asgn1a -- INTRODUCTION:
What are Exercises and How Should You Do Them?

This first exercise tells you what these exercises are like and how you should do them. You should understand the answers to the following questions by the time you finish it.

- How will I get the material for this class?
- What are these exercises I have to do like?
- Why do we have these exercises?
- How should I do these exercises, and why?

**NOTE:** Grey areas, like the box below, supplement the main text with illustrations, examples, etc. *Text that is underlined and in italics* is usually a topic sentence. **Bold type** usually indicates important terms.

This is a comment a student wrote in fall, 1997 on the evaluations of the exercises that you will use for this class:

"I have taken this class before at another college. I got F's my first two tests, so I decided to take it over here. I got an A+ on my first test. What helped me is the beginning of the packet at the IU Bookstore that explained how to answer your questions." This exercise covers the same material.

This exercise explains how to use this on-line text to get the most out of it. The text consists of "exercises," like this one. They can help you learn from the material, not merely reproduce it (Kintsch, 1994). To do this, they have quiz questions every few paragraphs, which ask about the preceding material.

The questions help you:

- **pay attention** to what you are reading.
- **think about the material** you have been reading.
- **tell whether you understand** what you have read.
- with **prompt feedback** on your understanding, which is important because:
  - It guides you to understand the material better.
  - It helps you get the right answer the next time, if you take time to understand WHY your answer is wrong (or right, for that matter).

The exercises have links to further information about the topic, to a glossary, or to hints, which go to places in the exercise where answers to the questions can be found. Putting the cursor over a link changes the cursor to a pointing hand. Click to activate it. This link explains how to adjust a computer to decrease eye strain. This one gives information about Student Technology Centers. Except for hints, clicking on a link usually opens a new browser window. To return to the exercise, close the new browser window.

If you prefer to read from paper rather than from a computer screen, the course outline explains how to get a printable version of the exercises. If you use the paper version, **use it while you are logged into the exercises** on the computer. The paper version does not have the electronic features, especially the prompt feedback.

**Figure 1-1a summarizes the way to do the questions in the exercises.** After you read the question:

1. If you don't know the answer, go back (using hints, if available) to find the needed information.
2. If you think you know, enter your answer. At the end of the exercise you click the Submit button, and the computer grades it and tells you which questions you missed.
3. If you get a question wrong, find the information you need to get the right answer. **DON'T JUST GUESS!**
4. Get help from the class assistant or from me, if you don't get 80% correct in one or two tries. You are probably doing the questions the wrong way. You can reach us most easily by e-mail, using the links at the end of each exercise and from the class home page. **Unfortunately, e-mail is not always reliable.** If you don't get a response in a day or so, try again!
To respond to questions, click on the button by the answer you choose. A black dot appears in the button. To change your answer, click on the button by your new choice. IMPORTANT: After you make your choice, click anywhere else on the screen to prevent it from being changed.

Q1. The exercises have questions like this one ___.
A. to help you pay attention to what you are reading
B. to show you whether you understand the idea the preceding screens presented
C. to give you prompt feedback on your answers
D. to encourage you to think actively about the idea the preceding screens presented
E. A, B, C, and D are all correct

Shallow and Deep Processing (Craik & Lockhart, 1972): Studying for words or studying for meaning.

- **Shallow processing** involves doing something (mainly) with what the words or pictures look like, not what they mean. Memorizing a definition by rote (repetition) is rather shallow processing. It lets you remember (temporarily) what the words are, but not the idea they stand for. Figure 2-1a illustrates that simply repeating definitions, etc., leaves them isolated, leading to poor understanding and poor recall.

- **Deep processing** involves doing something with the meaning of information. For example, you use deep processing to link a definition to something you already know -- a mental structure you already have. This makes new information much easier to recall, because you can find it through its connections to things you already know. Figure 3-1a shows that deep processing connects several pieces of information to form an idea or concept. This kind of learning is based on elaborative rehearsal, because it elaborates on the material, connecting the pieces together and to what you already know. Creating and using such networks makes understanding and recalling new material much easier. This is what you need to do.

The next two questions have no direct connection to the preceding material. But if you understand from that material what deep and shallow processing mean, you can recognize the connection and find the correct answer. Just memorizing the words and their definitions won't help much.

Q2. [Mark EACH item True or False] In an experiment on memory (Bower & Clark, 1969), half the participants "memorized" (by rote repetition or maintenance rehearsal) a list of words. The other half made up a story using the same list of words. Immediately after finishing, both groups recalled almost all the words, but several weeks later the first group recalled less than 20%, whereas the second recalled more than 90%.

The second group remembered better because they ___.
T F A. did deep processing on the words in the list
T F B. memorized by rote the whole story instead of just the list of words
T F C. could retrieve the words on the list by recalling the story they created from information they already had
T F D. did deep maintenance on the words in the list

Hint for A: Hint for B: Hint for C: Hint for D

Q3. Guides in foreign countries sometimes memorize in English the stories they tell about the places they show. They actually know little English and do not really understand what they are saying. So if you ask such a guide a question not in his/her canned speech, s/he simply repeats the story, even though it is irrelevant to your question. This shows that ___.

A. you did not process what the guide said at a deep level
B. the guide learned the stories at a very shallow level
C. the guide learned the story by rote memorization
D. you were not paying attention to what the guide was saying
E. B and C are both correct
F. A, B, C, and D are all correct

Hint:
Students often ask instructors whether they need to know the details or is the "general idea" enough. I say I expect the "general idea," but that means understanding what concepts mean, not the vague impression that many students have in mind. Shallow processing stores a vague impression "general idea." Deep processing stores the meaning "general idea."

Q4. A test question gives new information and asks you to identify the idea to which it is related. The alternatives are worded differently than the original description. To answer such questions you must __. Hint
A. retrieve (almost) the exact wording of the idea from memory.
B. identify the general idea [= underlying principle] it fits best.
C. figure out what idea the question asks about. D. B and C are both correct E. A, B, and C are all correct

Memorizing terms and definitions is often a necessary starting point, but you also need to figure out what the words mean. Many people do quite well in school by memorizing terms and definitions, because the tests often ask them simply to recognize what they had memorized. Most college-level classes expect you to understand what the terms and definitions mean and use them in new situations.

If you have little background in a subject, you have to build a mental structure from scratch. Introductory courses can be harder than advanced courses -- mine certainly were -- because it's hard to build new mental structures. In advanced courses, you have mental structures to which you can link new information.

Pre-existing mental structures can interfere with learning new material, if they disagree. Unlearning existing information is difficult. When new information confronts an incorrect mental structure, the new information is often changed to fit the mental structure, and not the other way around. As a dean at Arizona State University put it: "Facts are negotiable; perceptions are rock-solid."

When I first learned about nerve cells, I changed what the instructor said to fit what I "knew": cells are small. When he said that some nerve cells go from your feet to your brain, up to five or six feet, I figured he meant that a whole long string of little cells hooked together was five or six feet long. Only after another class, when I learned why they were so long and a bit about how they worked, did I get the idea that single nerve cells really could be more than 6 feet long.

All the natural sciences have conflicts with what people "know" about the world, even physics (McCloskey et al., 1983). The problem is especially common in psychology, because most people are competent practical psychologists. We create explanations with our intuitive psychologies, but these explanations are too often incorrect. (Gilovitch, 1991)

Q5. [Mark EACH item True (T) or False(F)] If you figure out and understand the meaning of the ideas in the preceding material, you are more likely to recall them on an exam because ___.
T F Q5A. you have changed the new information to fit your existing mental structure
T F Q5B. you can find the idea in memory by its connections to other information
T F Q5C. the material got more rote rehearsal while you were figuring it out
T F Q5D. you saved specific details about the form of the material you read
T F Q5E. you constructed a new mental structure for the new information or added it to an existing one

Hint for A; Hint for B; Hint for C; Hint for D; Hint for E

Link to more suggestions on how to do the exercises.

Finally, get help promptly if you are having difficulty doing the quiz questions. Getting people to get help is like pulling teeth. I half-understand why, but if you want/need to do better, please get over whatever holds you back from getting help. The class assistant and I can show you more efficient ways to study.

Come to help sessions for this class (see the course outline and announcements on the class home page for times, dates, and places), come to office hours, or make an appointment with one of the class assistants or with me. We can help quite a few people (unfortunately not everyone) be more successful.

Q6. If you have trouble doing the exercises and the tests, you should ___.
A. drop the course B. do nothing til the last week of classes, then plead for extra credit to get a passing grade
C. get a tutor D. complain to your RA E. complain to the dean F. get help from the assistants or from me
The chief aim of science is not to open a door to infinite wisdom, but to set a limit to infinite error."  
-- from Galileo by B. Brecht

... science [is] actually a process not of "getting it right" but rather one of perpetually "getting it less wrong." -- Paul Grobstein

This exercise introduces the basic ideas of the scientific approach. This exercise emphasizes:
- the fundamental roles of observation and theory
- the necessary incompleteness of scientific knowledge and understanding.

The exercise presents some basic ideas about theories and models in science. It explains:
- What theories and models are and how they depend on data (observations, "facts").
- How data are used to select among competing theories and models.
- That a good theory or model is one that makes specific predictions.
- That because good theories and models make specific predictions, they are testable and disprovable:
  - If a theory or model makes a prediction that is not confirmed, the correctness of the theory is put into doubt. The more different incorrect predictions a theory makes, the less confident you can be that it is correct.

When you have finished this exercise, you should be able to explain what a good theory is and recognize examples of good and of poor theories. You should understand how data are required to select among competing theories. You should understand why models are used in scientific research.

Explanations: what sets scientific explanations apart from other kinds of explanations.

People everywhere try to explain and understand the world in which they live. Each cultural group has its own stories -- usually called myths -- to explain their world and everything in it: the plants and animals, the weather, growth, death, etc. The explanation uniquely associated with the modern technological world comes from the natural sciences. Link to some definitions of myth

The natural sciences originated from philosophy in European universities during the Middle Ages as a particular form of philosophy, called natural philosophy. It differed from traditional philosophy because used observation of the natural world as its philosophical tool. An important stimulus to its rise was the translation of Islamic and Greek texts into Latin, the common language of European scholars of the time (Grant, 1997).

The natural sciences eventually broke away from philosophy and became independent disciplines: first astronomy and physics, then chemistry, then biology, and most recently psychology. Until well into the 20th century, many colleges and universities had psychology as part of philosophy. Most colleges and universities group academic subjects into three categories: the natural science, the social sciences, and the humanities. The word Psychology is used in all three of these areas. This workbook uses almost entirely the natural scientific approach.

The scientific approach makes a fundamental assumption: the natural world follows lawful natural processes, which can be explained by theories based on observation. Because they describe lawful processes, scientific theories used to be called "laws of nature," like Newton's three laws of motion.

Scientific "laws" describe (say what does happen); they do not prescribe (~say what should happen). They use objective data to describe how nature actually works; they don't say how nature should work. Laws made by Congress, state legislatures, etc., are prescriptive. They prescribe (~tell) people how they should behave. This difference is important. In 1897, the Indiana Legislature considered a bill to establish the "true" value of pi (the mathematical constant that describes the relation between the diameter of a circle and its area and perimeter). The legislator who introduced the bill did not understand that legislated laws say what should be, whereas mathematical "laws" describe what is. Link to information about pi.

The scientific approach looks for lawful natural processes as causes. The scientific approach to psychology looks for the causes of behavior in genetic and environmental processes. "Cause" is not a simple idea (Killeen, 2001), but the common sense
meaning usually works adequately -- something that acts on something else to change it -- will be satisfactory here. For example, people who study with deep processing recall information better than do people who do shallow processing. This result fits the idea that deep processing is a cause of better recall.

The important thing to understand about causes in psychology is this: Any specific behavior has many causes. Something seemingly as simple as eating is affected by several physiological (body function) factors, by several psychological ones, like learning, expectancies, social processes, etc. (see asgn4n-p).

The natural sciences are only myths so they aren’t true
Q1A. T F
Q1B. T F claim that nature follows lawful processes
Q1C. T F provide true explanations
Q1D. T F try to find causes in lawful natural processes

Theories, Data, Hypotheses, and Models

Data (singular = datum) are "facts" obtained from systematic well-controlled observations. The words "data" and "facts" mean about the same thing, but "fact" often means something stronger and more certain than does "data." Therefore, scientists usually use "data" and avoid "facts."

Theories are the "laws" or concepts that organize existing data and predict new data. The more different kinds of data a theory organizes and the more specific predictions it makes, the better the theory is.

Successful scientific theories provide explanations for natural phenomena. They explain them by organizing many different kinds of data, showing the relation among them, and predicting new data.

For example, the theory of thermodynamics explains the heat of a pot of water as reflecting the average kinetic (movement) energy of the molecules in it. The theory of the genetic code explains genetic transmission from one generation to the next as the action of long strands of DNA. These are all enormously successful theories.

Psychological theory is far more primitive and is far more limited. For example, retrieval failure theory explains forgetting as the result of poor coding of the information and/or poor retrieval cues. Like all useful scientific explanations, these three examples show how underlying processes produce the phenomena they describe. This is true for any useful explanation.

Match the term to the alternatives that go with it. D = data, T = theory

Q2A. D T observations
Q2B. D T explanations of observations
Q2C. D T organize the results of observation and predict what new observations will show
Q2D. D T like “facts,” but not so strong

It is very important to understand the difference between data and theories and how they are related. Data ("facts," observations, measurements, etc.) are things that actually can be observed, counted, measured, etc. For example, how many drops of sugar water a rat drinks, your score on this exercise, how tense your muscles are and how moist your hands get when you speak to a group all can be data.

Data are important because they provide the only way of testing scientific theories. To test theories you find out how well they predict new data and organize existing data. Theories are attempts to organize data with some more general or abstract processes.

For example, the glucostatic theory of hunger states that hunger as measured by amount eaten depends on levels of blood glucose (blood sugar). It provides a possible explanation for why eating starts and/or stops. Intelligence is a theoretical process that is supposed to explain (partly) why people are different in how well they do in school, etc. Anxiety is a theoretical internal processes assumed to show up in increased muscle tension, perspiration, blood pressure, trembling, and statements like "I feel anxious."

Mark the following with a T if it is a theoretical explanation or with D if it is data that could be used for (or against) an explanation.

Q3A T D Morris falls asleep in an average of 11 minutes after his psychology class starts.
Q3B T D Boredom is a mental process that occurs when people receive too little stimulation.
Q3C T D Forgetting is a failure to retrieve (find) information in memory.
Q3D T D The average recall for a list of 40 words is 18 if observers get no cues and 29 if they do get cues.
Theoretical terms and concepts in psychology can never be observed directly, because they are inside your mind/brain. They can only be inferred from behavior using operational definitions.

Inference means to figure out something that you can't observe directly from the traces or effects it produced. For example, you can infer from tire tracks on your lawn that a car or truck drove on it. An expert can infer the kind of tire and even the kind of vehicle from just the tracks. In the same way, inferring mental processes from behavior means that you figure out what mental processes occurred from what people and other animals do in different conditions. You can't see the car that made the tire tracks, and you can't see the contents on another person's mind. Link to further explanation of inference.

Mark each example with I if it is an inference or O if it is an observation.
Q4A I  O Sally is an intelligent person.  Q4B I  O Ed got 33 out of 36 questions on the test correct.
Q4C I  O Stan is depressed.  Q4D I  O Joan cries easily and says that she is a worthless person.

Which of the following could be an operational definition of anxiety level?
Q5A T F the dictionary definition  Q5B T F how much a person's hand perspires and trembles
Q5C T F a properly constructed psychological test of anxiety  Q5D T F a survey of the definitions people use

The word "theory" is often used in other ways, especially as meaning "not supported by fact." The basic meaning of "theory" is the exact opposite. Good scientific theories must be strongly supported by "facts." "Theory" is also used to mean an educated guess about the cause of something. Such educated guesses are more accurately "hypotheses."

For example, after the recent space shuttle disaster, the news media described “theories” about the cause. One was that a piece of foam insulation damaged the protective shield. This was an educated guess about the cause of a specific event [which has since been strongly supported]. It is a hypothesis, not a theory by the proper definition.

Hypotheses (singular = hypothesis) are educated guesses. Often a hypothesis predicts what will happen under particular conditions. Such hypotheses take the form: If A happens, then B will happen. For example, Gordy hypothesizes that if he is on his best behavior for several days, then his parents will let him drive up to see the Stones concert.

People also make hypotheses about possible causes of something. For example, Sheila suddenly stops talking all the time about Tom. You may hypothesize that Sheila and Tom have broken up.

Hypotheses can come from anywhere: your intuition, your general knowledge, things you notice, an analogy to something you know about (e.g., in 1662, René Descartes' idea of reflexes came from an analogy between the fluid system that activated robots and how reflexes work, (see asgn1d). The most useful hypotheses usually come from good theories. For example, Newton's laws of motion predict that the force with which a baseball hits the catcher's glove depends on the ball's mass and acceleration. Mendel's theory of heredity predicts that a genetically controlled trait can disappear in one generation and reappear in the next.

Q6. In the natural sciences, “Theory” means ___.
A. contrary to fact  B. a small set of ideas or concepts that organize a lot of data and predict new data
C. a possible explanation of a specific observation or event  D. A, B, & C are all correct

Hypotheses (singular = hypothesis) are educated guesses. Often a hypothesis predicts what will happen under particular conditions. Such hypotheses take the form: If A happens, then B will happen. For example, Gordy hypothesizes that if he is on his best behavior for several days, then his parents will let him drive up to see the Stones concert.

People also make hypotheses about possible causes of something. For example, Sheila suddenly stops talking all the time about Tom. You may hypothesize that Sheila and Tom have broken up.

Q7. Which of the following is NOT correct? A hypothesis can be ___.
A. a prediction about the outcome of an experiment  B. a proof of a theory
C. created from things you happen to know about  D. a possible explanation of something
E. A, B, C, & D are all correct
Scientific Models

A model is a simplified version of the real thing, with which it shares some important feature. For example, model airplanes look like real airplanes, and many of them fly. But they are much simpler in every other way. Scientific models are also simplified versions of natural processes. Because models are much simpler than the real process, they are much easier to study. They let scientists and engineers study processes without interfering effects from other features of the real thing.

Scientific models take many forms: physical models, like model airplanes, mathematical models, animal models, computer simulations, analogues, etc. For example, starting with the Wright brothers, models played a crucial role in developing new aircraft designs. Engineers and scientists used physical models in wind tunnels to find out how a design would fly under different conditions. When large, high-speed supercomputers became available, mathematical models replaced the physical ones.

Most scientific experiments are simplified models of the processes they try to study. They simplify by isolating the process of interest from other processes that usually go along with them. For example, chemistry studies unnaturally pure chemicals in unnaturally simple and well-controlled environments to understand a process that usually is mixed with other processes in the "real world."

Figure 1-1b illustrates the overlap between models and the thing they are intended to model. Note that the model overlaps the real thing in the feature that the researcher intends to study but not in most others. Link to more explanation of scientific models.

Q8. A scientific model, like an animal or a mathematical model, ___.
A. simplifies a complex system or problem  B. is not guaranteed to act like the real process to be modeled
C. must be like the system it models in most, if not all, its features  D. A and B are both correct  E. A, B, and C are all correct

Psychology and the biomedical sciences often use animal models. By far the most frequently used animals are specially bred laboratory mice and rats, though animals ranging from bacteria to fruit flies to monkeys are also used.

The laboratory rat model has several advantages for psychological research, among them:
• Rats are much simpler animals than are humans.
• Rats grow up much faster and are easy to care for.
• A lot is known about the rat's physiology and behavior, more than about humans.
• The rats' environment can be controlled quite well.
• Researchers can use procedures with them that are unacceptable with humans.

It has one main disadvantage:
• It may not be valid (~appropriate). For example, rats are used to study effects of stress, but they may react to stress differently than do people. So the rat may not model stress reactions in humans well.

The use of animals in research has become a very controversial ethical question in the past quarter century. Some people say that ethically animals are no different from humans. Therefore, they have the same rights as humans.

Others, including most scientists, say that humans have a responsibility to treat animals with care and respect in all situations, and research procedures must minimize harm and discomfort as much as possible. Link to a discussion of the controversy about animals in research. Link to a debate about animal research in set of articles in Scientific American (Feb., 1997). Link to an article about the ethics of animal research.

Answer to Qx. Psychological processes are all inside your mind, only you have any direct access to your mind.
The Scientific Process

Scientific theories develop through the interplay of data from observations and theory. Unlike other kinds of explanations, scientific theories are continuously tested by observation. They change when they fail to organize and predict new data. This feature of systematically testing theories with data and changing them makes the scientific "myth" different.

The fate of two controversial ideas proposed in the mid-80s illustrates the fundamental importance of data (Palevitz and Lewis, 1997). Stanley Prusiner proposed a controversial explanation for Creutzfeld-Jakob disease and its close relatives. (One of them, "Mad Cow disease," has been in the news for several years, starting when it spread among cattle in England.) Prusiner proposed that proteins, which he called prions, causes these diseases. This idea was so controversial because infectious diseases are caused by bacteria or viruses, all of which have DNA or RNA.

At about the same time, Peter Duesberg, an eminent virologist, proposed that the HIV virus did not cause AIDS. Rather, the immune suppression, which is basic to AIDS, is the result of life-style. Since then, data have supported Prusiner's hypothesis. They support it so well that Prusiner was awarded the 1997 Nobel Prize in Physiology or Medicine. Link to a description of Prusiner's work. In contrast, data have failed to support Duesberg's hypothesis and still support the role f the HIV virus. Most AIDS researches now ignore his hypothesis.

Q1. Scientific explanations ___.
A. are different from other kinds of explanations because they change when they can’t fit the new observations  
B. are tested against new observations  
C. assume that nature is lawful  
D. A, B, and C are all correct

If a theory cannot be tested against data, it is almost certainly useless as a scientific theory. This requirement of testing makes scientific explanations unique. For example, many people think that Freud's theory of psychoanalysis is a poor one, because it can explain almost any observation. Link to an example of testing a prediction.

Q2. Kevin has a theory that little green people in digital clocks run them. Kasey is skeptical so she suggests they open one up to see them. Kevin says the little green people are very shy and hide. Every other test Kasey proposes Kevin says won’t work. Kevin's theory is a very poor scientific theory because ___.
A. it's wrong  
B. Kevin is stupid or nuts  
C. it can’t be tested  
D. no one else believes it  
E. both A & B

The scientific process is about testing theories against data. It has five steps, summarized in Figure 2-1b.

- getting data by observing under well-controlled conditions what happens in the world.
- developing a theory (or models) to organize (~”explain”) the data.
- Using the theory to generate testable hypotheses
- checking the theory against these hypotheses with further observations (testing the theory against new data). This process repeats over and over to improve the explanations, not 10 times, not 100 times but indefinitely.
- Revising (or discarding) the theory if new observations don’t fit its prediction

This continuing interplay between data and theory is an important feature of why the natural scientific approach is unique.

Q3. Which of the following is the most important in the scientific process?
A. making observations to get data.  
B. figuring out an explanation for the data.  
C. testing the explanation by getting more data.  
D. arriving at a final explanation.  
E. A, B, & C are all required.  
F. A, B, C, & D are all required.

The process of testing and refining theories never finishes, because scientific theories are never completely proven (not even Newton's spectacularly successful theory of universal gravitation, which has been around for 350 years). Some uncertainty always remains for every scientific
theory, no matter how successful. Most important, new data may reveal completely new and unexpected phenomena (~what you perceive), which require changes in existing theories or the creation of new ones.

The most famous example of a true scientific revolution occurred in physics at the beginning of the 20th century, shortly after physics had been declared complete. The discovery of radioactivity and the development of quantum theory and of relativity theory totally changed modern physics. More recently, stomach ulcers were found to depend on a bacterial infection. This disease had long been treated as abnormal stomach acid function. And reevaluation of their fossils indicates that Tyrannosaurus was more likely a scavenger than a ferocious hunter.

Q4. When is a scientific theory considered proven correct?
A. After at least 100 cycles through the testing process.  
B. When logical study shows that it is proven.  
C. When it explains the available data and makes useful predictions 
D. Never, because scientific theories always may be revised based on new ideas and data  
E. Strictly, only D is correct, but C is also used casually

Objective Data

Any scientific theory must be based on such objective data. Objective (~unbiased) data come from observations that, in principle, anyone could make, (if s/he has the needed equipment and knows how to use it).

Unfortunately, people are not objective observers, even when they try. We all have biases and expectations, which make us perceive selectively what we want and expect to perceive. The scientific approach can work around this human limitation. Different people have different biases, which lead to different ideas and different ways of getting and looking at data. Eventually individual biases and expectations tend to cancel each other out. Therefore, diversity of thinking should be a very important value for science. Unfortunately, too often it isn't.

For example, Garcia (1981) described the problems he had when he first reported new and very unexpected findings. Garcia showed a strong association develops following a single pairing of a flavor and nausea, even when the nausea starts hours after the flavor is tasted. This is much faster learning and a much longer time interval between the stimuli that were associated than anyone had reported before. The scientists who evaluated the paper found all kinds of objections based mostly on what they "knew" about learning association, not on Garcia's manuscript and its data.

Dement (2000) had the same experience when he tried to publish the first report of REM sleep, which we now know is linked to dreams (see asgn4i, j). The EEG ("brain waves") that shows this condition look almost exactly like the EEG during waking. The editor's and referees' biases, based on what they "knew" about sleep, made them assume that this medical student had mixed up his records.

Q5. Data are objective when __; Theories are scientific when they __. Hint
A. they describe objects, not actions;   are correct  
B. anyone could (in principle) observe or collect them; organize and predict objective data  
C. they are obtained using instruments like microscopes;   are mathematically expressed as equations  
D. they use logic to tell how the natural world is organized;   fit the rules for logic  
E. the people who collect them are objective;   are created by people who are objective

Testing a theory against data

To test a theory you make a specific prediction from it and see whether the prediction is correct. A very early example of such a test is a clear example. In 1662, Descartes (see asgn1d) proposed a hydraulic theory of muscle shortening. He claimed that muscles bulge out and shorten when their nerves fill them with a fluid as part of his theory of reflex action, as shown in Figure 3-1c.

Swammeerdam and Glisson both tested this prediction and showed that it was wrong. Glisson’s experiment illustrates testing a theory’s prediction. Glisson realized that Descartes’ hydraulic model makes the following prediction:

![Diagram of prediction from Descartes' theory of muscle shortening by filling with "nerve fluid.

Figure 3-1c. Diagram of prediction from Descartes' theory of muscle shortening by filling with "nerve fluid."
If muscles flex because they fill up with a fluid then they must increase in volume (get bigger).

He then figured out a way to test this prediction. He measured whether muscles do actually get bigger by having a man flex his arm muscles in a container of water. By Archimedes' principle,

If the muscles actually got bigger, then the water level in the container would rise.

Careful measurements from this simple experiment showed that the water level did not rise measurably, so the muscles do not get bigger when they flex. Descartes' hydraulic model cannot account for (explain) this fact, so we can reject the model as wrong. (We now know that muscle fibers get shorter to produce force, but they do not change volume [get bigger] when they flex.)

Q6. Descartes' hydraulic model of how the mind makes the body react is no longer used because __.  
A. it is wrong  
B. we have technologies that are better than hydraulics  
C. muscles don't get measurably bigger when they flex, which Descartes' model requires  
D. most scientists do not accept Descartes' idea of dualism  
E. A, B, & C are all correct.  

Important: Take a minute to think about this question and the text above it. That should let you get it correct on the first try. If you don't, and especially if you don't understand why the correct answer is correct, please, please, please come to a help session or make an appointment to see one of us individually! This is the kind of question you need to understand to do well in this class and in college in general.

Q7. To test a theory, you __.  
A. figure out what it says will happen under some specific conditions  
B. measure what happens under those specific conditions  
C. compare what happened under those specific conditions with what the theory said would happen.  
D. A, B, & C are all correct  

Link to a brief description of the way new theories develop.

Asgn1d -- HISTORY: Development of the Scientific Approach to Psychology

The next three exercises give a definition of psychology as a scientific discipline and describe how it originated. This very brief history describes mainly the origin of the "tools" that are special to the natural scientific approach in psychology. To make it clearer, the story is necessarily very oversimplified and distorted.

This brief history emphasizes that "doing" psychology changed from observing the contents of your own mind to objective methods that measure behavior: what people and (other) animals do. You should understand the answers to the following questions when you've finished it.

- What is the modern definition of psychology? Why is it defined this way?
- What are the basic features of a scientific approach to psychology?
- How did a scientific approach to psychology develop?

The following assignments give a very brief, very selective outline of psychology's short history. It emphasizes the development of the empirically based (based on observation), scientific psychology.

All scientific disciplines evolved from philosophy. However, except for René Descartes, this summary leaves out all the philosophers and thinkers who contributed the psychology's long past. It leaves them out because their way of "doing" psychology was largely thinking about what they observed in their own minds -- a process called introspection. (~ directly inspecting the conscious content of your own mind; “intro” = inside; “spect” = looking, inspecting; see below) In contrast, modern scientific psychology depends on systematic observation under the best controlled conditions possible.
Origins of Modern Psychology

The French philosopher, René Descartes (1596-1650), proposed that living things work like machines. The word "machine" is used in a very general sense: anything that can do work. Hammers, levers, pumps, etc., are machines, just as automobile and drill presses are machines. This idea opened the way to modern biology and eventually to modern psychology.

The story goes that Descartes got this idea during a visit to the Royal Gardens of Versailles (a 17th century Disneyland for the King of France's court). There he saw robots and heard music activated by water pressure when a person stepped on hidden valves (Watson, 1968). This suggested to Descartes that the nerves in the body are tubes carrying fluid to make the body work as the robots at Versailles did.

Based on this idea, Descartes proposed that the nervous system works like a hydraulic machine. According to his model, nerves were thin tubes that carried information by a fluid. (This idea is incorrect as explained in asgn1c.)

Descartes’ drawing, shown in Figure 2-1b, shows a burning stimulus from fire pushes a fluid through the nerves to the brain. The diagram does not show the next steps: Valves in the brain send the fluid back down nerves, which fills up those muscles and makes them get fatter but shorter. Making the muscle shorter makes the leg move away from the fire, which removes the burning pain. This model describes the modern concept of the reflex, except of course that neural signals and muscle fibers have replaced the fluid and the valve. Modern psychology extended this idea to mental processes. So, if the mind is like a machine (like a telephone switchboard or a computer, for example), then mental processes also can be described by natural laws, just as physiological processes of the body can.

Q1. How has modern psychology used Descartes’ idea that the body works like a machine?
A. to exclude mind from scientific study and restrict psychology to the study of behavior
B. to explain the mind as a cluster of reflexes
C. to make psychology a part of physiology
D. to justify looking for lawful processes in mental and behavioral processes
E. B and C are both correct

Descartes proposed a second idea that also has had a strong effect on psychology, though more in the reactions to it, rather than the idea itself. He claimed that mind and body are completely different. The body is material (made of matter, which you can see or touch), because it takes up space. Because the body is made of matter, it can be described by the same physical and chemical laws that describe all matter. The mind, which Descartes believed only humans had, is not made of matter, because it does not take up space. Therefore, the mind does not follow natural laws. This idea is called Dualism.

Nevertheless the non-material mind can control the material body, because the mind connects with the body through the brain. Most scientifically oriented psychologists reject Descartes’ separation of mind and body. Link to an article on the development of the "mind-body problem."

The modern approach to psychology may not be as much fun as the late-night speculations and opinions that try to pass as philosophy, but it works. The following links connect to sites that describe some applications of psychological research based on the natural scientific model:

- Anxiety and panic disorders
- Airplane safety
- Behavioral factors in heart disease
- Model of the biology of fear
- Abstract of an article showing long-term effectiveness of behavioral treatment of autism

What is psychology?

Here are some definitions of psychology that different ways of thinking about and studying psychology. They show psychology's shift from examining the contents of one's own conscious mind to studying behavior to making inferences (~figuring out) about how mental processes work.
Q2. Scientific psychology started out __. Today most psychologists define it as the study of __.
A. assuming that mind creates the body; the mind as part of the body
B. studying conscious experience; mental processes inferred from what animals and people do
C. studying what consciousness does; studying what behavior does
D. studying conscious experience; the mind

Q3. Inferring mental processes from behavior means to figure out __.
A. what behavior will be from what's in the mind
B. the mental processes that produce behavior
C. the structure of the mind from its adaptive function
D. the adaptive function of the mind from its structure

The beginning of a scientific psychology.

Psychology began to separate from philosophy in 1879 when Wilhelm Wundt (1832-1920) published the first textbook for psychology and established the first psychological laboratory at the University of Leipzig. His laboratory adopted an experimental approach to the study of the mind, instead of the traditional philosophical approach of logical thought about the mind.

Wundt said that the content of consciousness was psychology's special subject. To study consciousness much experimental work in Wundt's laboratory used introspection. In this method trained observers reported the content of their minds under well-controlled conditions in response to well-specified stimuli. From these reports early psychologists tried to develop a theoretical description of the mind’s structure. Hence, the name Structuralism, an approach especially championed by Wundt's student, E. B. Titchner. Link to more information about Wundt and Structuralism.

Q4. Which of the following is the best example of introspection?
A. measuring how quickly you can name objects you recall in a test picture immediately after seeing it
B. measuring how quickly you can name the objects you see in a test picture
C. describing what is going on inside your mind when you look at some test pictures
D. measuring how quickly you can count all the objects you see in a test picture

Introspection is not a useful research method because it provides subjective data about what is in an observer's mind. Introspection is subjective because it is private: no one else can observe that observer’s mind. Therefore, when observers disagree about their mental introspections under the same conditions, their differences cannot be resolved.

For example, David says that [his] consciousness has no sense of self – only as series of sensory impressions. Gabriel says that [his] consciousness has a strong sense of self during these sensory impressions. Who is right? David? Gabriel? Or both, for themselves? We can’t tell. Furthermore, introspection cannot be used with non-verbal subjects, because they cannot report what introspections they might have. This excludes infants and very young children and all other kinds of animals from psychological study by introspection. Finally, most mental processes turn out to be unavailable to consciousness, as asgn4c explains. Link to an explanation of the problems with introspection as a scientific research tool.

Q5. What is the basic problem with introspection? What is in your mind __.
A. is not something that other people can observe
B. cannot be described objectively
C. can be observed only by you
D. A, B, & C are all problems

The first modern psychologist. Soon after Wundt founded the first psychological laboratory, Hermann Ebbinghaus, (1850-1909) started the experimental study of memory, even though Wundt had claimed that memory could not be studied experimentally. His general approach, described his classic book Über
Ebbinghaus developed research methods that had most features of modern methods. 

- He used nonsense syllables (like KIG and VUD) to avoid individual differences in familiarity with words, because he wanted to study the process of memory in general. He assumed that nonsense syllables are equally familiar to everyone.

- He tested memory under the same, well-controlled conditions.

- He tested only one possible effect on memory at a time. For example, he varied the time between learning a list of syllables and recalling it from a few seconds to a week. He kept everything else in the test situation the same. This showed how memories are lost, with everything controlled except the passage of time.

- He averaged the results from many trials to even out effects of chance on individual trials.

Q6. Ebbinghaus used methods like those modern experimental psychology uses. He __. 

A. tried to control error by avoiding meaningful stimuli  
B. controlled for error by averaging results over trials  
C. made objective, quantitative measures of memory performance  
D. measured how long relearning took, something that anyone can measure  
E. B and D are both correct  
F. A, B, C, and D are all correct

The beginnings of American psychology.

William James (1842-1910), the godfather (if not the father) of modern American psychology, was very interested in the new, experimentally based scientific psychology, but his great strength was acute observation of everyday events, detailed knowledge of the scientific and philosophical literature about the mind, and clear thinking about them. His writings still provide the origins for many currently active areas in scientific psychology.

Unfortunately, very few people can observe and think as clearly as William James did. The rest of us need the discipline of systematic methods of observation.

James was trained as a physician and taught anatomy and physiology at Harvard University before following his true interests into psychology and later philosophy. He established a teaching laboratory for psychology in 1875 and published his influential text, Principles of Psychology, in 1890. This textbook shaped much of American psychology and can still be read for important insights into mental processes as they are studied today. True to his pragmatic philosophy, James did not limit himself to a single approach. He used whatever helped him understand mental and behavioral processes.

James set the stage for Functionalism, which developed in North America at the beginning of the 20th century. Functionalism was interested in the adaptive function of mind -- what mental processes did to help individuals adapt to demands of their environments. This goal reflected Charles Darwin's theory of evolution by natural selection.

According to Darwin, individuals with traits that help their adaptation to their environment will reproduce more successfully (have more children). Therefore, genes that affect those traits become more frequent in following generations. Darwinian theory requires that the mind have some adaptive advantage that increases fitness. (See exercise asgn1p.)

Because Functionalist psychologists were interested in adaptive function rather than mental content, they studied the effects of mind as they appear in what individuals say and do. In other words, they studied behaviors. This let them study subjects that cannot speak. Therefore, much Functionalist research studied animals. Because of its use of behavioral
measures, Functionalism provided the foundation for John B. Watson, who started out as a Functionalist, to develop Behaviorism.

For example, when he was still a functionalist, Watson studied nesting behavior in sooty terns, seabirds that nest in large groups on sandy beaches of Caribbean islands. To learn how the birds could find their own nests, he systematically varied features of nests and their surroundings. He showed that they used visual landmarks around their nests and a fixed path to it, because removing or changing landmarks around a nest was the only change that disturbed the birds’ ability to find it.

Q7. Functionals studied how the mind __.
A. functions (~works) rather than what it contains
B. can do mathematical functions
C. from what people and (other) animals did, not from their reports of mental experience
D. helps adaptation
E. A, C, & D are both correct

In his *Principles of Psychology* (1890), William James defined psychology as "the science of mental life." Less than 25 years later John B. Watson (1878-1958) defined psychology as "the science of behavior" in a paper, *Psychology as the Behaviorist Views it* (1913). This definition describes Behaviorism, which dominated American psychology for the next 50 years.

**Behaviorism substituted behavior for the mind as psychology's subject, because behavior can be observed objectively, but mind cannot.** Here are some examples of objective observations: Anyone can observe whether a person smiles or frowns, trembles, and perspires; what a person says, recalls; etc. With proper equipment and training, anyone can measure whether a person's EEG ("brain waves") shows waking or sleep patterns.

Q8. Watson rejected William James' definition of psychology as the science of mental life because __.
A. mental life cannot be observed objectively
B. only you can observe directly your own mental life
C. (in principle) anyone can observe scientifically acceptable data
D. scientific data must be public
E. A, B, C, & D are all correct

Furthermore, Watson claimed that simple reflexes and learned associations among them are basic to all behavior. He used conditioned reflexes, which I. P. Pavlov (1849-1936) had recently studied and described, as the model for associations (see asgn3a-c).

Watson's (and Behaviorism's) approach fit the philosophical approaches to knowledge called **empiricism** and **associationism**.

**Empiricism states that knowledge of the world comes through sense experience.**

**Associationism states that stimuli that occur together become connected.** So if one stimulus happens, it activates the traces of other stimuli associated with it.

Q9. Behaviorism is closely tied to the idea(s) that what people and animals do__.
A. is based on experience
B. the philosophical idea of associationism
C. is based on learning with conditioned reflexes
D. the philosophical idea of empiricism
E. B & D are both correct
F. A, B, C, & D are all correct

**Behaviorism treats language like any other behavior.** It is a response with no special status other than its exceptional flexibility. In contrast, introspection assumes that language provides direct access to
mental processes, and "common sense" agrees. The evidence supports the behavioral approach. First, most mental processes are not conscious, though their products often can be. Second, people often don't report mental content accurately. Sometimes social desirability leads people to modify what they say about mental content. Sometimes the distortions are quite unconscious. Third, the way questions are phrased can create big changes in the way people answer them.

Q10. A Behaviorist uses language __.
A. as the only way to study mental processes
B. like any other response
C. to make inferences about behavior
D. not at all because it is part of mind which they say does not exist

asgn1d-- HISTORY: Body and Mind as "Machines"
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asgn1e -- HISTORY (cont.)

At the same time American Behaviorism was rejecting Wundt's attempt to study conscious content, Gestalt psychology in Germany was also rejecting Wundt's approach, but for a very different reason (Boring, 1950, p. 587ff). Gestalt psychology emphasizes the interrelation among different parts of the stimulus world in perception, cognition (~thinking, mental processes), and action.

The German word "Gestalt," has become a word in English, meaning the overall configuration (~pattern or picture). This name indicates what Gestalt psychologists believed was fundamental in mental processes: the pattern or organization (~configuration) of information.

Primarily students of visual perception, Gestalt psychologists rejected the idea that mental processes can be broken down into elements. Rather, they believed that psychology's task is to discover how the information that reaches the senses becomes organized into the perception of objects against a ground.

Consider a blue sky with a large white cloud. The cloud forms a figure against the (back)ground of the sky. A bird flies in front of the cloud. Now the cloud forms the ground for the figure of the bird. Gestalt psychologists tried to discover principles or laws that explain how objects, like the cloud and the bird, get organized as figures against a ground, like the sky or the cloud (asgn2r has more on the Gestalt approach).

Gestalt psychology is associated with Nativism, a philosophical position which claims that basic knowledge is built into the way the mind (brain) is organized. Gestalt psychologists believed that the organizing principles that segregated figures from the background were built into the brain.

Q1. Gestalt psychology objected to Structuralism for different reasons than did Behaviorism. Gestalt psychology claimed that __.
A. introspection is objective if it separates the figure from ground
B. perception starts by organizing stimulus patterns into figures against a background
C. the first step in introspection is to identify the figure's ground
D. mental processes are made of mental elements added together
E. A, B, C, and D are all correct

Q2. Mark each item with B if it applies more to Behaviorism, or a G if it applies more to Gestalt psychology.
A. B G learning
B. B G nativism
C. B G the idea that behavior is organized by experience
D. B G empiricism
E. B G organization of the perceptual world into figures against a background
F. B G the idea that the basic structure of knowledge is built into the mind

Link to extensive description of current versions of Gestalt psychology.
Link to information about founders of Gestalt Psychology: Wolfgang Kohler, Max Wertheimer, Kurt Koffka
ETHOLOGY

Ethology, the biological approach to the study of behavior, emphasizes behavior's evolutionary origins, adaptive functions, and developmental course. Ethology studies animal behavior differently than did Behaviorism. Developed by zoologists primarily in Europe, ethology studied many different species, including humans, in something close to their natural habitat (as opposed to a few species in restricted laboratory settings). The founders of ethology, Karl von Frisch, Konrad Lorenz, and Nikolaas Tinbergen, won the Nobel prize in 1973.

Many psychologists have proposed the use of ethological concepts and methods in the study of traditional questions in Psychology. Nevertheless, ethology has had relatively little impact on Psychology. One notable exception is the work of Bowlby, Ainsworth, and their colleagues on the development of attachment of human infants and their mothers or other caregivers (Ainsworth & Bowlby, 1991).

Traditionally ethology has emphasized four topics in the study of behavior (McFarland, 1982):

1. Evolutionary history and origins
2. Development (how behavior is "assembled")
3. Stimulus control (the signals or stimuli that trigger a particular behavior)
4. Adaptive function (How behavior helps survival and successful reproduction)

Link to examples of question ethology studies.

Ethologists are especially interested in species typical behavior (which used to be called instinctive behavior). Species typical behaviors are ones that all normal members of a species exhibit under appropriate conditions. For example:

- Birds sit on eggs in the nest to hatch them.
- Baby robins make begging responses only to a worm dangled above them.
- Mother rats retrieve newborn pups that have gotten out of the nest.
- Human caregivers respond to babies' attempts at speech with "motherese" (slowed, very clear speech with exaggerated tone changes).

Ethologists describe behaviors in detail, identify the conditions needed for these behaviors to develop and appear, figure out how these behaviors help animals survive and reproduce successfully, etc. They use such information from different, related species to make inferences (~figure out) about the four topics listed above.

Most ethologists study behavior in its natural settings, or something close to it. Many behaviors in natural settings may not appear or be recognized in the restricted laboratory environment, because the appropriate conditions for them are not present. Furthermore, the behaviors that do appear cannot be understood properly without understanding how they occur under natural conditions. Their evolutionary origin and adaptive value are easier to identify in natural settings that in restricted laboratory environments.

Ethologists’ studies in natural settings often include experimentation. For example, black-headed gulls remove from the nest the eggshells from which chicks have hatched. They may do this for several reasons: keeping the nest clean; protecting the chicks from the sharp eggshells; removing a strong signal to predators that baby gulls are there to be eaten; etc. The last reason was confirmed experimentally. Broken eggshells were placed at different distances from the nest. The closer the shells were to the nest, the more likely it was that chicks would be caught by predators (Tinbergen et al. 1962).

Q3. Ethologists study animal behavior __.
A. in settings like the ones in which their subjects normally live  
B. to understand how behaviors evolved.
C. in species ranging from humans to sea gulls to sticklebacks (small fish) to insects
D. to understand how "instinctive" behaviors operate and what triggers them  
E. A, B, C, & D are all correct
PSYCHIATRY

Psychiatry, the medical treatment of psychopathology (~"mental" disorders and illnesses), is another important root for modern psychology. Psychiatry started out in the 19th century looking for brain abnormality as the source of "mental" disorders. This is called the organic approach to "mental" disorders, because it looks for abnormalities in the brain -- the organ of the mind -- to understand behavioral and mental disorders. (The first three chapters of The Broken Brain [Andreasen, 1985] give an excellent introduction to different approaches to understanding abnormal behavior).

Although researchers found brain changes for several disorders, they failed for some disorders, most notably schizophrenia and affective disorders (depression, mania), which therefore became treated as functional, "mental" disorders. Brain abnormalities associated with "functional" (psychological or mental) disorders were convincingly found only a century later.

Sigmund Freud turned much of psychiatry, especially in the United States, from the organic (brain disease) approach to a functional approach. Freud was trained as a neurologist (physician who studies and treats diseases of the nervous system) and made important contributions to the study of brain diseases. His book on aphasia (language loss after brain damage) is still referred to in the scientific literature. Freud became interested in patients with mental and behavioral symptoms that could not be explained by existing neurological ideas. Because no brain pathology seemed to go with these disorders, Freud developed a psychological or functional approach to them, which he called psychoanalysis. The functional approach to "mental" disorders claims that the disorders reflect mental or psychological, not physiological or organic, processes, and they must be treated with psychological methods. Even though Freud left neurology and the study of the nervous system for a functional study of "mental" disorders, he believed that psychoanalysis would eventually be connected to brain functions.

Q1. Freud developed psychoanalysis in an attempt to __.
A. treat patients with behavioral disorders that could not be explained in terms of abnormalities in the brain.  
B. discover the brain pathology that caused mental abnormalities.  
C. show that disturbed language in mental illness is based on brain damage.  
D. B and C are both correct.

Q2. Freud treated many psychiatric disorders, like schizophrenia as functional disorders because __.
A. he was a functionalist psychologist  
B. no brain pathology could be found that went with it  
C. they were learned, not genetic disorders  
D. he showed that abnormal brain function caused abnormal mental processes  
E. A & D are both correct

Psychoanalysis is a theory about motivation. The core idea in Psychoanalysis is that unconscious emotional conflicts play the dominant role in human mental and behavioral activity. In The Psychotherapy of Everyday Life (1901/1914), Freud claimed that emotional conflicts affect all aspects of life. "Minor" conflicts can become conscious and often show up in ordinary behavior, most famously in the "Freudian slip." He claimed that these are slips of the tongue that reveal feelings that the speaker is consciously aware of but doesn't want to express.

Freud claimed that major emotional conflicts are not available to consciousness. These are the driving force directing most human behavioral and mental activity. These conflicts are actively repressed ("pushed down" to keep hidden) from unconscious, because they are too emotionally painful. They must be released somehow, so they show up symbolically and indirectly in mental and behavioral functioning.

Traditionally, psychoanalysis claimed that the core repressed emotional conflicts are based on unresolved infantile sexual conflicts. These conflicts reflect the universal rivalry between infant boys and their fathers for the mothers' (sexual) attentions. Freud named this rivalry the Oedipus complex, because he thought that the ancient Greek tragedy, Oedipus Rex reflected this unconscious mental process. (Infant girls are supposed to have a similar conflict with their mothers, but this aspect of psychoanalysis is much less worked out.) These ideas had more influence in North America than in Europe, where much of
Freud believed that the essential step in relieving psychopathology was to bring repressed conflicts to consciousness. At first Freud used hypnosis, but he soon replaced it with a procedure he called free association. In this procedure the patient is encouraged to say freely his thoughts and feelings, often in response to a dream or an event the patient reported. The psychiatrist's task was to help the patient discover what unconscious conflicts the patient's associations reflected. Successful analysis enables patients to find and bring to consciousness their repressed conflicts.

Patients' dreams and their interpretation played a central role in the development of psychoanalysis and in psychoanalytic therapy. One of Freud's earliest books was *The Interpretation of Dreams* (Freud, 1900/Brill, 1913), in which he tried to show how dreams were disguised versions of repressed conflicts. Scientifically, Freud's claims about dreams have not held up well. A recent review (Domhoff, 2000) of a new English edition of this book claims that modern research contradicts almost every major point Freud had made. A psychoanalyst presents a much more positive view of the impact of this book.

Q3. According to Freud, psychopathology ___.
A. is a disturbance in the functioning of normal consciousness
B. shows that the brain is important for understanding literature and art
C. can be treated by helping patients discover unconscious conflicts
D. reflects emotional conflicts the conscious mind avoids
E. C & D are both correct

Freud's ideas and methods have lost much of their importance in psychology, but they remain influential in the humanities. Most psychologists think that psychoanalytic concepts are not supported by research, and many also claim that psychoanalysis is untestable and therefore not a scientific approach. The core idea of repressed conflict remains influential, but in a rather different form, and other ideas in psychology have evolved from his work.

Carl Gustav Jung was one of Freud's earliest and closest disciples, but he came to disagree with Freud about the importance of unconscious sexual conflicts in psychopathology and in the interpretation of dream content. Freud did not tolerate any disagreement from his followers, so he and Jung broke off their close relationship. Jung went on to develop an analytic psychology that emphasized the role of universal mental symbols both in dreaming and in waking life.

**COGNITIVE PSYCHOLOGY**

The cognitive (thinking) approach is now dominant view in much of psychology. It tries to infer how the mind processes information from behavior in carefully devised conditions. Information here means what the senses [seeing, hearing, touching, etc.] bring to the mind. Processing means selecting, organizing, interpreting, and responding to that information.

The cognitive approach took form in the middle of the 20th century. It returned mental processes to the center of psychology, but in a radically different way (Mandler, 1984). It emphasized higher level information processing, which behaviorism mostly ignored. Hebb (1962) defined this as brain or mental activity that is (partly) independent of the immediate stimulus environment and response possibilities (Hebb, 1962). This includes perception, memory, and thinking.

The cognitive approach used behavioral methods to study mental processes indirectly by inference from behavior. This means that cognitive psychology tries to figure out how information is transformed as it flows from the senses into the mind and (eventually) affects some later behavior.
Q4. [Mark EACH item True (T) or False (F)] Jerry speaks with a loud, strained voice, bares his teeth and thrusts his head forward, gets red in the face, has tensed muscles. Joanie concludes that Jerry is angry.

Joanie came to this conclusion __.  
T.F.  A. by observing Jerry's mental state  
T F C. through inference from behavior  
T.F.  B. by figuring out Jerry's mental state from his actions  
T F D. because Jerry told her so

It is very important to distinguish between inference and observation. Observations are things you can actually see, hear, count, measure, etc. Inferences are what you think observations mean. ALL psychological terms like learning, personality traits (e.g., extroversion), emotional states (e.g., disgust, joy) are inferences, based on observing some behavior.

Any external act can help you to infer mental states. For example, facial expressions often let you infer the emotions someone feels. You can infer that Jordan is feeling the emotion of disgust if his nose pulls back to flare his nostrils, his mouth is slightly open, with the corners turned down and the tongue beginning to stick out. These facial features are objectively observable -- anyone can see and describe them. Ekman (1975) has developed an objective coding process that measures individual features of the face during emotional expressions. Asgn4q describes expression of emotion further.

Q5. Mark EACH item Inferred (I) or Observed (O): Three-month-old Ross follows a toy train by turning his head and eyes. The train approaches and enters a tunnel, but a different train comes out the other end of the tunnel. Ross jerks his head back, opens his mouth and eyes wider, when he sees the different train.

Hint: Which describes his mental state? Which describes something he does, which you can see?

I O Q5A. Ross jerks his head back, opens his mouth and eyes wider.  
I O Q5B. Ross recognizes the difference between the two toy trains.  
I O Q5C. Ross expects the same train to come out of the tunnel as the one that went in.  
I O Q5D. Ross turns his head and eyes.

Cognitive psychologists use Behaviorism's method for psychology as the tool to study mental processes indirectly by inference. They select behaviors they believe reflect the mental process they want to study. Then they measure what subjects do during different test conditions and infer something about the mental processes that produce the responses.

For example, priming is one way cognitive psychologists study memory organization, a process inside the mind. They measure how quickly subjects decide whether letters, like N U R S E., form an English word, when they are preceded by apparently related or unrelated words, like DOCTOR or FEATHER. Faster responding when the preceding word is related is an objectively observable measure of the relation between the words.

One way to measure mental imagery (mental pictures in your head) is to compare how quickly participants solve a task when asked to create mental pictures or to use words. Faster and more accurate performance using mental pictures indicates use of mental imagery. Anyone can make these measurements, so they are objectively observable.

An early experiment on mental imagery used the following procedure to test whether imagery is really different from verbal coding (Brooks, 1968). Picture a grid like the one in Figure 3-1d in your mind. Now mentally place the following letters into the boxes of the grid: Put A in the second box from the top, left corner; move right one box and put B in it; down one, C; right one, D. Now mentally rotate the grid 90 degrees (1/4 turn) to the right, so the dot in the upper left corner is now in the upper right corner. Where is the letter D in the rotated grid?

Answering this question is not very hard if you have a picture of the filled-in grid in your head and rotated it mentally. Trying to figure it out using only words is quite difficult. In general, people who are instructed to form a mental image in their heads do this kind of task faster and more accurately than people who are given the same information but without the suggestion to imagine the grid. This is the kind of experiment that cognitive psychologists have used to make inferences about mental images and how they work.
Q6. Peggy tests how well two groups of people can estimate distances between Indiana towns. She asks one group to form a picture in their minds of an Indiana map they had seen for a minute. She shows the other group a mileage chart, showing the distance between some but not all pairs of towns. The people then make their estimates. Peggy compares the speed and accuracy of the two groups. She is __.  

A. probably a behaviorist studying the relation between stimuli and responses  
B. probably a cognitive psychologist comparing the efficiency of mental imagery vs. verbal coding  
C. using methods derived from a behaviorist's approach to psychology  
D. trying to infer mental processes from the participants' performance on these tasks  
E. A, C, and D are all correct  
F. B, C, and D are all correct  

Q7. Cognitive psychology studies __.  
A. mental processes with introspection  
B. mental processes inferred from behavior  
C. how mental processes choose, recode, store, and retrieve information  
D. only conscious mental processes  
E. B and C are both correct  
F. A, B, C and D are all correct  

Cognitive psychology is an important part of cognitive science, which is a rapidly growing interdisciplinary approach, which includes researchers from many different areas besides psychology, computer science, linguistics (the study of language), philosophy, mathematics, and many other areas of social and natural sciences.