# 2

# The Study of Learning and Behavior

**Chapter Outline**

Preview
The Natural Science Approach
Measures of Learning
  Errors/Topography/Intensity/Speed/Latency/Rate/Fluency
Sources of Data
  Anecdotes/Case Studies/Descriptive Studies/ Experiments/Limitations of Experiments
Animal Research and Human Learning
A Final Word
Recommended Readings
Review Questions
Practice Quiz
Query Answers

**Main Points**

The fundamental lesson to be learned from this chapter (and from the introductory course in learning, in my view) is that behavior can be studied with the same rigor as topics in other sciences by taking the natural science approach. Basically this means looking for relations between environmental and behavioral events. It is well to emphasize to students that this does *not* mean denying that people think and feel; it means that thinking and feeling are viewed as behavior. Learning can be measured as changes in number of errors, topography, intensity, speed, latency, rate, and fluency. Various kinds of evidence contribute to our understanding of learning: anecdotes; case studies; descriptive studies; between-subjects and within-subject experiments. Each has its strengths and weaknesses. The use of animals in learning research is controversial, but there are good reasons for it. One way to begin discussing this chapter is to consider the Huxley quotation on the first page.

**Class Notes**

Natural science approach. This section sets out some of the underlying assumptions made by a natural science approach to behavior. Similar assumptions are taken for granted in other areas of science, but where behavior is concerned they are questioned. The ideas that all behavior is caused and that the causes are natural phenomena (not mind or will) is very difficult for most students (and many psychologists) to accept. But since these assumptions underlie the text, they are worth discussing here. One has to be careful to avoid treading on religious views, however. Perhaps the best way to do this is to make the point that these assumptions are just that, assumptions, not

dogma. The assumptions are necessary for the conduct of any science. Some scientists, including behavior scientists, have fundamentalist religious views, yet take the natural science approach in their research. They argue that they wear two hats, one when dealing with religion, the other when dealing with science. When they enter the lab, they wear their scientist hat. Another way of saying essentially the same thing is that when dealing with scientific questions, we must adopt the assumptions of science and leave behind the assumptions of religion. By taking this approach, you are not asking students to abandon their religious views, but to set them aside when studying learning.

Measures of learning. Students have a hard time thinking of learning as the *decrease* in any measure of behavior other than errors; they think of it as acquiring something. This issue deserves special attention since learning means changes in behavior do not always involve the acquisition of new forms of behavior.

Sources of data. Some instructors may consider the inclusion of anecdotes as a source of data inappropriate. I include them for two reasons. First, most people rely heavily on anecdotes, and we can point out their limitations only if we take them up as a source of data. Second, anecdotes are not entirely useless. Many anecdotes have led to scientific discoveries. One example in the area of learning is John Garcia`s development of an aversion to licorice that led to his analysis of conditioned taste aversions (see text, p.108).

Anecdotes, case studies, and descriptive studies all have value, but also have severe limitations. Considering each of these sources of data is a way of leading students to appreciate the necessity of experiments. Experiments also have limitations, and it`s important to acknowledge them.

Statistics are sometimes useful in interpreting data, but it is important for students to realize that they do not compensate for methodological weakness. If the data obtained in a series of interviews or a survey or in direct observations are inaccurate, no statistical test will improve them. If people do not answer interview questions honestly, for example, then statistical analysis becomes a mathematics of lies.

Some instructors assume that students taking their learning course already know the material covered in this chapter and so they need not discuss these topics. I think this is a serious mistake. The fact that students have had a course in experimental psychology or research methods does not mean that they have truly grasped the topics covered here. Many of these courses are limited to descriptive and experimental research, and some do not even consider single-subject design experiments.

Animal research and human learning. Students are increasingly concerned about animal rights. The issue is difficult, and it is good to bring the issues out into the open early in the course, especially since some experiments the students will read about involve the use of strong aversives with animals.

Some instructors may want to point out that students who use cosmetics or soap, take medications, or undergo surgery, radiation or other medical treatments are benefiting from animal research. Eye shadow, for instance, is routinely tested on rabbits to make sure it is safe, often to the great discomfort of the animals. Students who wear wool clothing or eat meat also support treatment of animals that is typically far worse than the treatment animals receive in research labs.

The relevance of animal research to human behavior is another topic that should be considered. Some students find it demeaning to them to suggest that their behavior follows the same basic rules followed by rats and pigeons. The fact that humans and many other animals learn in similar ways does nothing to detract from the fact that people learn a great deal more from experience.

One topic that always seems to come up in discussions about animal research is the use of computer simulations. Since computer simulations are used to predict the course of weather systems, why not write computer simulations to predict how a rat`s behavior will be altered by certain events? The problem with this argument is that we cannot write a software program to determine how a rat`s behavior will be affected by a certain experience until we have done the research to answer that question. If simulations could anticipate new findings, medical researchers would have given up doing animal research years ago.

It should be noted that the text includes many basic and applied studies with human subjects. This is worth emphasizing since students seem inclined to think the learning course deals only with animal learning. If instructors want their students to believe that the principles covered in their course apply to humans as well as animals, then they will do well to call attention to experiments that use human subjects.

**Sniffy Exercise: Observing Behavior**

Careful observation is fundamental to science, so it may be useful to introduce the students to *Sniffy the Virtual Rat* by asking them to observe Sniffy's behavior for two minutes. Students might list all the things Sniffy does during this period: scratch, walk around, groom, raise up on his hind legs, etc. After discussing the observed behaviors with the class, ask the students to observe Sniffy again, this time counting the number of times one particular behavior (such as scratching) occurs in a five minute period. If the students work in pairs or small groups, they should compare their results with their partners, and report them to the class as a whole. Counts will tend to differ, even though the students are watching the same "rat." The possible reasons for these discrepancies should be discussed. Each group's count may then be averaged and the data from the class as a whole tabulated and plotted on the blackboard as a frequency graph.

**Sniffy Exercise: The Slope of Learning**

Each time that Sniffy presses the lever, that behavior is reflected on a cumulative record. This record then serves as a handy way of demonstrating how a cumulative record is produced, and how it is interpreted. In addition to allowing students to observe the formation of a cumulative record by a lever-trained Sniffy, the instructor might provide printouts of cumulative records (from Sniffy or a real animal). The class might be asked to identify when the behavior rate slows, when it increases, and when it is steady.

**Exercise: Animal Debate**

If there is strong sentiment in the class against the use of animals in behavioral research, it might be useful to have two groups of students debate the issue. To shake up student thinking, ask those who are opposed to animal research to argue in its behalf, and ask those who support animal research to argue against it. As preparation for the debate, you might have all students read *Ethics for Animal Trainers* by Mary Burch and Jon Bailey (2000). The article is available online at http://www.diamondsintheruff.com/ethics.html. The article includes a useful bibliography on ethical issues.

**Key to Review Questions**

1. Define the following terms in your own words. Give an example or illustration of each that is not provided in the text.
   ABA reversal design: A type of within-subject experiment in which behavior is observed before (A) and after (B) an experimental manipulation. The original (A) condition is restored, sometimes followed again by the experimental (B) condition. Instructors may want to ask students when it might be appropriate to restore the experimental condition. It may not occur to them that in therapeutic situations it is often very important to do so.
   Anecdotal evidence: First- or secondhand reports of personal experience.
   Aversives: Any stimuli an animal or person will avoid, given the opportunity to do so.
   Baseline period: In a within-subject experiment, a period of observation (often designated "A") during which no attempt is made to modify the behavior under study. The notion that the baseline period provides a basis for comparison should be stressed.
   Between-subjects experiment: An experimental design in which the independent variable is made to vary across two or more groups of subjects. Also called between-treatment or group design.
   Case study: Detailed study and description of a single case. Usually used in clinical settings.
   Control group: In a between-subjects experiment, those subjects not exposed to the independent variable.
   Cumulative record: A graphic record of behavior, each point of which reflects the total number of times the behavior has been performed as of that time.
   Dependent variable: The variable by which the outcome of an experiment is measured. It is expected to vary with (to depend on) the independent variable.
   Descriptive study: A study in which the researcher attempts to describe a group by obtaining data from its members.
   Experiment: A research design in which the researcher measures the effects of one or more independent variables on one or more dependent variables.
   Experimental group: In a between-subjects experiment, those subjects exposed to the independent variable.
   Fluency: A measure of learning consisting of the number of correct responses per minute.
   Independent variable: In an experiment, the variable that the researcher controls. The independent variable is usually expected to affect the dependent variable.
   Matched sampling: A procedure for reducing extraneous differences among subjects in between-subjects experiments, by matching those in the experimental and control groups on specified characteristics, such as age, sex, and weight.
   Within-subject experiment: A research design in which the independent variable is made to vary at different times for the same subject. Students are often unfamiliar with this kind of experiment. It may be a good idea to emphasize that each subject acts as both experimental and control subject. Some people prefer the terms single-subject or single case experiment.
   Topography. The form a behavior takes.

2. What are the principal *similarities* between within-subject and between-subjects designs?

   *I emphasize similarities here because the differences are fairly obvious. Students might mention that both are experimental designs and both involve comparisons between experimental and control conditions.*

3. Distinguish among speed, rate, and latency.

*In discussing this item, you might ask what all three have in common. Time is probably the best answer, and each item uses time in a slightly different way: Time it takes to perform an activity (speed); the number of times an act is performed in a period of time (rate); and the time that elapses before an act begins (latency).*

4. How could you quantify the changes in topography associated with learning to speak a foreign language?

*One way would be to record the student's speech over a period of weeks or months and then present the tapes in random order to experts in the language. The degree to which the average ratings go up would reflect learning. Another approach might be to compare the sound wave patterns of the student with those from a native speaker. If the discrepancy diminishes over a period of time, the student's proficiency has improved.*

5. Explain how the rate of behavior is reflected on a cumulative record.

*The idea here is for students to describe in their own words how to interpret a cumulative record. Answers should mention the fact that the ink pen moves across the page each time a response occurs, so that the steeper the resulting line, the higher the response rate.*

6. What is the chief virtue of matched sampling?

*Matching reduces the amount of uncontrolled variability between groups.*

7. In what kind of experiment is statistical analysis least likely to be necessary?

*Single-subject or within subject design. While statistical analysis is possible in such experiments, the data graphs often show unambiguous differences between baseline and intervention periods. In such cases, statistical analysis is superfluous.*

8. You are studying cocaine addiction in rats. An animal rights activist accuses you of animal cruelty. How can you defend your work?

*Answers might mention that animals provide less variability in genetic and learning backgrounds than humans, are less expensive, and provide insights that may ultimately help animals as well as humans.*

9. You are attempting to discover learning principles by studying the effects of experience on the eye blink. A friend says that eye blinking is a trivial kind of behavior, not worth studying. Defend your work.

*Again, the object is to get students to play Devil's advocate since many students think that eye blinking and the like are trivial subjects for study. The hope is that students will learn that simple responses such as eye blinks and lever presses are merely convenient ways of rigorously studying fundamental principles.*

10. Some researchers argue that learning is a change in the brain produced by experience. Discuss the virtues and weaknesses of this definition.

*Students might discuss the fact that learning may be said to occur without any apparent change in behavior. They may observe that learning must in some sense be recorded in the brain, since we "carry" our learning with us. They might also talk about the problems with the notion of potential (which is implicit in such definitions), particularly the fact that a potential for behavior is never identified until the behavior occurs.*

**Key to Practice Quiz**

1. This book takes the natural science approach to behavior.

2. One reason that many learning studies use animals is that with animals it is possible to get greater control over variables.

3. T. H. Huxley wrote, "Sit down before fact as a little child."

4. The law of parsimony says that the simplest explanation that fits the data is best.

5. The kind of experiment that can be likened to turning a light switch on and off is an ABA reversal design.

6. Between-subjects/group design experiments assume that there are no important differences among participants.

7. A change in topography means a change in the form a behavior takes.

8. Fluency is a measure of learning that combines errors and rate.

9. If there is a reduction in the time that passes before a behavior occurs, we say that learning is measured in terms of latency.

10. The cumulative record measures learning as a change in rate of behavior.

## Chapter 2 Quiz: Study of Learning and Behavior

1. _____ is the number of correct performances (answers/responses) per minute.

2. The natural science approach to behavior assumes that behavior is the result of _____ phenomena.

3. A change in _____ involves a change in the form a behavior takes.

4. In a _____ record, learning is indicated by a change in the rate at which a behavior occurs.

5. The essential element of a between-subjects design is that the independent variable varies across _____.

6. In a within-subject experiment, each subject's performance during a treatment period is compared to that subject's performance during a _____ period.

7. Many psychiatrists and clinical psychologists used to believe that homosexuality was a neurotic disorder because their homosexual clients had psychiatric disorders. The therapists were led astray by _____ study evidence.

8. _____'s heliocentric theory was accepted because it provided a far simpler explanation of astronomical events than the geocentric theory.

9. A person who argues that something is true because "Everyone knows that..." is relying on _____ evidence.

10. Response _____ refers to the time that passes before a behavior occurs.

**Key to Chapter 2 Quiz**

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7. Many psychiatrists and clinical psychologists used to believe that homosexuality was a neurotic disorder because their homosexual clients had psychiatric disorders. The therapists were led astray by case study evidence.

8. Copernicus's heliocentric theory won out because it provided a far simpler explanation of astronomical events than the geocentric theory.

9. A person who argues that something is true because "Everyone knows that..." is relying on anecdotal evidence.

10. Response latency refers to the time that passes before a behavior occurs.