Hello. In this lecture, we are going to briefly discuss cognitive psychology in a historical context. Cognitive psychologists were the first to study human psychology in a scientific way. While the nature of the mind has been a topic for philosophers for as long as we have a written record, scientific investigation of the mind did not begin until the middle of the 1800s.

It was only with the establishment of the United States of America and a government that was not affiliated with the church did people find it possible to scientifically investigate issues that were, until that time, the provenance of God. As the waves of democratic principles began to take hold in Europe, so did the liberation of scientists from the religious doctrine. In this sense, cognitive psychology is inherently tied to the development of democracy as we now know it.

One of the most important early cognitive psychologists was Franciscus Donders. He investigated mental chronometry, or the timing of the mind. In other words, he sought to measure how long it took the mind to accomplish fundamental tasks. The dependent measure in such investigations is reaction time. In this case, it is the interval between the presentation of a stimulus and the production of a response.

The mind does many things in very short durations. Thus, the challenge is to measure how long each of these processes takes. In one of Donders' classic experiments, he sought to measure how long it takes for someone to make a simple decision.

Here, we see the modern version of the setup that Donders used. The stimulus is a flash of light displayed on a computer monitor. The subject's task is to press a button when he sees the light flashed.

There are two conditions of the experiment. In one condition, the subject simply has to respond to the stimulus. In the other condition, the subject must press the J key if the stimulus is on the left side of the monitor, or the K key if the stimulus is on the right side of the monitor.

Donders measured the reaction time in each condition. The important thing to note is that the condition in which a subject must decide on which side the flash occurred is slightly more complex than the condition in which the subject simply had to respond to the presence of the light. Namely, the more complex task required an additional decision.

Donders used his method of subtraction to determine how long the decision took by simply subtracting the time it took to perform the simple task from the amount of time it took to perform the task that also required the decision. The method of subtraction is widely used today. As you will see in our section on brain imaging, it is even used in

technically-sophisticated research.

Herman Von Helmholtz was a pioneer in the study of perception. Researchers interested in perception ask the simple question, how do we perceive the world? That is, what processes are involved in seeing, hearing, tasting, et cetera?

Helmholtz made a very provocative assumption, that what we perceive is influenced by unconscious assumptions that we make about the environment. This idea that there are unconscious influences on what we perceive preceded Freud's work by decades. Today, we know that our thoughts and behaviors are routinely affected by unconscious factors.

But why did Helmholtz suggest that unconscious inferences were necessary to perceive the world? Take a look at stimulus A. Almost everyone would agree that this stimulus consists of a gray rectangle in front of a white rectangle, like those shown in panel B.

However, there is no reason that the stimulus could not consist of the combination of shapes shown in panels C and D. In fact, there are an infinite number of possible combinations of shapes that could give rise to what is perceived in panel A. Yet, the mind naturally infers that the stimulus consists of a gray rectangle in front of a white rectangle.

The big idea here is that the stimulus in panel A is ambiguous, and the mind resolved this ambiguity in a manner that is most consistent with its past experience or its knowledge about how the world usually works. Over and over again in this course, the issue of the mind resolving ambiguities via inference will come up again and again. Indeed, the mind often infers things that are not actually present.

Hermann Ebbinghaus conducted the first experiments on learning and memory. He hypothesized that just because we cannot remember something doesn't mean that a memory for that information does not exist. To test this assumption, he used what is referred to as the method of savings.

This method requires a subject to memorize a list of items-- say, words. After a period of time, of course, subjects will forget what was on the list. The period of time is known as a retention interval. After the retention interval, subjects were asked to relearn the list of material.

What is typically found in an experiment like this is that it takes less time to relearn the list of material than it took to learn it the first time. This difference is used to compute savings. Savings is a proportion of time saved relearning the material.

Savings is the result of retaining some of the information that was originally learned. The figure on the right shows

some of Ebbinghaus' classical findings. It plots savings on the y-axis as a function of the retention interval on the x-axis. Savings decreased as the retention interval increased. That is, we forgot more and more over time.

However, what Ebbinghaus established is that almost everything that you will forget, you forget very quickly-- say, in the first day of retention. Interestingly, Ebbinghaus also established that the rate of forgetting is constant. The same proportion of the material that you forgot yesterday you'll forget tomorrow. It's just that there's less information for you to remember tomorrow. So the amount of information that is forgotten decreases, but the rate of forgetting remains constant.

Structuralism was a dominant way of thinking in the 1800s. The structuralists were fascinated by the progress made in chemistry in organizing the periodic table of atomic elements, which dictated how physical substances could be combined. The structuralist wondered if the mind could be understood in the same way. And they proposed that the basic building block of the mind was sensations.

They sought to organize sensations in the same way the periodic table organizes atoms, and thus understand how thoughts were constructed. The main technique they used to investigate sensation was introspection. The introspective method required trained subjects to describe their experiences and thought processes in response to stimuli.

Use of the introspective method gave rise to behaviorism. According to Watson, there were two main problems with introspection. The results were inconsistent, and the results were impossible to verify.

While Watson's criticisms of the introspective method were useful, the behaviorists went beyond that to conclude that it was impossible to study or understand the way the mind works. The behaviorists adopted three principles-- rejection of introspection, rejection of consciousness as a topic for investigation, and assumed that behavior is the only valid topic for scientific investigation.

Today, behaviorism usually gets a bad rap, but it it's important to appreciate the study of behavior is very useful. For instance, one of the best known and most influential proponents of behaviorism was BF Skinner. He introduced the methods of operant conditioning to better understand how the costs and rewards present in the environment influence behavior.

He proposed that if given the proper schedule of reinforcement, he could shape the behavior of anyone in any way he desires. What we would observe mostly in pigeons were occurrences of certain behaviors in response to reward or punishment. The cumulative response record then plots the total number of behaviors as a function of time

Skinner observed that these functions were scalloped. In other words, as a pigeon nears the time for a reward,

the frequency of the desired behavior would increase.

The figure on the right shows a similar cumulative response record for members of the US Congress. It plots the number of bills passed as a function of time. The rate of bill passage increases as Congress approaches vacation. Thus, members of Congress behave in a manner very similar to pigeons, rats, and other undesirable species--true story.

In the early 1950s, there was a great debate between BF Skinner and Noam Chomsky, a professor at MIT. Chomsky criticized Skinner's theory on the grounds that there was no way for reinforcement to explain how people learn language. The key observation was that children express language that they have never heard before. Moreover, we understand sentences and language that we have never heard before. Thus, Skinner's theory could not provide answers for one of the very hallmarks of being a human.

At this point, the cognitive revolution began. It was fortified by many communication scientists returning from World War II. Today, cognitive theory dominates psychological research. There is no area of psychological science that has not adopted the basic principle that the mind is a valid topic for scientific investigation.

Cognitive psychologists were the first to study human psychology in a scientific manner, true or false? The answer is true. Prior to cognitive psychologists, human psychology was in the domain of the church.

True or false, Donders' goal for using the subtraction method was to measure the duration of simple cognitive processes? The answer is true.

True or false, von Helmholtz believed that the mind perceives only what is in our present environment? The answer is false. Von Helmholtz believed that through processes of unconscious inference, that oftentimes what we perceived was not actually there.

The mind has a terrible time dealing with ambiguous information, true or false? The answer is true. Von Helmholtz proposed that through processes of unconscious inferences, that ambiguous information could be easily interpreted.

True or false, Ebbinghaus found that forgetting accelerates over time? The answer is false. Forgetting occurs at a constant rate even though we forget more and more information as the retention interval increases.

True or false, a key problem with the structuralist approach concern the methods that they used? The answer is true. Introspection proved to be an unreliable and invalid way of testing psychological hypotheses.

Skinner's debate with Chomsky led to the behavioral revolution. True, Chomsky observed that language could be

learned that had never been experienced before. Thus, reinforcement could not be used to account for how children learn language.