition, the stories were altered. Even when participants recalled accurate information, they filled in gaps with false information. Bartlett attributed this tendency to the use of *schemas*. A schema is a generalization formed in the mind based on experience. People tend to place past events into existing representations of the world to make memories more coherent. Instead of remembering precise details about commonplace occurrences, people use schemas to create frameworks for typical experiences, which shape their expectations and memories. The common use of schemas suggests that memories are not identical reproductions of experience, but a combination of actual events and already-existing schemas. Likewise, the brain has the tendency to fill in blanks and inconsistencies in a memory by making use of the imagination and similarities with other memories.

Leading Questions

Much research has shown that the phrasing of questions can also alter memories. A leading question is a question that suggests the answer or contains the information the examiner is looking for. For instance, one study showed that simply changing one word in a question could alter participants' answers: After viewing video footage of a car accident, participants who were asked how "slow" the car was going gave lower speed estimations than those who were asked how "fast" it was going. Children are particularly suggestible to such leading questions.

Mood Congruence Effect

The mood congruence effect is the tendency of individuals to retrieve information more easily when it has the same emotional content as their current emotional state. For instance, being in a depressed mood increases the tendency to remember negative events.

Mood-State Dependent Retrieval

Another documented phenomenon is mood-state dependent retrieval, which is a type of context-dependent memory. The retrieval of information is more effective when the emotional state at the time of retrieval is similar to the emotional state at the time of encoding. Thus, the probability of remembering an event can be enhanced by evoking the emotional state experienced during its initial processing.

Considerations for Eyewitness Testimony

Increasing evidence shows that memories and individual perceptions are unreliable, biased, and manipulable.

Eyewitness testimony has been considered a credible source in the past, but its reliability has recently come into question. Research and evidence have shown that memories and individual perceptions are unreliable, often biased, and can be manipulated.

Encoding Issues

Nobody plans to witness a crime; it is not a controlled situation. There are many types of biases and attentional limitations that make it difficult to encode memories during a stressful event.

Time

When witnessing an incident, information about the event is entered into memory. However, the accuracy of this initial information acquisition can be influenced by a number of factors. One factor is the duration of the event being witnessed. In an experiment conducted by Clifford and Richards (1977), participants were instructed to approach police officers and engage in conversation for either 15 or 30 seconds. The experimenter then asked the police officer to recall details of the person to whom they had been speaking (e.g., height, hair color, facial hair, etc.). The results of the study showed that police had significantly more accurate recall of the 30-second conversation group than they did of the 15-second group. This suggests that recall is better for longer events.

Other-Race Effect

The other-race effect (a.k.a., the own-race bias, cross-race effect, other-ethnicity effect, same-race advantage) is one factor thought to affect the accuracy of facial recognition. Studies investigating this effect have shown that a person is better able to recognize faces that match their own race but are less reliable at identifying other races, thus inhibiting encoding. Perception may affect the immediate encoding of these unreliable notions due to prejudices, which can influence the speed of processing and classification of racially ambiguous targets. The ambiguity in eyewitness memory of facial recognition can be attributed to the divergent strategies that are used when under the influence of racial bias.

Weapon-Focus Effect

The weapon-focus effect suggests that the presence of a weapon narrows a person's attention, thus affecting eyewitness memory. A person focuses on a central detail (e.g., a knife) and loses focus on the peripheral details (e.g. the perpetrator's characteristics). While the weapon is remembered clearly, the memories of the other details of the scene suffer. This effect occurs because remembering additional items would require visual attention, which is occupied by the weapon. Therefore, these additional stimuli are frequently not processed.

Retrieval Issues

Trials may take many weeks and require an eyewitness to recall and describe an event many times. These conditions are not ideal for perfect recall; memories can be affected by a number of variables.

Time

The accuracy of eyewitness memory degrades swiftly after initial encoding. The "forgetting curve" of eyewitness memory shows that memory begins to drop off sharply within 20 minutes following initial encoding, and begins to level off around the second day at a dramatically reduced level of accuracy. Unsurprisingly, research has consistently found that the longer the gap between witnessing and recalling the incident, the less accurately that memory will be recalled.

There have been numerous experiments that support this claim. Malpass and Devine (1981) compared the accuracy of witness identifications after 3 days (short retention period) and 5 months (long retention period). The study found no false identifications after the 3-day period, but after 5 months, 35% of identifications were false.

The forgetting curve of memory: The red line shows that eyewitness memory declines rapidly following initial encoding and flattens out after around 2 days at a dramatically reduced level of accuracy.

Leading Questions

In a legal context, the retrieval of information is usually elicited through different types of questioning. A great deal of research has investigated the impact of types of questioning on eyewitness memory, and studies have consistently shown that even very subtle changes in the wording of a question can have an influence. One classic study was conducted in 1974 by Elizabeth Loftus, a notable researcher on the accuracy of memory. In this experiment, participants watched a film of a car accident and were asked to estimate the speed the cars were going when they "contacted" or "smashed" each other. Results showed that just changing this one word influenced the speeds participants estimated: The group that was asked the speed when the cars "contacted" each other gave an average estimate of 31.8 miles per hour, whereas the average speed in the "smashed" condition was 40.8 miles per hour. Age has been shown to impact the accuracy of memory as well. Younger witnesses, especially children, are more susceptible to leading questions and misinformation.

Bias

There are also a number of biases that can alter the accuracy of memory. For instance, racial and gender biases may play into what and how people remember. Likewise, factors that interfere with a witness's ability to get a clear view of the event—like time of day, weather, and poor eyesight—can all lead to false recollections. Finally, the emotional tone of the event can have an impact: for instance, if the event was traumatic, exciting, or just physiologically activating, it will increase adrenaline and other neurochemicals that can damage the accuracy of memory recall.

Memory Conformity

"Memory conformity," also known as social contagion of memory, refers to a situation in which one person's report of a memory influences another person's report of that same experience. This interference often occurs when individuals discuss what they saw or experienced, and can result in the memories of those involved being influenced by the report of another person. Some factors that contribute to memory conformity are age (the elderly and children are more likely to have memory distortions due to memory conformity) and confidence (individuals are more likely to conform their memories to others if they are not certain about what they remember).

Repressed Memories

Some research indicates that traumatic memories can be forgotten and later spontaneously recovered.