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A Comparison of Four Methods to Teach Complex Verbal Concepts Using a Computer-Assisted Instruction Program

John Byron Connors
Western Michigan University

A COMPARISON OF FOUR METHODS TO TEACH COMPLEX VERBAL CONCEPTS USING A COMPUTER-ASSISTED INSTRUCTION PROGRAM

by

John Byron Connors

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A COMPARISON OF FOUR METHODS TO TEACH COMPLEX VERBAL CONCEPTS USING A COMPUTER-ASSISTED INSTRUCTION PROGRAM

John Byron Connors, Ph.D.

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This study compared four instructional programs which taught terminology in behavioral psychology using computer-assisted instruction (CAI) with college students. The independent variable was the type of instruction presented by one of four CAI programs: (a) Rules Only, (b) Rules Plus Positive Examples, (c) Rules Plus Negative Examples, and (d) Rules Plus Positive and Negative Examples. The dependent variables were the: (a) pretest scores, (b) posttest scores, (c) 1-week delayed posttest scores, and (d) preference questionnaire scores. Using the pretest as a covariate, results approached significance (p=.07) on posttest scores only for the Rules Only and Rules Plus Positive Examples over the Rules Plus Negative Examples and Rules Plus Positive and Negative Examples. Subject compliance may have been a factor in some programs more than others. There were no significant differences between time to complete the programs or error rate per program. The results are discussed in terms of the deductive versus inductive teaching controversy. Sophisticated learners may benefit more from deductive lessons while naive learners may benefit more from inductive lessons.

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Connors, John Byron, Ph.D.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

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John Byron Connors

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CHAPTER I

INTRODUCTION

This investigation compares inductive versus deductive teaching sequences involving psychological definitions and examples using a computer-assisted instruction (CAI) program with college students.

Statement of the Problem

The question of which instructional method is most conducive to learning goes back at least as far as Socrates. In fact, the Socratic method of using carefully arranged questions to lead the pupil to the answer has been described as an early example of programed learning. One common assumption is that "all of the developments in pre-programmed self-instructional materials, and devices for presenting them, are based fundamentally on Socratic question-and-answer or problem-and-solution methods of teaching" (Lumsdaine, 1960, p. 13).

In a scene from the Meno (Plato, cited in Hamilton & Cairns, 1961, pp. 353-384) Socrates leads an uneducated slave boy through the Pythagorean proof on doubling the square by asking him a series of leading questions to which he has to respond only yes or no. The basic theorem is that, given a square, another square double its area can be constructed by

using the diagonal from the first square. However, this type of example has been objected to by Skinner (1968) who calls it "one of the great frauds in the history of education" (p. 61). The problem is that the boy would later be unable to construct a similar proof by himself since his discovery in no way resembles the original behavior of Pythagoras. Socrates assumed that the student already knew the truth and that the teacher had only to draw it out of him. He even tells Meno that "there is no such thing as teaching, only recollection" (Plato, cited in Hamilton & Cairns, 1961, p. 364). The lesson begins correctly as Socrates uses an already existing behavioral repertoire in the slave boy and proceeds in small steps to the criterion behavior. What Socrates was unaware of was that unless verbal prompts are eventually removed the student remains dependent on the teacher. At the conclusion of the tutorial it is not possible to determine if any learning has taken place. For "although Socrates himself and some of those among his listeners who were already familiar with the theorem may have understood the proof better at the end of the scene, there is no evidence whatsoever that the boy understood it or could reconstruct it" (Skinner, 1972, pp. 203-204). The Meno episode was recently improved by getting the student to respond with less prompting (Cohen, 1962). It involved taking the dialogue and rewriting it as a programed instruction lesson.

As might be expected, Plato's writings have been defended by

philosophers who claim that the Socratic method was not a method of teaching at all but only a method of inquiry. One critic noted:

> The Socratic method is simply not useful when the proper answers to questions are already known. The method itself is a way of exploring the kinds of answers that can be given to questions and perhaps a way of weeding out bad answers and moving towards good ones. ... If one learns anything from the Socratic method, he probably learns to bring forth counter instances. (Jordan, 1963, p. 104)

So while it may not be proper to think of programed instruction as a modern version of dialectic teaching, the counter instances used by Socrates may be the first use of presenting non-examples of the concept.

Changes in educational technology can also be traced back to the Greeks. In Plato's Phadreus the inventor of the alphabet is lectured by Socrates:

> If men learn this, it will implant forgetfulness in their souls; they will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks. What you have discovered is a recipe not for memory, but for reminder...for by telling them of many things without teaching them you will make them seem to know much, while for the most part they will know nothing. (Plato, cited in Hamilton & Cairns, 1961, p. 520)

The Greeks feared that the use of books in order to store knowledge in readily accessible form would downgrade the importance of memory and so produce an inferior race (Silberman, 1970). Two thousand years later this problem has again risen with the advent of microcomputers in the home and schools. The amount of information that has to be either

committed to memory or written down will again be radically decreased by this "electronic notebook." The computer today has been compared to the introduction of clocks in the Middle Ages: "To men who lived at the pace of nature and the seasons, clocks brought a new notion of time. In the same way computers give us a taste for accuracy by imposing it on us" (Pocztar, 1972, p. 21).

The rebirth of programed instruction as computer-assisted instruction has been hailed as "comparable to Gutenberg's invention of the printing press in terms of the potential effect it will have on education" (Stolurow, cited in Silberman, 1970, p. 187). However, the computer may have less initial impact on teachers than the book, which eliminated their monopoly on knowledge and thus gave students a chance to learn on their own. Although the modern teacher's role may not be lessened, it will probably change to that of a manager using the techniques of different instructional media to help motivate the student along with test scoring and record keeping to monitor student progress. By being freed from the repetitious tasks of drilling facts and scoring papers, teachers can spend more time talking and listening to students and reading what they have written (Skinner, 1984). Perhaps there will even be time for Socratic dialogues.

The potential impact of this educational technology has led to claims such as "millions of school children will have access to what Philip of

Macedon's son Alexander enjoyed as a royal prerogative: the personal services of a tutor as well-informed and responsive as Aristotle" (Suppes, 1966, p. 207). The education of the aristocratic classes since the Greeks has been primarily tutorial. At classical universities such as Oxford and Cambridge the individual tutorial instruction provided is regarded as the ideal learning experience. The method is praised for its high success rate and only criticized for its economic inefficiency (Suppes, 1966). For proponents of CAI, "this happy combination of a classical education and modern technology seemed to promise the best of both worlds" (Cohen, 1962, p. 773). These types of claims for CAI give rise to the democratic vision of quality universal education for all. In the ideal sense, the role of the computer would be

> to keep track of a person moving at his own pace in a continuous progress environment where the particular branching of the curriculum is tailor-made for his own learning aptitudes and level, [which] requires a computer to manage the curriculum and assist with the instruction. The student begins at that point in the curriculum where he is best capable of learning and moves at his own rate with his behavior being reinforced--rewarded or disapproved--immediately following his answer. The particular sequence of the curriculum may be controlled almost entirely by the computer or it may be completely under the control of the student, depending on the type of material to be learned, the kind of student, and the purposes of instruction. (Holtzman, 1970, pp. 1-2)

In contrast, more modest and cautious statements about CAI are being voiced such as:

> We are only trying to do better and faster what is now being done less well and more slowly. But much of what we are now doing in education may be wrong and if technology helps us do it very efficiently, it may lead us beyond the point where we can detect and correct our errors. (Mesthene, 1970, p. 391)

There are also those who worry about whether technology can ever be culturally neutral instead of dictating new values. The ultimate irony would be if CAI, in the name of individualizing instruction, would force students into a passive, docile role of just completing prearranged goals and objectives (Silberman, 1970). For example, if a rigid computer system would only accept one right answer and one algorithm for solving problems it would be unable to recognize a more creative approach of searching for several solutions.

In spite of these potential flaws, the widespread use of computers in education appears inevitable. By 1984 more than two out of every three public schools in this country owned at least one computer (Hassett, 1984). Although no one knows precisely how many computers are in American classrooms at present, their use has been doubling for the past few years. From 1981 to 1986, the percentage of schools using microcomputers in their curriculum jumped from 18 to 96% (U. S. Department of Education [DOE], 1990). By 1989 the percent of students using computers at school had risen to 43%, while the percent of students using computers at home had risen to 21% (U. S. DOE, 1990).

The hardware problem is no longer an overriding factor as today's microcomputers are smaller, cheaper, and more powerful than ever before. The biggest obstacle to implementing large scale CAI programs is the lack of quality software. A nonprofit group called the Educational Products Information Exchange has reviewed over 7,000 educational software programs and has concluded that only 25% meet minimum technical and instructional standards while less than 5% are considered superior (Hassett, 1984).

Although fancy graphics and games are now used to jazz up CAI lessons, the programs themselves are based on traditional didactic educational models. Much of it is still drill and practice routines. The instructional principles on which to base a teaching module have been lacking. A noted expert writes:

> Our present and most pressing problem is the lack of an empirically validated theory of teaching. In fact, we even lack a useful set of empirically validated principles of instruction that could form the basis for a theory of teaching. In effect, CAI makes our meager knowledge of teaching patently obvious. Our ignorance cannot go unnoticed as with some other forms of instruction (Stolurow, cited in Silberman, 1970, p. 195).

Modern instructional methods are designed to move a large group of students through a curriculum in a lock step fashion that produces a standard bell shaped curve for the final examination. Suppes (1966) writes that "the primary obstacles to computer-assisted instruction are not

technological but pedagogical: how to devise ways of individualizing instruction that are suited to individuals instead of groups" (p. 208). The result of the feedback received from CAI validation procedures has been to accelerate the search for principles to form a basic instructional theory. The result should be a method for analyzing a domain of knowledge and classifying it into a concept hierarchy (e.g., Resnick, Wang, & Kaplan, 1973) and then presenting it to students in the most efficacious method according to the data.

The area of educational psychology called instructional design has evolved out of the programed learning movement over the last 25 years. The use of "cognitive strategies" as general reasoning and problem solving techniques outside of any specific content area is gradually being replaced by developing thinking abilities within the context of domain-specific knowledge (Glaser, 1984). This more integrated approach suggests that general process reasoning is mostly used when an individual is presented with a problem in an unfamiliar content area. A major component of thinking behavior (i.e., rule-governed verbal behavior) then consists of the availability of accessible and usable knowledge in specific domain areas which permit rule-forming strategies.

Issues of general versus specific knowledge can be stated as follows:

> The dilemma posed is that general methods are weak because they apply to almost any situation and will not alone provide an evaluation of specific task features that enable a problem

> to be solved. In contrast, skills learned in specific contexts are powerful enough when they are accessed as part of a knowledge schema, but the problem of general transfer remains. (Glaser, 1984, p. 102).

It does appear that domain-independent skills of heuristics, reasoning, and problem solving behavior suffer from the logical flaw of overinclusiveness in relation to specific content areas. For example, the generation of hypotheses about the best way to solve a problem is difficult to accomplish unless one can first discriminate which elements of the problem are relevant and which are irrelevant.

The Present Study

This study is an attempt to combine recent technological advances in CAI along with instructional design principles in order to test the classic debate of induction versus deduction as a teaching sequence. The test of ability to transfer knowledge to a novel situation will be used as a test of concept attainment. The domain area of behavioral psychology will be used as a theoretical context to teach textual verbal stimulus relations and their functions.

Background Information

Conceptual Behavior

The classic definition of conceptual behavior refers to generalization

within classes of stimuli and discrimination between classes of stimuli (Keller & Schoenfeld, 1950). In a general sense, we can say that organisms discriminate between things by making different responses to different stimuli from distinct non-overlapping sets; they generalize among things by making the same response to stimuli within a set. Certain classes of responses are called operants while certain classes of stimuli are referred to as concepts. Therefore, in order to conceptualize redness it is necessary to be able to respond in a specific, similar way to all stimuli we call red and make different responses to those stimuli which we do not call red (such as orange or yellow).

There are many types of concepts. Concepts defined by only one critical feature are called abstractions (Skinner, 1957). An example of an abstraction would be classifying objects only by color. If the discriminative stimuli are difficult to define due to multiplicity of critical features, they are termed natural concepts as opposed to concrete concepts. An example of a natural concept is that of recognizing faces. The term concept acquisition is used when infinite concept classes are used, in contrast to concept attainment in which the members of the concept set are finite. Most natural concepts such as plants and animals can be considered "infinite" whereas many man-made concepts such as the English alphabet or the numbers from 1-100 can be considered finite.

Concepts are often classified as conjunctive (both A and B),

disjunctive (A and/or B), or relational (A > B) categories (Carroll, 1964). Examples would be a blue circle for conjunctive, either a circle or a square for disjunctive, and a large and small square for relational. Another way of looking at concepts is in a hierarchical system using superordinate, subordinate, coordinate concepts (Tiemann & Markle, 1990). An example would be the concept of "dog" which has the canine family as a superordinate concept, a collie as a subordinate concept, other canines such as wolves as a coordinate concept, and a cat as a non-example coordinate concept. An important point to remember is that several stimuli must share at least one dimension in order for the term to be a concept. For example, "Chicago" cannot be a concept because it only refers to one thing. Chicago, however, is an example of the concept of "city" (Tiemann & Markle, 1990).

When experimental analogs of conceptual behavior are designed, the symbol S+ stands for an example of the concepts; the symbol S- is a non-example of the concept; and the symbol S^{Δ} (ess delta) is an irrelevant feature of the concept. Standard types of concept attributes or defining features include the physical dimensions of color, size, shape, texture, thickness, and/or brightness. In the development of concept formation studies, discrimination training is required in which the organism is reinforced for responding correctly to relevant stimulus features and is put on extinction when not responding correctly to irrelevant stimulus features.

There has been much research with animals in an attempt to discover the necessary and sufficient conditions needed to learn what we call concepts. The usual approach is to test for the concepts of sameness and difference. Two commonly used procedures are called matching-to-sample and oddity-to-sample discrimination trials. Typically there is a three key arrangement with the center key called the sample stimulus and the two side keys called comparison stimuli. The keys may be lit up simultaneously or, more often, there is a short delay between sample key offset and comparison key onset (e.g., delayed matching-to-sample). Reinforcement is contingent upon pecking (in pigeons) the same color as in matching, or a different color as in oddity, as the sample key. While this discrimination training is an analog to the concepts of sameness and difference in humans, there is only partial evidence to demonstrate that pigeons learn the matching rule. In most cases the birds will memorize all stimulus pair relations (a pseudoconcept) and not be able to transfer from training to test stimuli.

Natural concepts, which often lack defining features, are often portrayed by prototypes which are typical examples of the concept. Other stimuli are then labeled as better or worse examples depending on their overall resemblance to the prototype. Remarkably, pigeons are easily able to learn to discriminate complex natural visual concepts while they have a more difficult time when transferring from concrete concepts. Perhaps

the natural concepts more closely resemble their environmental habitat outside the laboratory. Another theory is that since there are multiple relevant stimuli to attend to, the pigeon can focus on any one feature and still be attending. In other words, there are no features which are totally irrelevant as there are in artificial concrete concepts.

The problem with using a pigeon or any other infrahuman organism is this: How can we be sure that they are "paying attention" to the critical stimulus features? This is where specific discrimination training procedures can be helpful in isolating the controlling variables. In order to show transfer of training from the sample stimuli to novel stimuli it is necessary to correlate some features with reinforcement, some features with nonreinforcement (i.e., extinction), and other features which show random correlation (i.e., 50% of the time if only two stimuli are used). For example, we could use a set of stimuli in which "color" was relevant and shape "irrelevant." In this set, red would always predict reinforcement, green would always predict nonreinforcement, and a circle or square would predict reinforcement 50% of the time (i.e., the color red is an S+, the color green is an S-, and shape is an S^{Δ}). If we later switch to different colors such as blue and yellow as an S+ and S- respectively, then the animal must make an intradimensional shift (different values on the same stimulus dimension) in order to continue maximizing reinforcement. If, however, we switch shapes to a diamond and triangle and shape becomes the relevant

dimension correlated with reinforcement (i.e., the diamond is now the S+, the triangle is the S-, and color is an S^{Δ}), then an extradimensional shift (different relevant dimensions) must be made. Numerous studies with rats, pigeons, human children, and human adults have shown that the intradimensional shift is more quickly learned and with fewer errors than an extradimensional shift (Schwartz, 1984). These findings support the view that learning to pay attention involves control by relevant (predictive) stimulus dimensions and no control by irrelevant stimulus dimensions.

When we try to translate these experimental studies into the classroom we find that most concepts taught do not have a limited number of attributes or critical features and are more similar to the natural concepts mentioned previously (also referred to as "defined" as opposed to "concrete concepts," e.g., Briggs & Wager, 1981). For example, how could a teacher present all of the attributes of "dogness" when teaching a child to correctly tact members of the canine family? In elementary education teachers often rely on using many examples of the concept while using a smaller amount of verbalization of rules as a teaching aid. As we move on to higher education there is an increased tendency to rely mostly on verbalizations of rules (in textbooks and lectures) with only an occasional example as a teaching aid. The use of non-examples in teaching has been a rare practice and has only recently been emphasized (Markle & Tiemann, 1974; Tiemann & Markle, 1990).

Research has examined the conditions under which conceptual learning takes place:

> The measure of concept attainment generally agreed upon is the student's ability to deal with examples and non-examples of the concept. A student who understands the instruction responds differentially to new examples and new non-examples not encountered during instruction. Being able to state the definition, which has been given to him in instruction, does not measure understanding. (Markle & Tiemann, 1974, p. 313)

A small number of variables which play an important role for students in learning concepts have been identified (Markle & Tiemann, 1974):

1. The nature of the definition itself in terms of how clearly it is written.

2. The completeness of the definition; it should include all critical attributes of the concept and suggest the range of application by listing important irrelevant attributes.

3. The use of technical terminology in the definition; key concepts may be defined in terms of other concepts from the same subject area which require previous or concurrent mastery.

4. The range of the set of examples is called exemplification; they should demonstrate the boundary limits of the concept.

5. The use of examples and non-examples are of equal importance in teaching concepts.

One basic principle which has emerged in research on teaching

concepts is: "A wide range of examples prevents undergeneralization, while a good selection of non-examples prevents overgeneralization" (Markle & Tiemann, 1974, p. 315). Too few examples would result in a misconception in which the students falsely assume that some irrelevant attribute (S^{Δ}) or combination of irrelevant attributes are critical features of the concept. Consequently, they may not recognize examplars of the attribute or be able to identify non-exemplars as not having this attribute (Tennyson, Woolley, & Merrill, 1972). It should be evident by now that no concept can be learned from a single example because each example contains an infinite number of stimulus features.

These same principles of concept learning have been emphasized by Engelmann and Carnine (Engelmann, 1980; Engelmann & Carnine, 1982) in terms of the sameness and difference principles. In the sameness principle maximum differences are created among positive examples in order to produce an interpolation of examples within the concept boundary. In the difference principle minimum differences between positive and negative examples produce extrapolation of examples outside the concept boundary. Following the first principle prevents undergeneralization (stipulation) errors and misconceptions while the second principle prevents overgeneralization errors as well as misconceptions.

Similar terminologies have been introduced (Tennyson et al., 1972) with the terms divergent and matched. They describe the differences

between pairs of examples and non-examples. Divergent examples differ on every possible variable attribute which is an important feature of the concept. Matched examples show a close non-example lacking only one critical attribute but also containing most of the other important attributes of the concept (Markle, 1983).

Other models include the mathetics system developed by Gilbert (1978) in the early 1960s. This system is used for training programs in industrial settings and to increase organizational efficiency. Users of this system have not been content to just teach concepts well. They continually strive to increase the efficiency of the instructional unit so that it can later be taught with less time and effort required. Discriminations are taught by two methods: (1) competitive grouping in which minimally different pairs of stimuli or multiple stimuli of the more difficult concepts are taught first before the easier concept pairs are introduced; and (2) the mediation technique of associating each stimulus with a different and unrelated stimulus which is already known. An example of the former is teaching the products of 8 x 6, 8 x 7, and 8 x 8 before introducing the other multiplication facts. The latter is exemplified by thinking of a pair of brown eyes in order to associate the color brown with the number 2 for teaching subjects to read the color band rotators on electric resistors. Generalization training is accomplished by "selective looking" for common attributes of all members in a set. Often this involves learning some theoretical background of the

concept so that specific information will not be forgotten and new situations can be more easily adapted.

Inductive Versus Deductive Methods

The field of educational psychology has long been a strong proponent of the advantages of learning by discovery. Supposed benefits include transfer of learning to new situations, development of problem-solving ability, intrinsic motivation, and helping a student to behave as a junior scientist by going beyond the data. The means of learning have been considered as important as the ends because it is desirable that students should have some practice at discovering answers for themselves. Often it is contrasted with rote learning methods with the conclusion that it is more important for students to be able to produce answers for themselves rather than just reproduce answers they learn from someone else (Wittrock, 1966).

Unfortunately almost none of the claims made for the discovery hypothesis has been empirically validated. The argument confuses means with ends since the ability to discover answers usually requires more than just simple practice at discovering. For although "the ability to solve problems is important, it is not the only important end. One must learn to acquire and comprehend much of his culture as well as to discover new knowledge and to solve problems" (Wittrock, 1966, pp. 36-37).

The roots of discovery learning can be found in the writings of Jean

Jacques Rousseau, Maria Montessori, and John Dewey. In Rousseau's Emile (1762) the young child is encouraged to develop on his own in a permissive environment without interference from teacher directions and standards. However, the education of Emile was not one which could be easily imitated in public education since it required the services of a private tutor. Montessori (1909) took the child out of the woods and into the classroom but still insisted that the teacher give little verbal directions or encouragement. She advocated a child-centered approach in which students were given access to an array of educational toys and apparatus from which they would choose an activity for themselves. Ideally learning would take place automatically by the natural feedback received through manipulating a carefully designed apparatus. While these ideas have some merit for preschool children in learning simple visual and auditory discriminations, they would be difficult to apply to higher order concepts.

Dewey suggested that students be actively involved in do-it-yourself practical projects and laboratory activities as a way of learning the scientific method. In Democracy and Education(1916), Dewey outlines his proposal that thinking is the method of educative experience:

> First that the pupil have a genuine situation of experience--that there be a continuous activity in which he is interested for its own sake; secondly, that a genuine problem develop within this situation as a stimulus for thought; third, that he possess the information and make the observations needed to deal with it; fourth, that suggested solutions occur to him which he shall be responsible for developing in an orderly way;

> fifth, that he have opportunity and occasion to test his ideas by application, to make their meaning clear and to discover for himself their validity. (Dewey, 1916, p. 163)

These writings have spawned the progressive education movement of the 20th century with the emphasis on giving the child maximum freedom and choice in a natural environment.

The discovery method of learning has often been identified with induction: the student starts with specific examples and proceeds to general rules and principles. However, deduction may also lead to more accurate results which produce more comprehensive generalizations. Testing for induction may also involve generating additional examplars as well as verbalizing the general proposition. Discovery sequences can be dichotomized into inductive sequences and trial and error sequences.

The most commonly used method of instruction is called the rule-example expository sequence. The student is presented with an explicitly stated rule and one or more typical examples and then is asked to respond to an incomplete example (Glaser, 1966). The deductive method is often preferred since it leads to quick results for both the student and teacher. The use of prompts minimizes the chance of error and gives the student practice in applying the rule. Rules can be easier to remember than a series of examples because the information is in condensed form composed by an expert. In addition, "the limited range of exemplars in most teaching and textbook situations may make it possible for the student

to induce what is essentially an incorrect rule but one which happens to fit all the examples presented" (Glaser, 1966, p. 16).

The discovery method was originally thought to better facilitate retention than the expository method but research has not borne this out. There has been evidence, though, that the discovery method is superior in producing transfer and general problem solving ability (Guthrie, 1969).

The learning by discovery and learning by rule instructional methods have been contrasted in a number of experimental studies (e.g., Egan & Greeno, 1973). Subjects who learn by a discovery type method receive very little initial instruction and must learn to solve problems and generalize to novel situations by inducing relationships among concepts. Subjects who learn by the rule-type method must interpret initial instruction and then memorize it and apply the algorithm. Therefore, the former requires more conceptual skills while the later requires more selection and memory skills. The discovery approach has been referred to as "figuring out" as opposed to merely "finding out." In programed instruction, priming is the most often used technique while discovery learning methods have been neglected (Markle, 1983). One reason is that "it is far easier to tell a learner than it is to arrange for the learner to figure out something from challenging and adequate information" (Markle, 1983, p. 127). Even Skinner admits that it is "easier to teach precept than practice, or rule than example, and the specific-general order is then reversed" (Skinner,

1968, p. 222). So, whereas the best way to help a student to remember an answer is to give him a strong hint, he will remember it better in the future if a weaker hint is sufficient. The dictum of the 17th century philosopher, Comenius, is relevant here: "The more the teacher teaches, the less the student learns" (Comenius, cited in Skinner, 1968, p. 144).

One major criticism of discovery learning is that the student will necessarily make more frequent errors in learning the concept compared with starting from the rule and applying it to examples. The bias against allowing errors to occur comes partly from experimental studies with pigeons (Terrace, 1963). What were called "errorless discrimination" procedures were used to teach simple visual discriminations such as red-green and horizontal-vertical. Under these conditions an error was defined as making a response in the presence of a stimulus correlated with nonreinforcement. In the experiments two stimuli were presented which showed maximum variation on three stimulus dimensions. Using a fading technique, the differences on two of the dimensions were progressively reduced until only the difference on the third remained. When the results were compared to birds that learned the same discriminations but with errors, it was found that only the later group showed "emotional" responses (e.g., wing flapping, turning away from the key) and had occasional response bursts in the presence of the S- as well as having less transfer to analogous discriminations.

The importance of these studies is that, in the past, extinction had been considered the hallmark of discrimination training. Terrace (1963) demonstrated that not only was extinction not necessary, but that it could produce detrimental side effects. It should be pointed out that Terrace's work was in discrimination training and not concept formation. However, these errorless discrimination techniques should be able to be modified to produce generalization in conceptual behavior.

Other objections to allowing errors in instruction came from Skinner's (1968) analysis that producing plausible wrong answers in multiple-choice programed learning frames allows "traces of erroneous responses [to] survive in spite of the correction of errors or the confirmation of a right answer" (p. 34). In other words, in the process of shaping the right answer, some unwanted stimulus-response relations are strengthened. Skinner has argued that the student should be made to compose his own answer rather than to select it from a set of alternatives. This type of responding requires different kinds of memory skills: recalling (without prompts) versus recognition (with prompts).

Traditionally programed learning materials, which have used the linear format proposed by Skinner (1968), have considered student errors as a fault on the part of the program. An error was defined as a response not acceptable to the programer. An analysis of erroneous responses would indicate one or more of the following:

1. A poorly designed item which fails to communicate and therefore needs to be rewritten;

2. A sequence in which prompts have been withdrawn too fast or inadequate practice given;

3. Assumed previous knowledge which in fact the student does not have;

4. Poor analysis of the subject matter, leading to a confusion not predicted by the programer. (Markle, 1983, p. 23)

From the student viewpoint, errors are not only a waste of time but time spent practicing incorrect responses. A high error rate could also result in lowered motivation in completing the program and less enthusiasm for the subject area.

On the face of it the discovery learning method does appear incompatible with the goal of error minimization. Without explicit rules to guide them, students still undoubtably make more errors in their initial trial and error approaches. There is also some research that has shown that a high percentage of correct answers correlates with academic success (Stevens & Rosenshine, 1981). However, it is important to realize that in most studies (especially animal studies) response errors were consequated by either extinction (ignoring) or punishment (verbal disapproval). Few attempts have been made to study the use of corrective feedback information following an incorrect response. A review of some recent studies in

education (Becker & Carnine, 1981) gives supportive evidence that correcting student errors is more effective than ignoring them. The type of correction procedure will vary with the learning task:

> "Although modeling the answer is usually appropriate for correcting mistakes on discrimination tasks, modeling the correct answer can be ineffective with errors that require the application of a multi-step strategy. In these situations, the correction should prompt the student to apply the strategy" (Becker & Carnine, 1981, p. 176).

The distinction between teaching a single discrimination and a set of discriminations as found in verbal learning tasks requires the programer to design the order of introducing new discriminations so that easier or more useful discriminations are taught first. Those discriminations which are similar in either sound or shape are separated in the sequence of paired-associate learning trials. Criterion learning of each discrimination set is accomplished in a cumulative fashion and previous discriminations are continually reviewed, either in review lessons or as part of other learning tasks. Related discriminations are begun with a review of familiar discriminations and proceed from a simplified to a more complex context (Becker & Carnine, 1981). Only as more of these variables are taken into account and controlled will comparisons of inductive versus deductive teaching sequences be considered a valid test.

Programed Learning and Instructional Design

Although some writers have credited Rene Descartes and his

Discourse on Method (1637) with inspiring the invention of programed instruction (others trace it back to Galen and Socrates), most educators date the beginning of the application of psychological principles to instruction with B.F. Skinner's 1954 article entitled, "The science of learning and the art of teaching" (1954). Lamenting the then shortage of teachers and the low frequency of reinforcement seen in most class-rooms, Skinner proposed that now was the time to extrapolate laboratory results from the experimental analysis of behavior to the field of education. With that began the programed instruction movement which became the focus of the preponderance of educational research in the late 1950s and the decade of the 60s (e.g., Callender, 1969; Coulson, 1962; DeCecco, 1964; Deterline, 1962; Fry, 1963; Glaser, 1965; Hartley, 1972; Komaski, 1963; Lumsdaine & Glaser, 1960; Lysaught, 1963; Margulies & Eigen, 1962; Ofiesh & Meierhenry, 1964; Pocztar, 1972; Skinner, 1968; and Taber, Glaser, & Schaefer, 1965.

English 2600 was published in 1960 and became the first programed textbook marketed for academic use (cited in Glaser, 1965). It taught traditional grammar with drill lessons included. Within 15 years, thousands of programs had been written for use in the academic, military, and industrial areas. Skinner and one of his colleagues published a programed text used at Harvard to teach introductory concepts in psychology (Holland & Skinner, 1968). Within a few short years, pro-

gramed instruction courses became common on many college campuses.

Although there were some early critics of programed instruction (e.g., Cronbach, 1962; Feldhusen, 1963), the movement continued to grow in popularity until it almost drowned in its own success by the early 1970s (Markle, 1983). The technological limitations of the early teaching machines and the continued mimicking of Skinner's early programs both contributed to its decline. In their zeal to produce new programs the writers overemphasized the small step sizes, used heavy prompting sequences, and required verbatim repetition of definitions. These long drill sequences bored even low performing students (Markle, 1983). The National Society for Programed Instruction ceased publication of its journal in 1971 and was reborn five years later as the National Society for Performance and Instruction. The term "programed instruction" began to be replaced by the term "instructional design" just as teaching machines were replaced by computers. Skinner's assurances that "the necessary techniques are known" (1968, p. 28) proved to be premature as the last 20 years has witnessed the slow evolution of instructional design principles.

The three basic principles of programed learning were derived from experiments with animals: active responding, errorless learning, and immediate feedback. Although Skinner is often quoted as suggesting that learning should proceed from the less complex to the more complex, a more accurate quotation is: "Certain natural orders are inherent in many subject

matters, but they are not always useful for instructional purposes....Order of complexity is also not a safe rule" (1968, pp. 221-222). Degree of difficulty should also not be judged by giving ambiguous prompts and primes but in the sequencing of instruction itself. Skinner (1968) objects to making the subject matter deliberately hard in order to teach "thinking," which could be better taught with programs composed of exercises in logic, mathematics, and the scientific method. The major questions concerning programing of material are summarized in Table 1 (Lumsdaine, 1960, p. 531).

Analogous to the shaping techniques used in animal experiments, Skinner advocates the use of small step sizes in order to maximize the success ratio and minimize errors. This proposal has several advantages. It avoids the trial and error method in which a student may learn not to repeat his mistakes but has a difficult time repeating his successes. The possibility of the student becoming inattentive to easy material is compensated for by the higher reinforcement rate and the reduction of aversive control. There is also the physical restraint imposed on programers using the early teaching machines which only allowed space for two or three sentences per frame.

There are operational difficulties in defining what is meant by the terms step and step size. The size of the step could refer to any one of the following:

Table 1

Some Major Questions Concerning Programing of Material

Major Questions	Examples
1. Size of step	1. Length of frame; difficulty of giving correct answer at that point in program; complexity or length of response; number of responses to questions before correction.
2. Content of prompts	2. Contextual within frame; cues from immediately preceding frames; cues from preceding cycle.
3. Content of correction or answer-frame	3. Right-wrong only; reveals correct answer; gives additional prompts if incorrect; explains why wrong or gives other explanation
4. Logic of program sequencing	4. Uniform versus contingent sequences, interacting with type of material and with step-difficulty sought; principles to applications, or vice versa, or mixed; spacing and form of review.

1. The length of the program frame, as indexed by the number of words or sentences;

2. The difficulty of giving a correct answer at any point in the program, as reflected by the proportion of students making errors on that particular frame;

3. The complexity or length of the response; or

4. The number of responses to questions required of the student before he received correction, feedback, or reinforcement. (Glaser, 1965, p. 395)

In comparing the linear, branching, and mathetical approaches as to the amount of information given in each step, they would respectively be termed small, large, and as large as possible. All of these are empirical issues which should be addressed during the evaluation phase. However, most researchers believe the programer should err on the side of overestimating the step size in order to be better able to diagnose errors.

The rate of presentation of programed material can be controlled by a mechanical or electronic device set by the instructor. The student can be paced by setting the teaching machine or computer to present frames at given intervals determined arbitrarily or depending on the characteristics of the student's performance, such as error rate or latency. For example, the machine may be programed to control the time interval between frames, the time between the student's response and the next frame presentation, of the amount of time the student has to answer. The total time allowed to complete the program can be adjusted according to the difficulty of the material, the student's previous error rate, and even errors made on particular frames. Of course, the simpler devices and nonmechanical programs gave the student full control over his rate of progressing through the program (Fry, 1963).

The questions of how much repetition or practice is needed before the

student "knows" the answer has still not been answered. There is certainly a difference between short term memorization of facts and long term understanding of concepts. Numerous experiments have been conducted as to the efficacy of spaced versus massed practice. Results vary with the complexity and length of the subject matter. Distributed practice sessions are favored when large amounts of information are to be retained over a longer time period (Fry, 1963). Gilbert (1978) has suggested a density gradient following a negative exponential curve. Frequent repetitions would be used soon after the material was presented and then tapered off in a progressively decreasing cumulative review.

The problem of how to make the student less dependent on the program can be solved by progressively removing the prompts so that the material must be completely recalled by memory in the terminal frames. The parallel terminology used by the major theorists for presenting and removing prompts is presented in Table 2. Skinner initially used the term "vanishing" to describe the process of forcing the student to practice responding in the absence of the prompt. The goal is an optimal progression from maximal cueing down to minimal or zero cueing. The feedback received then becomes the reinforcement needed to continue the program lesson. How important overt responding and immediate confirmation of results are to program success may be inversely related to the probability of correct responding (Evans, 1965). The simpler the pro-

Table 2

Parallel Terminology for Presenting and Removing Prompts Used by Major Theorists

Theorist	Complete Prompt	Incomplete Prompt	Minimal Prompt
1. Skinner	prime	prompt	probe
2. Gilbert	demonstrate	prompt	release
3. Crowder	introductory	practice	terminal
4. Markle	criterion	supplementary	terminal
5. Engelmann	model	lead	test
6. Engelmann	firm	fade	review
7. traditional	instruction	cueing	criterion

gram the less need the learner has to check his answer. In more difficult programs immediate feedback is more reinforcing. Although the concept of feedback as reinforcement has been criticized on the grounds that "confirmation or correction in instructional programs cannot be equated theoretically to any conception of reinforcement in the sense of reward" (Evans, 1965, p. 385), Skinner's contention is only that "it is characteristic of the human species that successful action is automatically reinforced" (1984, p. 952).

In contrast to Skinner's linear program sequences are the branching

programs of Crowder (1963). The parallel terms employed by each to describe his own version of programed learning are as follows:

1. Skinner: response-centered, extrinsic, linear, unisequential, constructed response format.

2. Crowder: stimulus-centered, intrinsic, branching, polysequential, multiple choice format.

These two approaches were the focus of much early research in programed instruction, some of it polemical in nature as each side sought to prove its theoretical position was superior.

Crowder was not a psychologist but an engineer whose job at one time was to train technicians in the repair of airplane engines (Pocztar, 1972). Unlike the naive student, the technician is already familiar with the engine. His job is to find the cause of engine failure without having to dismantle the entire engine. To do this requires systematic search techniques in which each mistake reduces the number of hypotheses to be tested. Therefore, false leads are not a waste of time but give valuable information about what is not wrong and eliminates these leads from further consideration. Only by disproving hypotheses does the technician eventually discover the underlying cause of failure. To use time efficiently he must ask the minimum number of questions in order to eliminate the maximum number of possible causes without going off on a tangent. For algorithms, efficiency rather than error minimization is the goal. For these

reasons Crowder's methods have proved most suitable in areas in which complex problem solving strategies are required (Hartley, 1972). There is little concern with the stages of learning but only with the final product.

In a linear program the student's response is carefully prompted and is considered part of the learning process, while in a branching program questions are primarily used for diagnostic purposes (Crowder, 1963). Instead of composing a response, a multiple choice format is utilized in which each selection leads to a different branch in the program. An incorrect selection leads to an explanation of the error and then returns the student to the original question. This remedial loop is called a first-order branch. In a second-order branch the student is placed in a subroutine in which the material is explained in smaller steps or with an alternative approach. New questions are then asked to test for mastery before the student returns to the mainstream of the program (Markle, 1969).

Early branching programs used a "scrambled book" format. The pages were not read in order but by following the directions given after each response alternative. For each question a short discussion is given followed by a multiple choice question designed to test the main point. Each alternative answer has a page number beside it to which the student turns after his selection. Correct answers lead to the next unit to be learned while incorrect answers lead to feedback loops and then return to the original question. Thus the student cannot ignore any material by

skipping ahead since the "next" page is not the sequentially numbered next page but the page number with the correct alternate choice (Crowder, 1963). In principle these loops would correct each specific mistake plus any previous mistakes as well. In practice this would make too large a book so that different routes do lead to common branching sections. Another drawback of this procedure is that "any single item in a branching program is a fallible basis for branching decisions, often yielding false positives such that the student skips over material he cannot afford to miss" (Anderson, 1967, p. 154). Students who have good "test taking skills" may also slip through.

Although Crowder states that intrinsic and extrinsic programs are dissimilar in approach and rationale, there do appear to be some similarities. In both systems students progress at their own pace and immediate confirmation of results is given. The question then arises about whether the two programing techniques can be compared to determine which one is better:

> This revives the old quarrel which set the Skinnerians against the Crowderites until they realized that they were often talking about different things: the former were attacking on theoretical grounds while the latter were defending themselves on practical grounds, and vice versa. (Pocztar, 1972, p. 72)

When comparisons were made no significant differences in learning efficiency were found. Students often find only linear or only branching programs to be tedious and monotonous in large doses and so many

programs now combine the two approaches in order to achieve variety. One example of this is called "skip-branching" which provides a fast cycle, a slow cycle, and a loop cycle for the student who needs to retrace his steps (Pocztar, 1972). As programed textbooks and scrambled books are replaced by CAI programs, many of the initial technical limitations of each approach no longer present a barrier. The limited amount of storage area and options previously available are now sometimes referred to as the "black car" age (or "Model T" stage) of instruction (Markle, 1969).

Some objections to programed instruction have been objections to the dull and repetitious writing styles that characterized many early materials. Many of these faults have been identified: copy frames, lecture frames, Swiss cheese frames, and formal prompt frames. Examples of over prompted frames are as follows:

> 1. Partial presentation of a word, with omitted letters to be filled in--letters present vary from nearly all present initially to all, or nearly all, absent terminally.
> 2. Similarity of ideas, calling for a response that is provided in a similar context--e.g., Just as smoke rises, warm air will also _______.
> 3. Similarity of grammatical construction--e.g., The higher the temperature, the faster the molecules move; lower the temperature, the ______ they move.
> 4. Constriction of the range of response by grammatical construction, e.g., The throttle is advanced just ______the ignition is turned on. (requiring a temporal word such as before or after)
> 5. Similarity of root words with similar meaning used in a preceding frame or an earlier part of the same frame--e.g., A candle flame is hot; it is a(n) _________ source of light. (desired response: incandescent)
> 6. Obvious transpositions, e.g., Gross profit less overhead equals net profit; so to get net profit you subtract _______ from _______.
> (Lumsdaine, 1960, p. 538)

Rules of thumb for writing good frames and sequences are now available (Markle, 1969). These include a full range of examples and non-examples of the concept, making use of elastic prompts, and providing branching frames. The grammatical structure of the sentences themselves in frames has been analyzed to determine what factors influence their comprehensibility (Hartley, 1972). For example, simple sentences which are affirmative, active, and declarative are more easily identified than complex sentences with negative qualifiers and connectives.

Whether or not a program is considered an effective teaching instrument must be determined by empirical testing. It is a two stage process of internal evaluation during the program development with a small number of students and external evaluation or validation of its effectiveness with the intended population. The overall aim of most programed materials is to conform to the 90-90 rule of thumb: 90% of the students should obtain 90% of the program's objectives (Hartley, 1972). Some researchers break it down more explicitly and chose the ratio of 95-95 for linear programs and 95-70 for branching programs (Pocztar, 1972). The letters scores, however, may not be a useful measure if high scores have already been obtained on the pretest. Therefore, the best measure of a program's effectiveness may be the increase of what is learned from what had previously been known. The gain ratio has been suggested as one measure (McGuigan & Peters, 1965). It is found by "dividing the mean gain between the pretest and the

letters scores by the mean possible gain (defined as the difference between the mean pretest scores and full marks on the letters, the tests being the same or parallel)" (Hartley, 1972, pp. 143-144). Even this measure may be invalid if too many easy items on the pretest were used and so this should be taken into account (Blake, 1966). Gain scores may also be misleading if the pre and posttests do not have equal interval properties, there are ceiling effects on the letters, or both methods of instruction take unequal times to complete. The statistical phenomenon of regression to the mean can also give spurious results. Other measures include a delayed letters or measure of retention and a transfer of learning to new situations. Some investigators have found that retention test scores decline over a period of time while transfer test scores remain constant (Hartley, 1972).

Most studies of the effectiveness of programed learning material do take measures in four major areas (Hartley, 1972): (1) test scores (pre, post, delayed, and transfer); (2) errors (on tests and frames); (3) time required (individual frames and entire program); and (4) a preference or attitude questionnaire. Since programs with low error rates would be difficult to revise, programers now usually overestimate jumps in the material to see if the branching subroutines are an effective remedy. What an error analysis will not reveal is whether the frames are faulty (i.e., overprompted, over-reviewed, too small a step size), the subject matter organization is faulty (i.e., inadequate task analysis), or the presentation

is boring and tedious (Horn, 1964). Instead of using total program time taken by the students as a measure, it may be more useful to analyze time taken per individual frame. Speed of responding may be directly related to error rate and so may be a better dependent variable. One final measure often overlooked is assessing student attitudes of how well they liked this form of presentation compared with conventional formats (Hartley, 1972).

Techniques are now available to help programers know how to revise their instructional sequences based on an error analysis. Generally, if a large proportion of students make similar errors in the same place, then the sequence may need to be rewritten. Less frequent errors in a particular part of the program may need to write in specific remedial sequences. A low error rate but with high variability may need only a general remedial sequence (Hartley, 1972). In order to prevent program revisions from resulting in a commensurate increase in the program's length, some flow chart analyses have been developed which provide decision rules for revision strategies. While these rules are helpful, program writing is not yet a precise science and programers often learn by doing. The first rule of program evaluation still remains: "You cannot tell by looking at it whether it works or whether it is too easy or too hard for students" (Markle, 1983, p. 37). In other words, the program needs to be tried out on students and revised based on the types and frequences of errors made.

Teaching Machines and Computer-Assisted Instruction

Since the turn of the century many different media have been promulgated as the new wave in instructional technology. Each decade has seen the application of a new technical medium to widespread educational use: 1900--phonograph and telephone (audio instruction); 1910--typewriter (writing aid); 1920--slides and overhead projectors (visual instruction); 1930 and 1940--films (audio-visual instruction); 1950--radio; 1960--television; 1970--computers; and 1980--microcomputers. Despite these advances a recent review states that "five decades of research suggest that there are no learning benefits to be gained from employing different media in instruction, regardless of their obviously attractive features or advertised superiority" (Clark, 1983, p. 450). While lessons presented on a television or computer screen can help students learn, the key is in the instructional method used. Instead of the media being the message, it turns out that it is the method that makes the message effective.

Although some early devices to teach spelling and logic were patented in the late 19th century, the invention of the teaching machine is usually credited to Sidney Pressey (Glaser, 1965). In the early 1920s at Ohio State University, Pressey saw a need to relieve teachers of the burden of drilling students to teach them facts and information. The question and answer classroom sessions appeared inefficient to him because only one student

could answer at a time while the others were often bored or inattentive. He decided to devise a mechanical device which would administer and score multiple choice test questions. His devices were versions of the memory drum used by experimental psychologists of the time. Their advantage was that all students could be asked questions at once and they each could respond and receive immediate confirmation of the answer (Pressey, 1926). On one machine a typewritten question is presented in a window on a revolving drum followed by four possible answers; the student presses down one of four keys. If the selection is correct, the drum advances to the next question. If a mistake was made the student must try again until the correct answer is found. A counter tabulates all responses. To Pressey's surprise this device not only saves teacher time by giving and scoring tests, but it also raised the student's score by lowering the number of errors. Normally students could expect a several day delay between taking a test and receiving the corrections back. The immediate feedback given by a self-scoring machine increased attention to mistakes and rewarded correct answers. A later version omitted questions from the drill sequence after they had been correctly answered twice in succession. Thus, the machine not only gave and scored tests but actually appeared to teach the subject matter (cited in Benjamin, 1988).

The significance of why the machines worked was called an example of Thorndike's so-called Laws of Learning. Four main principles were said to

influence the learning curve: (1) the law of recency (the more recent in time that a response is made, the more likely that response will be repeated in the future); (2) the law of frequency (more frequent responses will be more likely to be repeated again): (3) the law of exercise (correct responses are more often practiced); and (4) the law of effect (if responses are given corrective feedback it will accelerate the learning process). Thorndike postulated that behavior was "stamped in" on a trial and error basis if followed by satisfying consequences (cited in Pocztar, 1972; Hartley, 1972). Pressey (1926) felt that his "drill apparatus" prevented needless overlearning of easy material and gave more practice on difficult items. The machines insured that correct responses were emitted most frequently and recently since they were needed to continue to the next program question. These first teaching machines never became popular with the educational establishment, possibly due to the subsequent economic depression and the oversupply of teachers. Psychology theories of the time were more concerned with forgetting curves based on massed versus spaced practice rather than what would motivate the student to initially learn new subject matter. Pressey's contribution is mainly remembered today for his emphasis on immediate feedback and self-pacing. It was not until the mid 1950's that interest in teaching machines again resurfaced (cited in Benjamin, 1988).

Although Pressey's devices did give feedback to students about their

answers, they did not teach new information. Students had to first study the material before using the machine. A device used to teach new information was not to be developed until the 1950's (cited in Benjamin, 1988). Skinner constructed a number of teaching machines in the 1950s at Harvard University, the most well known of which was a disk machine. A program is printed in 30 radial frames on a 12-inch disk. Once the disk is inserted in the machine it cannot be removed until the student completes the program. Each frame appears in a center window while the response is written on a strip of paper on the right hand side. After each response the student lifts a lever on the front side of the machine and his written response is rotated under a transparent cover. The correct answer is then revealed in the upper corner of the central window frame. If the answers match, the student moves a horizontal lever to the right which punches a hole beside his response and alters the machine so that particular frame will not reappear when the disk is fully rotated. By moving the lever back to the left end, the next frame in the sequence appears. After responses have been made to all 30 frames, the disk continues to stop at frames which were incorrectly answered on the first revolution. This process continues until the disk revolves without stopping. The program has then been completed. Earlier versions required a two-stage confirmation procedure in which the student had to make two correct responses to each frame before it was considered learned. Skinner

contended that the teaching machine itself did not teach but was only a labor-saving device designed to bring the student into contact with the program. Unlike the role of Pressey's machines as a follow up or adjunct to instruction, these question and answer programs were designed as primary instructional materials (Skinner, 1968).

The major types of autoinstructional devices or teaching machines developed up to 1960 are illustrated in Figure 1. They differ in function in four ways: (1) form of response; (2) basis for feedback; (3) reciprocal feedback to the device and its program based on the student's response; and (4) visual display characteristics (Lumsdaine, 1960). These factors are further described in Table 3 (Lumsdaine, 1960, p. 520).

The devices in the top row allow a freely constructed response which is judgmentally compared against a visual criterion. In the middle row discrete response alternatives permit automatic scoring without revealing the correct answer. If incorrect answers are made, before the student can proceed to the next question, he must make further attempts to select the answer. For the devices in both rows the student is prevented from looking backward or forward in the series when responding to any particular one item. The length of the verbal stimulus in each frame is likewise spatially constrained and so permits only short question and answer statements (Lumsdaine, 1960).

The devices in the bottom row combine the features of the constructed

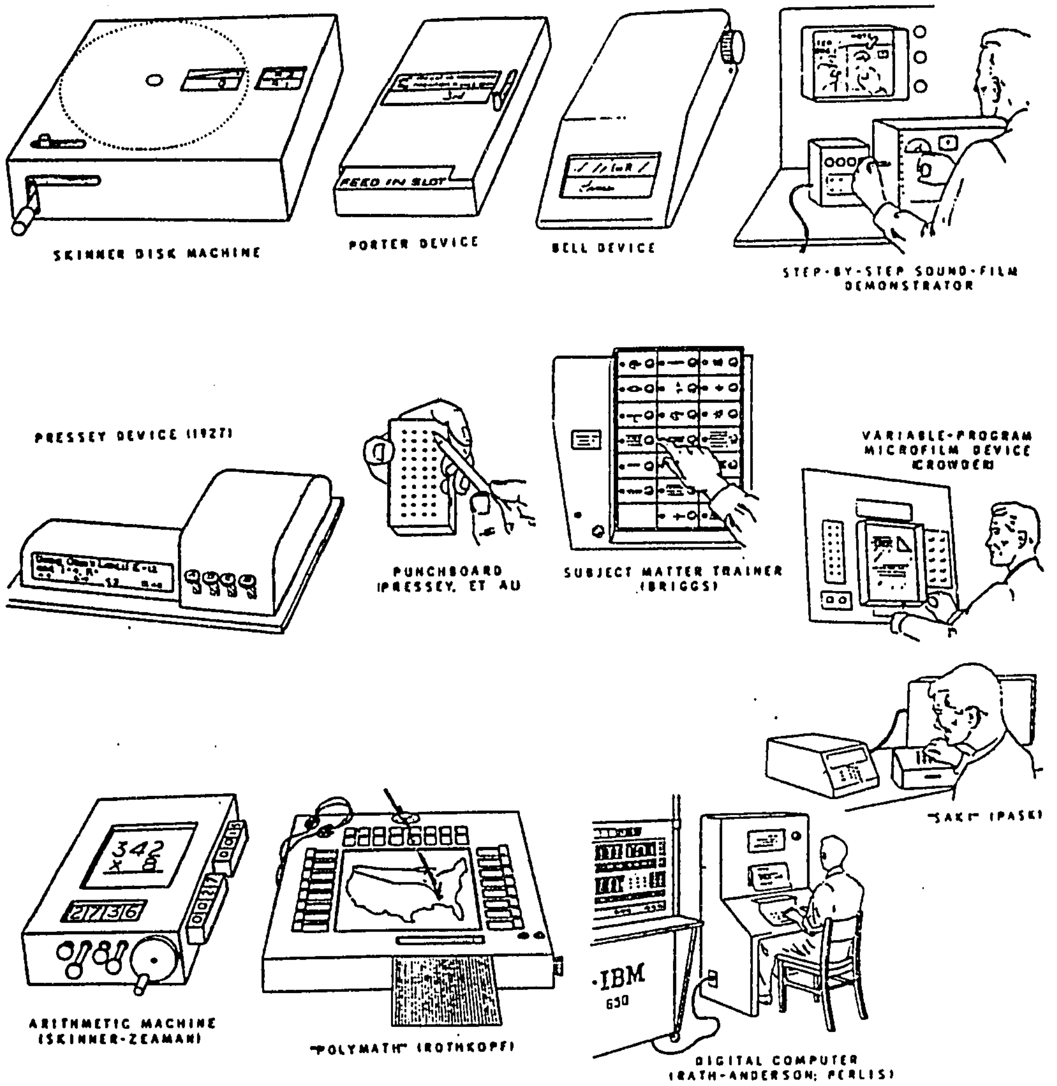


Figure 1. Teaching Machines Illustrating Various Characteristics.

Source: Lumsdaine, A. A. (1960). Some issues concerning devices and programs for automated learning. In A. A. Lumsdaine & R. Glaser (eds.), Teaching machines and programmed learning: A source book. Washington, DC: National Education Association, p. 524.

Table 3

Some Specific Subissues Related to the Role of Teaching Machines

Specific Subissues	Examples
1. Form of the student's response	1. Construction versus recognition; "free" versus constrained or discrete; large versus small number of possible choices.
2. Basis for feedback/correction to the student	2. Automatic versus judgmental scoring; correct answer necessarily revealed versus not; correction at end of lesson, each frame, or each element.
3. Effect of student's response on the program	3. Item drop-out; program branching item by item or section by section; program variation based on single response or on performance over a series; program variation in content and/or speed.
4. Visual display characteristics	4. Controlled sequencing of large display versus changing display within frames; special provisions for prompting cues.

response with discrete responses automatically scored. They range in complexity from the Skinner-Zeaman arithmetic machine in which sliders and dials are used to set up the numerical answer, to electronic digital computers that can automatically score a wide repertoire of alphanumeric characters. The polymath apparatus depicted allows three different response modes: multiple choice, constructed response, and 2-dimensional

tracings with a stylus. More extensive stimulus material including pictures and diagrams can be presented through the use of adjunctive display panels such as microfilm projection equipment. The introduction of computers greatly expanded the versatility of the programs by freeing them from the constraints of predetermined sequences by permitting branching and subroutine programs (Lumsdaine, 1960). The intent was to simulate the adaptive teaching methods of a skilled human tutor.

The renewed interest in teaching machines at mid century proved to be short lived. Despite Skinner's contention that "with teaching machines and programed instruction one could teach what is now taught in American schools in half the time with half the effort" (1984, p. 948), by the 1970s teaching machines had become obsolete. Programed textbooks could present the same format more inexpensively while computers were more flexible. The programed textbook has been called a Socratic workbook and a paper machine. It became a popular alternative to autoinstructional devices due to its simplicity and low cost. Response and correction sequences were provided by placing the answer to each question always on the succeeding page. One main problem, however, was that students could always cheat by peeking first at the answer before reading the question. The programed texts were not self-scoring so the teacher still had to score each lesson. From the student's viewpoint, the textbooks were not as interesting as the machines and devices that gave automatic

feedback. Programed textbooks may soon become extinct as they are being rapidly replaced by CAI programs.

A brief summary of the development of computer-assisted instruction (CAI) will now be given. More complete histories are readily available (e.g., Chambers & Sprecher, 1983; Hofmeister, 1984). Although computers were first developed during World War II, it has only been recently that large scale educational applications have materialized. During that time rapid advances in technology have dramatically reduced the size and cost of computers while memory and speed of responding have increased. The vacuum tubes of the first generation of computers were replaced by transistors and then by integrated circuits. The first CAI programs in public schools occurred in New York City in 1959. They used teletype terminals connected by telephone lines to a large mainframe IBM computer. A new and simplified computer language called BASIC was developed at Dartmouth University in 1959 and was used to write CAI programs. By the mid 1960s the teletype was replaced by the cathode ray tube (CRT). In 1968 minicomputers were introduced and many private corporations became interested in CAI. By the mid 70's computer-managed instruction (CMI) became a new application for computers by storing data on student test scores and their progress in the curriculum. With CMI it was the teacher and not the pupil who interacted with the computer. By the late 1970s the growth of computer applications had slowed considerably. This

was due to a combination of high expectations not fulfilled, high cost, and the small number of quality programs available. Relief came in the form of microcomputers which became available for educational use around 1977. By 1979 hard disc systems enabled them to "stand alone" without being connected to large central computers. By the 1980s the last obstacle to widespread applications of CAI was the lack of quality software that has proven effective. Many of the programs being sold today have been produced by cottage industries and are often too fragmented in structure and conceptualization to be useful additions to the curriculum (Hofmeister, 1984).

Currently there are four major divisions in CAI applications: (1) programed instruction based CAI; (2) artificial intelligence based CAI; (3) simulation-oriented CAI; and (4) tool applications (Hofmeister, 1984). Programs that use instructional design concepts originally used to develop programed instruction materials are the most common type of CAI lessons and include drill and practice lessons as well as tutorial programs. Much of the field of cognitive psychology uses artificial intelligence programs to try and emulate human thinking processes. Instead of concentrating on a particular subject area, it attempts to identify basic problem solving stages the pupil must use to conceptualize responses and anticipate error patterns. Simulation based CAI is often used in social studies and science classes since it creates a real life situation in which the pupil is required to make

quick decisions. Common examples range from many of the arcade video games to flight simulators used for pilot and astronaut training. The computer as a tool in instruction can be used as a word processor, a calculator, to perform statistical analyses, and to search information bases.

While the vehicle of instruction may have changed every decade during this century, the goals of individualizing education have not. Programs are still designed to provide immediate feedback on answers, more practice on difficult material, less practice on material easily learned, and to provide correction procedures for predictable errors. The technological advantage of computers is that longer and more complex programs can be prepared with better anticipation of wrong answers and more branching capabilities. It is interesting to note that many of the computer's most advertised capabilities, such as high resolution graphics and lightning-like respondi-ng, may make only minor contributions to education. CAI's importance as an educational technology will focus on its ability to replicate the adaptiveness of human instruction and to collect data on the effectiveness of different instructional methods (Hofmeister, 1984).

Instructional Sequencing

In the late 1950s a research group at the University of Pittsburgh made the first significant attempt to use behavior analysis methods to fragment and structure a subject area (Evans, Homme, & Glaser, 1962;

Glaser, 1966; Homme & Glaser, 1960). Instead of referring back to laboratory studies with animals it borrowed concepts from the field of logic. It began with the premise that all verbal information can be classified into two groups of statements: rules and examples. The "ruleg" system of programing was named after the abbreviation of ru(l) for rule and eg from the Latin term of "for example" (exempli gratia or e.g.). The logical concepts of a priori and a posteriori reasoning were translated into deductive and inductive teaching sequences. The ruleg system was a deductive strategy and contrasted with the egrul(e) system of using an inductive strategy. Although the system is not precise enough to enable computers to generate standard frame designs, it does give the human programer a rough formula to create frame sequences. While other programing terminology (i.e., prime, prompt, probe) classified the functional characteristics of a frame without regard to content, the ruleg system structured and sequenced the subject area using a matrix analysis (Markle, 1969; Markle, 1990). While the original authors only advocated the ruleg approach to instruction, the controversy surrounding the ruleg versus egrul formulas has rekindled the educational debate between learning by rule or by discovery.

When an event occurs often enough to be of some interest, the scientist will typically give the event a name. Tacting an event therefore is the lowest level of law or abstraction. By careful observation the general

parameters under which the event occurs will be described and so the event becomes a law. When several laws can be deduced from a more inclusive concept a theoretical statement is generated. These events, laws, and theories exist at all levels of complexity and abstractness. At each level these event classes may be exhaustively analyzed into rules and their exemplification. A rule is then a principle and an example is an instance or a special case of the principle. Each rule and example may be either true or false and have transitive properties. Although this description may necessarily oversimplify the relationships among events, it does have sufficient precision to hold true at each level of complexity (Homme & Glaser, 1960).

How can the logical analysis of rules and examples be translated into psychological concepts? It must first be noted that both rules and examples may function as verbal prompts. In fact, a rule can be considered as the archetype of the thematic prompt in that it often shares none of the formal properties of the behavior it evokes. Technically the definition of thematic control is that there is no point to point correspondence between the controlling variables and the response product (Peterson, 1978). The thematic prompt is better known as a hint. In a real sense, the entire intraverbal dependency of language may be regarded as a kind of thematic prompt. If a rule is used as a formal prompt, as in rote learning, then it is called a mnemonic device. Used in

the prompting at a play rehearsal, the formal prompt may include either echoic or textual prompts. Different examples will also have varying amounts of thematic or formal prompting properties. An example of a rule may gain enough strength to act as a thematic prompt on future occasions when similar examples are presented (Skinner, 1957).

When teachers give instructions to students they are changing behavior by means of stimulus control. Expository teaching usually involves a rule-example-incomplete example presentation which minimizes incorrect responses and gives the student practice in directly applying the rule. This teaching sequence is deductive in nature and is the norm in most class lectures and textbooks. The deductive sequence is also common in persuasive material, in step by step instructions, and when qualifications to a statement are being specified. When examples are presented first in an effort to get the student to induce the general proposition, we call the teaching sequence inductive. This example-rule pattern is often found in newspaper articles in which simple relationships are being described and in technical articles in which extensive training on the part of the reader is assumed. Rules are not given in rote learning sequences involving associations which do not have a set pattern. Concept formation experiments also only present a class of examples and non-examples and then test for generalization of a set of novel examples (Homme & Glaser, 1960).

From this logical analysis of verbal and symbolic concepts evolved the ruleg programing system. The relationships of ru's and eg's are not mutually exclusive. On the contrary, they have proved to be relative concepts in which the same statement may be a rule or example depending on the relevant level of abstraction required. For this reason a definitive description of a rule or example has not been required. From a behavioral perspective, rules or principles are statements of some relationship between sets of concepts (Markle, 1969).

The original ruleg article described rules as:

> A definition (operational or otherwise), a mathematical formula, an empirical law, a principle, axiom, postulate, or hypothesis. The invariant feature of all ru's is that they are all statements of some generality, from which substitution-instances can be obtained (Evans et al., 1962, p. 513).

The range of examples may include:

> A description of a physical event, a theorem or deduction of any sort, or a statement of relationship obtaining between specific objects, whether the objects are physical or conceptual. The invariant feature of all eg's is that they are all statements of some specificity, derived from more generalized ru's (Evans et al., 1962, p. 513).

The most obvious examples of ru's come from the sciences, such as the law of accelerating bodies (i.e., $s = 1/2gt^2$), in which there are clear relationships between sets of well-defined concepts. If the ru is: most metal expands when heated, then a corresponding eg could be: copper expands when heated to a certain temperature. Of course, the purest

instances of ru's and eg's comes from the field of mathematics. A concrete example would be combining 4 stones and 3 stones to make 7 stones and then demonstrating that the same number of stones is obtained if 3 stones are combined with 4 stones. This is a specific example of the commutative property of addition ($4 + 3 = 3 + 4$). This property is itself usually described by the algebraic formula: $a + b = b + a$, which in turn is an example of a rule in group theory such that $a \circ b = b \circ a$. In this sequence we progress from identifying both the objects and the operator to a level in which neither is specified (Glaser, 1962). Similar examples could be constructed in verbal subject matter by transforming a sentence into its equivalent in symbolic logic.

The ruleg system attempts to provide an approximate formula and notation for frame writing which is a scaffold for the instructional designer to build on. It gives a set of general rules to sequence a subject domain, sets up a teaching format, and decides which and how many examples to present. It is intended for use primarily with complex verbal concepts and applications of principles. The formulas require the use of extensive exemplification of all concepts being taught. The system is flexible enough so that many different teaching sequences can be diagramed using the same notation (Markle, 1990).

In the ruleg system ru's and eg's are each subdivided into two categories: complete and incomplete. We abbreviate incompleteness by

placing a tilde (~) over the ru's and eg's: $\widetilde{\text{ru}}$ and $\widetilde{\text{eg}}$ (read ru-tilde and eg-tilde). Terminal frames in which the criterion behavior is performed in the presence of minimal cues is represented by a double tilde: $\widetilde{\widetilde{\text{ru}}}$ and $\widetilde{\widetilde{\text{eg}}}$ (read ru-double-tilde and eg-double-tilde). Non-examples or negative instances of ru's and eg's are abbreviated with a superscript horizontal bar used as a negation sign: $\overline{\text{ru}}$ and $\overline{\text{eg}}$ (read ru-bar and eg-bar). In the current notation there is no way to differentiate negative exemplars as a prime, prompt, or terminal frame. Markle (1990) has suggested the term "neg" for negative example. The present author would like to add the term "neru" for a non-example of a rule. Therefore, a neru and neg would represent complete or prime frames; a neru and neg (read neru--bar and neg-bar) would represent incomplete or prompted frames; and $\overline{\overline{\text{neru}}}$ and $\overline{\overline{\text{neg}}}$ (read neru-double-bar and neg-double-bar) would represent the criterion behavior of the terminal frame with minimal stimulus support. Multiple ru's and eg's can be denoted by adding subscript numbers and using connecting plus signs as in $ru_1 + ru_2 + ru_3$ or $eg_1 + eg_2 + eg_3$. Thus we now have 12 distinct categories which are usually mutually exclusive on a certain level or complexity and which are categorically exhaustive of all possible teaching concepts. By combining these concepts in different permutations we have an almost unlimited number of possible teaching sequences. The full notation system is summarized in Table 4.

The authors of the ruleg system proposed that each rule should be taught separately in a sequence of practice frames that would become progressively more difficult. The teaching sequence tries to avoid all errors by the use of a large number of examples which provide practice and review of the new concept. The standard prescription for a series of frames to teach the concept is as follows (Evans et al., 1962; Markle, 1990):

1. ru + eg + $\widetilde{\text{eg}}$ (introduce with immediate practice)
2. ru + $\widetilde{\text{ru}}$ (practice on some technical vocabulary)
3. ru + $\widetilde{\text{eg}}$ (practice without the fully worked example)
4. eg + $\widetilde{\text{ru}}$ (help in verbalizing the rule)
5. eg + $\widetilde{\text{eg}}$ (help by analogy, rule applying practice)
6. $\widetilde{\widetilde{\text{ru}}}$ (verbalize the rule with minimal prompts)
7. $\widetilde{\widetilde{\text{eg}}}$ (applying the rule with minimal prompts)

This frame series is a lean ruleg sequence in that no frame type is repeated and it does not include any negative examples. Theoretically this 7-frame sequence would be the least number of frames needed to teach a concept. In actual practice only simple rules could be taught this quickly.

Ruleg programers have a clear preference for the deductive or priming approach in which generalizations are presented and followed by applications to specific examples. The frame type of choice is the ru +

Table 4

The Revised Ruleg Notation System

Rules

Positive		Negative	
ru	complete rule	neru	complete negative rule
$\widetilde{\text{ru}}$	incomplete rule	$\overline{\text{neru}}$	incomplete negative rule
$\widetilde{\widetilde{\text{ru}}}$	terminal rule with minimal cues	$\overline{\overline{\text{neru}}}$	terminal negative rule with minimal cues
$ru_1 + ru_2 + ru_3$	multiple rules	$neru_1 + neru_2 + neru_3$	multiple negative rules

Examples

Positive		Negative	
eg	complete example	neg	complete non-example
$\widetilde{\text{eg}}$	incomplete example	$\overline{\text{neg}}$	incomplete non-example
$\widetilde{\widetilde{\text{eg}}}$	terminal example with minimal cues	$\overline{\overline{\text{neg}}}$	terminal non-example with minimal cues
$eg_1 + eg_2 + eg_3$	multiple examples	$neg_1 + neg_2 + neg_3$	multiple non-examples

eg + $\widetilde{eg}$ sequence for introducing a new rule. It not only explicitly states the rule and presents an example, but then it gives the student immediate practice in applying it to a new situation. The egrul approach of using examples to prompt generalizations is discouraged. The logic of their reasoning is as follows:

> Why not eg + $\widetilde{eg}$? This would be an analogy frame. The chief characteristic is that one must induce the ru from the first eg, and then apply it to the eg. Rather than run the risk of having the student induce an incorrect ru, it may be preferable to state the ru for him explicitly. Incidentally, this same philosophy may lead to the rejection, in general, of the inductive presentation which might be symbolized as: $eg_1 + eg_2 ... eg_n + ru$. Here a large number of eg's are given and the student is asked to state the ru involved. After the student can recognize and apply a ru with proficiency, then eg + $\widetilde{eg}$ frames are acceptable. But until that time, it may be often hazardous and slow to approach a ru through induction and incidental learning. (Evans et al., p. 516)

The supporters of the egrul approach have equally forceful arguments. One problem with deduction is in the ambiguity of verbal rules. Markle (1975) points out that:

> The majority of so-called concept presentations consist of giving the learner a definition that does not define very well, if at all, accompanied in most cases by an example or two that in no sense exemplifies the broad domain to which the concept label is applied by subject matter experts. Almost certain would be a total lack of nonexamples or coordinate concepts. (pp. 3-4)

The problem with definitions and rules is that they do not often describe the boundary areas of what is and what is not the concept. For example:

> School textbooks are full of definitions that don't define and

> principles that can't be applied because it is impossible to figure out what they really mean. The solid learning that takes places turns out to be exactly what the proponents of verbalizing are hoping to avoid--analogy and induction. (Markle, 1969, p. 183)

A classic example is in defining a sentence as "expressing a complete thought." One would first have to define "expresses" and "complete thought" before the student would be able to discriminate a sentence from a non-sentence. Another kind of error is in defining an easily exemplified concept into terms more abstract than the concept itself. Consider the dictionary definition of a door as "a means of access." Synonyms of vocabulary words are not definitions but only more verbalization. Saying that "to go around" means "to circumvent" does not explain the concept. Often illustrations of objects found in dictionaries and encyclopedias have such limited variability that a single picture will not enable the student to identify all instances of the object (Markle, 1975).

In all of these cases the critical feature is not the number of examples, but the range of examples chosen to prevent incorrect generalizations (Markle, 1990). Both the ruleg and egrul approaches came from academic orientations in which the emphasis was on verbalization and problem solving. Neither system works well when mechanical or manipulative skills are the subject area. A third approach called "egeg" is possible when discrimination programing is needed and verbalization is

not necessary, such as in industrial settings. When operating a machine it might be irrelevant to be able to list all the parts but critical that the parts be located quickly. The mathetics system mentioned previously also minimizes verbalization and teaches each task as a unit instead of breaking it down into parts. It assumes categorical specific learning conditions to which the performance components can be classified in order to identify the best conditions for learning. Both the discrimination programers and matheticists will design training programs based upon a task analysis of job requirements in particular situations without regard to theory (Markle, 1969).

Before the question of how to teach can be answered, the programer must decide what to teach. This means that the subject matter must be arranged in some conceptual hierarchy. A rather straightforward technique from the field of behavior analysis was devised by Mechner (1965). He proposed that problem solving strategies can best be described in a flow chart structure of continually subdividing concepts until they exist in their most elementary form. These "atoms of knowledge" should be able to be introduced every 5 to 10 frames in a program. It is similar in design to the branching of a tree in which the trunk turns into branches, twigs, and then leaves. Concepts must be learned at each choice point in the learning sequence, starting with the most basic form and moving in the direction of more complex concepts. Mechner's system is similar to

the PERT procedure used to plan production activities in industrial manufacturing (Pocztar, 1972).

The ruleg system uses the concept of verbal matrices to organize the important relationships in a subject domain and permit discrimination of intraverbal connections, similarities, and differences. First, the programer should write down all the subject matter rules he can think of without regard to organization or pattern. Then textbooks and notes should be consulted for more difficult rules. There is no one specific way to order these rules; it depends primarily on the structure of the subject matter and the type of population to which they shall be taught. Some guidelines are as follows:

> Useful methods for ordering rules include complexity (simpler ru's first), chronology (ordering or ru's in time, as perhaps in a history program), spatiality (ordering ru's in space, as perhaps in a geography program), and dependence on other ru's (in a statistics program where it is necessary to introduce ru's about the mean before ru's about variance are introduced). (Evans et al., 1962, p. 514)

After some preliminary ordering the ru's are set up on both axes of a matrix with the same ru's listed horizontally and vertically (see Figure 2). Separate matrices are set up for each set of relationships to be established. Each matrix is called an operator. Ru differences would be plotted on a discriminator operator while ru similarities would be on a relator operator. The ru matrix is a systematic method for examining the set of all ordered pairs in terms of these operators. For example,

asking how is cell 1 different from cell 2 might be different than asking how cell 2 is different from cell 1 if the order of the relationship is important. If order is of no consequence then symmetrically placed cells would be redundant. The ordered pairs themselves may be added to the axes as new row and column entries, thus expanding the matrix to form ordered triplets, quadruplets, and so on.

Cells on the diagonal relate each rule to itself and so are called definitional operators. The diagonal cells are used to define the ru in terms of previous knowledge while the vertical and horizontal cells describe the relationships between ru's, either similarities or differences. Matrices of eg's are then formed called example operators which contain cells which give instances of the various ru's. As a rule of thumb, the first example operator should be the simplest non-trivial example of the concept. Maximum differences among the set of eg's allows adequate generalization while minimum differences among the set of neg's allows adequate discrimination to occur. The cells are then numbered for future identification (Evans et al., 1962; Glaser, 1966).

Now the programer is ready to make his first draft of the program using the numbered ru matrix as a prompt. Using the ruleg sequence one would probably begin with definitional operators first; with the egrul sequence one would begin with similar eg operators of a ru definition. The type of population for which the program is intended should be taken

Operator	Ru 1	Ru 2	Ru 3
Ru 1	1	2	3
Ru 2	4	5	6
Ru 3	7	8	9

Figure 2. The Ru Matrix. (Evans, J. L., Homme, L. E., & Glaser, R. (1962, p. 514)

Source: Evans, J. L., Homme, L. E., & Glaser, R. (1962). The ruleg system for the construction of programmed verbal learning sequences. Journal of Educational Research, 55, 513-518.

into account when estimating the optimal number and distribution of frame types to be used. The rough program is then assembled and tried out on a small number of students. Revisions are made on the basis of an item analysis of student errors and gain score ratios for pre and posttests. The largest amount of time allocated for programing should be spent on these trial and error revisions until it is pragmatic-ally reliable (Fry, 1963).

CHAPTER II

REVIEW OF LITERATURE

Previous Related Studies

There have been innumerable studies on the effects of rule versus discovery learning and excellent reviews are available (e.g., Anderson & Faust, 1973; Megarry, 1989; Wittrock, 1966; and Yabroff, 1963). In general the empirical evidence does not support one method consistently over the other, but comparisons have been difficult to make due to the varying operational definitions used. Independent variables have included presenting principles, answers, verbal cues, verbal mediators, verbal instructions, and verbalization by the subject. Dependent variables have been less often studied and have included transfer, motivation, and ability to solve problems (Wittrock, 1966). It should be noted that expository teaching versus the discovery method are different variables than the use of deductive versus inductive teaching sequences. A student may discover or generalize from either very general or very specific cues depending on the subject matter and the individual's learning history.

Two early studies showing the advantages of the inductive method

will now be described. Judd (1908) studied the effect of teaching a relationship between the depth of water and refraction. The angle of incidence changes as one looks from a less dense medium such as air into a more dense medium such as water. Two groups of 5th and 6th grade students practiced throwing darts at a target submerged in water. The experimental group was given verbal instructions concerning the principles of light refraction before throwing the darts. The control group received no such instruction. When the depth of the water was reduced the experimental group was able to make adjustments in their aim while the control group was not able to transfer their practice skills to this new situation. Discovery learning has also been shown to transfer better when the students discover the problem solving principles themselves rather than being told. Kersh (1958) divided college students into 3 groups and gave them two mathematical puzzles to solve. The groups were as follows: (1) no help method--problems are presented without solution hints and no students' questions were answered; (2) direct-reference method--hints to problem solution were given but a minimum of verbal feedback was given in response to student questions; and (3) rule-given methods--students were presented with the rule and also given direct aid in solving the problem. On a 20-item achievement test the rule-given group was initially superior to the other 2 groups. However, these findings were reversed 4 weeks later on similar type

problems as the no help group scored the highest. Kersh theorized that the no help group became so intrigued with the math puzzles that they continued to solve them after the original learning task was completed, while the rule-given group forgot the principle involved. It does appear that discovery learning is specific to the subject matter domain in which it occurs and so cannot be generalized to other areas.

Most of the studies reviewed used the presence or absence of verbal hints as the basis on which to compare rule and discovery learning. Two important variables often not controlled for include the amount of information given to the students prior to and following problem solving activities and the amount of learner participation. Therefore the comparison of these two methods is confounded by these variables (Yabroff, 1963). Surprisingly enough, very little research has been conducted on the comparative effects of deductive versus inductive teaching sequences. A literature review produced only two related studies using similar independent and dependent variables. Almost 30 years ago Yabroff (1963) suggested that: "If the same amount of guidance is given following discovery of rules in the inductive method as is given prior to the application of rules in the deductive method, the true worth of these methods might better be appraised" (pp. 23-24). He wrote a programed learning lesson in elementary statistics and presented it to college students. The program was written in a linear sequence and contained 33

rule frames and 84 problem frames. The independent variables were: (a) method of instruction: deductive and inductive; (b) arrangement of frames: mixed and block (a blocked sequence means that all rules for a given concept appear before the series of sample problems; in a mixed sequence rules and examples are alternately presented); and (c) intelligence: high and low (based on Miller Analogy Test scores). The dependent variables were: (a) a transfer test given 2 weeks later; (b) the time required to complete the transfer test; and (c) interest in programed booklet material (measured by a questionnaire). The following variables were held constant for all groups: (a) content and manner of presentation; (b) amount of overt learner activity; (c) feedback given; and (d) the testing conditions.

Three null hypotheses were presented before the study was conducted:

1. Inductive groups would perform with greater speed and accuracy on the transfer test and show more interest in the programed booklet than deductive groups;

2. Mixed arrangements would produce greater speed and accuracy than blocked arrangements;

3. There will be no significant differences involving intellectual level.

Yabroff obtained the following results: (a) comparing inductive ver-

sus deductive methods, there were no significant differences on scores or in the time required to complete the transfer test; (b) the deductive method produced fewer errors in programed instruction and a more favorable attitude; and (c) the inductive method showed greater speed in answering transfer of rule questions.

Yabroff concluded that both inductive and deductive methods were equally efficient in terms of time required to teach a given body of information and in producing accurate transfer of training. Although there was some speed gain on transfer of rules by the inductive method, it was offset by dissatisfaction with the method of instruction. In his discussion section Yabroff stated that at least he had shown that the inductive method was not slower as long as the step size and feedback given are comparable to the deductive method. In other studies the subject had been required to discover several concepts in a row without receiving immediate feedback on the accuracy of each generalization. In future studies he recommended that transfer tests should include measures of inductive and deductive reasoning processes as well as accuracy of subject matter content.

The major critique of the study is that the program was not first tested and then revised based on student errors. It was designed entirely on theoretical notions of how learning should take place. It is an example of the student fitting the theory rather than the theory fitting

the student, which is characteristic of the hypothetico-deductive approach to conducting experiments.

Guthrie (1969) taught college students to decipher cryptograms (-words 4-10 letters in length occurring 20-30 times per million in adult reading materials) using one of 6 rules. Four treatment conditions were then randomly assigned: (a) Example-Rule: Examples of cryptograms were presented until a criterion of 8 consecutive responses was attained; the rule was then taught with a programing technique until subjects could verbalize it upon request; (b) Rule-Example: The rule was taught first and then examples of the rule were presented until the criterion was met; (c) Example Only: Only examples of cryptograms were presented until the criterion was met; and (d) No-Example (control group): No training on deciphering cryptograms was given but a comparable amount to time was spent learning Russian vocabulary.

The results of the Guthrie study were compared in the areas of retention, near transfer (applying rules learned to new examples), and remote transfer (applying rules similar to those learned to new examples). The data showed that the Example only group was superior on remote-transfer tasks and the Example Only and Example-Rule groups were superior on near-transfer tasks. The Rule-Example group was superior on retention and speed of learning.

Although not directly analogous to the present study, the classic

studies of Tennyson et al. (1972) and Markle and Tiemann (1974) were influential in demonstrating how to analyze complex verbal concepts. Both studies were with college students, the former using the concept "trochaic meter" in poetry selections while the later using the concept "morpheme" with compound words. Their system of breaking down concepts into critical defining features, irrelevant features, and positive and negative examples of the concept was essential in the task analysis of concepts in behavioral psychology. Of particular interest was the ability of these researchers to predict the types of errors students would make based on the range of example and non-examples given. Their results demonstrated that restricting the range of positive examples caused students to make undergeneralization errors, a poor selection of non-examples caused students to make overgeneralization errors, and a restricted range of irrelevant attributes caused students to make misconception errors.

The literature review did not reveal recent studies using either the ruleg or egrul systems, although some of the principles may be unconsciously borrowed. When they are referred to, it is as an old model from the early days of programing, although it is still presented as a good teaching device in current textbooks (Markle, 1990). Even the original authors of the ruleg system seemed to have lost interest in applying this formula to frame writing as no further reference to it can be found since

their initial articles in the early 1960s.

Uniqueness of the Present Study

Much of the recent research in teaching strategies has come from the field of cognitive psychology and artificial intelligence. Computer simulations are to resemble cognitive processes. Thus we read studies which conclude: "The result of learning by discovery is a well-integrated cognitive structure....[while] learning by rule is primarily the addition of new components to cognitive structure rather than the reorganization of existing components" (Egan & Greeno, 1973, p. 96). These types of descriptions make it difficult to isolate the independent variables in the environment which would permit study replication.

The present study evolves out of the present author's interest in the fields of behavior analysis, instructional design, and educational technology. It is unique in that it combines a number of important conceptual issues in instructional sequencing: it extends previous studies on the ruleg system by directly comparing it with the egrul system, uses a task analysis to organize the subject domain, applies teaching strategies developed by Markle and Engelmann, and utiiizes a CAI program to present instruction and score student responses.

The knowledge domain used is the area of behavioral psychology. A concept analysis was originally developed for about 50 basic terms and

another 50 prerequisite terms. The concepts involved were complex and have proved difficult to teach to college students and for students to remember. This list was later reduced to 7 basic concepts in order to produce instructional programs which students could finish in one sitting.

An attempt was made to write an instructional program following the strict guidelines of the ruleg and egrul systems. The author discovered that while a ruleg program could be written following the concept analysis in a fairly straightforward manner, it was difficult to organize the concepts using a strictly egrul approach. Too many types of examples would be needed in order to present a faultless communication of each concept. Therefore, after several attempts a compromise was reached: all the programs would use some rules but the types of examples would be varied. Formal definitions were defined as those which contained all critical defining features plus additional background and irrelevant features; informal definitions contained critical defining features only. Four instructional sequences then evolved: (a) rules containing formal definitions but minimal examples; (b) informal rules plus positive examples; (c) informal rules plus negative examples; and (d) informal rules plus positive and negative examples but with fewer examples of each type. The programs were made of similar lengths and all covered the same 7 concepts in behavioral psychology: the reflex, respondent

conditioning, respondent extinction, respondent punishment (aversive counterconditioning), operant conditioning (or reinforcement), operant extinction, and operant punishment.

The proposed subject area therefore has the following features: (a) it is a self-contained system requiring only a minimal knowledge of psychology; (b) it uses a task analysis of complex textual verbal stimuli as a basis for writing CAI programs; (c) the program teaches a series of concepts and their relationships; and (d) corrective feedback is given on all correct incorrect answers. The use of a CAI program available via computer terminals on campus permits a large number of students to access the program at their own convenience while also performing the necessary data tabulation required. The CAI program used is the PASS System (Jenks, 1989) which is an authoring system developed at Western Michigan University (WMU). Its advantage is that it requires only a limited knowledge of computer programing skills to enter lessons which are in programed instruction format. The lessons are stored for later presentation to students via remote terminals, uses a time-sharing system so different students can use the program simultaneously, and stores all student performance data. College undergraduates taking either Child Psychology, Abnormal Psychology, or Research Methodology during Spring semester 1991 were solicited as subjects. All subjects had at least one previous college class in psychology and so the instructional

programs were partly review and partly new concepts.

This study is intended to demonstrate the following functional relationships: (a) the revised ruleg notation can be utilized to describe complex verbal statements; (b) that inductive teaching sequences can be as or more effective than deductive sequences if enough examples are presented which delineate the boundary lines of the concept; and (c) that environmental events can entirely describe higher level cognitive processes without inferences to cognitive structures by analyzing critical and irrelevant features of concepts. It is designed to give some advice to textbook writers on the best method to introduce and review new terminology to students given a limited amount of time and text length. In a sense, teaching the vocabulary required in most college courses is similar to teaching a foreign language because subject mastery usually requires a working knowledge of several hundred new terms and their relationship to each other.

CHAPTER III

METHODS

Subjects

College undergraduates taking one of three psychology classes (PSY 160, PSY 250, & PSY 330) at Western Michigan University (WMU) during the 1991 Spring semester were asked to participate in this research project. Two of the three instructors agreed to give a bonus of 2% of the total points in their classes as an incentive for students. Consent forms (see Appendix A) were handed out the first day of classes and 105 students initially signed up. It was made clear to the subjects that their participation in this study was voluntary, that they could withdraw at any time by notifying the researcher, and that their performance in the study was to be kept confidential. The instructors for the subjects' classes were to be notified only of their participation and not their performance on the program.

About 75 students signed up for appointments the next week and 62 students eventually completed all programs. All but one of the students had at least one previous class in psychology and they were mostly juniors and seniors. Demographic data on subjects are presented on major or minor in Table 5, number of previous psychology classes (from 1 to 9) in

Table 5

Demographic Frequencies: Major or Minor

Major	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Psych Major	37	59.7	37	59.7
Psych Minor	5	8.1	42	67.7
Neither	20	32.3	62	100.0

Table 6, class status (freshman, sophomore, junior, or senior) in Table 7, gender (male or female) in Table 8, and naivete level (less than 3 previous college psychology classes or more than 3 previous college psychology classes) in Table 9.

Setting

Appointments were set up every hour from 9 a.m. to 5 p.m. in the computer lab at the Bernhard Center on the WMU campus over a 2 week period. Although computers could not be reserved specifically for the study, there were 22 computer terminals in the lab so that access was seldom a problem. Data were collected starting on May 16th and continued until May 29th, 1991. The first session took from 1 1/2 to 2 hours while the while the second session took about 30 minutes. There was the background

Table 6

Demographic Frequencies: Number of Previous Psychology Classes

Classes	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.6	1	1.6
1	21	33.9	22	35.5
2	7	11.3	29	46.8
3	6	9.7	35	56.5
4	8	12.9	43	69.4
5	5	8.1	48	77.4
6	7	11.3	55	88.7
7	4	6.5	59	95.2
8	2	3.2	61	98.4
9	1	1.6	62	100.0

noise of people talking, and the clattering of printers.

Apparatus

The apparatus used includes the computer terminals (the VT220 model manufactured by the Digital Equipment Corporation) which log on to the WMU VAX mainframe computer (model 8650), which then connected

Table 7

Demographic Frequencies: Class Status

Status	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Freshman	4	6.5	4	6.5
Sophomore	6	9.7	10	16.1
Junior	25	40.3	35	56.5
Senior	27	43.5	62	100.0

Table 8

Demographic Frequencies: Gender

Gender	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Male	17	27.4	17	27.4
Female	45	72.6	62	100.0

to the VAX/VMS operating system, the PASS CAI system (available through WMU Academic Computer Services), and several CAI tests and programs written by the author. The SAS (n.d.) and MINITAB (n.d.) systems were used for statistical analysis.

The computer programs were originally typed on a Zenith home

Table 9

Demographic Frequencies: Naive Level

Naive	Frequency	Percent	Cumulative Frequency	Cumulative Frequency
Naive	29	51.8	29	51.8
Not so Naive	27	48.2	56	100.0

computer using the WordPerfect (1990) word processing system. These programs were then converted to ASCII text and loaded onto the VAX computer using the KERMIT program. After entering PASS the "build" command was used to convert the text into a CAI program which would collect and store data. Data could be accessed by the researcher using the "grades" command in PASS. All students who signed up to participate in the study were then assigned usernames and passwords by Academic Computer Services at WMU. The author was assigned 5,000 blocks of memory and all data were entered and stored under the author's username (90CONNORS).

Independent Variables

This study involved four independent variables which are all variations of instructional sequences presented via a CAI program: (1)

rules only; (2) rules plus positive examples; (3) rules plus negative examples; and (4) rules plus positive and negative examples. Each instructional program taught some of the basic concepts in behavioral psychology which included the reflex along with respondent and operant conditioning, including conditioning (reinforcement), extinction, and punishment (see Appendices G, H I, & J).

The programs were expected to take 90 minutes to complete for the first session. Each program had 6 sections of text followed by 9 questions for a total of 56 questions for each program. In addition there was a pretest consisting of 25 questions (see Appendix D) and a posttest consisting of 25 questions and a 5 item preference questionnaire (see Appendix E). The follow-up session took place a week later and was expected to take approximately 30 minutes. It included a delayed posttest of 50 questions which was a combination of the pretest and posttest questions (see Appendix F). In addition, the qualitative measure of the programs in general was collected and scored informally as to the subjects' likes and dislikes about the CAI lessons.

Dependent Variables

Six general categories of dependent variables were investigated: (1) mean test score differences for the pretest, posttest, and delayed posttest; (2) mean test score differences for the pretest and the first 25 identical

items on the delayed posttest (presum) compared to the posttest and the second 25 identical items on the posttest (postsum); (3) correlations between the preference questionnaire and each of the four instructional programs; (4) correlations between demographic data (major or minor in psychology, number of previous classes, undergraduate status, and gender) and mean test score differences; (5) total number of corrective feedback statements presented for each instructional program; and (6) total amount of time used for each instructional program. A qualitative measure was also taken at the end of the delayed posttest for which subjects wrote out anonymous answers to questions on the suitability of the program and suggestions for improvement.

Procedure

At the "Local>" prompt, each student typed "C PIGLET" or "C KANGA" to gain access to one of the VAX host computers (other Winnie the Pooh names could also have been used such as POOH, TIGGER, or WINNIE). Each student was assigned a username and a temporary password to use in logging on to the system. At the "Enter Username>" prompt, each student entered a 3-digit number and their surname. At the "Password:" prompt, they entered a 6 character random alphanumeric code. They then had to enter a new 6 letter password two times in order to comply with the computer center's new security system. At the "$" prompt

the command "pass" allows the students to access the CAI program written by the author. After the PASS logo was displayed, hitting any key then displayed the PASS menu which was as follows:

Introduction to PASS

Pretest

Rules Only

Rules Plus Positive Examples

Rules Plus Negative Examples

Rules Plus Positive and Negative Examples

Posttest

Delayed Posttest

The "Introduction to PASS" was a general tutorial to the PASS system written by WMU Academic Computer Services. Since this program took about 30 minutes to complete, the author decided not to use this program. Instead each subject was given some initial instruction about using the program and the investigator proctored all sessions to help if questions arose.

All students took the pretest, one of the four instructional programs, and then the posttest. The preference questionnaire was attached at the end of the posttest. General instructions were as follows:

> To advance to the next question press the SPACE bar. After reading the question, pressing the TAB key will display 5 multiple choice answers labeled a, b, c, d, or e. Choose one answer by pressing a

> letter key and RETURN. For the pre and posttests you will be given confirmation only of the answer you have selected. If you accidentally hit the SPACE bar before answering a question, pressing CTRL B will return the screen to the previous question.

For the instructional programs some additional instructions were given:

> Corrective feedback will given on all answers. If your answer is incorrect, you will be given a hint as to the correct answer. Keep trying until you answer correctly. In other words, don't go on to the next question until you have chosen the correct answer and read why that answer was correct. Some text sections may be too long to fit on the screen. If that is the case, use the cursor keys to scroll down until you have reached the end of the text section.

The pretest and posttest took about 15 minutes each while the instructional programs took about 90 minutes each. Each subject was required to log off the system before leaving. Unfortunately there was no way to exit and re-enter a program that was not completed so each component had to be completed in one sitting.

About a week later students returned to take the delayed posttest which took about 20-30 minutes. They then were asked to provide some informal feedback by answering the following two questions:

1. What did you like about this CAI program?
2. How could this CAI program be improved?

Answers were written on paper and collected for later analysis. Demographic data were also confirmed at this point by having the students to verify its accuracy from their original consent forms.

Reliability

Since all data were collected by the PASS CAI system, there were no chances of human error in tabulating scores or in response definitions. Any data from incomplete lessons or tests were discarded and not used in the statistical analysis. Due to a design flaw in the software used, subjects could skip through questions without answering them.

Experimental Design

A one-factor randomized group design with four response measures was used as an experimental design. Subjects were assigned to one of four groups using a stratified random sample. The subjects from each of the three classes sampled were placed in alphabetical order and assigned numbers from 1 to 4 which represented the group in which they were placed. The groups were as follows: (a) rules only; (b) rules plus positive examples; (c) rules plus negative examples; and (d) rules plus positive and negative examples (the actual programs are contained in the Appendix). A pretest was given to all groups and used as a covariate. Some demographic data was also correlated with the covariate including major or minor in psychology, number of previous college classes in psychology, undergraduate status, and gender. After treatment three additional tests were administered: (1) posttest; (2) preference questionnaire; and (3) 1-

week delayed posttest.

The delayed posttest consisted of all of the pre- and posttest questions combined. Due to time constraints it was not possible to statistically equate the pre- and posttests to make sure they were parallel forms. Ideally the pre- and posttests would be initially presented to a similar group of subjects and correlation coefficients would be calculated to make sure they were of similar difficulty levels. Therefore, the most signficant mean score differences between pre- and posttest scores may be the comparison between the pretest and presum (taken from the first 25 items on the delayed posttest) and the posttest and the postsum (taken from the last 25 items on the delayed posttest). A qualitative measure of the program's effectiveness was also taken following the delayed posttest. An analysis of covariance (ANCOVA) on mean test scores was computed using the SAS (n.d.) program. The advantage of this design over the traditional analysis of variance test is that no assumptions about the homogeneity of the randomized groups need be made (Huitema, 1980). Descriptive statistics were computed with the MINITAB program (n.d.).

CHAPTER IV

RESULTS

This results section provides information toward answering the basic research questions of this study. The research questions include the following: (a) comparison of pretest, posttest, and delayed posttest scores; (b) comparison of types of instruction; (c) comparison of naive and not naive students; (d) comparison of males and females; (e) comparison of class Level; (f) comparison of major and minors in psychology; and (g) comparison of compliance and noncompliance.

The results of this study are presented in both tabular and graphic form. Both descriptive and inferential statistics were calculated on these data using the SAS (n.d.) and MINITAB (n.d.) statistical packages using a VAX/VMS computer operating system.

The first question is whether that are significant differences for the entire group for pretest, posttest, and delayed posttest scores. This was computed using the inferential statistic of analysis of covariance. Using the pretest mean raw score as a covariate, an analysis of covariance (ANCOVA) was run using the raw scores of four separate dependent variables: the posttest, the delayed posttest, the presum (the first 25 questions on the delayed posttest), and the postsum (the second 25 questions on the delayed

posttest). The results are summarized in Table 10. As can be seen, only the comparison among posttest scores using the pretest as a covariate approaches significance. Computing an ANCOVA on mean percentage scores gives similar results as seen in Table 11.

Table 10

Analysis of Covariance on Mean Raw Scores on the Pretest, Posttest, Delayed Posttest, Presum, and Postsum

Dependent Variable	Covariate	F Value	p Value	Sig
Posttest	Pretest	2.44	.0728	.10
Delayed Posttest	Pretest	0.39	.7616	NS
Presum	Pretest	0.44	.7228	NS
Postsum	Posttest	1.95	.1333	NS

If an analysis of variance (ANOVA) is computed on posttest scores without using the pretest as a covariate, a p value of .208 is obtained which is not significant. Therefore, it does appear that taking the pretest score into account does reduce the error term in the analysis.

Descriptive statistics comparing mean raw scores for the dependent variables are shown in Table 12 (values are rounded to the nearest hundredth. It should be remembered that the Delayed Posttest contained twice as many questions as the other measures. In order to show scores in

Table 11

Analysis of Covariance on Mean Percentage Scores for the Posttest, Delayed Posttest, Presum, and Postsum

Dependent Variable	Covariate	F Value	p Value	Sig
Posttest	Pretest	2.28	0.0881	.10
Delayed Posttest	Pretest	0.42	0.7420	NS
Presum	Pretest	0.44	0.7228	NS
Postsum	Pretest	1.95	0.1333	NS

which all the values are equal, the mean percentages for each measure were also calculated. Similar descriptive statistics are seen in Table 13 comparing mean percentage scores for the dependent variable. These data for the pretest, posttest, and delayed posttest are displayed in graphic form in Figure 3.

In the next step t tests were computed comparing mean scores between naive and not naive students for the combined scores for the pretest, posttest, delayed posttest, presum, and postsum. The naive group is defined as those students having fewer than three previous classes in psychology while the not naive group is defined as having three or more previous classes in psychology. The results are shown in Table 14 (results are rounded to the nearest hundredth). In each comparison, the not

Table 12

Descriptive Statistics Comparing Mean Raw Scores for the Pretest, Posttest, Delayed Posttest, Presum, and Postsum

Group	Pretest	Posttest	Delayed Posttest	Presum	Postsum
Rules Only	8.56	11.00	21.20	8.13	10.80
Rules/Pos	10.63	12.00	24.00	10.87	10.80
Rules/Neg	10.50	9.79	22.93	10.50	10.43
Rules/Both	10.50	9.93	22.71	10.57	11.00

Table 13

Descriptive Statistics Comparing Mean Percentage Scores for the Pretest, Posttest, Delayed Posttest, Presum, and Postsum

Group	Pretest	Posttest	Delayed Posttest	Presum	Postsum
Rules Only	34.00	37.33	42.27	32.27	43.20
Rules/Pos	42.53	39.11	47.60	43.47	43.20
Rules/Neg	42.00	32.64	45.71	42.00	41.71
Rules/Both	42.00	32.93	45.43	42.29	44.00

naive group mean score was higher on all measures but not at a significant level. The data from Table 14 indicate that the pretest and posttest were not parallel forms and that the posttest was either more difficult, or that fatigue and noncompliance were significant factors.

Table 14

Comparison of Mean Percentage Scores on all Dependent Variables for the Naive Versus Not Naive Groups

Group	Pretest	Posttest	Del Posttest	Presum	Postsum
Naive	38.37	34.41	42.25	45.52	39.20
Not Naive	44.15	37.50	48.69	51.24	46.32

At this point it is important to remember that the delayed posttest contained identical versions of both the pretest and the posttest. Therefore, the most interesting statistic in terms of what was learned may be the difference between the pretest scores from the first time they are presented to the second time as part of the delayed posttest. Likewise, the best measure of what was remembered may be the difference between the posttest scores from the first time they are presented to the second time as part of the delayed posttest.

One question was if the naivete level of the students made a difference in how well they scored on the tests. An ANCOVA was computed

showing significance at the .001 level using the posttest as the covariate and the presum as the dependent variable. As the presum score went up, so did the posttest score. Therefore, improvement can be shown to be a function of the instructional programs for subjects with fewer than three previous college psychology classes.

A visual inspection of the data indicated that one problem of interpretation may have been student noncompliance with instructions with the specific learning method using the tutorial programs. The PASS program was designed so that students could scan all the questions before beginning to respond. Specifically, some students would either skip questions by not answering them or advance to the next question before choosing the correct answer. These students produced outlier data that skewed the group mean results. Therefore, a decision was made to eliminate the data for any students who had 10 or more "errors" in compliance in order to see if there would be significant changes in the results due to noncompliance with a specific learning method.

An analysis of variance (ANOVA) was computed to see if this elimination of outlier data would be biased in favor of any one group which would affect either the pretest or posttest scores. In other words, noncompliance may have been more of a factor with some instructional groups than with others. A two factor ANOVA was run using the groups as a whole, the naive group only, and the interaction between the naive and

whole group. The p value for the groups including outliers was 0.15 which was not significant. Therefore, outlier data did not make significant changes in either pre- or posttest scores.

The next question was to see if noncompliance might have skewed the data more with naive versus not naive students. In other words, did subjects who have had less previous classes in psychology classes skip more questions than subjects with more previous classes in psychology? A two factor ANOVA was computed separately on naive versus not naive groups to see if there was a difference in noncompliance among these groups. There were significant differences at the .01 level for the whole group and at the .003 level for the group and naive interaction but not for the naive group by itself. Therefore, a one factor ANOVA was computed which showed there was less compliance with the Rules Only group with both naive and not naive subjects compared to all other groups. p values were .0358 and .0004 respectively. These data are reported in Table 15.

Another question was if naive subjects demonstrated more noncompliance in specific instructional groups compared to not so naive subjects. An analysis of variance (ANOVA) comparing naive versus not so naive subjects for number of missed questions shows significance at the .04 level (p = 0.0358). Using the Bonferroni t tests to compare not so naive (more than three classes) subjects, the Rules Only group has significantly higher scores than either the Rules + Positive Examples and the Rules +

Table 15

Analysis of Variance of Missed Questions
With Naive and Not Naive Subjects

Group	DF	SS	Mean Square	F Value	Pr > F
Naive	3	17.93	5.58	3.49	0.0358
Not Naive	3	43.74	14.58	10.55	0.0004

Negative Examples (critical value of $\underline{t}$ = 2.98, minimum significant difference = 2.20). This same test when used with naive subjects (fewer than three classes) showed significantly more noncompliance with the Rules Only Group over the Rules + Negative Examples Group (critical value of $\underline{t}$ = 2.94, minimum significant difference = 2.40). Therefore, for all groups the Rules Only instructional program was more prone to noncompliance problems and the Rules Plus Negative Examples had the least compliance problems.

An ANOVA was computed on differences between time in minutes for each instructural module to be completed and for number of errors per instructural module. A summary of these differences is shown in Table 16 (values are rounded to the nearest hundredth). It should be noted that the scores for errors contain outlier data. None of the between group compari-

sons is significant when outlier data were excluded. Therefore, the effect of time or error rate was not a confounding variable.

The procedure of Exploratory Data Analysis (EDA) was computed using the MINITAB program to compare the distribution of errors and time between instructional modules and test sections. Visual inspection of dot histograms and stem and leaf displays do not reveal differences between groups for time or error distributions and there is no evidence of bimodal distributions. Data for number of errors for the total group are presented in a histogram in Figure 4 and by instructional group in Figures 5, 6, 7, and 8. Data for number of minutes for the total group to complete instructional programs are presented in Figure 9 and by instructional group in Figures 10, 11, 12, and 13.

A similar EDA procedure was computed by naive versus not so naive subjects, by gender, and by a certain number of data points missing (>3) or out of range (>11). Again, a visual analysis reveals similar distributions. Therefore, noncompliance problems were equally distributed over subjects with few versus many previous college psychology classes and for males versus females.

Unfortunately, the data for the preference questionnaire had to be discarded because the PASS program is not set up to collect survey data and so did not keep track of which answer was selected. A question concerning attitudes or preferences for specific instructional programs had

Table 16

Mean Score Differences Between the Four Instructional Groups for Time and Errors

Group	Minutes	Errors
Rules Only	69.80	44.73
Rules + Positive	67.53	40.53
Rules + Negative	66.26	29.05
Rules + Both	65.72	33.33

answers such as "liked very much" down to "did not like." No one answer was considered correct. However, the PASS program randomly chose one answer as "correct" and the other four as "incorrect" instead of keeping track of choices on a 1 to 5 Likert Scale. Qualitative data were recorded by all students at the end of the delayed posttest. Generally students had favorable remarks about the program and reported that it improved their ability to discriminate the terms presented. Most of the students had never worked on a computer-assisted instruction program before and they liked the opportunity to improve their knowledge of terms. Suggestions for improvement included reserving a quieter computer lab, breaking up the lessons into parts, using graphics and a color monitor, allow students to branch off for extra practice on examples and nonexamples of the concept,

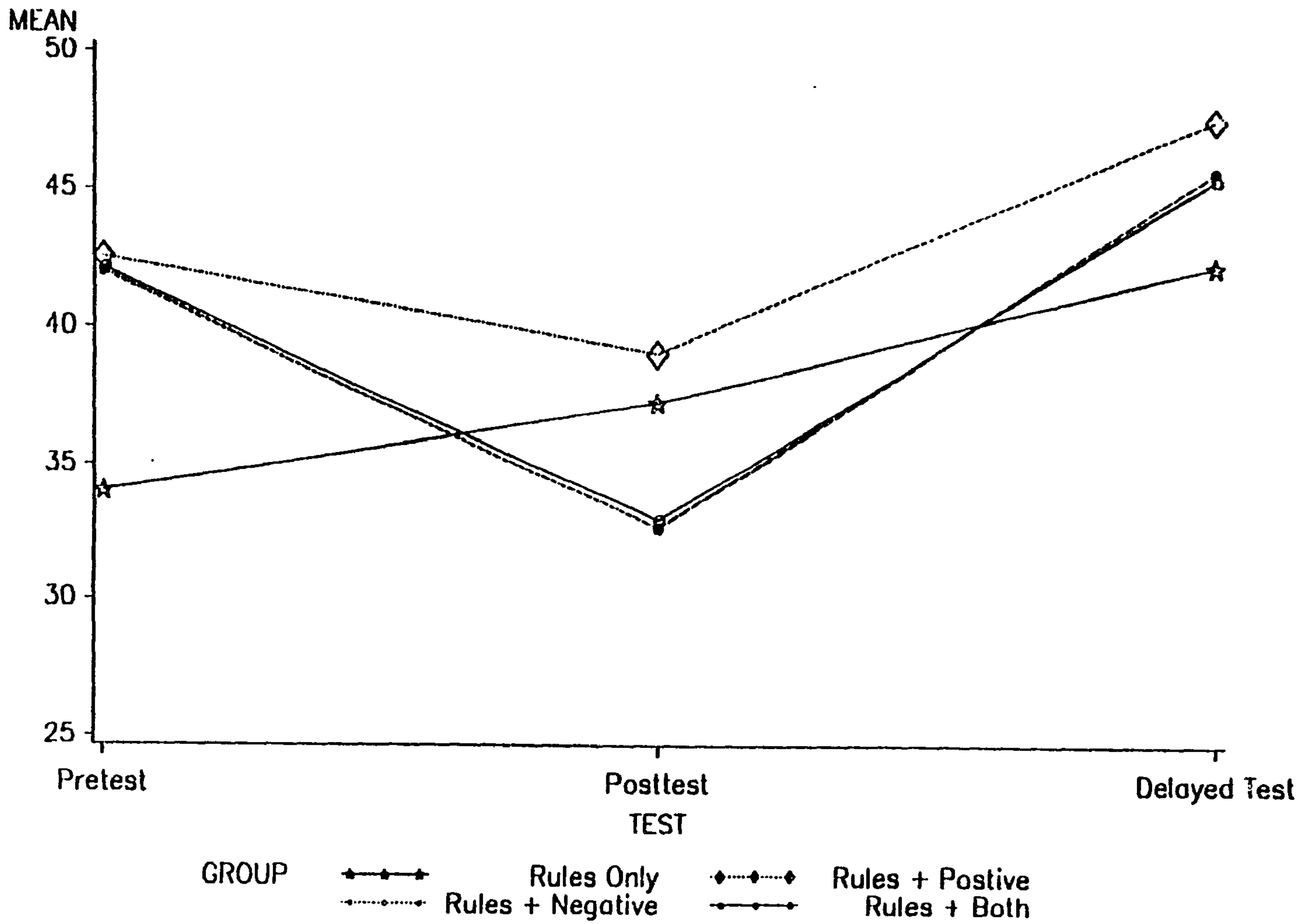
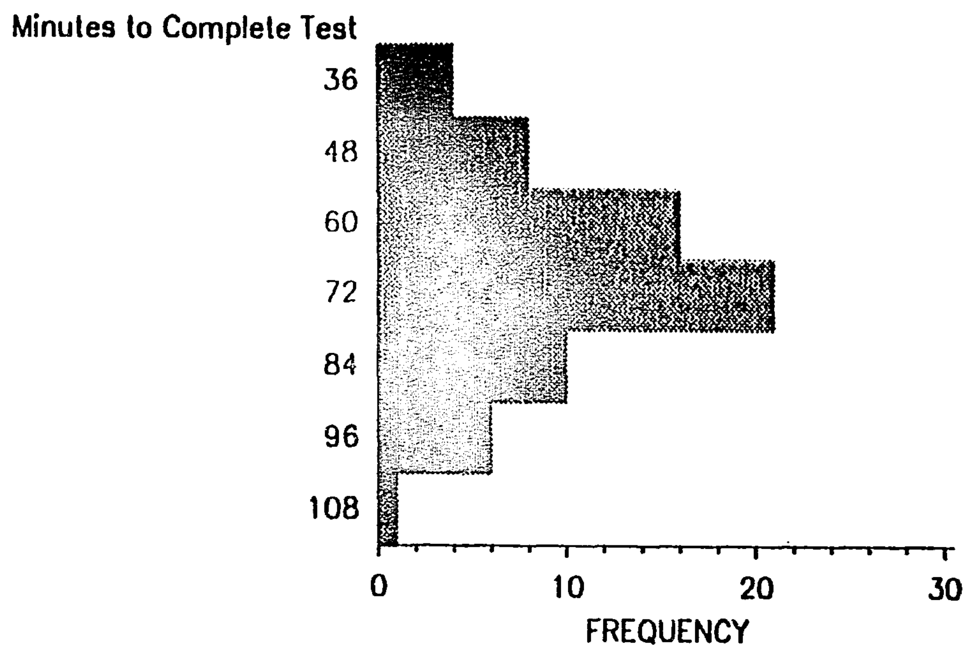
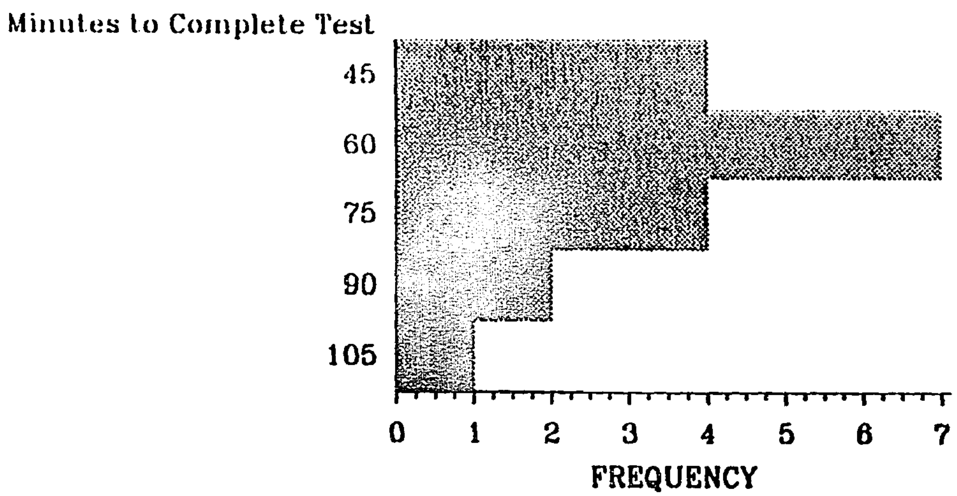


Figure 3. Mean Percent Correct for Pre, Post, and Delayed Posttest Scores by Learning Method.



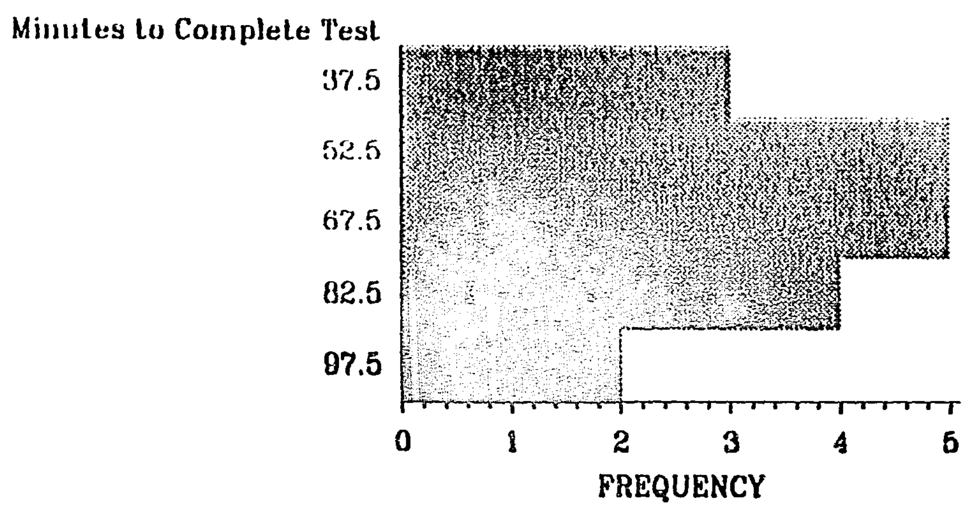
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
4	4	6.06	6.06
8	12	12.12	18.18
16	28	24.24	42.42
21	49	31.82	74.24
10	59	15.15	89.39
6	65	9.09	98.48
1	66	1.52	100.00

Figure 4. Histogram of Average Time Used to Complete the Test.



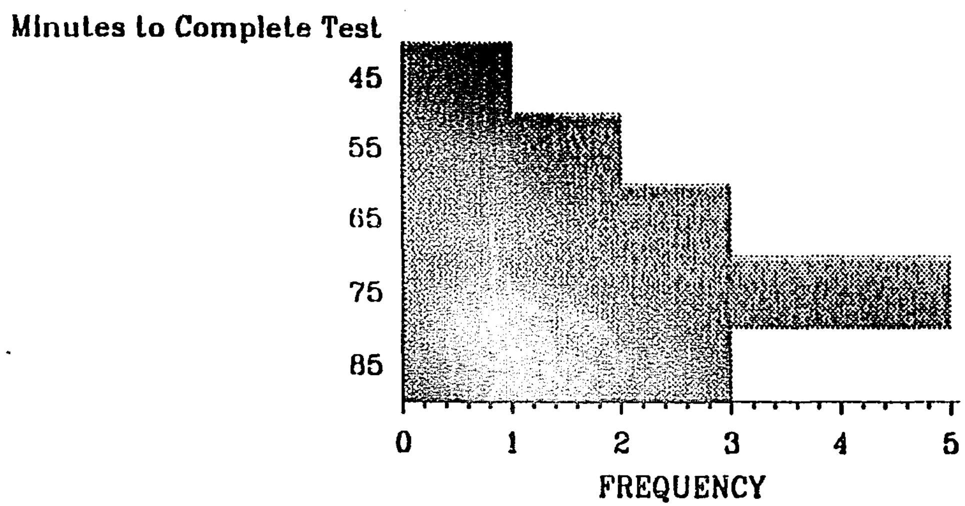
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
4	4	22.22	22.22
7	11	38.89	61.11
4	15	22.22	83.33
2	17	11.11	94.44
1	18	5.56	100.00

Figure 5. Histogram of Time in Minutes: Rules Only.



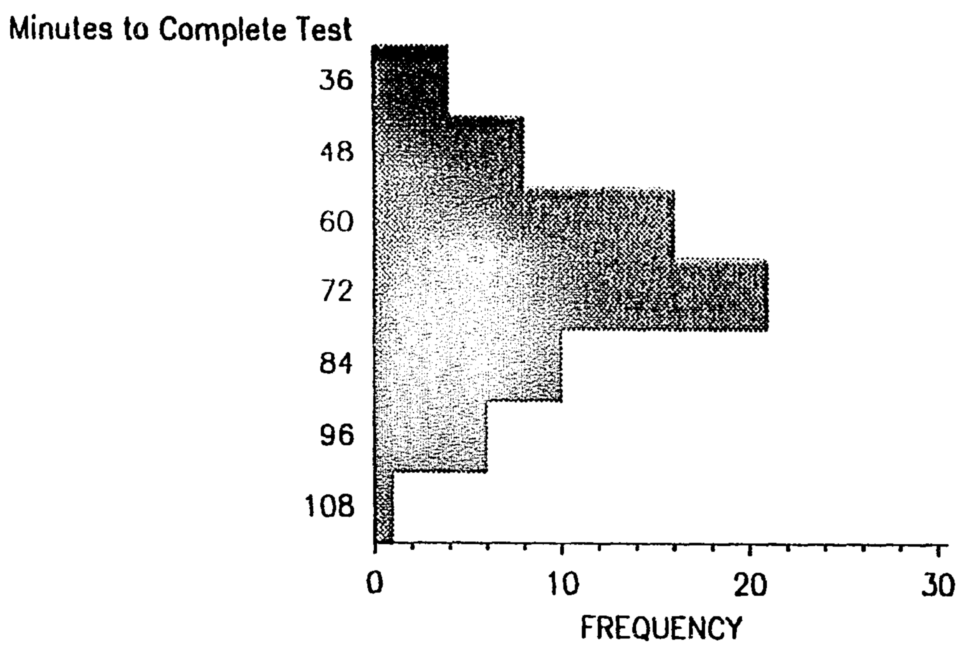
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
3	3	15.79	15.79
5	8	26.32	42.11
5	13	26.32	68.42
4	17	21.05	89.47
2	19	10.53	100.00

Figure 6. Histogram of Time in Minutes: Rules + Positive.



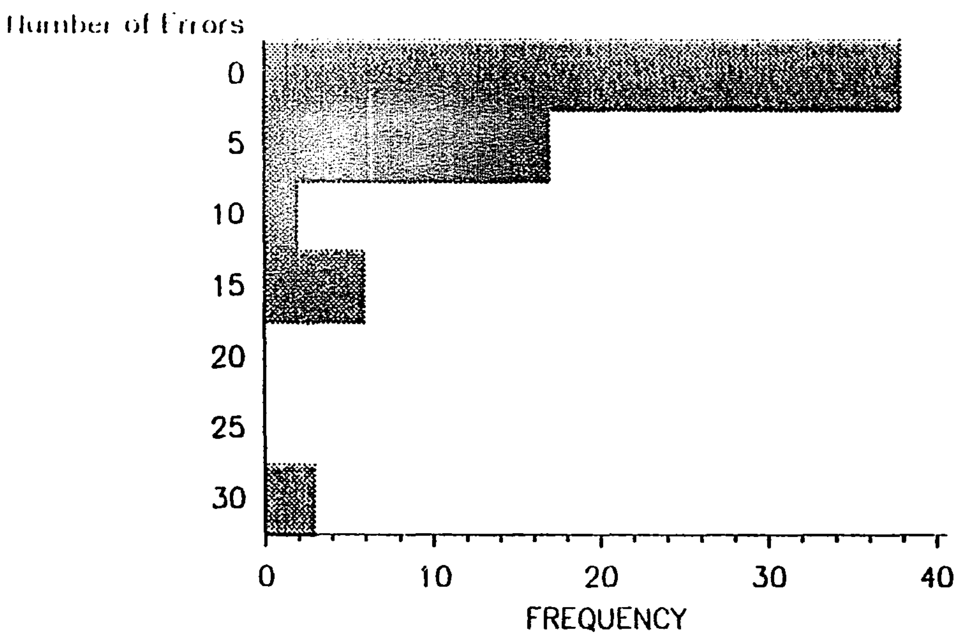
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
1	1	7.14	7.14
2	3	14.29	21.43
3	6	21.43	42.86
5	11	35.71	78.57
3	14	21.43	100.00

Figure 7. Histogram of Time in Minutes: Rules + Negative.



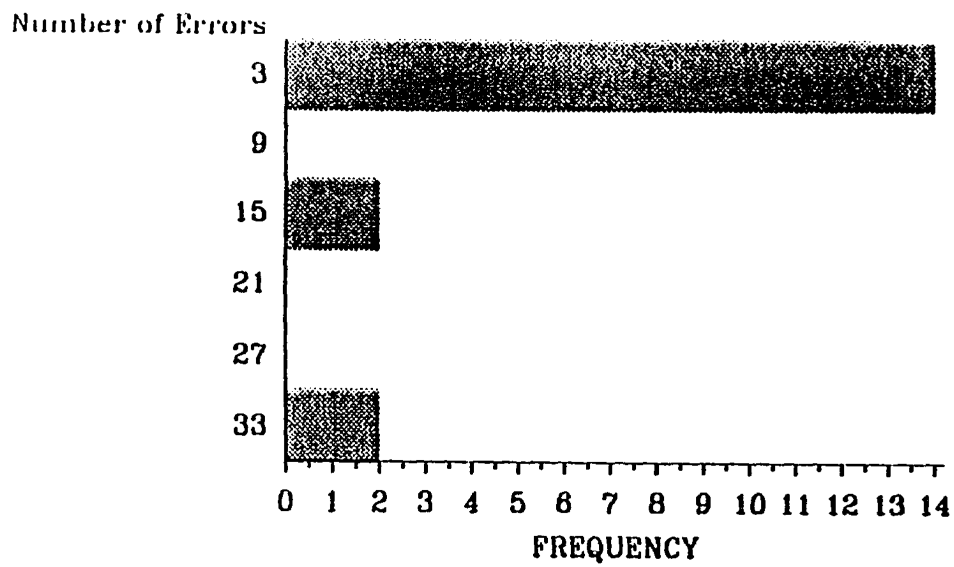
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
4	4	6.06	6.06
8	12	12.12	18.18
16	28	24.24	42.42
21	49	31.82	74.24
10	59	15.15	89.39
6	65	9.09	98.48
1	66	1.52	100.00

Figure 8. Histogram of Time in Minutes: Rules + Both.



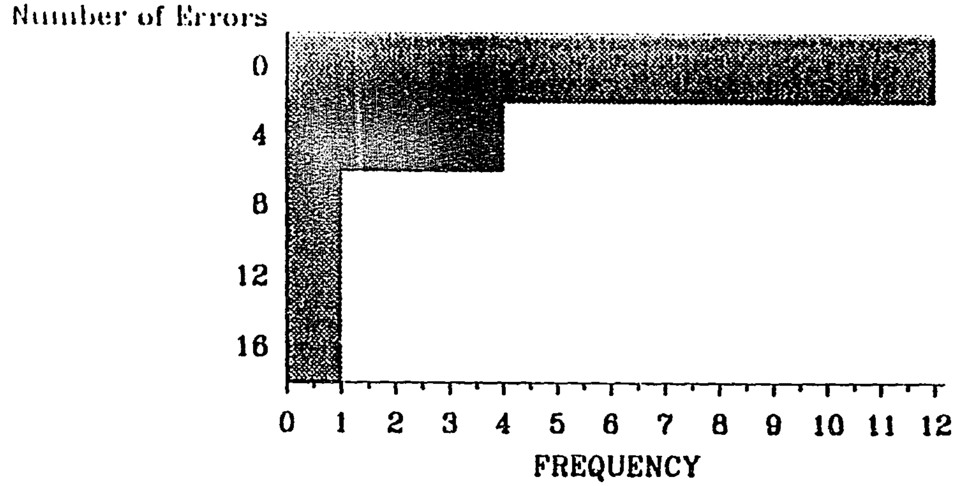
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
38	38	57.58	57.58
17	55	25.76	83.33
2	57	3.03	86.36
6	63	9.09	95.45
0	63	0.00	95.45
0	63	0.00	95.45
3	66	4.55	100.00

Figure 9. Histogram of Average Number of Errors.



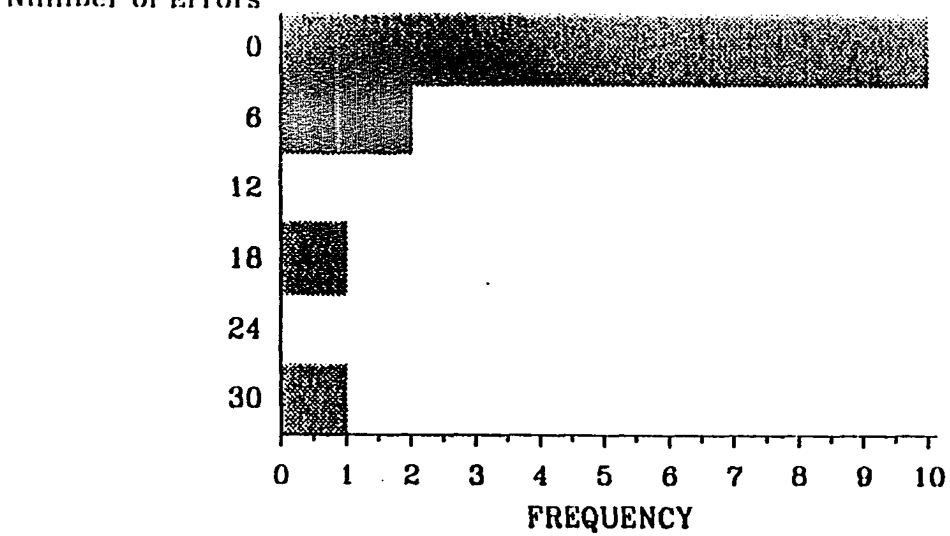
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
14	14	77.78	77.78
0	14	0.00	77.78
2	16	11.11	88.89
0	16	0.00	88.89
0	16	0.00	88.89
2	18	11.11	100.00

Figure 10. Histogram of Number of Errors: Rules Only.



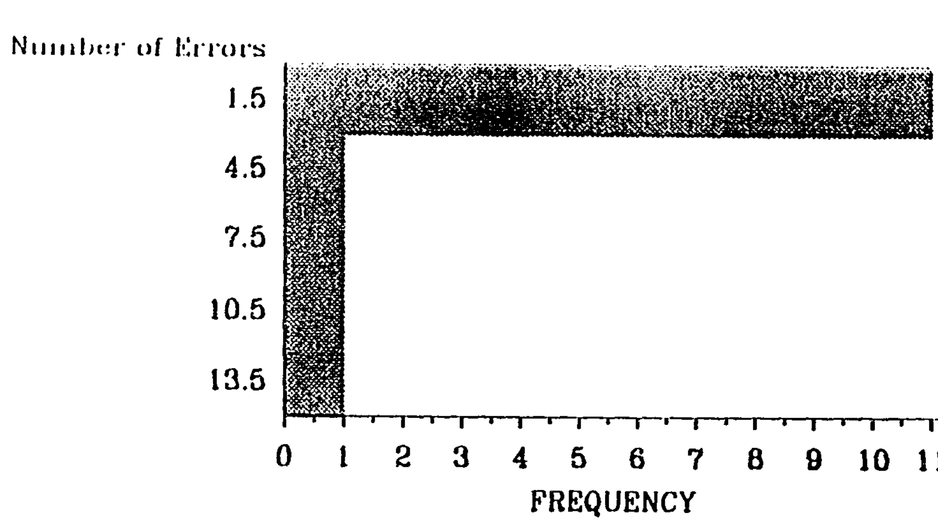
FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
12	12	63.16	63.16
4	16	21.05	84.21
1	17	5.26	89.47
1	18	5.26	94.74
1	19	5.26	100.00

Figure 11. Histogram of Number of Errors: Rules + Positive.



FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
10	10	71.43	71.43
2	12	14.29	85.71
0	12	0.00	85.71
1	13	7.14	92.86
0	13	0.00	92.86
1	14	7.14	100.00

Figure 12. Histogram of Number of Errors: Rules + Negative.



FREQ.	CUM. FREQ.	PCT.	CUM. PCT.
11	11	73.33	73.33
1	12	6.67	80.00
1	13	6.67	86.67
1	14	6.67	93.33
1	15	6.67	100.00

Figure 13. Histogram of Number of Errors: Rules + Both.

and getting more feedback on test performances. The biggest complaint was that the program took too the immediate feedback on incorrect answers and the chance to practicelong to complete in one sitting. Many students would have liked to use the computer as a supplement to a normal lecture class with a textbook for extra practice.

Subject attrition was a minor problem as about 20 subjects did not show up for any appointments and 4 subjects did not return for the delayed posttest. Attrition was largest for students in the class which did not offer any bonus points for participation in the study. Therefore, the author does not recommend using students for research projects in which no class incentives are used. The students who did not return for the delayed posttest later told the author that either car or work problems prevented them from coming to finish. No students reported that they dropped out as a result of dissatisfaction with the research procedure.

CHAPTER V

DISCUSSION

Restatement of the Problem

A comparison of deductive versus inductive teaching procedures was the original impetus for this research. The Rules Only program was intended to be mostly a deductive approach by presenting more formalized definitions, containing critical features of the concept plus additional background features and irrelevant features, and minimizing examples of the concept. The three other programs: Rules + Positive Examples, Rules + Negative Examples, and Rules + Positive and Negative examples were intended to be more inductive. Some briefer definitions, consisting of only critical features of the concept, were followed by several examples and/or nonexamples of the concept plus using example identification as part of the questions asked. Several previous attempts by the present author to produce purer inductive programs teaching complex verbal concepts were unsuccessful, perhaps because of the longer length it would have required and the complexity of the concepts taught.

The teaching lessons were prepared by first making up a concept analysis of the terms to be taught (see the Concept Analysis of Behavioral

Terms in Appendix C). The analysis included: (a) a set of critical defining features, (b) additional information that is helpful but not necessary for discrimination with other concepts, (c) irrelevant features which are necessary for concept discrimination, and (d) a range of positive and negative examples of the concept involved. Several revisions were made, based on critiques by several experts in behavior analysis (the author's dissertation committee), before an acceptable form was ready to use in preparing teaching lessons.

The original list of 22 terms was reduced down to a more manageable size. The final form of the concept analysis included seven basic terms in behavioral psychology including the reflex along with basic respondent and operant conditioning procedures. It had been intended to use the program with mostly naive subjects who were taking an introductory psychology class in college. The semester it was ready, however, was the spring session in which only three undergraduate classes were being taught, none of which were on the introductory level. The program was, therefore, modified to make it more difficult and challenging to students who should be already familiar with the terminology. Interestingly, there was a nonsignificant difference on pretest scores between students who had fewer than three psychology classes and those who had more than three classes.

The ANCOVA test using the pretest as a covariate and the posttest as the dependent measure did approach significance (p=.07), thus indicating

a preliminary finding of a treatment effect. The effects were significant among some teaching groups if missed questions, which indicated noncompliance, were removed from the data. The author suspects that if greater class incentives could have been made contingent on a high score, then a more pronounced difference would have been evident. It may also be that the teaching modules would have been more effective if broken down into shorter units as many students complained about the length of the program. However, the program lengths were certainly comparable to those of normal lecture classes and therefore, inexperience with CAI as a teaching method may have been significant.

Data Collection

There were several problems during the data collection which may have affected the results. Some equipment failure occurred: several times the keyboard would freeze up and once the program quickly scrolled all the way to the end. Turning the terminal off for 10 seconds and then typing "res" (for "resume") when the terminal was turned on again usually worked. Once the screen went completely blank and typing CTRL Z brought it back.

There were some problems with either usernames or passwords which the computer would not accept and calls had to be made to WMU Academic Computer Services (ACS) to reset them. Several students who were added on to the original list found that the normal command "pass"

did not work; the longer version "run lib$cai:pass" then had to be entered. One student had not been given any "computer money" and so could open the program until ACS reset the account.

Three students did not have time to take the posttest after completing the instructional program and so had to return the next day to take it. Several students also took the pretest, instructional program, and posttest but did not show up for the delayed posttest and so their data had to be discarded. One student had to take the posttest over again since her keyboard froze up and could not be fixed. Another student only finished half of an instructional program and had to leave, so the program had to be taken again from the beginning several days later.

The computer lab itself caused some students problems. It was a large room with over 100 personal computers and computer terminals. Often there were 50 or more students there at one time. The background noise of the printers along with other students frequently getting up to walk around or talk was distracting. The cold air conditioning was also uncomfortable for a few students who were dressed for summer weather. Students who came late in the afternoon after attending classes all day were more likely to be fatigued and complain the program was too long. When fatigue was a factor, students would be more likely to start guessing at answers and jumping to the next frame before reading the feedback on correct answers, or advance to the next frame before selecting the correct

answer. Some students were not used to learning at a computer terminal and this was their first opportunity to use computers at WMU.

Recommendations

PASS Recommendations

This dissertation was the first large scale project using the PASS CAI system at Western Michigan University in Kalamazoo, Michigan. Although several other departments on campus are currently using PASS, it is mainly used for short tutorial reviews and quizzes. Therefore, the author would like to make some suggestions to improve the user friendliness of the PASS CAI system for both instructors and students. For the instructor and student they include:

1. Allow the order that questions are presented to be randomized. It would be especially useful if PASS could select so many questions from each unit of a larger test bank and then randomize the order of presentation. In that way, students would take comparable tests but each test would be unique.

2. Take data on up to 5 responses per question. Since most multiple choice tests have 4 to 5 possible responses, the instructor would know how many times the students tried per question and for the total unit.

3. Don't allow the student to progress to the next question until the

previous question has been correctly answered. Too many times students will accidentally, or in frustration, advance without knowing the previous answer. It would also help if a 5 second limited hold could be used after each answer is selected to make sure the student reads the corrective feedback or praise.

4. Allow students to exit and re-enter programs in the middle of the lesson. Right now, if a student has to leave suddenly, the entire program must start over from the beginning.

5. Set up PASS so that data can be collected on preference and attitude questionnaires in which there is no right answer.

6. Shorten the command to run PASS from "run lib$cai:pass" to just "pass."

7. Key changes include using the RETURN key to advance to the next frame instead of SPACEBAR. The author has found that students will often hit the SPACEBAR accidentally and sometimes not realize that they have skipped a frame. Also change the command to move back one frame from CTRL G to just BACKSPACE. The ESCAPE key could be used to exit the program quickly if the student wants to re-enter it later at the same place. These changes should make it easier for the first time user.

8. Set up the data file so that frequency data can be retrieved as easily as percentage data.

9. Arrange the program so that it can interact with a graphics editor

and allow it to use a color monitor. This would increase the animation aspects of the program to make it more "lively."

Further Research

Although the debate over the effectiveness of deductive versus inductive teaching sequences remains unanswered, there are some suggestions for component research. Logically it would appear that a more deductive approach is more effective with more sophisticated learners who are reviewing concepts previously learned. A more inductive approach should be more effective with naive learners who are being introduced to the concepts for the first time. So a significant difference would be more likely when using the Rules Only lesson compared to the Rules + Positive and/or Negative Examples lesson with students taking an introductory psychology class. The most effective review for senior psychology majors may be the Rules Only program since it goes into more detail than the programs that emphasize examples only. Deductive approaches to instruction should more abstract thinking, therefore, sophisticated learners may be more ready to utilize the detailed rules and principles that allow more generalization to similar concepts.

Based on research by Englemann (1980), it would appear that the Rules + Positive and Negative Examples should be most effective with naive learners since it teaches the boundary points of each concept with a

minimum of abstraction. Rather than attempting to learn abstract principles, naive students need to distinguish the boundary points between concrete examples versus nonexamples of the concept. Therefore, an inductive approach should be most effective with college freshmen students who are being introduced to these concepts for the first time. Further research should emphasize the differences been naive and sophisticated learners with inductive versus deductive programs. Initially the research should concentrate on teaching differences with just one or two concepts in order to identify what are the critical defining features of each term. Later studies should concentrate on the cumulative effect of using these instructional sequencing methods with larger units involving some cumulative review. As the field of applied behavior analysis continues to evolve as a more mainstream curriculum for psychology majors, it will be important to not only standard the definitions of terms used, but to use the discipline itself to better structure more effective teaching methods. These methods should insure both initial ease of mastery, long term retention, and application to novel situations. The present author hopes to conduct further research in this area.

Another area in which CAI teaching modules may be helpful is in its ability to be easily edited and updated. Based on data collected from a college psychology class, a professor could make corrections as they were needed each time the course was taught. More feedback loops for classes

with lower entrance skills could be inserted as needed. The frequent need for revising introductory textbooks, now often every 3 to 4 years, could then occur each semester.

The suggested changes in the PASS program would prevent some noncompliance such as skipping questions or answers. An incentive system contingent on test scores would help some subjects take the research more seriously. Using a transfer test in which generalization to similar concepts and examples is presented may be the best measure of what learning has occurred. Perhaps some previous experience with the PASS CAI or similar systems would make subjects more comfortable using the computer as a learning tool. Certainly an environment with less distractions would be more conducive to learning. All of these factors may produce more significant results in any replication.

Learning the terminology in any new subject area is similar to the process of learning a foreign language. Most language training programs utilize much review and practice of the words learned in a variety of situations. Perhaps the college psychology curricula could benefit from some of these similar training exercises. As a discipline, psychology certainly can be criticized for espousing new terminology every time a new "school" or theory is developed. Behavioral psychology terms may be particularly difficult to master since, unlike psychoanalytic and humanistic terms, they are not often used in journalistic or literary articles. Even

behaviorists themselves can't agree on specific criteria for many common terms, such as the many uses for the term "discriminative stimulus."

By the 1990s, it does appear that computers are truly revolutionizing the ways in which we store and present data. Entire encyclopedia sets are now being stored on a single CD rom disk. Rows of large card catalogues in libraries are being replaced with a single computer terminal. Large mainframe computers that previously took up several rooms are now being outperformed by super microcomputers the size of a small filing cabinet. Whether the Greeks' prophecy of books reducing the importance of memory is renewed again with the advent of computers is yet to be determined. It may be less necessary to memorize information than it will be to remember how to access computer data banks and verify the accuracy of data retrieved. For now all we can say that it is likely that computers will come to play an increasingly important role in helping us to teach ourselves. I think Socrates would have approved.

Appendix A

Consent Forms for Subjects

Western Michigan University
Spring Session 1991

CONSENT FORM

I agree to participate in the experiment, "A comparison of four methods to teach complex verbal concepts using a CAI program," in exchange for receving bonus points to be used to computing my final grade in my psychology class. I understand that the experiment will require about 2 hours total time: about 1 hour 45 minutes for the first session and about 15 minutes for the second session. Although some of the material presented in the experiment may help me understand concepts in my psychology class, it should be regarded as only an enrichment program and that it is not designed to improve my scores in psychology tests. Data obtained from the experiment will be kept confidential and destroyed when the experiment is completed. My name will be kept for attendance purposes only and my psychology instructor will be notified only of my participation. In order to obtain bonus points it is necessary that I attend both sessions.

My participation is voluntary and I may withdraw from the study at any time by notifying the researcher. This decision would then have no effect on the grade in this class.

Signed______________________________Dated________________________

DEMOGRAPHIC DATA FOR STATISTICAL PURPOSES (Please print)

1. Last 4 numbers of SS#: ________________________________

2. List previous psychology classes and grade received:
____

____

3. Are you a psychology major? (Yes/No) Are you a psychology minor? (Yes/No)
4. Undergraduate level(circle one): Freshman, Sophomore, Junior, Senior, Permission to Take Classes (PTC)
****
Thank you for agreeing to participate in this research study.
John Connors, Psychology Graduate Student

Appendix B

Approval Form From HSIRB

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: September 12, 1990

To: John B. Connors

From: Mary Anne Bunda, Chair Mary Anne Bunda

Re: HSIRB Project Number: 90-09-10

We have received the changes in your research protocol as requested in our September 6 memo. This letter will serve as confirmation that your research protocol, "A Comparison of Four Methods to Teach Complex Verbal Concepts using a CAI Program," has been approved under the exempt category of review by the HSIRB. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the approval application.

You must seek reapproval for any changes in this design. You must also seek reapproval if the project extends beyond the termination date.

The Board wishes you success in the pursuit of your research goals.

xc: Galen J. Alessi, Psychology

Approval Termination: September 12, 1991

Appendix C

Concept Analysis of Behavioral Terms

CONCEPT ANALYSIS OF BEHAVIORAL TERMS

by
John B. Connors

Terms Included: reflex, respondent behavior, respondent conditioning, respondent extinction, respondent punishment (counterconditioning), operant behavior, positive reinforcement, negative reinforcement, operant extinction, positive punishment (Type I) and negative punishment (Type II).

1. REFLEX

Critical Defining Feature:

1. A stereotyped pattern of movement on the part of the body that can be reliably elicited by presenting the appropriate stimulus.

2. The relation between a particular stimulus and a particular response such that the stimulus produces or is correlated with the response.

Additional Information:

1. In a simple sense, the stimulus triggers the response. Most reflexes inside the body are caused by the release of hormones; most reflexes outside the body are caused by sudden stimulus changes. Reflexes usually involve glands and smooth muscles although skeletal muscles may be reflexive in response in an aversive stimulus.

2. The reflex is composed of both a stimulus component and a response component. Several different stimuli may produce the same response.

3. To specify the relation between a stimulus and a response, it is necessary to determine the strength of the response in the absence of the stimulus as well as in its presence. In other words, a response that is infrequent when the stimulus is absent but occurs reliably when that stimulus is present is said to be reflexive.

4. In reflex inhibition, the presence of the stimulus decreases the strength of the response.

5. The latency of the response usually does not exceed 30 seconds.

6. The reflex may be either unlearned or learned. The former is termed an unconditioned reflex while the later is termed a conditioned reflex.

7. There are two main types of reflexes: phasic reflexes such as the eyeblink, knee-jerk, and flexion withdrawal which have a brief duration; and tonic reflexes, such as those involved in balance and posture, which consist of a continuous series of adjustments in muscle tension.

8. A particular unconditioned reflex is usually characteristic of all members of a species.

9. Members within a species can inherit a specific capacity to be reinforced or punished by certain environment-behavior relations.

10. The reflex may be temporarily diminished through the process of habituation; it may later increase without retraining through the process of spontaneous recovery.

Irrelevant Features:

1. Whether it involves glands, smooth muscles, or striped muscles.

2. The topography of the behavior.

3. The modality of the stimulus.

4. Whether the reflex is learned or unlearned.

5. Whether it is of a brief or continuous duration.

Positive Examples:

1. Pupillary reflex: the change in the size (by contraction or dilation) of the pupil of the eye in response to a change in the intensity of light.

2. Patellar reflex: the jerking movement of the lower leg in response to a blow delivered just under the kneecap.

3. Lachrymal reflex: the tearing of the eye in response to a foreign object in the eye (i.e., dust particle), or in response to the aroma of a freshly peeled onion or of smoke.

4. Salivary reflex: the secretion of saliva into the mouth in response to food in the mouth or in response to a weak acid solution in the mouth (e.g., lemon juice).

5. Piloerection reflex: the erection of hair follicles in response to cold or to extreme fright.

6. Nasal reflex: sneezing as a response to an irritation in the nasal mucosa (pepper in the nose).

7. Coughing reflex: forcefully expelling air from the mouth in response to an irritation in the throat.

8. Activation syndrome: in response to a sudden or painful stimulus the following behaviors occur: increased heart rate and secretion of adrenaline into the blood, vasoconstriction in the periphery, vasodilation in the skeletal muscles, and cessation of visceral activity.

9. Flexion reflex: a hand or foot is quickly withdrawn in response to an aversive stimulus (electric shock, extrreme hot or cold temperature).

10. Vasodilation and vasoconstriction reflex: relaxation and constriction of the capillaries which produces low and high blood pressure .

11. Righting reflex: vestibular reflexes cause the head to assume a normal orientation with respect to the ground (e.g., cats).

12. Tonic neck reflex: causes the body to follow the head

when it turns to the left or right or it rotates.

13. Eye blink reflex: closure of the eylid in response to a touch on the cheek or an aversive stimulus (puff of air, loud sound).

14. Nicatating membrane reflex: closure of a membrane under the eyelid that protects the eye in response to objects approaching the eye; seen in animals that must run through underbrush such as rabbits.

15. Goose bump reflex: a roughness of the skin produced by erection of the papillae in response to cold or fear.

16. Galvanic skin reflex: a change in the electrical conductivity in the skin in response to a weak electric current or by emotional reactions such as fear or surprise.

17. Sweating reflex: surface vasodilation and increased perspiration through the skin pores in response in an increase in temperature and/or humidity.

18. Shivering reflex: surface vasoconstriction and rapid shaking of limbs in response to a decrease in temperature or a firghtening stimulus.

19. Peristaltic reflex: regurgitation in response to an irritation in the esophagus or stomach.

20. Some infant reflexes: Visual tracking reflex: pupil fixation on a slowly moving object; Sucking reflex: puckering of the lips and sucking in response to a nipple; Parachute reflex: spreading out of the arms and legs when suspended in air by the waist; Babinski reflex: splaying or spreading out of the toes in response to lightly stroking the bottom of the foot.

Negative Examples:

1. The response of coughing: no mention is made of the stimulus involved.

2. A flashing bright light: no mention is made of the response

involved.

3. Writing a letter in response to a telephone call received six weeks ago: too much time has elapsed between the stimulus and the response to be considered a reflex.

4. A light paired with a bell: it must describe the relation between a stimulus and a response, and not only the relation between two stimuli.

5. Every time a child smiles he is given an M & M candy: the stimulus must come before the response to be considered reflexive.

6. The roots of a plant grow downward in response to gravity; this is a tropism and not under neural control.

7. Feeling upset when you wake up late; this emotional response is conditioned behavior.

8. Saluting by a soldier in the presence of a superior officier: this is operant behavior and is learned through motor imitation.

2. RESPONDENT BEHAVIOR

Critical Defining Features:

1. A reflexive type response that is produced by a particular stimulus.

2. It is behavior that is susceptible to respondent conditioning.

Additional Information:

1. The prior stimulus is referred to as an "antecedent."

2. It usually involves the involuntary responses of the smooth muscles and glands or other involuntary effector organs, although there are several common excepttions such as the eyelid and knee-jerk reflexes.

3. It is not affected by consequences.

4. Respondent behavior is said to be elicited by a particular stimulus and so "responds" to the environment.

5. It is described by the 2 term contingency: S -> R.

Irrelevant Features:

1. The direction of behavior change.

2. The topography of the behavior.

3. The dynamic characteristics of the response.

3. <u>Respondent conditioning</u>

Critical Defining Feature:

1. A procedure in which a conditioned reflex is formed when a neutral stimulus is paired with an unconditioned stimulus; eventually, the neutral stimulus becomes a conditioned stimulus and will produce the same response.

Additional Information:

1. The procedure of respondent conditioning is illustrated in the following diagram:

a. NS ---> No response or irrelevant response

b. US ---> UR

c. US ---> UR
CS ---> CR

d. CS ---> CR (which resembles the UR)

2. Some measures of the strength of respondent conditioning include the following:

a. Magnitude of the CR (i.e., drops of saliva, extent of muscular movement)

b. Latency of the CR (elapsed time between the stimulus presentation and the beginning of the response)

c. Trials to criterion (the number of pairings with the US before a measurable CR appears)

d. Fatigibility or resistence to extinction.

3. The procedure is often referred to as "stimulus substitution" because the CS replaces the US in producing the response.

4. Examples of some reflexes which can be respondently conditioned in animals:

a. weak acid solution, food --> salivation

b. puff of air, touch cheek --> eyeblink

c. tap on knee --> knee jerk

d. light intensity increase --> pupillary constriction

e. light intensity decrease --> pupillary dilation

f. smoke --> tearing of the eye

g. painful stimulus to hand or foot --> hand or foot withdrawal

h. temperature increase --> sweating

i. electrical stimulation --> galvanic skin response

Teaching Example:

1. Pavlov's original experiment involved a dog placed in a harness. When a bell tone was rung the dog pricked up its ears and turned its head towards the sound. This is called an orienting reflex. With successive rings, however, these orienting responses diminished in magnitude and then

disappeared. The sound became a neutral stimulus through the process of habituation.

When meat powder was placed in its mouth, the dog salivated and made chewing movements with his jaw. A bell tone was then rung 5 seconds before each food delivery. After several pairings the dog began to salivate and chew during the 5 second interval between the bell tone and presentation of the meat powder. Eventually (after 30 to 50 pairings), the dog salivated and chewed at the sight of the bell alone, even if on occasional trials the food was omitted.

The procedure can be diagramed as follows:

Neutral stimulus--> NS (bell)--> Orienting response--> No response

Unconditioned reflex--> US (meat powder)--> UR (salivation & chewing)

Conditioning--> US (meat powder)--> UR (salivation & chewing)
CS (tone of bell)--> CR (salivation & chewing)

Conditioned reflex--> CS (tone of bell)--> CR (salivation & chewing)

Note: salivation was respondently conditioned while chewing was operantly conditioned.

Positive Examples:

1) The US is paired with a NS to elict a CS; there are typically 30-50 pairings; there are five procedures which produce varying conditioning effects:

a. simultaneous conditioning: US and CS occur at the same type - weak effect

b. trace conditioning: CS occurs and disappears before US onset - weak effect

c. short delay conditioning: CS occurs and remains on for a few seconds during US onset - strong effect

d. long delay conditioning: CS occurs and remains on for a longer period of time before US onset - less strong

effect

e. backward conditioning: CS occurs immediately after US offset - weak or no effect

Negative Examples:

1) present CS several seconds after US offset

2) pair 2 US's for the same UR in order to make one a CS (i.e., puff of air and touch on cheek already both elicit an eyeblink)

3) present reinforcement after the CS (this is not an operant procedure)

4) CS was not originally neutral (it may produce other unintended effects)

5) pairing CS1 with CS2 while US is still present (this is an incorrect procedure for second-order conditioning)

6) Pair 2 NSs to elicit a CS (no response will occur)

7) use inappropriate US for UR (ex., use puff of air as US for salivating)

8) pair NS with startle reflex to produce a CS (after habituation the response will extinguish)

9) Not a sufficient number of pairings (no conditioning will take effect)

4. <u>Respondent extinction</u>

Critical Defining Feature:

1. A procedure in which the conditioned stimulus is repeatedly presented without the unconditioned stimulus; as a result, the conditioned stimulus becomes a neutral stimulus and no longer produces the conditioned response.

Additional Information:

1. Extinction does not permanently end the CR since, following a rest period, the CS will again produce the CR without any further US-CS pairings. This phenomenon is known as spontaneous recovery and suggests that extinction acts more as an inhibition of the CR and that the response is not just forgotten.

Teaching Example:

1. If a dog is conditioned to salivate at the tone of a bell, but later the bell is repeatedly rung without pairing it with food, the bell tone will eventually cease to elicit or produce salivation. Repeatedly presenting the CS without the US describes the process of respondent extinction.

A. Positive Examples:

1) Present CS by itself

2) P(US/CS) < P(US/noCS) (a molar approach)

3) Low ratio of US/CS pairings

5) Long delays (more than 5 sec) between CS and US presentations

B. Negative Examples:

1) Long passage of time (the effects of conditioning are not "forgotten;" there are only reduced due to extinction or counterconditioning)

2) Don't give the US (occasional US alone trials will not produce extinction to the CS)

3) Don't reinforce the CS (this is not an operant procedure)

4) UR and CR are incompatible responses (i.e., the compensatory CR in drug tolerance)

5) Muscle fatigue (response will reoccur after a rest period)

6) Satiation (previous establishing operation is no longer effective)

7) Habituation (response decrease to a startle or orienting stimulus that decreases aftert repeated exposure)

5. Respondent punishment (counterconditioning)

Critical Defining Feature:

1. A procedure in which one stimulus, which is rein- forcing, is paired with another stimulus, which is aversive, and produces an inhibition or elimination of the response in the presence of the reinforcing stimulus by itself.

Additional Information:

1. The reinforcing stimulus can be either a US or a CS, while the aversive stimulus is usually a US.

2. A strong aversive stimulus will effectively eliminate the behavior over a long period of time.

3. Intermittent pairing of reinforcing and mild aversive stimuli is more effective in maintaining the behavior reduction over a period of time.

4. The aversive stimuli referred to here all have immediate effects; more delayed consequences, such as those produced by food poisoning, will not be discussed in this lesson.

Teaching Example:

1. If a bell tone is paired with electric shock it will come to elicit emotional responses of increased heart rate and adrenaline secretion associated with escape behavior. After several such pairings the bell tone by itself will elicit these emotional responses by itself.

A. Positive Examples:

1) Pairing the CS and an aversive US

2) The CS is correlated with aversive ambient stimuli

3) The CS is correlated with high ratio strain schedule

B. Negative Examples:

1) The US is not a strong enough aversive stimulus (i.e., water mist paired with tap on knee to elicit knee jerk reflex)

2) CS onset occurs several seconds after US offset

3) Withdraw a CS correlated with reinforcement

4) Present an aversive stimulus to punish the CR

5) Present a warning stimulus so the organism can avoid the aversive stimulus

6. <u>OPERANT BEHAVIOR</u>

Critical Defining Features:

1. It is behavior which is susceptible to operant conditioning.

Additional Information:

1. This behavior often appears spontaneously rather than as a reaction to stimulation; it may or may not be produced by a current stimulus.

2. The term "operant" refers to a class of responses which have particular consequences and which operate on the environment. The response class is defined, therefore, by the stimulus it produces. Operant is, therefore, is used to refer to behavior in general, while a specific instance of the behavior is called a response.

3. It usually involves the voluntary responses of the striated (skeletal) muscles or other voluntary effector organs.

4. If a prior or antecedent stimulus can be identified it is said to evoke operant behavior. Often, the stimulus is not apparent and the behavior seems to occur "spontaneously."

5. It is affected by consequences (the stimuli which follow the response).

6. The consequences must occur within 3--60 seconds after the response. Operant conditioning can have an affect through remote as well as immediate contingencies, but it is a more complicated process involving rule-governed behavior.

7. It is described by the 3 term contingency: S ---> R ---> S.

8. Basically, the operant procedure involves pairing a response with a particular stimulus while the respondent procedure involves pairing two stimuli.

Irrelevant Features:

1. The learning history of the organism.

2. The direction of behavior change.

3. The topography of the behavior.

4. Dynamic characteristics of the response.

7. Operant Conditioning: Positive Reinforcement

Critical Defining Features:

1. A procedure in which an environment-behavior relation is maintained or strengthened by arranging a consequence contingent upon a response.

2. There are two types of operant conditioning procedures:

a. Positive reinforcement in which a positive reinforcer is presented or increased following a particular response.

b. Negative reinforcement in which an aversive stimulus is removed, reduced, or prevented following a particular response.

Additional Information:

1. The term "conditioning" as used here is synonymous with "reinforcement" and "strengthening."

2. It is a functional definition in that the procedure is defined by its consequences, and not whether positive or negative reinforcers are used.

3. The reinforcement procedure is effective only when the appropriate motivative variables are present. The same stimulus may or may not be reinforcing depending on the situation (more about this later).

4. Some measures of the strength of operant conditioning include the rate of response, the magnitude of the response, the number of trials to criterion, and the total number of responses during extinction. The increase in behavior is compared with its previously unreinforced performance, which is called the operant level.

5. Some stimulus events, when they follow some kinds of behaviors, cause an increase in the future strength of the behavior. Those events are called reinforcers, the procedure is called reinforcement, and the effect on behavior is referred to as operant conditioning.

6. Negative reinforcement is involved in most escape and avoidance schedules. However, organisms "want" negative reinforcement just as much as positive reinforcement. Both procedures increase the future frequency of behavior.

Irrelevant Features:

1. Whether a reinforcing or punishing stimulus is used.

2. Whether a stimulus is presented or taken away.

3. Whether the stimulus was reinforcing or punishing in the past.

A. Positive Examples:

1) Present SR immediately after the response (i.e., food, liquids, physical affection)

2) Present Sr immediately after the response (i.e., attention, praise, tokens, stars, happy faces, points in a record book, high grades, free time, access to preferred activity, money, etc.)

B. Negative Examples:

1) Long delay (more than 30 sec) between the response and reinforcement

2) Reinforcement given before the response (in an operant procedure the SD comes before the response and the SR comes after)

3) Fixed-time schedule (reinforcement is given on a temporal basis only and not contingent on any particular response; while it may reinforce some behavior it almost certainly will not be the behavior of interest)

4) Establishing operation not effective at that time (satiation has reduced the reinforcer effectiveness)

5) Removing the CS (this is a respondent conditioning procedure)

8. <u>OPERANT CONDITIONING: NEGATIVE REINFORCEMENT</u>

A. Positive Examples:

1) Remove unconditioned aversive stimulus immediately after the response (i.e., reduce shock intensity, reduce bright light intensity, increase cold temperature to warm, reduce wetness, reduce headache/nausea, reduce loud noise)

2) Remove conditioned aversive stimulus immediately after the response (i.e., frown, negative tone of voice, fine, written retraction of public censure)

B. Negative Examples:

1) Response is an unconditioned reflex (i.e., removing your

hand from a hot stove)

2) Removing US to stop UR (this is a respondent procedure)

3) Verbal threat to remove SR or Sr

4) Withholding reinforcement

5) Long delay between response and removal of aversive stimulus

Specific Examples:

1. Every time a baby utters a vocal sound the mother picks him up and hugs him: this is positive reinforcement for vocal behavior.

2. When it starts raining a man opens up his umbrella: this is negative reinforcment for staying dry.

3. A salesman gets a commission on each car that he sells: this is positive reinforcement for selling behavior.

4. A student studies and then immediately takes the exam; doing well is positive reinforcment for studying behavior; it could also be negative reinforcement for avoiding a poor performance on the test.

5. A teacher is working with an autistic child with no verbal skills; every time the teacher says, "Look at me" and the child gives the teacher eye contact, then the teacher presents him with a poker chip token which the child can turn in later to earn time playing with toys: this is positive reinforcment for compliance behavior.

Specific Negative Examples:

1. A child is given a cookie if he agrees to eat his dinner later: the reinforcement must be presented contingent upon the response and not before it.

2. An author writes a book and then receives royalities

several years later: the reinforcement must closely follow the behavior to be considered positive reinforcement; book writing behavior is probably reinforced by other more immediate factors.

3. A girl smiles at her boyfriend in order to reinforce him: reinforcement is effective only on people's behavior, it is incorrective to speak of reinforcement as reinforcing the person himself.

4. In order to reinforce their child for eating his dinner, the parents offer him 10 ice cream cones instead of the usual one cone to reinfoce eating behavior: the effect of satiation will negate the effects of the reinforcers since the child will no longer be hungry.

5. A person in a stop smoking program is given an electric shock every time he picks up a cigarette in order to reinforce the person for not smoking: this is a punishment procedure since the behavior is decreased in strength.

6. A dog salivates in order to be reinforced for being fed: salivation is normally respondent behavior which occurs after the stimulus and not before it.

9. Operant extinction

Critical Defining Feaure:

1. A procedure in which an environment-behavior relation is weakened by no longer presenting a reinforcing consequence after a response. As a result, the operant behavior ceases to occur or occurs at a relatively low level.

Additional Information:

1. In other words, the decrement in performance is due to the nonreinforcement of previously reinforced behavior.

2. The organism must have an opportunity to engage in the previously reinforcing behavior before the use of the term extinction is appropriate.

3. Extinction usually has the side effect of increasing the variability of the response.

4. Often the rate and intensity of responding will temporarily increase at the start of the extinction procedure before it starts decreasing. This phenomenon is called an extinction burst and can produce some aggressive behavior.

5. Extinction does not permanently eliminate the behavior since, after a rest period, the operant behavior will again temporarily increase in a phenomenon called spontaneous recovery.

6. Extinction occurs more rapidly following a continuous reinforcement procedure rather than a partial or inter- mittent procedure. The longer the reinforcement history the longer it will take for extinction to occur.

7. Extinction should be distinguished from forgetting in which the reduction in behavior is due only to the passage of time and not the removal of a specific contingency. Extinction also occurs much more quickly than forgetting.

8. Extinction and satiation resemble each other but their procedures differ; in extinction no reinforcement is available while in satiation reinforcement is continuously available.

9. Extinction is most effective when it is combined with differential reinforcement for some other behavior (called a DRO procedure).

10. The strength of extinction is measured by the change in the rate of responding during the procedure and the total number of responses before the behavior returns to its normal rate prior to conditioning.

11. Resistance to extinction is one measure of the strength of reinforcement.

12. The term "extinct" refers only to a vanished species and is not used to refer to the extinction procedure.

Irrelevant Features:

1. The prior rate of behavior.

2. Whether there are other concurrent procedures used for alternate behaviors.

3. Whether the response is temporarily or permanently eliminated.

A. Positive Examples:

1) Allow the response to occur without reinforcement

2) Reduce the amount of SR/Sr presented after the response

3) Switch to a fixed-time schedule (reinforcement is not contingent on the behavior of interest)

4) Reinforce incompatible behavior

5) There is a several minute delay between the response and the delivery of reinforcement

B. Negative Examples:

1) Satiation (behavior will regain strength when the EO becomes effective again)

2) Passage of time- forgetting

3) Muscle fatigue

4) Present aversive stimulus immediately after the response

5) Present aversive stimulus immediately after the response

6) Present aversive stimulus just before the response

10. <u>Operant punishment: Positive Punishment</u>

Critical Defining Features:

1. A procedure in which an environment-behavior relation is weakened or eliminated by arranging a consequence of responding that reduces the strength of a response.

2. There are two distinct procedures:

   a. The presentation of an aversive stimulus following a response is called Type I punishment or positive punishment.

   b. The removal of a reinforcing stimulus following a response is called Type II punishment or negative punisment.

Additional Features:

1. It should be noted that new behavior is not produced by punishment, although it may have some side effects such as emotional responses, aggression, and/or escape behavior.

2. Note that we can strengthen behavior with a positive or an aversive stimulus and that we can weaken behavior with a positive or an aversive stimulus. What is important is the particular contingency used and not the type of stimulus.

3. The distinction between negative punishment and extinction is sometimes difficult to make since the procedures are similar and both result in a decrement in responding. The important point to recall is that in the extinction procedure, nothing happens following a response so nothing is taken away. In a negative punishment procedure, a positive reinforcer is removed following a response so that the organism has less reinforcement each time a response is made. In other words, in extinction a positive reinforcer is prevented while in negative punishment a positive reinforcer is removed. Punishment also has a more immediate behavior reduction effect than extinction and if, the punishment is severe, the effect is irreversible.

4. When mild punishment is used, after a rest period, the phenomenon of spontaneous recovery does occur.

5. To be effective, the aversive stimuli must be more powerful

than the reinforcing stimuli maintaining the response.

6. The strength of the punishment procedure is measured by the change in the rate of responding and the total number of responses that occur before the behavior ceases.

7. Some stimulus events, when they follow some kinds of behavior, cause a decrease in the future strength of the behavior. Those events are called aversive stimuli. the procedure is called punishment, and the effect on behavior is referred to an operant punishment.

Irrelevant Features:

1. Whether a positive reinforcer or aversive stimulus is presented.

2. Whether a stimulus is presented or removed.

3. Whether the response is temporarily or permanently eliminated.

4. The intensity of the reinforcing or aversive stimulus.

5. The rapidity of response reduction.

Type I - Positive Punishment

A. Positive Examples:

1) Present SP immediately after the response

2) Present Sp immediately after the response

3) Increase response effort required

4) Increased ratio strain schedule

B. Negative Examples:

1) Remove aversive stimulus immediately after the response

2) Remove reinforcing stimulus immediately after the

response

3) Pair 2 SP's

4) Decreased behavior after a long period of time

5) Reducing SP intensity

6) Reduced behavior due to fatigue

7) Reduced behavior due to satiation

8) Long delay (more than 30 sec) between the response and punishment

9) Present aversive US immediately before the response (this is a respondent procedure)

10) Conditioned suppression (operant responding does decrease but no responses are punished)

Type II - Negative Punishment

Positive Examples:

1) Remove unconditioned positive reinforcer immediately after the response

2) Remove conditioned positive reinforcer immediately after the response

Negative Examples:

1) Present aversive stimulus immediately after the response: this is positive punishment

2) Satiation: fucntion altering effect will again be effective when establishing operation changes

3) Muscle Fatique: will subside after a rest period

4) Passage of time: effect will remain in similar stimulus conditions unless incompatible responses are reinforced

5) Remove reinforcing stimulus just before the response (the consequence must be contingent upon the response)

6) Remove aversive stimulus immediately before the response (this is a respondent procedure)

7) Long delay (more than 30 sec) between the response and the removal of reinforcement

Appendix D

PASS Pretest

```
!----------------------------------------------------------
! Title: PSYCHOLOGICAL TERMS PRETEST
! Author: John B. Connors
! Created On: October 10, 1990
! Revised On: May 10, 1991
! Topic: Pretest on introductory terms in behavior analysis
! using original examples not found in the program to test
! applications of concepts and generalization to new situations
! Terms: reflex, respondent conditioning, respondent extinction,
! respondent punishment (aversive counterconditioning), operant
! conditioning (positive and negative reinforcement, operant
! extinction, and operant punishment (positive and negative)
! Form: 25 multiple choice questions using 5 choices
!----------------------------------------------------------
.i 1.0:
!----------------------------------------------------------
```

This short pretest will precede a CAI program designed to teach some introductory terms in behavior analysis. The terms describe procedures in respondent and operant conditioning. Don't worry if the concepts are unfamiliar to you as they will be taught to you during the teaching program to follow.

This test is in multiple choice format. It is necessary that you answer each question, even if you have to guess. Do not spend too much time on any one question. No feedback will be given on answers. A similar posttest will then follow the CAI teaching program. There are 25 questions. You should be able to complete this test within 15 minutes.

```
!----------------------------------------------------------
.o 1.1:
!----------------------------------------------------------
```

Which one of the following is an example of reflexive behavior?

```
!----------------------------------------------------------
.r1; closure of the eyelid in response to a touch on the cheek
.w1; rapid withdrawal of the leg
.w2; secretion of saliva into the mouth
.w3; a light paired with a tone
.w4; surface vasoconstriction and rapid shaking of the arms
!----------------------------------------------------------
.o1.2:
!----------------------------------------------------------
```

In respondent conditioning procedures, the unconditioned and conditioned stimuli are presented without regard to the animal's ____________.

```
!----------------------------------------------------------
```

.r1; behavior
.w1; awareness
.w2; expectation
.w3; presence
.w4; situation
!---
.o1.3:
!---
For best results in respondent conditioning, in what order is the stimulus produced in relation to the response?
!---
.r1; just before the response
.w1; at the same time
.w2; just after the response
.w3; 5 seconds before the response
.w4; 5 seconds after the response
!---
.o1.4:
!---
Operant behavior usually involves which of the following bodily systems?
!---
.r1; skeletal muscles
.w1; smooth muscles
.w2; cardiac muscles
.w3; endocrine glands
.w4; effector organs
!---
.o1.5:
!---
although both extinction and satiatioan have similar efects on behavior, what is the main procedural difference with exitnction?
!---
.r1; no reinforcement is available
.w1; reinforcement is intermittent
.w2; reinforcement is time dependent
.w3; differential reinforcement is used
.w4; reinforcement is continuously available
!---
.o1.6:
!---
You are walking outside carrying your coat. Suddenly it becomes windy and cold so you stop and put on your coat to keep warm. This is an example of which of the following procedures?

!--
.rl; negative reinforcement
.wl; positive reinforcement
.w2; negative punishment
.w3; avoidance behavior
.w4; escape behavior
!--
.o1.7:
!--
In a classroom the teacher uses a response cost system of taking away recess time for inappropriate behavior during work time. If students lose more than two recesses in a day, then they have to stay after school for detention. What type of procedure is this?
!--
.rl; negative punishment
.wl; positive punishment
.w2; operant extinction
.w3; negative reinforcement
.w4; counterconditioning
!--
.o1.8:
!--
Squirts of lemon juice in the mouth elicit salivary responses. Often this results in the sight of a lemon eliciting this response by itself. When this occurs the presentation of the lemon by itself has become which of the following stimuli?
!--
.rl; a conditioned stimulus
.wl; a discriminative stimulus
.w2; an unconditioned stimulus
.w3; a reinforcing stimulus
.w4; an aversive stimulus
!--
.o1.9:
!--
In a weight reduction program, slides of high calorie foods were paired with painful shocks delivered through electrodes attached to the arm. This type of procedure is called which of the following?
!--
.rl; respondent punishment
.wl; respondent conditioning
.w2; respondent extinction
.w3; operant extinction

.w4; operant punishment
!---
.o2.0:
!---
When turning on the ignition in your car, a buzzer goes on until you fasten your seatbelt. You are motivated to put on your seatbelt faster due to which of the following procedures?
!---
.r1; negative reinforcement
.w1; avoidance behavior
.w2; escape behavior
.w3; positive punishment
.w4; negative punishment
!---
.o2.1:
!---
Operant extinction is most effective when it is combined with which of the following procedures?
!---
.r1; differential reinforcement of other behavior (DRO)
.w1; intermittent reinforcement
.w2; respondent extinction
.w3; spontaneous recovery
.w4; positive reinforcement
!---
.o2.2:
!---
While camping the temperature drops below the freezing mark. By building a campfire in order to get warm again, what kind of behavioral procedure is in effect?
!---
.r1; negative reinforcement
.w1; positive reinforcement
.w2; positive punishment
.w3; omission training
.w4; respondent conditioning
!---
7.o2.3:
!---
The sequence of sneezing as a result of pepper in the nose is called which of the following?
!---
.r1; unconditioned reflex

.w1; unconditioned stimulus
.w2; unconditioned response
.w3; respondent conditioning
.w4; respondent punishment
!--
.o2.4:
!--
Sitting on the back porch during the summertime, you are having a conversation with friend's while there is the persistent sound of crickets in the background. After a while you don't even notice the cricket's sound anymore. This effect is due to which process?
!--
.r1; habituation
.w1; satiation
.w2; extinction
.w3; counterconditioning
.w4; forgetting
!--
.o2.5:
!--
The procedure of positive punishment is which of the following?
!--
.r1; contingent presentation of an aversive stimulus
.w1; contingent removal of an aversive stimulus
.w2; contingent presentation of a reinforcing stimulus
.w3; contingent removal of a reinforcing stimulus
.w4; pairing a reinforcing and aversive stimulus
!--
.o2.6:
!--
The procedure of counterconditioning involves pairing a(n) ___________ stimulus with a(n) _______________ stimulus.
!--
.r1; reinforcing, conditioned aversive
.w1; aversive, reinforcing
.w2; neutral, aversive
.w3; reinforcing, unconditioned aversive
.w4; conditioned, unconditioned
!--
.o2.7:
!--
What are the two main types of reflexes?
!--

.r1; tonic and phasic reflexes
.w1; salivary and eyeblink reflexes
.w2; righting and vestibular reflexes
.w3; shivering and sweating reflexes
.w4; nasal and coughing reflexes
!---
.o2.8:
!---
What can never occur during higher-order conditioning?
!---
.r1; pair the second CS with the US
.w1; pair the first CS with the second CS
.w2; pair the second CS with an NS
.w3; pair the first CS with the US
.w4; pair the third CS with the second CS
!---
.o2.9:
!---
Habituation usually occurs with which of the following stimuli?
!---
.r1; startle and orientation stimuli
.w1; auditory and visual stimuli
.w2; aversive stimuli
.w3; intermittent stimuli
.w4; unconditioned stimuli
!---
.o3.0:
!---
Which one of the following would not cause a decrement in responding?
!---
.r1; spontaneous recovery
.w1; extinction
.w2; satiation
.w3; fatigue
.w4; the passage of time
!---
.o3.1:
!---
In order for a consequence to be immediate what must occur?
!---
.r1; the stimulus must occur within 10 seconds after the response
.w1; the stimulus must occur within 30 seconds after the response
.w2; the stimulus must occur within 60 seconds after the response

.w3; unconditioned reinforcement must be delivered within 10 seconds of conditioned reinforcement
.w4; the stimulus and response must occur simultaneously
!---
.o3.2:
!---
Which of the following is not a side effect of a punishment procedure?
!---
.r1; new behavior is learned
.w1; emotional responses
.w2; aggressive responses
.w3; escape behavior
.w4; avoidance behavior
!---
.o3.3:
!---
In order for a punishment procedure to be effective, the _________ stimuli must be more powerful than the _________ stimuli maintaining the response.
!---
.r1; aversive, reinforcing
.w1; reinforcing, aversive
.w2; unconditioned, conditioned
.w3; conditioned, unconditioned
.w4; immediate, delayed
!---
.o3.4:
!---
Which of the following is not an example of a positive punishment procedure?
!---
.r1; remove a reinforcing stimulus after the response
.w1; present an unconditioned aversive stimulus after the response
.w2; present a conditioned aversive stimulus after the reponse
.w3; increase the response effect required
.w4; increase the ratio strain of the schedule
!---
.o3.5:
!---
Aversive stimuli may affect behavior either as a(n) ___________ or as a(n) ___________ event.
!---
.r1; antecedent, consequent

.w1; reinforcer, punisher
.w2; escape, avoidance
.w3; deprivation, satiation
.w4; inhibition, habituation
!---
That is the end of this pretest. Go back to the main menu in PASS and choose the CAI program assigned to you. Thank you.
!---

Appendix E

PASS Posttest and Preference Questionnaire

```
!-------------------------------------------------------------
!       Author: John B. Connors
!       Created On: May 3, 1991
!       Title: PSYCHOLOGICAL TERMS POSTTEST
!       Topic: Posttest on introductory terms in behavior analysis
!       using original examples not found in the programs to test
!       applications of concepts and generalization to new
!       situations
!-------------------------------------------------------------
.i1.0:
!-------------------------------------------------------------
```

This short posttest follows your interaction in one of four CAI programs designed to teach some introductory terms and examples in behavior analysis. Your score on this test will help determine how effective the teaching programs are. Again the test is in multiple choice format with no feedback given on right or wrong answers. A short preference questionnaire will follow. You should be able to complete this test within 15 minutes. Please do not spend too much time on any question.

```
!-------------------------------------------------------------
.o1.1:
!-------------------------------------------------------------
```

A person who is afraid of black cats can be counterconditioned to remain calm in their presence by which one of the following procedures?

```
!-------------------------------------------------------------
.r1; respondent conditioning
.w1; respondent punishment
.w2; respondent extinction
.w3; habituation
.w4; satiation
!-------------------------------------------------------------
.o1.2:
!-------------------------------------------------------------
```

In aversive counterconditioning the reinforcing stimulus can be either a(n) ______________ or a(n) ______________.

```
!-------------------------------------------------------------
.r1; unconditioned stimulus, conditioned stimulus
.w1; reinforcing stimulus, aversive stimulus
.w2; antecedent stimulus, consequent stimulus
.w3; neutral stimulus, discriminative stimulus
.w4; stereotyped stimulus, unique stimulus
!-------------------------------------------------------------
.o1.3:
!-------------------------------------------------------------
```

While walking outside a person starts getting wet due to a sudden rainstorm. He quickly puts on his raincoat and opens his umbrella. This behavior is an example of which kind of procedure?
!--
.r1; negative reinforcement
.w1; positive reinforcement
.w2; conditioned reflex
.w3; avoidance behavior
.w4; stimulus substitution
!--
.o1.4:
!--
Which of the following is not considered reflexive behavior?
!--
.r1; saluting the flag using arm extensors
.w1; surface vasoconstriction due to a frightening stimulus
.w2; surface vasodilation due to an increase in temperature
.w3; change in the electrical conductivity in the skin in response to a weak electric current
.w4; secretion of saliva in response to a weak acid solution in the mouth
!--
.o1.5:
!--
Reflexes usually involve glands and smooth muscles although skeletal muscles may be reflexive in response to a(n) ___________ stimulus.
!--
.r1; aversive
.w1; reinforcing
.w2; conditioned
.w3; unconditioned
.w4; neutral
!--
.o1.6:
!--
The most effective type of respondent conditioning procedure is which of the following?
!--
.r1; short delay conditioning
.w1; long delay conditioning
.w2; backward conditioning
.w3; simultaneous conditioning
.w4; trace conditioning
!--

.o1.7:
!--
Antecedent stimuli can
produce behavior changes in both respondent and operant conditioning. In respondent behavior we say that a stimulus ___________ a response while in operant behavior we say that a stimulus ___________ a response.
!--
.r1; elicits, evokes
.w1; evokes, elicits
.w2; triggers, produces
.w3; pushes. pulls
.w4; precedes, follows
!--
.o1.8:
!--
Using traffic tickets and fines to try and prevent people from driving at a higher speed than posted involves which one of the following procedures?
!--
.r1; negative punishment
.w1; positive punishment
.w2; counterconditioning
.w3; aversive counterconditioning
.w4; avoidance training
!--
.o1.9:
!--
Which procedure is considered the simplest type of learning?
!--
.r1; habituation
.w1; respondent conditioning
.w2; counterconditioning
.w3; respondent extinction
.w4; respondent punishment
!--
.o2.0:
!--
Which is the most is the most common way to measure reflex strength?
!--
.r1; response latency
.w1; stimulus magnitude
.w2; response duration
.w3; response intensity
.w4; stimulus duration

!--
.o2.1:
!--
How are muscular and glandular fatigue different from habituation?
!--
.r1; fatigue is more temporary and a several minute resting period will often restore responding
.w1; fatigue acts more quickly and takes longer to restore responding
.w2; fatigue is more stimulus specific
.w3; fatigue is more response specific
.w4; spontaneous recovery is more often seen with fatigue
!--
.o2.2:
!--
The patellar reflex, in which a jerking movement of the lower leg is made in response to a blow delivered just below the kneecap, is considered which of the following?
!--
.r1; a phasic reflex
.w1; a tonic reflex
.w2; a conditioned reflex
.w3; a flexion reflex
.w4; activation reflex
!--
.o2.3:
!--
The term "stimulus substitution" is often used as a synonym for which procedure?
!--
.r1; respondent conditioning
.w1; habituation
.w2; satiation
.w3; deprivation
.w4; spontaneous recovery
!--
.o2.4:
!--
In the Pavlov experiment, after several weeks of experiments the dog would begin to salivate when strapped into its harness. What is a plausible explanation for this?
!--
.r1; the harness was paired with the presence of meat powder so it came to elicit salivation by simple respondent conditioning

.w1; the harness was paired with the bell tone so it came to elicit salivation through higher-order conditioning
.w2; after several weeks the dog came to expect to be given food after being placed in the harness
.w3; being placed in the harness signaled the end of an extinction period and salivation began as a result of spontaneous recovery
.w4; the dog learned that as soon as it salivated that it would be reinforced with meat powder
!--
.o2.5:
!--
In backward conditioning the CS occurs immediately after the US offset. Often it has a weak effect. How is it more likely to be effective?
!--
.r1; using aversive stimuli
.w1; using intermittent stimuli
.w2; using unconditioned stimuli
.w3; using conditioned stimuli
.w4; using reinforcing stimuli
!--
.o2.6:
!--
A person who has a fetish for leather boots enters a behavior therapy program in order to reduce his uncontrollable desires. In his treatment session slides of women wearing a variety of boots are projected on a screen. Several seconds later an electric shock is delivered through electrodes attached to his leg. After 2 weeks of treatment he reports that leather boots have lost their erotic appeal. What procedure is this an example of?
!--
.r1; aversive counterconditioning
.w1; counterconditioning
.w2; positive punishment
.w3; negative punishment
.w4; habituation
!--
.o2.7:
!--
A woman revisits her childhood home after not seeing it for over 30 years. As she walks though the various rooms of the house she experiences strong memories of people and events as well as sentimental feelings about her youth. These memories and feelings were developed as a result of which of the following?

!---
.r1; respondent conditioning
.w1; respondent extinction
.w2; operant conditioning
.w3; spontaneous recovery
.w4; counterconditioning
!---
.o2.8:
!---
The main difference between operant extinction and forgetting is which of the following?
!---
.r1; extinction removes a specific contingency
.w1; extinction occurs more slowly
.w2; extinction happens due to the passage of time
.w3; in extinction other incompatible stimulus-response relations are learned
.w4; behaviors during extinction are less variable
!---
.o2.9:
!---
A child is told he cannot have a snack just before dinner and starts crying. The parent ignores these behaviors and finally they subside. However, the next evening before dinner the child again starts crying when he can't have a snack before dinner. This resumption of crying is due to which of the following?
!---
.r1; spontaneous recovery
.w1; operant extinction
.w2; respondent extinction
.w3; negative reinforcement
.w4; habituation
!---
.o3.0:
!---
A pigeon is on a FR 10 schedule of reinforcement and receives grain for each completed component. After a steady state of performance is achieved the schedule is then changed to FR 50. A decrease in the pecking rate would be due to which one of the following procedures?
!---
.r1; positive punishment
.w1; negative punishment
.w2; counterconditioning

.w3; respondent punishment
.w4; satiation
!--
.o3.1:
!--
A hungry rat receives food pellets on an FR 5 schedule but also receives an electric shock on a FI 2-min schedule. The punishment procedure is then changed to FI 4-min and the rate of bar pressing increases. What procedure is responsible for this change?
!--
.r1; positive reinforcement
.w1; negative reinforcement
.w2; positive punishment
.w3; negative punishment
.w4; counterconditioning
!--
.o3.2:
!--
In respondent conditioning the most important variables are ______________ while in operant conditioning the most important variables are ____________.
!--
.r1; antecedent stimuli, consequent stimuli
.w1; consequent stimuli, antecedent stimuli
.w2; unconditioned stimuli, conditioned stimuli
.w3; latency, rate
.w4; continuous stimuli, intermittent stimuli
!--
.o3.3:

!--
Which of the following is not a measure of the strength of the extinction procedure?
!--
.r1; the prior rate of behavior before the extinction procedure
.w1; the change in rate of behavior from the conditioning phase to the extinction phase
.w2; the amount of variability during extinction
.w3; the total number of responses before the behavior returns to its baseline rate
.w4; the change in latency from conditioning to extinction
!--
.o3.4:

!--
Which of the following does not describe a punishment procedure?
!--
.r1; reducing the duration of an aversive stimulus
.w1; presenting an aversive stimulus
.w2; reducing the duration of a reinforcing stimulus
.w3; increasing the response effort
.w4; increasing the number of responses required
!--
.o3.5:
!--
The distinction between negative punishment and extinction is that in the former _____________ is taken away while in the latter a reinforcing stimulus is ____________.
!--
.r1; a reinforcing stimulus, withheld
.w1; nothing, removed
.w2; an aversive stimulus, restored
.w3; a contingency, withheld
.w4; a conditioned stimulus, eliminated
!--
.i3.6:
!--
This concludes this posttest in behavior analysis terms. There will now be a short preference questionnaire.
!--
.o3.7:
!--
On a scale of 1 to 5, please indicate how you felt about this program as a way of learning new and complex information compared to reading it in a textbook.
!--
.r1; 1-very favorable
.r2; 2-favorable
.r3; 3-neutral
.r4; 4-unfavorable
.r5; 5-very unfavorable
!--
.o3.8:
!--
On a scale of 1 to 5, please indicate how well you think you were able to learn the material presented in the lesson.
!--

.r1; 1-very well
.r2; 2-well
.r3; 3-average
.r4; 4-poor
.r5; 5-very poor
!---
.o3.9:
!---
On a scale of 1 to 5, please rate your opinion of the length of the program in terms of being able to comprehend it.
!---
.r1; 1-optimal length
.r2; 2-good length
.r3; 3-difficult to say
.r4; 4-too long
.r5; 5-much too long
!---
.o4.0:
!---
On a scale of 1 to 5, please indicate your opinion of the difficulty level of this material.
.r1; 1-very easy
.r2; 2-relatively easy
.r3; 3-average difficulty
.r4; 4-difficult
.r5; 5-very difficult
!---
.o4.1:
!---
On a scale of 1 to 5, please indicate whether you would be willing to participate in another similar type of CAI program experiment.
!---
.r1; 1-very willing
.r2; 2-willing
.r3; 3-somewhat willing
.r4; 4-not sure
.r5; 5-not willing
!---
.i4.2:
!---
You have now completed the pretest, CAI program, and posttest. In one week you will return to take another posttest to determine how much material is retained over a longer period of time. At the completion of this

delayed posttest, you then be given credit for bonus points in PSY 250 and PSY 330. Check with the proctor as to the exact day and time to return. Thanks for
your participation. I hope the experience was both informative and interesting. You may now exit the program.
!---

Appendix F

PASS Delayed Posttest

```
!-----------------------------------------------------------
! Title: PSYCHOLOGICAL TERMS DELAYED POSTTEST
! Author: John B. Connors
! Created On: October 10, 1990
! Revised On: May 10, 1991
! Topic: Pretest on introductory terms in behavior analysis
! using original examples not found in the program to test
! applications of concepts and generalization to new situations
! Terms: reflex, respondent conditioning, respondent extinction,
! respondent punishment (aversive counterconditioning), operant
! conditioning (positive and negative reinforcement, operant
! extinction, and operant punishment (positive and negative)
! Form: 50 multiple choice questions using 5 choices
!-----------------------------------------------------------
.i 1.0:
!-----------------------------------------------------------
```

This delayed posttest follows by one week a CAI program designed to teach some introductory terms in behavior analysis. The test is a combination of the pre and posttest taken previously and is designed to determine how well students retain information learning through using CAI programs.

This test is again in multiple choice format. It is necessary that you answer each question, even if you have to guess. Do not spend too much time on any one question. No feedback will be given on answers. There are 50 questions. You should be able to complete this test within 25 minutes or less.

```
!-----------------------------------------------------------
.o 1.1:
!-----------------------------------------------------------
```

Which one of the following is an example of reflexive behavior?

```
!-----------------------------------------------------------
.r1; closure of the eyelid in response to a touch on the cheek
.w1; rapid withdrawal of the leg
.w2; secretion of saliva into the mouth
.w3; a light paired with a tone
.w4; surface vasoconstriction and rapid shaking of the arms
!-----------------------------------------------------------
.o1.2:
!-----------------------------------------------------------
```

In respondent conditioning procedures, the unconditioned and conditioned stimuli are presented without regard to the animal's ____________.

```
!-----------------------------------------------------------
.r1; behavior
```

.w1; awareness
.w2; expectation
.w3; presence
.w4; situation
!--
.o1.3:
!--
For best results in respondent conditioning, in what order is the stimulus produced in relation to the response?
!--
.r1; within 2 seconds before the response
.w1; at the same time
.w2; within 2 seconds after the response
.w3; 5 seconds before the response
.w4; 5 seconds after the response
!--
.o1.4:
!--
Operant behavior usually involves which of the following bodily systems?
!--
.r1; skeletal muscles
.w1; smooth muscles
.w2; cardiac muscles
.w3; exteroceptors
.w4; effector organs
!--
.o1.5:
!--
Although both operant extinction and satiation have similar effects on behavior, what is the main procedural difference with extinction?
!--
.r1; no reinforcement is available
.w1; reinforcement is intermittent
.w2; reinforcement is time dependent
.w3; differential reinforcement is used
.w4; reinforcement is continuously available
!--
.o1.6:
!--
You are walking outside carrying your coat. Suddenly it becomes windy and cold so you stop and put on your coat to keep warm. This is an example of which of the following procedures?
!--

.r1; negative reinforcement
.w1; positive reinforcement
.w2; negative punishment
.w3; avoidance behavior
.w4; escape behavior
!---
.o1.7:
!---
In a classroom the teacher uses a response cost system of taking away recess time for inappropriate behavior during work time. Misbehaviors result in stars being erased from the blackboard. If students lose more than two recesses in a day, then they have to stay after school for detention. What type of procedure is this?
!---
.r1; negative punishment
.w1; positive punishment
.w2; operant extinction
.w3; negative reinforcement
.w4; counterconditioning
!---
.o1.8:
!---
Squirts of lemon juice in the mouth elicit salivary responses. Often this results in the sight of a lemon eliciting this response by itself. When this occurs the presentation of the lemon by itself has become which of the following stimuli?
!---
.r1; a conditioned stimulus
.w1; a discriminative stimulus
.w2; an unconditioned stimulus
.w3; a reinforcing stimulus
.w4; an aversive stimulus
!---
.o1.9:
!---
In a weight reduction program, slides of high calorie foods were paired with painful shocks delivered through electrodes attached to the arm. This type of procedure is called which of the following?
!---
.r1; respondent punishment
.w1; respondent conditioning
.w2; respondent extinction
.w3; operant extinction

.w4; operant punishment

!--

.o2.0:

!--

When turning on the ignition in your car, a buzzer goes on until you fasten your seat belt. You are motivated to put on your seat belt faster due to which of the following procedures?

!--

.r1; negative reinforcement
.w1; avoidance behavior
.w2; escape behavior
.w3; positive punishment
.w4; negative punishment

!--

.o2.1:

!--

Operant extinction is most effective when it is combined with which of the following procedures?

!--

.r1; differential reinforcement of other behavior (DRO)
.w1; intermittent reinforcement
.w2; respondent extinction
.w3; spontaneous recovery
.w4; positive reinforcement

!--

.o2.2:

!--

Response duration and response magnitude vary ___________ with stimulus magnitude, and response latency varies ___________ with stimulus magnitude.

!--

.r1; directly, inversely
.w1; inversely, directly
.w2; directly, directly
.w3; inversely, inversely
.w4; slightly, in proportion

!--

.o2.3:

!--

The sequence of sneezing as a result of pepper in the nose is called which of the following?

!--

.r1; unconditioned reflex

.w1; unconditioned stimulus
.w2; unconditioned response
.w3; respondent conditioning
.w4; respondent punishment
!---
.o2.4:
!---
Sitting on the back porch during the summertime, you are having a conversation with friend's while there is the persistent sound of crickets in the background. After a while you don't even notice the cricket's sound anymore. This effect is due to which process?
!---
.r1; habituation
.w1; satiation
.w2; extinction
.w3; counterconditioning
.w4; forgetting
!---
.o2.5:
!---
The procedure of positive punishment is which of the following?
!---
.r1; contingent presentation of an aversive stimulus
.w1; contingent removal of an aversive stimulus
.w2; contingent presentation of a reinforcing stimulus
.w3; contingent removal of a reinforcing stimulus
.w4; pairing a reinforcing and aversive stimulus
!---
.o2.6:
!---
The procedure of counterconditioning involves pairing a(n) ___________ stimulus with a(n) _______________ stimulus.
!---
.r1; reinforcing, conditioned aversive
.w1; aversive, reinforcing
.w2; neutral, aversive
.w3; reinforcing, unconditioned aversive
.w4; conditioned, unconditioned
!---
.o2.7:
!---
What are the two main types of reflexes?
!---

.r1; tonic and phasic reflexes
.w1; salivary and eye blink reflexes
.w2; righting and vestibular reflexes
.w3; shivering and sweating reflexes
.w4; nasal and coughing reflexes
!--
.o2.8:
!--
What can never occur during higher-order conditioning?
!--
.r1; pair the second CS with the US
.w1; pair the first CS with the second CS
.w2; pair the second CS with an NS
.w3; pair the first CS with the US
.w4; pair the third CS with the second CS
!--
.o2.9:
!--
Habituation usually occurs with which of the following stimuli?
!--
.r1; startle and orientation stimuli
.w1; auditory and visual stimuli
.w2; aversive stimuli
.w3; intermittent stimuli
.w4; unconditioned stimuli
!--
.o3.0:
!--
Which one of the following would not cause a decrement in responding?
!--
.r1; spontaneous recovery
.w1; extinction
.w2; satiation
.w3; fatigue
.w4; the passage of time
!--
.o3.1:
!--
In order for a consequence to be immediate what must occur?
!--
.r1; the stimulus must occur within 10 seconds after the response
.w1; the stimulus must occur within 30 seconds after the response
.w2; the stimulus must occur within 60 seconds after the response

.w3; unconditioned reinforcement must be delivered within 10 seconds of conditioned reinforcement
.w4; the stimulus and response must occur simultaneously
!--
.o3.2:
!--
Which of the following is not a side effect of a punishment procedure?
!--
.r1; new behavior is learned
.w1; emotional responses
.w2; aggressive responses
.w3; escape behavior
.w4; avoidance behavior
!--
.o3.3:
!--
In order for a punishment procedure to be effective, the __________ stimuli must be more powerful than the __________ stimuli maintaining the response.
!--
.r1; aversive, reinforcing
.w1; reinforcing, aversive
.w2; unconditioned, conditioned
.w3; conditioned, unconditioned
.w4; immediate, delayed
!--
.o3.4:
!--
Which of the following is not an example of a positive punishment procedure?
!--
.r1; remove a reinforcing stimulus after the response
.w1; present an unconditioned aversive stimulus after the response
.w2; present a conditioned aversive stimulus after the response
.w3; increase the response effect required
.w4; increase the ratio strain of the schedule
!--
.o3.5:
!--
Aversive stimuli may affect behavior either as a(n) ____________ or as a(n) ____________ event.
!--
.r1; antecedent, consequent

.w1; reinforcer, punisher
.w2; escape, avoidance
.w3; deprivation, satiation
.w4; inhibition, habituation
!--
.o3.6:
!--
A person who is afraid of black cats can be counterconditioned to remain calm in their presence by which one of the following procedures?
!--
.r1; respondent conditioning
.w1; respondent punishment
.w2; respondent extinction
.w3; habituation
.w4; satiation
!--
.o3.7:
!--
In aversive counterconditioning the reinforcing stimulus can be either a(n) ______________ or a(n) ______________.
!--
.r1; unconditioned stimulus, conditioned stimulus
.w1; reinforcing stimulus, aversive stimulus
.w2; antecedent stimulus, consequent stimulus
.w3; neutral stimulus, discriminative stimulus
.w4; stereotyped stimulus, unique stimulus
!--
.o3.8:
!--
While walking outside a person starts getting wet due to a sudden rainstorm. He quickly puts on his raincoat and opens his umbrella. This behavior is an example of which kind of procedure?
!--
.r1; negative reinforcement
.w1; positive reinforcement
.w2; conditioned reflex
.w3; avoidance behavior
.w4; stimulus substitution
!--
.o3.9:
!--
Which of the following is not considered reflexive behavior?
!--

.r1; saluting the flag using arm extensors
.w1; surface vasoconstriction due to a frightening stimulus
.w2; surface vasodilation due to an increase in temperature
.w3; change in the electrical conductivity in the skin in response to a weak electric current
.w4; secretion of saliva in response to a weak acid solution in the mouth
!---
.o4.0:
!---
Reflexes usually involve glands and smooth muscles although skeletal muscles may be reflexive in response to a(n) ___________ stimulus.
!---
.r1; aversive
.w1; reinforcing
.w2; conditioned
.w3; unconditioned
.w4; neutral
!---
.o4.1:
!---
The most effective type of respondent conditioning procedure is which of the following?
!---
.r1; short delay conditioning
.w1; long delay conditioning
.w2; backward conditioning
.w3; simultaneous conditioning
.w4; trace conditioning
!---
.o4.2:
!---
Antecedent stimuli can produce behavior changes in both respondent and operant conditioning. In respondent behavior we say that a stimulus ___________ a response while in operant behavior we say that a stimulus ___________ a response.
!---
.r1; elicits, evokes
.w1; evokes, elicits
.w2; triggers, produces
.w3; pushes. pulls
.w4; precedes, follows
!---
.o4.3:

!---
Using traffic tickets and fines to try and prevent people from driving at a higher speed than posted involves which one of the following procedures?
!---
.r1; negative punishment
.w1; positive punishment
.w2; counterconditioning
.w3; aversive counterconditioning
.w4; avoidance training
!---
.o4.4:
!---
Which procedure is considered the simplest type of learning?
!---
.r1; habituation
.w1; respondent conditioning
.w2; counterconditioning
.w3; respondent extinction
.w4; respondent punishment
!---
.o4.5:
!---
Which is the most is the most common way to measure reflex strength?
!---
.r1; response latency
.w1; stimulus magnitude
.w2; response duration
.w3; response intensity
.w4; stimulus duration
!---
.o4.6:
!---
How are muscular and glandular fatigue different from habituation?
!---
.r1; fatigue is more temporary and a several minute resting period will often restore responding
.w1; fatigue acts more quickly and takes longer to restore responding
.w2; fatigue is more stimulus specific
.w3; fatigue is more response specific
.w4; spontaneous recovery is more often seen with fatigue
!---
.o4.7:
!---

The patellar reflex, in which a jerking movement of the lower leg is made in response to a blow delivered just below the kneecap, is considered which of the following?

!---

.r1; a phasic reflex

.w1; a tonic reflex

.w2; a conditioned reflex

.w3; a flexion reflex

.w4; activation reflex

!---

.o4.8:

!---

The term "stimulus substitution" is often used as a synonym for which procedure?

!---

.r1; respondent conditioning

.w1; habituation

.w2; satiation

.w3; deprivation

.w4; spontaneous recovery

!---

.o4.9:

!---

In the Pavlov experiment, after several weeks of experiments the dog would begin to salivate when strapped into its harness. What is a plausible explanation for this?

!---

.r1; the harness was paired with the presence of meat powder so it came to elicit salivation by simple respondent conditioning

.w1; the harness was paired with the bell tone so it came to elicit salivation through higher-order conditioning

.w2; after several weeks the dog came to expect to be given food after being placed in the harness

.w3; being placed in the harness signaled the end of an extinction period and salivation began as a result of spontaneous recovery

.w4; the dog learned that as soon as it salivated that it would be reinforced with meat powder

!---

.o5.0:

!---

In backward conditioning the CS occurs immediately after the US offset. Often it has a weak effect. How is it more likely to be effective?

!---

.r1; using aversive stimuli
.w1; using intermittent stimuli
.w2; using unconditioned stimuli
.w3; using conditioned stimuli
.w4; using reinforcing stimuli
!---
.o5.1:
!---
A person who has a fetish for leather boots enters a behavior therapy program in order to reduce his uncontrollable desires. In his treatment session slides of women wearing a variety of boots are projected on a screen. Several seconds later an electric shock is delivered through electrodes attached to his leg. After 2 weeks of treatment he reports that leather boots have lost their erotic appeal. What procedure is this an example of?
!---
.r1; aversive counterconditioning
.w1; counterconditioning
.w2; positive punishment
.w3; negative punishment
.w4; habituation
!---
.o5.2:
!---
A woman revisits her childhood home after not seeing it for over 30 years. As she walks though the various rooms of the house she experiences strong memories of people and events as well as sentimental feelings about her youth. These memories and feelings were developed as a result of which of the following?
!---
.r1; respondent conditioning
.w1; respondent extinction
.w2; operant conditioning
.w3; spontaneous recovery
.w4; counterconditioning
!---
.o5.3:
!---
The main difference between operant extinction and forgetting is which of the following?
!---
.r1; extinction removes a specific contingency
.w1; extinction occurs more slowly

.w2; extinction happens due to the passage of time
.w3; in extinction other incompatible stimulus-response relations are learned
.w4; behaviors during extinction are less variable
!--
.o5.4:
!--
A child is told he cannot have a snack just before dinner and starts crying. The parent ignores these behaviors and finally they subside. However, the next evening before dinner the child again starts crying when he can't have a snack before dinner. This resumption of crying is due to which of the following?
!--
.r1; spontaneous recovery
.w1; operant extinction
.w2; respondent extinction
.w3; negative reinforcement
.w4; habituation
!--
.o5.5:
!--
A pigeon is on a FR 10 schedule of reinforcement and receives grain for each completed component. After a steady state of performance is achieved the schedule is then changed to FR 50. A decrease in the pecking rate would be due to which one of the following procedures?
!--
.r1; positive punishment
.w1; negative punishment
.w2; counterconditioning
.w3; respondent punishment
.w4; satiation
!--
.o5.6:
!--
A hungry rat receives food pellets on an FR 5 schedule but also receives an electric shock on a FI 2-min schedule. The punishment procedure is then changed to FI 4-min and the rate of bar pressing increases. What procedure is responsible for this change?
!--
.r1; positive reinforcement
.w1; negative reinforcement
.w2; positive punishment
.w3; negative punishment

.w4; counterconditioning
!--
.o5.7:
!--
In respondent conditioning the most important variables are ______________ while in operant conditioning the most important variables are ____________.
!--
.r1; antecedent stimuli, consequent stimuli
.w1; consequent stimuli, antecedent stimuli
.w2; unconditioned stimuli, conditioned stimuli
.w3; latency, rate
.w4; continuous stimuli, intermittent stimuli
!--
.o5.8:
!--
Which of the following is not a measure of the strength of the extinction procedure?
!--
.r1; the prior rate of behavior before the extinction procedure
.w1; the change in rate of behavior from the conditioning phase to the extinction phase
.w2; the amount of variability during extinction
.w3; the total number of responses before the behavior returns to its baseline rate
.w4; the change in latency from conditioning to extinction
!--
.o5.9:
!--
Which of the following does not describe a punishment procedure?
!--
.r1; reducing the duration of an aversive stimulus
.w1; presenting an aversive stimulus
.w2; reducing the duration of a reinforcing stimulus
.w3; increasing the response effort
.w4; increasing the number of responses required
!--
.o6.0:
!--
The distinction between negative punishment and extinction is that in the former ____________ is taken away while in the latter a reinforcing stimulus is ___________.
!--

.r1; a reinforcing stimulus, withheld
.w1; nothing, removed
.w2; an aversive stimulus, restored
.w3; a contingency, withheld
.w4; a conditioned stimulus, eliminated
!--
.i6.1:
!--
This concludes this delayed posttest in behavior analysis terms. The results will be used to conduct further research in the area of instructional design. Thank you for your participation in this project. Your instructor will be notified of your participation only. You may now exit the program and logout.
!--

Appendix G

PASS Rules Only

```
!       BASIC CONCEPTS IN PSYCHOLOGY.Rules plus positive examples
!       Author: John B. Connors
!       Affiliation: Western Michigan University
!       Created On: 9-10-90
!       Revised On: 10-29-90. 5-3-91
!       Terms: reflex, respondent behavior (conditioning,
!       extinction, and punishment) and operant behavior
!       (reinforcement, extinction, and punishment)
!------------------------------------------------------------
.i 1.0:
!------------------------------------------------------------
```

Welcome to Basic Concepts in Psychology. This is a Computer-Assisted Instruction (CAI) program designed to teach some of the definitions and examples of common terms used in behavioral psychology. By completing this lesson you should be able to talk (both vocal and written) more effectively about environmental events and their function in changing behavior. Precise usage of these terms will allow you to communicate effectively with other scientists when describing the prediction and control of behavior in laboratory and applied settings.

The most important terms being taught will be underlined when they are first introduced, but other supplementary terms will be used for contrast. There are 6 text sections followed by 9 questions each in multiple choice format. Corrective feedback will be given on all answers to questions, whether correct or incorrect. Please don't try to memorize what you are reading. Just read at a rate appropriate for any textbook and try to understand the concepts involved. Normally the program takes about 75 minutes to complete.

```
!------------------------------------------------------------
.i 2.0:
!------------------------------------------------------------
```

Let's begin the program by learning about reflexive behavior.

The most basic type of behavior in animals is called a <u>reflex</u>. In simple terms, a stimulus triggers a response. More formally this behavior is a stereotyped pattern of movement of a part of the body that can be reliably elicited by presenting the appropriate stimulus. The word "appropriate" refers to the fact that no training is required. There is an innate connection between a stimulus and a response. Particular reflexes are usually characteristic of all members of a species.

Another way of explaining the reflex is to say that the relation between a particular stimulus and a particular response is such that, the stimulus

elicits or is correlated with the response. It is important to remember that the reflex is composed of both a stimulus component and a response component. The relation between the two events defines the reflex. The reflex is not a stimulus, nor is it a response. Several different stimuli may produce the same response.

!--

.i 3.0:

!--

There are many examples of reflexes which occur in humans. The following eight reflexes are representative:

1) Pupillary reflex: the change in size (by contraction or dilation) of the pupil of the eye in response to a change in the intensity of light.

2) Patellar reflex: the jerking movement of the lower leg in response to a blow delivered just under the kneecap.

3) Lachrymal reflex: the tearing of the eye in response to a foreign object in the eye (e.g., dust particle), or in response to smoke or the aroma of a freshly peeled onion.

4) Salivary reflex: the secretion of saliva into the mouth in response to food in the mouth or in response to a weak acid solution in the mouth (e.g., lemon juice).

5) Piloerection reflex: the erection of hair follicles in response to cold or extreme fright.

6) Sneezing reflex: expulsion of air from the nose and mouth as a response to an irritation (e.g., pepper) in the nose.

7) Flexion reflex: withdrawing the hand by contraction of the elbow in response to painful stimulation (e.g., heat, cold, abrasion, or electrical stimulation).

8) Startle reaction: increased heart rate, breathing, and secretion of adrenaline into the blood in response to a new and sudden stimulus.

!--

.i 4.0:

!--

Related to learning, there are two types of reflexes observed in humans: unconditioned reflexes and conditioned reflexes. For example, if you salivate when food has been placed in your mouth that reflex is

unconditioned because the reflex is innate and does not require any conditioning history. However, if you salivate when you smell food, see a picture of food, or just read about food, then this is learned behavior and therefore is called a conditioned reflex.

It can be seen that all reflexive behavior is in response to specific stimuli. Many of the more familiar reflexes, such as the pupillary contraction, the knee-jerk, and withdrawal reflexes, are called phasic reflexes and have a brief response duration. In contrast are the tonic reflexes, such as those involved in balance and posture, which consist of a continuous series of adjustments in muscle tension. Standing on one leg requires different muscle tensions in order to not fall down and is an example of a tonic reflex.

!--

.i 5.0:

!--

A reflex may diminish through the process of habituation. If an eliciting stimulus is repeatedly presented over a period of time, the responses will decrease in size and increase in latency. For example, the loud sound of a gunshot may produce a startle reaction. After 100 gunshots, however, the startle reaction has decreased until it has disappeared completely. After a period of time during which no gunshots are heard, a sudden burst of gunshots again will produce a startle reaction. This effect of the passage of time is called spontaneous recovery. It should be noted that habituation is stimulus-specific so that even after the gunshots no longer produced a startle reaction, the sound of a dynamite explosion would produce a startle reaction.

Habituation should be distinguished from muscular and glandular fatigue. Fatigue is more temporary and a short resting period of several minutes will often restore responding. For example, the leg muscles may fatigue quickly after several dozen demonstrations of the knee-jerk reflex. However, if you wait for 10 minute resting period, the reflex will be seen again. Habituation to the hammer striking the tendon below the kneecap would not occur until perhaps several dozen trials had occurred.

!--

.i 6.0:

!--

The strength of the reflex is typically measured by response latency. In other words, how long does it take for the response to occur after the stimulus has been presented? Response latency varies inversely with stimulus magnitude. For example, the brighter the light, the faster the pupil of the eye contracts. The harder the hammer blow to the knee, the

faster the leg swings forward. The size or intensity of the response (response magnitude) and its duration (how long it persists) vary directly with the stimulus magnitude. Using this same example, the brighter the light the more the pupil of the eye will decrease in size and will remain small.

You will now be asked some questions about reflexes.
!---
.o 6.1:
!---
Which of the following would be considered a reflex?
!---
.r1; sneezing due to an irritation in the nose
.t; Correct- this example includes both the stimulus of the nasal irritation and the response of sneezing
.w1; a flashing bright light is turned on
.t; Sorry but a stimulus alone does not constitute a reflex
.w2; loud sounds in the room next door
.t; Sorry but a stimulus alone does not constitute a reflex
.w3; moving your hand away quickly
.t; Sorry but a response by itself does not constitute a reflex
.w4; a sudden increase in heart rate and respiration
.t; Sorry but a response by itself does not constitute a reflex
!---
.o 6.2:
!---
Check out these examples and find the reflex.
!---
.r1; withdrawing your hand after touching a hot stove
.t; Good thinking! This example includes both the stimulus of the hot stove and the response of hand withdrawal
.w1; the roots of a plant grow downward in response to gravity
.t; Sorry but plant growth is not behavior since it is not under neural control
.w2; every time a child smiles he is given an M & M candy
.t; Sorry but reflexes include only behavior elicited by a prior stimulus
.w3; covering your mouth with your hand when you cough several times in a row
.t; Sorry- even though you may move your hand before you cough, your hand movement does not elicit the cough so there is no stimulus triggering a response
.w4; pairing the sound of a tone with a light
.t; Sorry but pairing two stimuli does not constitute a reflex

!---
.o 6.3:
!---
A person salivates as he chews his favorite chocolate cake. The next day he is very hungry and sees an ad in a magazine for chocolate cake and begins to salivate. This is an example of which of the following?
!---
.r1; conditioned reflex
.t; Yes, this example includes both the stimulus and the response which constitute the reflex
.w1; unconditioned reflex
.t; Wrong, incredible as it may seem, you have to learn to like the sight of chocolate cake
.w2; conditioned stimulus
.t; Close but this example include both a stimulus and a response
.w3; conditioned response
.t; Close but this example includes both a stimulus and a response
.w4; startle reflex
.t; Wrong, startle reflexes only occur in reaction to a sudden or aversive stimulus
!---
.o 6.4:
!---
In the piloerection reflex, which of the following sequences would occur?
!---
.r1; in response to a frightening stimulus the hair follicles become erect
.t; Good, the piloerection reflex occurs when the hair follicles on your skin become erect in response to cold temperature or a frightening stimulus
.w1; in response to an electric shock a hand is quickly withdrawn
.t; Incorrect, this is the flexion reflex
.w2; in response to a blow on the kneecap the lower leg jerks forward
.t; Incorrect, this is the patellar reflex
.w3; in response to cold water goose bumps on the skin appear
.t; Incorrect, this is the goose bump reflex
.w4; in response to stimulation the nipples become erect
.t; Incorrect, this is the nipple reflex
!---
.o 6.5:
!---
A reflex is defined as the __________ between a particular stimulus and a particular response in such a way that the stimulus __________ the response. Choose the answer that best fills in the blanks.
!---

.r1; relation, elicits
.t; Yes, this is the standard definition of a reflex
.w1; contrast, produces
.t; Sorry but the contrast between the stimulus and response is not relevant
.w2; interaction, maintains
.t; Sorry but the stimulus acts as more of a trigger for the response
.w3; conditioning, reinforces
.t; Sorry but since the stimulus precedes the response it can not have a reinforcing effect
.w4; behavior, connects
.t; Sorry but these terms are too vague
!---
.o 6.6:
!---
To determine the strength of a reflex, it is necessary to know what the response is in the ___________ of the stimulus as well as in its ____________. Choose the answers that best fill in the blanks.
!---
.r1; absence, presence
.t; Yes, both conditions are necessary to measure the strength of a reflex
.w1; vicinity, location
.t; No, proximity of the stimulus to the response is not relevant
.w2; conditioning, magnitude
.t; No, whether the reflex is conditioned or not is not relevant to its strength
.w3; magnitude, latency
.t; No, latency is only relevant in terms of the response
.w4; environment, behavior
.t; No, these terms are too vague
!---
.o 6.7:
!---
The strength of a reflex may diminish through the process of ________________.
!---
.r1; habituation
.t; Correct, especially in startle and orientation reflexes in response to relatively weak stimuli
.w1; spontaneous recovery
.t; Incorrect as spontaneous recovery increases the strength of a reflex
.w2; extinction
.t; Incorrect, as a reflex occurs automatically it is not susceptible to

extinction
.w3; latency
.t; Incorrect as latency is only a measure of reflex strength and not a procedure
.w4; elicitation
.t; Incorrect as elicitation only refers to the triggering mechanism in the reflex and it is not a procedure
!--
.o 6.8:
!--
A tight rope walker balances on one leg as he crosses a guy wire 100 feet above the ground. Which reflexes does he use?
!--
.r1; tonic reflexes
.t; Good memory! Tonic reflexes are involved in balance and posture and consist of a continuous series of adjustments in muscle tension
.w1; phasic reflexes
.t; Close but phasic reflexes are briefer and consist of a protective reaction to aversive stimuli
.w2; righting reflex
.t; Sorry but this is a vestibular reflex which causes the head to assume a normal orientation with respect to the ground when falling or jumping, for example as seen in cats
.w3; flexion reflex
.t; Sorry but this refers to quickly withdrawing the hand or foot in response to an aversive stimulus
.w4; orienting reflex
.t; Sorry but refers to turning the head in the direction of a new sound, for example when a dog pricks up its ears
!--
.o 6.9:
!--
A young infant will grasp any object put in its hand. This is an example of which kind of reflex?
!--
.r1; unconditioned reflex
.t; Yes, the grasping reflex is innate and does not have to be learned
.w1; conditioned reflex
.t; No, this is not a learned behavior
.w2; unconditioned stimulus
.t; No, the reflex consists of more than just a stimulus
.w3; unconditioned response
.t; No, the reflex consists of more than just a response

.w4; tonic reflex
.t; No, the tonic reflex only refers to balance and posture
!---
.i 7.0:
!---
Let's turn to a discussion of respondent behavior. It is behavior that is elicited by a particular stimulus called the antecedent and it is not affected by consequences. Therefore, it is a reflexive type response that is triggered by an eliciting stimulus. Usually it involves the involuntary responses of the smooth muscles and glands or other involuntary effector organs. Examples include many of the reflexes we have studied such as the heart beat, gland secretion, peristaltic movement of the intestines, pupillary contraction or dilation in the eye, coughing or sneezing, sweating, and milk release in lactating women. It is also involved in much of what we call emotions, feelings, and attitudes.

Note that this procedure is typically conducted with smooth muscles and glands. However, there are several exceptions involving protective reflexes. An example of respondent conditioning with skeletal muscles is the eye blink reflex.
!---
.i 8.0:
!---
Respondent conditioning is a procedure which was first demonstrated by the Russian physiologist Pavlov at the turn of the century. Pavlov's original experiment involved a dog placed in a harness. When a bell tone was rung the dog pricked up its ears and turned its head towards the sound. With successive rings, however, these orienting responses diminished in magnitude and then disappeared. The sound became a neutral stimulus through the process of habituation.

When meat powder was placed in its mouth, the dog made salivating and chewing movements. A bell tone was then rung 5 seconds before each food delivery. After several pairings the dog began to salivate and chew during the 5 second interval between the bell tone and presentation of the meat powder. Eventually (after 30 to 50 pairings), the dog salivated and chewed at the sight of the bell alone, even if on occasional trials the food was omitted.

Note that only salivating is considered respondent behavior. Chewing is performed by the skeletal muscles of the jaw and was evoked by the salivary response, not by the bell tone.
!---

.i 9.0:
!--
The procedure of respondent conditioning can be diagramed as follows:

Neutral stimulus---> NS (bell tone)---> Orienting response---> No response
Unconditioned reflex---> US (meat powder)---> UR (salivating)
Respondent
conditioning---> US (meat powder)---> UR (salivating)
CS (bell tone)---> CR (salivating)
Conditioned reflex---> CS (bell tone)---> CR (salivating)

This procedure is sometimes called stimulus substitution because the CS substitutes for the US in eliciting a response.
!--
.i 10.0:
!--
The strength of respondent conditioning can be measured in several ways. For the Pavlovian experiment it could include the following:

1. The number of drops of saliva.
2. The elapsed time between the ringing of the bell tone and the secretion of saliva.
3. The number of pairings of the bell tone with the meat powder before the bell tone by itself would produce a measurable amount of saliva.
4. The number of times the bell tone could be later presented without following it by meat powder before the salivary response would disappear.

Any one of these could be used to determine the effect of the bell tone as a conditioned stimulus.
!--
.i 11.0:
!--
In higher-order respondent conditioning a second CS is paired with the first CS and comes to elicit the CR despite the fact that the second CS was never paired directly with the US. For example, after pairing the bell with meat powder, a light could be paired with the bell. After several pairings, the light by itself would come to elicit salivation.

An example with humans could consist of pairing a weak shock (which elicits a galvanic skin response) with the presentation of flashing lights. After several pairings, then pair the flashing lights with a musical tone of

middle C. Occasionally the flashing lights would continue to be paired with the shock when the tone was not on. Eventually, the middle C tone will come to elicit a galvanic skin response by itself when no lights are present.

Let's now try to answer some questions about respondent conditioning.

!--

.o 11.1:

!--

Suppose we want to condition an eye blink to the sound of a buzzer. First we would check to make sure the buzzer sound is a neutral stimulus with respect to blinking and then would pair it with a US such as a puff of air. After a number of such pairings, the buzzer by itself should produce which of the following responses?

!--

.r1; blinking of the eyelid

.t; Correct, the buzzer has now become a conditioned stimulus for eliciting the conditioned response of blinking

.w1; tearing of the eye

.t; Incorrect as blinking is a separate glandular response

.w2; pupillary constriction

.t; Incorrect as the US for the pupil constricting is a bright light

.w3; pupillary dilation

.t; Incorrect as the US for the pupil dilating is a dim light

.w4; a puff of air

.t; Incorrect as the puff of air is the unconditioned stimulus and not a response

!--

.o 11.2:

!--

In the Pavlov experiment, the meat powder is considered a ___________ while the tone is considered a ___________.

!--

.r1; unconditioned stimulus, conditioned stimulus

.t; Good, the dog innately salivates at the taste of meat powder while it learns by respondent conditioning to salivate to the tone

.w1; conditioned stimulus, unconditioned stimulus

.t; No, you are confusing the stimuli

.w2; unconditioned response, conditioned response

.t; No, the meat powder and tone are stimuli

.w3; conditioned response, unconditioned response

.t; No, the meat powder and tone are stimuli

.w4; satiation stimulus, neutral stimulus

.t; No, satiation is a process and not a stimulus

!--
.o 11.3:
!--
In trace conditioning a conditioned stimulus ______________ before the unconditioned stimulus onset.
!--
.r1; occurs and disappears several seconds before US onset
.t; Good memory! Trace conditioning has only a weak effect since the CS and US are not present simultaneously
.w1; occurs and remains on for several seconds until the US onset
.t; Sorry but this procedure is short delay conditioning
.w2; occurs immediately after the US offset
.t; Sorry but this procedure is backward conditioning
.w3; occurs and disappears several minutes before US onset
.t; Sorry but there is too much time elapsed for this to be trace conditioning
.w4; occurs at a weak intensity level
.t; Sorry but the intensity level of the stimulus is not relevant to the type of conditioning procedure
!--
.o 11.4:
!--
What was the neutral stimulus before conditioning in the Pavlov experiment?
!--
.r1; the bell tone
.t; Great! At the start of the series of experiments conducted by Pavlov the bell tone was a neutral stimulus
.w1; the meat powder
.t; Wrong, the meat powder is an unconditioned stimulus
.w2; chewing movements
.t; Wrong, the chewing movements are operant responses
.w3; the harness
.t; Close since the harness was a neutral stimulus but no attempt was made to condition it
.w4; drops of saliva
.t; Wrong, the saliva drops are the conditioned response
!--
.o 11.5:
!--
The eye blink reflex can be elicited by a puff of air to the eye. If the air puff is repeatedly paired with a buzzer, the buzzer will comes to elicit the eye blink reflex by itself. What stimulus function does the buzzer have for

the eye blink reflex?

!---

.r1; conditioned stimulus

.t; Yes, through the process of respondent conditioning the buzzer sound has gone from a neutral to a conditioned stimulus

.w1; unconditioned stimulus

.t; No, the sound of the buzzer does not innately elicit eye blinking

.w2; conditioned response

.t; No, the buzzer is a stimulus and not a response

.w3; unconditioned response

.t; No, the buzzer is a stimulus and not a response

.w4; neutral stimulus

.t; No, although the buzzer was initially a neutral stimulus it has been repeatedly paired with an air puff

!---

.o 11.6:

!---

Skeletal muscles are attached to the skeleton and are also found in the limbs, truck, face, jaws, and eyeballs. They are involved in some reflexes in which there is a protective response to an aversive stimulus. Which one of the following reflexes uses skeletal muscles?

!---

.r1; patellar reflex (knee-jerk)

.t; Good, the patellar reflex uses the skeletal muscles of the thigh and calf and occurs in order to prevent injury to the knee cap

.w1; lachrymal reflex (tearing)

.t; Sorry but the lachrymal reflex uses glands to secrete tears

.w2; vasoconstriction reflex (blood vessels)

.t; Sorry but the vasoconstriction reflex uses the smooth muscles which line the blood vessels

.w3; galvanic skin reflex ((electrical conductivity)

.t; Sorry but the galvanic skin reflex involves a change in the electrical conductivity in the skin in response to a weak electric current

.w4; salivary reflex

.t; Sorry but the salivary reflex uses glands to secrete saliva into the mouth in response to food or a weak acid solution and does not involve the tongue

!---

.o 11.7:

!---

Smooth muscles line the walls of all the hollow organs and are found in the walls of the digestive tract, bladder, veins and arteries, and various ducts. Which of the following reflexes use smooth muscles?

!--
.r1; vasodilation reflex
.t; Correct, the vasodilation reflex constricts the capillaries and raises the body's blood pressure
.w1; salivary reflex
.t; Incorrect as the salivary reflex uses glands
.w2; coughing reflex
.t; Incorrect as the coughing reflex uses skeletal muscles in the throat
.w3; sweating reflex
.t; Incorrect as the sweating reflex uses glands
.w4; sneezing reflex
.t; Incorrect as the sneezing or nasal reflex uses skeletal muscles in the throat
!--
.o 11.8:
!--
In a higher-order conditioning experiment a light is paired with a puff of air in order to elicit blinking; then a buzzer is paired with the light. In behavioral terms, how are the light and the buzzer similar?
!--
.r1; both are conditioned stimuli
.t; Yes, both the light and buzzer can now elicit the conditioned response
.w1; both go on and off
.t; No, the particular stimulus properties are not relevant to the conditioned response they elicit
.w2; both are unconditioned stimuli
.t; No, neither the light or the buzzer will naturally elicit blinking
.w3; both are conditioned responses
.t; No, the light and buzzer are stimuli
.w4; both neutral stimuli
.t; No, the light has been paired with a puff of air and the buzzer has been paired with the light
!--
.o 11.9:
!--
In the previous example it is important to pair the buzzer with which of the following?
!--
.r1; only the light
.t; Good thinking! In higher-order conditioning the second CS is only paired with the first CS
.w1; occasionally the puff of air
.t; No, in higher-order conditioning the second CS is never paired with the

US
.w2; with the blinking
.t; No, the CS elicits the response and is not paired with it
.w3; with other buzzer sounds
.t; No but through the process of respondent generalization, other buzzer sounds may also come to elicit the CR
.w4; with the light and puff of air
.t; No, the second CS is only paired with the first CS and not with the US
!---
.i 12.0:
!---
Respondent extinction is a procedure in which the CS is no longer paired with the US. It can be demonstrated by continuing the Pavlov example. If a dog is conditioned to salivate at the tone of a bell, but later the bell is repeatedly rung without pairing it with food, the bell tone will eventually cease to elicit or produce salivation. Repeatedly presenting the CS without the US describes the process of respondent extinction.

If at a later time the bell tone is again presented, some salivary responses will again occur in a phenomenon known as spontaneous recovery.

Respondent punishment (also known as aversive counter-conditioning) is a procedure in which a reinforcing stimulus is paired with an aversive stimulus. It can be demonstrated by pairing a bell tone with a painful electric shock. If the bell tone previously had elicited salivary responses, after several new pairings the bell tone will now inhibit or eliminate (depending on the strength of the shock) salivation by itself. It will also elicit emotional responses of increased heart rate and adrenaline secretion which in turn will produce some escape or avoidance behaviors. It is often used in the treatment of alcoholism, cigarette smoking, drug addiction, obesity, and sexual fetishes. Don't confuse it with counterconditioning in which a reinforcing stimulus is paired with a conditioned aversive stimulus as in treatments for phobias.

Let's try some questions regarding respondent extinction and punishment.
!---
.o 12.1:
!---
The abbreviation US stands for ____________ ____________ and CS stands for ____________ ____________.
!---
.r1; unconditioned stimulus, conditioned stimulus
.t; Yes, the antecedent stimuli in respondent conditioning are the

unconditioned stimulus (US) and the conditioned stimulus (CS)
.w1; unlearned stimulus, contrived stimulus
.t; Wrong, these are not standard terms
.w2; conditioned stimulus, unconditioned stimulus
.t; Wrong, you have confused the two terms
.w3; unconditioned stimulus, conditioned response
.t; Wrong, don't confuse stimuli and responses
.w4; unusual stimulus, conditioned stimulus
.t; Wrong, the first term is not standard
!--
.o 12.2:
!--
Suppose a person has been conditioned to begin sweating when he puts on a red towel because, in the past, he always put on a red towel before he got into his sauna. A relative now gives him a present of a complete set of red towels and now he uses them on any number of occasions: to take a shower, to go swimming, walking down the hall to brush his teeth, to dry the dishes, and to dust the furniture. The fact that a red towel will no longer elicit increased sweating is an example for which of the following?

!--
.r1; respondent extinction
.t; Correct, the CS (red towel) has been paired with many other stimuli besides the sauna so the extinction process has occurred
.w1; respondent conditioning
.t; Incorrect, since no new behavior has been learned
.w2; respondent punishment
.t; Incorrect, although some behavior is decreased, there was no use of aversive stimuli
.w3; habituation
.t; Incorrect, since no startle or orientation stimuli were present
.w4; satiation
.t; Incorrect since the stimulus did not involve food, water, or any consummatory stimuli
!--
.o 12.3:
!--
In a weight reduction program, a rancid odor was paired with smelling favorite high calorie foods. After several weeks of this treatment the participants no longer salivated and actually felt nauseous when smelling these high calorie foods. This procedure is an example of which of the following?
!--

.r1; respondent punishment
.t; Good, since an aversive stimulus is paired with a reinforcing stimulus and the response is glandular, the procedure is respondent punishment or aversive counterconditioning
.w1; respondent conditioning
.t; Sorry but an aversive rather than a neutral stimulus was used
.w2; respondent extinction
.t; Sorry but there are no CS alone trials
.w3; habituation
.t; Sorry but no startle or orientation stimuli were involved
.w4; satiation
.t; Close since the effect is to reduce appetite for food but an aversive stimulus was used
!--
.o 12.4:
!--
During behavior therapy, a person trying to stop smoking is squirted in the face with a mist of water every time he takes a puff on his cigarette. However, after several weeks of treatment he still has not lost his desire to stop smoking. Which of the following could account for this treatment failure?
!--
.r1; the water mist was not a strong aversive stimulus
.t; Yes, it appears that the reinforcing effects of nicotine were much stronger than the weak aversive effect of a water mist
.w1; the water mist became a reinforcing stimulus
.t; Possibly but not likely
.w2; the person changed his mind about stopping smoking
.t; But what were the contingencies?
.w3; the person was satiated
.t; Not likely, since nicotine is an addictive drug it is not easy to become satiated smoking, usually you crave more
.w4; the person habituated to the water mist
.t; No, since nicotine is addictive and not a startle or orientation stimulus
!--
.o 12.5:
!--
A tone has been paired with lemon juice to elicit salivation. Now the tone is continually presented but is no longer paired with anything. After a period of time the tone will again become a neutral stimulus. This process is called which of the following?
!--
.r1; respondent extinction

.t; Good for you! A CS presented without any further US pairings will eventually become a neutral stimulus again
.w1; respondent conditioning
.t; No, in respondent conditioning a NS becomes a CS
.w2; respondent punishment
.t; No, in respondent punishment an aversive stimulus is paired with a reinforcing stimulus
.w3; habituation
.t; Close but in habituation a relatively weak US is repeatedly presented until the response diminishes
.w4; satiation
.t; Close but in satiation a consummatory US is repeatedly made available until it becomes a NS for a short period of time
!---
.o 12.6:
!---
The sight of a black cat at night startles a woman so much that her hair stands on end and she gets goose bumps. This is an example of which type of learning?
!---
.r1; respondent conditioning
.t; Right, since the sight of black cats is not a US, it has been paired with some other US, possibly through language, and it now has become a frightening CS
.w1; habituation
.t; No since in habituation a relatively weak US is repeatedly presented until the response diminishes
.w2; respondent punishment
.t; No since no aversive US is presented
.w3; respondent extinction
.t; No since a CS is not repeatedly presented without a US
.w4; counterconditioning
.t; No since a reinforcing stimulus is not paired with an aversive stimulus
!---
.o 12.7:
!---
In order to control his habit of drinking alcohol, a man submits himself to a behavioral treatment program. A drug called antiabuse will produce nausea if taken just before alcohol consumption. This procedure is called which of the following?
!---
.r1; respondent punishment
.t; Good, this is respondent punishment or aversive counterconditioning

since the antiabuse is the aversive stimulus and paired with alcohol which is the reinforcing stimulus
.w1; respondent extinction
.t; Wrong since no CS is presented by itself
.w2; deprivation
.t; Wrong since the man is not depriving himself of drinking alcohol
.w3; satiation
.t; Wrong since the antiabuse prevents much alcohol from being taken
.w4; habituation
.t; Wrong since a relatively weak US is not repeatedly presented by itself
!---
.o 12.8:
!---
As a person is reading a cookbook, his mouth starts to water and his stomach contracts in a hunger pang. These responses are considered which kind of procedure?
!---
.r1; respondent conditioning
.t; Right! Since cookbooks are not unconditioned stimuli, it is obvious that they have been paired with some other unconditioned stimuli such as food
.w1; spontaneous recovery
.t; Sorry but spontaneous recovery only refers to response increases after a resting period following habituation
.w2; deprivation
.t; Sorry but no evidence was given that the person was food deprived
.w3; satiation
.t; Sorry but satiation would decrease salivation and hunger pangs
.w4; salivary reflex
.t; Sorry, although the salivary reflex is active when the mouth starts to water, the question asked for a procedure
!---
.o 12.9:
!---
Review item: Often the amount of energy expended by the organism during a reflex is ____________ than the energy provided by the eliciting stimulus.
!---
.r1; much more
.t; Correct as seen in the amount of energy expended in a sneeze or cough
.w1; similar to
.t; No, often the energy expended in the reflex is different from the energy provided by the stimulus
.w2; less
.t; No, think of the stimulus as a trigger mechanism

.w3; much less
.t; No, think of the stimulus as a trigger mechanism
.w4; slightly more
.t; No, think of the amount of energy expended in a sneeze or cough
!--
.i 13.0:
!--
We now turn our attention to operant behavior. It is defined generally as behavior which is susceptible to operant conditioning. This behavior often appears spontaneously rather than as a reaction to stimulation; it may or may not be evoked by a current stimulus.

The term "operant" refers to a class of responses which have particular consequences and which operate on the environment. The response class is defined, therefore, by the stimulus it produces. Operant conditioning usually involves the voluntary responses of the striped muscles or other voluntary effector organs. When the behavior is controlled by the presence of a stimulus we say the response has been evoked. It is affected by consequences and is described by the 3-term contingency: S --> R --> S.

Examples include any action of the skeletal muscles such as running, jumping, throwing, talking, playing the piano, dancing, and doing somersaults. There may be no obvious antecedent stimulus but there is always a consequent stimulus after the behavior has occurred. This consequential stimulus is said to be dependent or contingent upon the prior response. Respondent behavior is said to be elicited by a stimulus while operant behavior is said to be evoked if the antecedent stimulus is apparent.

The response component also has the additional requirements of time and number in order to be effective. For example, in a FR 10 schedule, only after the tenth response is made is reinforcement delivered. In a FI 2-min schedule, a response is reinforced only if it is made after the time interval has elapsed. Other more complicated schedules require a certain number of responses within a specified time period.
!--
.i 14.0:
!--
These are three basic procedures designed to alter operant behavior: conditioning (or reinforcement), extinction, and punishment. Operant conditioning is a procedure in which behavior is increased. There are two ways to do this: positive reinforcement and negative reinforcement. Let's look at some examples:

1. Every time a 6 month old baby utters a vocal sound its mother picks him up and hugs him. The mother then finds that frequency of vocal behavior rapidly increases. This is positive reinforcement for vocal behavior.

2. When it starts raining, a man opens up his umbrella; this is negative reinforcement for staying dry and increases umbrella opening behavior.

3. When an alarm goes off in the morning a woman gets out of bed, gets dressed, and drives to work. Getting out of bed, getting dressed, and driving to work right away is negative reinforcement for not being late to work.

4. A teacher is working with an autistic child with no verbal skills. Every time the teacher says, "Look at me" and the child gives the teacher eye contact, then the teacher presents the child with a poker chip token which can be exchanged for sips of juice. This is positive reinforcement for compliance behavior.

!--

.i 15.0:

!--

The strength of operant conditioning can be measured at least four ways. Let's use the example of reinforcing a pigeon for key pecking behavior with grain. The strength of the behavior can be measured by any of the following:

1. the rate of key pecking
2. the intensity of the key pecks
3. the number of grain presentations necessary before key pecking behavior is established
4. the number of key pecks still produced after grain is removed and no reinforcement is given.

Now let's use an example of measuring the strength of behavior with people. A child is learning to tie his shoes and is reinforced by verbal praise from his parents. The strength of the behavior can be measured by any of the following:

1. the response duration or how long it takes to tie his shoes
2. the number of practice trials it takes before he can tie his shoes correctly
3. the response latency or how long it takes from the time he is

asked to tie his shoes and he starts tying them
4. the number of times he continues to tie his shoes after parental attention and praise are removed

The increase in behavior is called the operant level and is always compared with its previously unreinforced performance or baseline level.
!--
.i 16.0:
!--
It should be noted that an operant reinforcement procedure is only effective when the appropriate motivative variables are present. The same stimulus situation may or may not be reinforcing depending on the deprivation or satiation state of the organism. For example, if the pigeon was not hungry it would not be motivated to peck the disk. If the child was mad at his parents and didn't want their attention and approval, he would not want to tie his shoes.

The term "conditioning" as used here is synonymous with both "reinforcement" and "strengthening." Please remember that reinforcement is a functional definition in that the procedure is always defined by its consequences. Both positive and negative reinforcement will increase behavior in similar situations in the future. For example, if someone smiles when you say hello, you will have an increased tendency to say hello when seeing that person again. This is positive reinforcement. When you turn on the stereo and the music is so loud that it hurts your ears, turning down the volume is negative reinforcement. In the future you will have an increased tendency to immediately turn down the volume when turning on the stereo.

We will now try some questions concerning operant conditioning.
!--
.o 16.1:
!--
To say that a stimulus is contingent upon a response means which of the following?
!--
.r1; it depends on the response occurring first
.t; Good, a contingency is an "if-then" statement that means, if a response occurs then a particular stimulus will follow
.w1; it depends on the response occurring last
.t; No, you are confusing operant and respondent procedures
.w2; it is similar to the response
.t; No, the stimulus and response are never similar

.w3; it can substitute for the response
.t; No, stimuli and responses are entirely separate and are not interchangeable
.w4; it depends on the stimulus occurring first
.t; No, you are confusing operant and respondent procedures
!---
.o 16.2:
!---
A general definition of operant conditioning would be that an environment-behavior relation is ____________ by arranging a consequence ____________ on a response.
!---
.r1; strengthened, contingent on
.t; Right, this is the procedure by which operant behavior is increased
.w1; allowed, depending
.t; Wrong, this answer is too vague
.w2; weakened, dependent
.t; Wrong, operant conditioning does not weaken behavior
.w3; conditioned, following
.t; Wrong, this answer is too vague
.w4; maintained, immediately
.t; Wrong, operant conditioning does more than just maintain a response
!---
.o 16.3:
!---
A woman is walking to work and suddenly it starts to rain. Since she is starting to get wet she immediately opens her umbrella to avoid getting any wetter. This is an example of which kind of procedure?
!---
.r1; negative reinforcement
.t; Yes, negative reinforcement is a procedure in which behavior is strengthened by removing an aversive stimulus
.w1; positive reinforcement
.t; No, in positive reinforcement a reinforcing stimulus is presented
.w2; operant behavior
.t; No, operant behavior only refers to behavior susceptible to operant conditioning
.w3; respondent conditioning
.t; No, you are confusing respondent and operant procedures
.w4; satiation
.t; No, satiation only refers to getting enough consummatory stimuli to decrease the organism's motivational state
!---

.o 16.4:

!---

Behavior that is susceptible to operant conditioning usually involves which kind of effectors?

!---

.r1; skeletal muscles

.t; Yes, skeletal muscles are attached to the skeleton and are also found in the limbs, trunk, face, jaws, and eyeballs-they are considered to be under voluntary control

.w1; smooth muscles

.t; No, smooth muscles line the walls of all hollow organs and are considered to be involuntary

.w2; cardiac muscles

.t; No, although cardiac muscles have some the features of both skeletal and smooth muscles, the heart is not under voluntary control

.w3; exteroceptors

.t; No, exteroceptors are receptor organs, located mainly in the skin, and receive stimulation from outside the body

.w4; interoceptors

.t; No, interoceptors are receptor organs, located mainly within the viscera of the body, and are sensitive to changes in position and temperature of various organs, glands, and blood vessels

!---

.o 16.5:

!---

What is the best measure of the effectiveness of operant conditioning?

!---

.r1; rate of response

.t; Correct, the response rate is considered to be the most sensitive to the strength of operant conditioning, especially when the behavior measured is brief and discrete

.w1; response duration

.t; Close, although response duration is occasionally the best measure when small samples of behavior are only available, it is not the most sensitive to conditioning changes

.w2; intensity of the response

.t; Incorrect, the response intensity may be related to other factors not related to operant conditioning

.w3; amount of reinforcement necessary before the behavior is established

.t; Incorrect, this may be related to between species differences

.w4; resistance to extinction

.t; Incorrect as this may be more related to the motivative variables present

!--
.o 16.6:
!--
In a factory with a piece rate system of pay, each employee gets paid in tokens based on the number of widgets produced per hour on an assembly line. Later he can cash in the tokens for money. A data sheet showing a steady increase in production could be attributed to which procedure?
!--
.r1; positive reinforcement
.t; That was an easy one! The presenting of conditioning reinforcing stimuli following a response or series of responses is called positive reinforcement
.w1; negative reinforcement
.t; Sorry but negative reinforcement requires the removal of an aversive stimulus
.w2; operant behavior
.t; Sorry but this answer is too vague
.w3; respondent conditioning
.t; Sorry but you are confusing respondent and operant procedures
.w4; incentive system
.t; Sorry but this answer is too vague
!--
.o 16.7:
!--
A pigeon is being reinforced with 3 seconds access to grain every time he pecks a disk 10 times in a row. Although the bird quickly learned to make the responses, it then lost interest and just wandered around the chamber and ignored the disk. This lose of interest in pecking for grain can probably be attributed to which of the following?
!--
.r1; satiation
.t; Right, since the behavior was established and no extinction or punishment procedure was used, the decrease in responding can probably be attributed to a lack of motivation due to satiation
.w1; deprivation
.t; No since deprivation would increase responding
.w2; habituation
.t; No since habituation is not related to consummatory stimuli
.w3; negative reinforcement
.t; No since no aversive stimulus was removed
.w4; operant extinction
.t; No since reinforcement was not withheld
!--

.o 16.8:
!--
In a classroom, a student increases his work rate at the end of the day in order to avoid having to stay after school. This increased behavior is due to which of the following procedures?
!--
.r1; negative reinforcement
.t; Yes, by working faster now, the student removes the conditioned aversive stimulus of staying after school- it is also a fixed interval schedule
.w1; positive reinforcement
.t; Close since you could look at leaving school on time as positive reinforcement for work completed, although this is probably not the main factor
.w2; the 3-term contingency
.t; No, this answer is too vague
.w3; spontaneous recovery
.t; No since this occurs only after a resting period following extinction
.w4; operant behavior
.t; No, this answer is too vague
!--
.o 16.9:
!--
Operant conditioning is contrasted with respondent conditioning in that the former behavior is ___________ and in the latter behavior is ____________.
!--
.r1; evoked, elicited
.t; Correct, the proper usage of these verbs is to say that operant behavior is evoked and respondent behavior is elicited
.w1: produced, triggered
.t; Incorrect since these are more layman's terms
.w2; elicited, evoked
.t; Incorrect, you are confusing operant and respondent relations
.w3; stronger, weaker
.t; Incorrect, as the strength or weakness of behavior is dependent on the organism and its past conditioning history
.w4; conscious, unconscious
.t; Incorrect as we may be both conscious or unconscious of both respondent and operant behavior
!--
.i 17.0:
!--
Operant extinction is a procedure used to decrease behavior by the nonreinforcement of previously reinforced behavior. It usually has the side

effect of increasing the variability of the response. Often the rate and intensity of the behavior will temporarily increase at the start of the extinction procedure before it starts decreasing. This phenomena is called an extinction burst and can produce some aggressive behavior.

Some examples of operant extinction are as follows:

1. You drop a quarter on the ground and immediately bend down to search for it. After many search procedures do not reveal its location you gradually become discouraged and give up looking for it.
2. A child throws a temper tantrum in order not to have to go to bed on time. The parent decides to just put the child in bed, turn off the light, close the door, and ignore the crying behavior. At first the crying becomes even louder and more insistent. But after about 15 minutes the child calms down and then goes to sleep.
3. A teacher gives out special colored stickers to elementary students who finish their work early. The whole class works extra hard to finish their work and the teacher has to buy extra stickers to keep up. After two weeks she decides the students shouldn't need extrinsic motivators anymore so she discontinues the rewards. As a result many papers are now handed in late or incomplete.

!---

.i 18.0:

!---

The fact that extinction does not permanently eliminate the behavior is seen by the following examples:

1. The child who calms down and goes to sleep may again wake up and start crying again.
2. The person who lost the quarter may again search the area whenever he walks by it.

This phenomenon of increased behavior after a rest period is known as spontaneous recovery.

The procedure of extinction should be distinguished from forgetting in which the behavior reduction is due only to the passage of time and not the removal of a specific contingency. For example, after a time period of several months the person who lost his quarter may forget all about it.

Extinction should be distinguished from satiation. The difference can be seen by these two examples:

1. After eating a large meal a child refuses to eat any more food even when offered his favorite dessert. This type of behavior reduction is called satiation.
2. Because he didn't eat his vegetables, the parents refuse to let the child have dessert despite many requests. This type of behavior reduction is called extinction.

Both examples demonstrate elimination of dessert eating behavior. But in the first instance reinforcement is continuously available while in the second instance reinforcement is no longer available.

!--

.i 19.0:

!--

Resistance to extinction is one measure of the strength of reinforcement. Extinction does occur more rapidly following a continuous reinforcement procedure rather than a partial or intermittent procedure. For example, if a pigeon was given grain after every key peck for 10 minutes and then grain was withheld, extinction would occur rather quickly. If the pigeon was given grain after 50 key pecks for a 10 minute period, then extinction would occur more slowly.

The strength of extinction is measured by the change in the rate of responding during the procedure and the total number of responses before the behavior returns to its baseline rate prior to conditioning. In the pigeon example, the total number of key pecks that occurred during extinction would be much greater after the intermittent reinforcement schedule (FR 50) than after the continuous reinforcement (CRF or FR1) schedule.

Let's turn to some questions concerning operant extinction.

!--

.o 19.1:

!--

How is the procedure in operant extinction different from respondent extinction?

!--

.r1; in operant extinction, the stimulus which comes after the response is withheld

.t; Yes, operant extinction is the withholding of consequent stimuli which were reinforcing

.w1; in operant extinction, the stimulus which comes at the same time as the response is withheld

.t; No, while two stimuli can occur simultaneously, it is not possible for a stimulus and a response

.w2; in operant extinction, the stimulus which comes just before the response is withheld
.t; No, you are confusing operant and respondent extinction
.w3; the reinforcing stimulus is no longer available
.t; No since this is similar for both
.w4; spontaneous recovery can occur
.t; no since this is similar for both
!--
.o 19.2:
!--
A good definition of operant extinction is that it is a procedure in which an environment-behavior relation is ____________ by no longer presenting a ____________ consequence after the response. !--
.r1; weakened, reinforcing
.t; Yes, this is the standard definition of operant extinction
.w1; strengthened, punishing
.t; No, this is negative reinforcement
.w2; neutralized, operant
.t; Sorry but there is no such word as "neutralized"
.w3; eliminated, weakened
.t; Close but extinction would preclude even a weakened consequence
.w4; changed, negative
.t; No, this is negative reinforcement
!--
.o 19.3:
!--
In an experiment a white rat is provided with a dipper of saccharine flavored water after pushing down a lever when a red light is on. After a steady state performance has been achieved, the experimenter stops making saccharine flavored water available for lever pressing when the red light is off. This ess delta training is called which of the following?
!--
.r1; operant extinction
.t; Good for you! The essence of operant extinction is that the response is still available but reinforcement is not
.w1; respondent extinction
.t; Wrong, you are confusing respondent and operant procedures
.w2; negative reinforcement
.t; Wrong since no aversive stimulus is removed
.w3; satiation
.t; Wrong since the rat will again press the lever when the red light comes on

.w4; habituation
.t; Wrong since the rat will again press the lever when the red light comes on
!--
.o 19.4:
!--
A person is trying to stop smoking by snapping an elastic band on his wrist every time he has an urge to light up a cigarette. After successfully losing the urge for two weeks, he then goes on a one week vacation. When he returns to his normal routine he suddenly finds he again has a strong urge to start smoking again. This phenomenon is an example of which of the following?
!--
.r1; spontaneous recovery
.t; Right, when mild punishment is used, after a rest period, the phenomena of spontaneous recovery does occur.
.w1; response variability
.t; No, response variability is not a side effect of a punishment procedure
.w2; extinction burst
.t; No, an extinction burst is not a side effect of a punishment procedure
.w3; forgetting
.t; No, punishment does not make the person forget his previous habit but only inhibits or suppresses the behavior
.w4; response latency
.t; No, response latency is only a measure of response strength and not a procedure
!--
.o 19.5:
!--
Extinction occurs more slowly following a(n) _______________ reinforcement procedure rather than a(n) ______________ procedure.
!--
.r1; intermittent, continuous
.t; Correct, intermittent schedules of reinforcement are more difficult to extinguish, probably because it is harder for the organism to distinguish between the reinforcement and extinction phase
.w1; continuous, intermittent
.t; Incorrect, you are confusing the extinction procedure
.w2; lengthy, brief
.t; Not necessarily, it depends on the type of schedule used
.w3; weak, strong
.t; Incorrect, although stimuli can be weak or strong, schedules are classified based on the delivery schedule of stimuli

.w4; operant, respondent
.t; Incorrect, as not enough information is given- the speed of operant and respondent extinction depends on other factors
!--
.o 19.6:
!--
In _______________ reinforcement is available but the organism does not respond while in _______________ no reinforcement is available for responding.
!--
.r1; satiation, extinction
.t; Right, this is the essential procedural difference between satiation and extinction
.w1; extinction, satiation
.t; Wrong, you are confusing the two procedures
.w2; satiation, deprivation
.t; Wrong, since in deprivation the organism is not allowed to respond
.w3; habituation, spontaneous recovery
.t; Wrong, habituation only refers to the simplest type of learned and not to operant procedures
.w4; positive stimuli, aversive stimuli
.t; Wrong, the sentence refers to procedures and not stimuli
!--
.o 19.7:
!--
In many ways noncontingent schedules of reinforcement are similar to extinction procedures. If an animal is on a FR 10 schedule (reinforced every tenth response) and switched to a FT 10-sec schedule (reinforced every 10-sec regardless of responses made) the rate of responding will eventually _______________.
!--
.r1; greatly decrease
.t; Good, changing from a contingent to a noncontingent schedule is similar to extinction although some reinforcement of behavior by coincidence may occur at first
.w1; greatly increase
.t; Sorry but noncontingent schedules will not increase behavior
.w2; stay the same
.t; Sorry but noncontingent schedules will not maintain behavior
.w3; slightly decrease
.t; Sorry but noncontingent schedules will not even maintain behavior at a slightly decreased level
.w4; slightly increase

.t; Sorry but noncontingent schedules will not increase behavior
!---
.o 19.8:
!---
In a conditioning experiment with monkeys, the delivery of food pellets changes from immediately after a chain pull to now 60 seconds after the response. What is this procedure called?
!---
.r1; operant extinction
.t; Good answer! A consequence 60 seconds or more after a response is considered a remote contingency and is only effective if mediated by language
.w1; positive reinforcement
.t; No, the consequence is now too remote from the response to be positive reinforcement
.w2; negative reinforcement
.t; No, the consequence is not removed but just made more remote
.w3; respondent extinction
.t; No, in respondent extinction the CS is presented repeatedly without the US
.w4; deprivation
.t; No, in deprivation no reinforcement is available and no response can be made
!---
.o 19.9:
!---
After a period of continuous reinforcement for key pecking, a pigeon is put on extinction for 4 hours and then returned to his home cage. The next morning when the pigeon is returned to the operant chamber responding again resumes similar to the previous reinforcement schedule. What phenomenon explains why this occurs?
!---
.r1; spontaneous recovery
.t; Yes, this demonstrates that extinction does not permanently eliminate a behavior since, after a rest period, the operant behavior will again temporarily increase in a phenomenon called spontaneous recovery
.w1; extinction burst
.t; Wrong, an extinction burst is an increase in responding but only at the start of the extinction phase
.w2; respondent extinction
.t; Wrong, this example refers only to operant behavior
.w3; negative reinforcement
.t; Wrong, negative reinforcement does increase behavior but only after the

removal of an aversive stimulus
.w4; habituation
.t; Wrong, habituation refers only to a simple type of learning in which responding diminishes, however, spontaneous recovery may occur after a resting period here as well
!---
.i 20.0:
!---
The last part of operant behavior we shall discuss involves punishment procedures. Operant punishment is a procedure which weakens behavior. Some examples of the procedure are as follows:

1. A child attempts a touch a hot stove and the parent yells "Stop!" just in time and the child turns away. Here the verbal stimulus is aversive or punishing.
2. In a classroom three students have not finished their work at recess time. The teacher decides to keep them inside as punishment for not completing their work. Here a reinforcing stimulus was taken away.
3. An autistic child persists in self-injurious behavior by biting his wrist and banging his head against a wall. In order to prevent serious injury without having to use physical restraints all the time, a psychologist arranges mild electric shocks to be given after each self-injurious episode. After several treatments the behaviors are eliminated.
4. A person is caught speeding and given a ticket by a policeman, and as a result has to pay a $25 fine. Here the reinforcing stimulus of money is taken away as punishment.

Examples 1 & 3 of presenting an aversive or punishing stimulus contingent upon a response are called positive punishment. Examples 2 & 4 of removing a reinforcing stimulus are called negative punishment.
!---
.i 21.0:
!---
Suppose we wanted to eliminate swearing from a child's verbal repertoire. We could use a punishment procedure which would present an aversive stimulus every time a swear word was used. However, the procedure would not teach what are appropriate substitute words to use on such occasions. The child may also become angry and refuse to continue coming to school. We would normally need to use a separate reinforcement procedure to teach the use of more descriptive or socially acceptable words. In fact, the punishment procedure could often be avoided by just expanding the verbal

repertoire.

Thus, punishment does not teach new behaviors but only eliminates or suppresses certain behaviors in those conditions. It also is considered the procedure of last resort since it may produce aggressive or escape behavior.

!--

. 22.0:

!--

Let's make clear the distinction between punishment and extinction by the following examples:

1. A white rat is on a continuous reinforcement schedule in which every time it pushes down a bar, it receives some sucrose solution in a hopper as reinforcement. Thus bar pressing becomes a well established behavior. Then reinforcement is discontinued completely so that nothing happens after a bar press response. Gradually the rat loses interest in this behavior and stops pushing the bar.

2. Another white rat is initially on the same continuous reinforcement schedule. This time the procedure change is to produce a loud annoying noise after every bar press. Quickly the rat learns to not make bar press responses any may engage in some aggressive behavior or try to escape from the experimental chamber.

In example number one, an extinction procedure is used which has a more gradual effect. In example number two, a punishment procedure is used which has a much quicker effect. The end result of response elimination is the same.

The strength of the punishment procedure would then be measured by the change in rate of the rat's bar pressing behavior from the reinforcement procedure to the punishment procedure. Or you could count the number of bar presses made during punishment until they ceased completely. In this case the strength would vary depending on the loudness of the noise produced. Of course, an even more effective aversive stimulus would be electric shock or some nauseous odor.

Let's now try some final questions on operant punishment.

!--

.o 22.1:

!--

Which of the following is an example of negative punishment?

!--
.rl; taking candy away from a child until he stops misbehaving
.t; Yes, removing a reinforcing stimulus in order to decrease behavior is a definition of negative punishment
.w1; removing a splinter from someone's foot
.t; No, although you are removing an aversive stimulus it is not clear what the effect on behavior is
.w2; stepping on a splinter
.t; No, this is presenting an aversive stimulus
.w3; trying to get candy from an empty vending machine
.t; No, this is withholding a reinforcing stimulus
.w4; stealing candy from a vending machine
.t; No, this is obtaining a reinforcing stimulus by a nonstandard procedure
!--
.o 22.2:
!--
Operant punishment can be defined as a procedure in which an environment-behavior relation is ________ by arranging a consequence of responding that __________ the strength of a response.
!--
.rl; weakened, reduces
.t; Right, this is the generic definition for punishment
.w1; strengthened, alters
.t; Sorry, but a punishment procedure does not strengthen behavior
.w2; changed, punishes
.t; Sorry but this is awkward working and could be misinterpreted
.w3; aversive, reinforces
.t; Sorry but punishment procedures do not reinforce a response
.w4; reduced, prevents
.t; Sorry but punishment does not prevent a response from occurring although it does make it less likely
!--
.o 22.3:
!--
In a treatment program to cure alcoholics, all participants take a drug called antiabuse before drinking which produces nausea when combined with alcohol. Therefore, the effect would be to decrease drinking alcoholic beverages due to which one of the following procedures?
!--
.rl; respondent punishment
.t; Good thinking! The aversive stimulus of antiabuse is paired with the reinforcing effect of alcohol in order to eliminate the behavior
.w1; operant negative punishment

.t; No, the reinforcing stimulus is not taken away, it is just paired with an aversive stimulus
.w2; operant positive punishment
.t; No, the aversive stimulus is not presented contingent on behavior but paired with a reinforcing stimulus
.w3; aversion therapy
.t; Sorry but this answer is too vague
.w4; operant negative reinforcement
.t; No, an aversive stimulus is not removed but paired with a reinforcing stimulus
!--
.o 22.4:
!--
The strength of a punishment procedure is best measured by which of the following?
!--
.r1; it includes all of these answers
.t; Good answer, that was a hard one. All of these factors combined provide the best measure of the strength of an operant punishment procedure
.w1; the strength of aversive vs. reinforcing stimuli
.t; Close but this is just a partial measure
.w2; change in rate from baseline to experimental phase
.t; Close but this is just a partial measure
.w3; total number of responses until cessation
.t; Close but this is just a partial measure
.w4; generalization to similar stimuli
.t; Close but this is just a partial measure
!--
.o 22.5:
!--
A child accidentally touches a hot stove and quickly withdraws his hand in a flexion reflex. The next time the child enters the kitchen, he will have a decreased tendency to touch the stove. What kind of procedure is this?
!--
.r1; operant positive punishment
.t; Right, presenting an aversive stimulus contingent on behavior is the definition of positive punishment
.w1; operant negative punishment
.t; Sorry but negative punishment only occurs when a reinforcing stimulus is removed
.w2; respondent punishment
.t; Sorry but respondent punishment only occurs when an aversive

stimulus is paired with a reinforcing stimulus
.w3; operant negative reinforcement
.t; Sorry but negative reinforcement only occurs when an aversive stimulus is removed
.w4; reflexive behavior
.t; Sorry but this answer is too vague
!---
.o 22.6:
!---
A rat is on a reinforcement schedule in which he receives a dipper of sucrose flavored water for every 5 lever presses (fixed ratio 5 responses or FR 5). Now the schedule is changed to reinforcement for every 50 lever presses (FR 50). A initial decrease in response rate would be due to which of the following procedures?
!---
.r1; positive punishment
.t; Good thinking! An increase in response effort is aversive and so an aversive stimulus is being presented, therefore, behavior will probably decrease at first
.w1; negative punishment
.t; Wrong, although reinforcing stimuli are more made effortful to obtain, they are not removed contingent upon behavior
.w2; extinction
.t; Wrong since reinforcing stimuli are not withheld but just made more effortful to obtain
.w3; negative reinforcement
.t; Wrong since no aversive stimulus is removed contingent on behavior
.w4; positive reinforcement
.t; Close, although both the FR 5 and FR 50 are positive reinforcement schedules, the decrease in responding is due to the increased effort required which is slightly aversive
!---
.o 22.7:
!---
A monkey is in a grid chamber in which he receives a 20 volt shock for chain pulls which also produce food pellets. The shock is then reduced to 10 volts and the chain pull response increases due to which procedure?
!---
.r1; positive reinforcement
.t; Congratulations! This is a case in which electric shock is reinforcing because it is decreased in intensity from its previous level
.w1; negative reinforcement
.t; No, an aversive stimulus is not removed contingent on behavior

.w2; positive punishment
.t; No, although an aversive stimulus is presented contingent upon behavior, its level of intensity is decreased from before
.w3; negative punishment
.t; No, a reinforcing stimulus is not removed contingent on behavior
.w4; aversive counterconditioning
.t; Close since an aversive stimulus is paired with a reinforcing stimulus, but this example involves operant behavior
!--
.o 22.8:
!--
In order to prevent their infant from hurting himself, the parents decide to condition the child to respond quickly on verbal command. The parent makes a loud clapping noise and yells "Stop!" whenever the infant is about to do something dangerous. If later the infant stops immediately whenever the parent says "Stop!," then this is an example of which procedure?
!--
.r1; positive punishment
.t; Correct, this example presents an aversive stimulus contingent on behavior
.w1; negative punishment
.t; Sorry but no reinforcing stimulus is removed contingent on behavior
.w2; aversive counterconditioning
.t; Close since an aversive stimulus is paired with some reinforcing response such as exploring, but this examples only involves operant behavior
.w3; negative reinforcement
.t; Sorry but no aversive stimulus is removed contingent on behavior
.w4; counterconditioning
.t; Sorry but no reinforcing stimulus is paired with an aversive stimulus in an attempt to increase respondent behavior
!--
.o 22.9:
!--
In the previous example, when the parent says "Stop!" the child's heart rate and breathing increases and his bronchi constrict. This effect is due to which procedure?
!--
.r1; respondent punishment
.t; Yes, the pairing of an aversive stimulus with a reinforcing stimulus increases negative emotions towards whatever activity the child was engaged in at the time
.w1; operant positive punishment

.t; No since the effect of presenting the aversive stimulus is a change in smooth muscle activity
.w2; operant negative punishment
.t; No since no reinforcing stimulus is removed contingent on behavior
.w3; respondent conditioning
.t; Close but no reinforcing US is paired with a NS
.w4; reflexive behaviors
.t; Sorry but this answer is too vague
!---
.i 23.0:
!---
You're finished! This completes this program in Basic Concepts in Psychology. You are now ready to take the posttest and preference questionnaire. In one week there will also be a delayed posttest on these concepts. Check with the proctor to see what date and time you should return.
!---

Appendix H

PASS Rules + Positive Examples

! BASIC CONCEPTS IN PSYCHOLOGY.Rules plus positive examples
! Author: John B. Connors
! Affiliation: Western Michigan University
! Terms: reflex, respondent behavior (conditioning,
! extinction, and punishment and operant behavior
! (reinforcement, extinction, and punishment)
!--
.i 1.0:
!--
Welcome to Basic Concepts in Psychology. This is a Computer-Assisted Instruction (CAI) program designed to teach some of the definitions and examples of common terms used in behavioral psychology. By completing this lesson you should be able to talk (both vocal and written) more effectively about environmental events and their function in changing behavior. Precise usage of these terms will allow you to communicate effectively with other scientists when describing the prediction and control of behavior in laboratory and applied settings.

The actual terms being taught will be underlined when they are first introduced. Please don't try to memorize what you are reading. Just read at a rate appropriated for any textbook and try to understand the concepts involved. Corrective feedback will be given on all answers to questions, whether correct or incorrect. You can try to answer each question up to 3 times or until you get it right. Normally the program takes about 45 minutes to complete but there is no time limit.
!--
.i 2.0:
!--
Lets begin the program by learning about reflexive behavior.

The most basic type of behavior in animals is called a <u>reflex</u>. In simple terms, a stimulus triggers a response. More formally this behavior is a stereotyped pattern of movement of a part of the body that can be reliably elicited by presenting the appropriate stimulus. The word "appropriate" refers to the fact that no training is required. There is an innate connection between a stimulus and a response. Particular reflexes are usually characteristic of all members of a species.

Another way of explaining the reflex is to say that the relation between a particular stimulus and a particular response is such that, the stimulus elicits or is correlated with the response. It is important to remember that the reflex is composed of both a stimulus component and a response component. The relation between the two events defines the reflex. The

reflex is not a stimulus, nor is it a response. Several different stimuli may produce the same response.

!---

.i 3.0:

!---

There are many examples of reflexes which occur in humans. The following eight reflexes are representative:

1) Pupillary reflex: the change in size (by contraction or dilation) of the pupil of the eye in response to a change in the intensity of light.

2) Patellar reflex: the jerking movement of the lower leg in response to a blow delivered just under the kneecap.

3) Lachrymal reflex: the tearing of the eye in response to a foreign object in the eye (e.g., dust particle), or in response to smoke or the aroma of a freshly peeled onion.

4) Salivary reflex: the secretion of saliva into the mouth in response to food in the mouth or in response to a weak acid solution in the mouth (e.g., lemon juice).

5) Piloerection reflex: the erection of hair follicles in response to cold or extreme fright.

6) Sneezing reflex: expulsion of air from the nose and mouth as a response to an irritation (e.g., pepper) in the nose.

7) Flexion reflex: withdrawing the hand by contraction of the elbow in response to painful stimulation (e.g., heat, cold, abrasion, or electrical stimulation).

8) Startle reaction: increased heart rate, breathing, and secretion of adrenaline into the blood in response to a new and sudden stimulus.

!---

.i 4.0:

!---

Related to learning, there are two types of reflexes observed in humans: unconditioned reflexes and conditioned reflexes. For example, if you salivate when food has been placed in your mouth that reflex is unconditioned because the reflex is innate and does not require any conditioning history. However, if you salivate when you smell food, see a picture of food, or just read about food, then this is learned behavior and

therefore is called a conditioned reflex.

It can be seen that all reflexive behavior is in response to specific stimuli. Many of the more familiar reflexes, such as the pupillary contraction, the knee-jerk, and withdrawal reflexes, are called phasic reflexes and have a brief response duration. In contrast are the tonic reflexes, such as those involved in balance and posture, which consist of a continuous series of adjustments in muscle tension. Standing on one leg
requires different muscle tensions in order to not fall down and is an example of a tonic reflex.

!--

.i 5.0:

!--

A reflex may diminish through the process of habituation. If an eliciting stimulus is repeatedly presented over a period of time, the responses will decrease in size and increase in latency. For example, the loud sound of a gunshot may produce a startle reaction. After 100 gunshots, however, the startle reaction has decreased until it has disappeared completely. After a period of time during which no gunshots are heard, a sudden burst of gunshots again will produce a startle reaction. This effect of the passage of time is called spontaneous recovery. It should be noted that habituation is stimulus-specific so that even after the gunshots no longer produced a startle reaction, the sound of a dynamite explosion would produce a startle reaction.

Habituation should be distinguished from muscular and glandular fatigue. Fatigue is more temporary and a short resting period of several minutes will often restore responding. For example, the leg muscles may fatigue quickly after several dozen demonstrations of the knee-jerk reflex. However, if you wait for 10 minute resting period, the reflex will be seen again. Habituation to the hammer striking the tendon below the kneecap would not occur until perhaps several dozen trials had occurred. !-------------
----

.i 6.0:

!--

The strength of the reflex is typically measured by response latency. In other words, how long does it take for the response to occur after the stimulus has been presented? Response latency varies inversely with stimulus magnitude. For example, the brighter the light, the faster the pupil of the eye contracts. The harder the hammer blow to the knee, the faster the leg swings forward. The size or intensity of the response (response magnitude) and its duration (how long it persists) vary directly with the stimulus magnitude. Using this same example, the brighter the

light the more the pupil of the eye will decrease in size and will remain small.

You will now be asked some questions about reflexes.

!--

.o 6.1:

!--

Which of the following would be considered a reflex?

!--

.r1; sneezing due to an irritation in the nose
.w1; a flashing bright light is turned on
.w2; loud sounds in the room next door
.w3; moving your hand away quickly
.w4; a sudden increase in heart rate and respiration

!--

.o 6.2:

!--

Check out these examples and find the reflex.

!--

.r1; withdrawing your hand after touching a hot stove
.w1; the roots of a plant grow downward in response to gravity
.w2; very time a child smiles he is given an M & M candy
.w3; sneezing several times in a row due to an allergy
.w4; pairing the sound of a tone with a light

!--

.o 6.3:

!--

A person salivates as he chews his favorite chocolate cake. The next day he is very hungry and sees an ad in a magazine for chocolate cake and begins to salivate. This is an example of which of the following?

!--

.r1; conditioned reflex
.w1; unconditioned reflex
.w2; conditioned stimulus
.w3; conditioned response
.w4; salivary reflex

!--

.o 6.4:

!--

In the piloerection reflex, which of the following sequences would occur?

!--

.r1; in response to a frightening stimulus the hair follicles become erect
.w1; in response to an electric shock a hand is quickly withdrawn

.w2; in response to a blow on the kneecap the lower leg jerks forward
.w3; in response to cold water goose bumps on the skin appear
.w4; in response to stimulation the nipples become erect
!---
.o 6.5:
!---
A reflex is defined as the __________ between a particular stimulus and a particular response in such a way that the stimulus __________ the response. Choose the answers that best fill in the blanks.
!---
.r1; relation, elicits
.w1; contrast, produces
.w2; interaction, maintains
.w3; conditioning, reinforces
.w4; behavior, connects
!---
.o 6.6:
!---
To determine the strength of a reflex, it is necessary to know what the response is in the __________ of the stimulus as well as in its __________. Choose the answers that best fill in the blanks.
!---
.r1: absence, presence
.r2; presence, absence
.w1; vicinity, location
.w2; conditioning, magnitude
.w3; magnitude, latency
.w4; environment, behavior
!---
.o 6.7:
!---
The strength of a reflex may diminish through the process of ______________.
!---
.r1; habituation
.r2; muscle fatigue
.w1; satiation
.w2; extinction
.w3; latency
.w4; elicitation
!---
.o 6.8:
!---

A tight rope walker balances on one leg as he crosses a guy wire 100 feet above the ground. Which reflexes does he use?

!---

.r1; tonic reflexes
.w1; phasic reflexes
.w2; righting reflex
.w3; flexion reflex
.w4; orienting reflex

!---

.o 6.9:

!---

A young infant will grasp any object put in its hand. This is an example of which kind of reflex?

!---

.r1; unconditioned reflex
.w1; conditioned reflex
.w2; unconditioned stimulus
.w3; unconditioned response
.w4; tonic reflex

!---

.i 7.0:

!---

Let's turn to a discussion of respondent behavior. It is behavior that is elicited by a particular stimulus called the antecedent and it is not affected by consequences. Therefore, it is a reflexive type response that is triggered by an eliciting stimulus. Usually it involves the involuntary responses of the smooth muscles and glands or other involuntary effector organs. Examples include many of the reflexes we have studied such as the heart beat, gland secretion, peristaltic movement of the intestines, pupil contraction or dilation in the eye, coughing or sneezing, sweating, and milk release in lactating women. It is also involved in much of what we call emotions, feelings, and attitudes.

Note that this procedure is typically conducted with smooth muscles and glands. However, there are several exceptions. An example of respondent conditioning with skeletal muscles is the eye blink reflex.

!---

.i 8.0:

!---

Respondent conditioning is a procedure which was first demonstrated by the Russian physiologist Pavlov at the turn of the century. Pavlov's original experiment involved a dog placed in a harness. When a bell tone was rung the dog pricked up its ears and turned its head towards the

sound. With successive rings, however, these orienting responses diminished in magnitude and then disappeared. The sound became a neutral stimulus.

When meat powder was placed in its mouth, the dog made salivating and chewing movements. A bell tone was then rung 5 seconds before each food delivery. After several pairings the dog began to salivate and chew during the 5 second interval between the bell tone and presentation of the meat powder. Eventually (after 30 to 50 pairings), the dog salivated and chewed at the sight of the bell alone, even if on occasional trials the food was omitted.

Note that only salivating is considered respondent behavior. Chewing is performed by the skeletal muscles of the jaw and was evoked by the salivary response, not by the bell tone.

!--

.i 9.0:

!--

The procedure of respondent conditioning can be diagramed as follows:

Neutral stimulus---> NS (bell tone)---> Orienting response---> No response
Unconditioned reflex---> US (meat powder)---> UR (salivating)
Respondent
conditioning---> US (meat powder)---> UR (salivating)
CS (bell tone)---> CR (salivating)
Conditioned reflex---> CS (bell tone)---> CR (salivating)

This procedure is sometimes called stimulus substitution because the CS substitutes for the US in eliciting a response.

!--

.i 10.0:

!--

The strength of respondent conditioning can be measured in several ways. For the Pavlovian experiment it could include the following:

1. The number of drops of saliva.
2. The elapsed time between the ringing of the bell tone and the secretion of saliva.
3. The number of pairings of the bell tone with the meat powder before the bell tone by itself would produce a measurable amount of saliva.
4. The number of times the bell tone could be later presented without following it by meat powder before the salivary response

would disappear.

Any one of these could be used to determine the effect of the bell tone as a conditioned stimulus.

!--

.i 11.0:

!--

In higher-order respondent conditioning a second CS is paired with the first CS and comes to elicit the CR despite the fact that the second CS was never paired directly with the US. For example, after pairing the bell with meat powder, a light could be paired with the bell. After several pairings, the light by itself would come to elicit salivation.

An example with humans could consist of pairing a weak shock (which elicits a galvanic skin response) with the presentation of flashing lights. After several pairings, then pair the flashing lights with a musical tone of middle C. Occasionally the flashing lights would continue to be paired with the shock when the tone was not on. Eventually, the middle C tone will come to elicit a galvanic skin response by itself when no lights are present.

Let's now try to answer some questions about respondent conditioning.

!--

.o 11.1:

!--

Suppose we want to condition the sound of a buzzer to an eye blink. First we would check to make sure the buzzer sound is a neutral stimulus with respect to blinking and then would pair it with a US such as a puff of air. After a number of such pairings, the buzzer by itself should produce which of the following responses?

!--

.r1; blinking of the eyelid
.w1; tearing of the eye
.w2; pupillary constriction
.w3; pupillary dilation
.w4; a puff of air

!--

.o 11.2:

!--

In the Pavlov experiment, the meat powder is considered a ___________ while the tone is considered a ___________.

!--

.r1; unconditioned stimulus, conditioned stimulus
.w1; conditioned stimulus, unconditioned stimulus

.w2; unconditioned response, conditioned response
.w3; conditioned response, unconditioned response
.w4; satiation stimulus, neutral stimulus
!---
.o 11.3:
!---
In trace conditioning a conditioned stimulus ____________ before the unconditioned stimulus onset.
!---
.r1; occurs and disappears several seconds before US onset
.w1; occurs and remains on for several seconds until the US onset
.w2; occurs immediately after the US offset
.w3; occurs and disappears several minutes before US onset
.w4; occurs at a weak intensity level
!---
.o 11.4:
!---
What was the neutral stimulus before conditioning in the Pavlov experiment?
!---
.r1; the bell tone
.w1; the meat powder
.w2; chewing movements
.w3; the harness
.w4; drops of saliva
!---
.o 11.5:
!---
The eye blink reflex can be elicited by a puff of air to the eye. If the air puff is repeatedly paired with a buzzer, the buzzer will comes to elicit the eye blink reflex by itself. What stimulus function does the buzzer have for the eye blink reflex?
!---
.r1; conditioned stimulus
.w1; unconditioned stimulus
.w2; conditioned response
.w3; unconditioned response
.w4; neutral stimulus
!---
.o 11.6:
!---
Skeletal muscles are attached to the skeleton and are found in the limbs, truck, face, jaws, and eyeballs. They are involved in some reflexes in which

there is a response to an aversive stimulus. Which one of the following reflexes also uses skeletal muscles?

!--

.r1; patellar reflex (knee-jerk)
.w1; lachrymal reflex (tearing)
.w2; vasoconstriction reflex (blood vessels)
.w3; galvanic skin reflex ((electrical conductivity)
.w4; flexion reflex (limb withdrawal)

!--

.o 11.7:

!--

Smooth muscles line the walls of all the hollow organs and are found in the walls of the digestive tract, bladder, veins and arteries, and various ducts. Which of the following reflexes use smooth muscles?

!--

.r1; vasodilation reflex
.w1; salivary reflex
.w2; coughing reflex
.w3; sweating reflex
.w4; sneezing reflex

!--

.o 11.8:

!--

In a higher-order conditioning experiment a light is paired with a puff of air in order to elicit blinking; then a buzzer is paired with the light. How are the light and the buzzer similar?

!--

.r1; both conditioned stimuli
.w1; both go on and off
.w2; both unconditioned stimuli
.w3; both conditioned responses
.w4; both neutral stimuli

!--

.o 11.9:

!--

In the previous example it is important to pair the buzzer with which of the following?

!--

.r1; only the light
.w1; occasionally the puff of air
.w2; with the blinking
.w3; with other buzzer sounds
.w4; with the light and puff of air

!--
.i 12.0:
!--
Respondent extinction is a procedure in which the CS is no longer paired with the US. It can be demonstrated by continuing the Pavlov example. If a dog is conditioned to salivate at the tone of a bell, but later the bell is repeatedly rung without pairing it with food, the bell tone will eventually cease to elicit or produce salivation. Repeatedly presenting the CS without the US describes the process of respondent extinction.

If at a later time the bell tone is again presented, some salivary responses will again occur in a phenomenon known as spontaneous recovery.

Respondent punishment (also known as aversive counter-conditioning) is a procedure in which a reinforcing stimulus is paired with an aversive stimulus. It can be demonstrated by pairing a bell tone with a painful electric shock. If the bell tone previously had elicited salivary responses, after several new pairings the bell tone will now inhibit or eliminate (depending on the strength of the shock) salivation by itself. It will also elicit emotional responses of increased heart rate and adrenaline secretion which in turn will produce some escape or avoidance behaviors. It is often used in the treatment of alcoholism, cigarette smoking, drug addiction, and obesity.
!--
.o 12.1:
!--
The terms US and CS stand for ______________ ____________ and ____________ ____________.
!--
.r1; unconditioned stimulus, conditioned stimulus
.w1; unlearned stimulus, contrived stimulus
.w2; conditioned stimulus, unconditioned stimulus
.w3; unconditioned stimulus, conditioned response
.w4; unusual stimulus, conditioned stimulus
!--
.o 12.2:
!--
Suppose a person has been conditioned to begin sweating when he puts on a red towel because, in the past, he always put on a red towel before he got into his sauna. Someone gives him a present of a set of red towels and now he uses them on any number of occasions: to take a shower, to go swimming, walking down the hall to brush his teeth, to dry the dishes, and to dust the furniture. The fact that a red towel will no longer elicit

increased sweating is an example of which of the following? !----------------
----
.r1; respondent extinction
.w1; respondent conditioning
.w2; respondent punishment
.w3; habituation
.w4; satiation
!--
.o 12.3:
!--
In a weight reduction program, a rancid odor was paired with smelling favorite high calorie foods. After several weeks of this treatment the participants no longer salivated and actually felt nauseous when smelling these high calorie foods. This procedure is an example of which of the following?
!--
.r1; respondent punishment
.w1; respondent conditioning
.w2; respondent extinction
.w3; habituation
.w4; satiation
!--
.o 12.4:
!--
During behavior therapy, a person trying to stop smoking is squirted in the face with a mist of water every time he takes a puff on his cigarette. However, after several weeks of treatment he still has not lost his desire to stop. Which of the following could account for this failure of treatment?

!--
.r1; the water mist was not a strong aversive stimulus
.w1; the cigarettes themselves didn't get wet
.w2; the person changed his mind about stopping smoking
.w3; the person was not water deprived
.w4; the person habituated to the water mist
!--
.o 12.5:
!--
A tone has been paired with lemon juice to elicit salivation. Now the tone is continually presented but is no longer paired with anything. After a period of time the tone will again become a neutral stimulus. This process is called which of the following?
!--

.r1; respondent extinction
.w1; respondent conditioning
.w2; respondent punishment
.w3; habituation
.w4; satiation
!--
.o 12.6:
!--
The sight of a black cat at night startles a woman so much that her hair stands on end and she gets goose bumps. This is an example of which type of learning?
!--
.r1; habituation
.w1; respondent conditioning
.w2; respondent punishment
.w3; respondent extinction
.w4; counterconditioning
!--
.o 12.7:
!--
In order to control his habit of drinking alcohol, a man submits himself to a behavioral treatment program. A drug called antiabuse will produce nausea if taken just before alcohol consumption. This procedure is called which of the following?
!--
.r1; respondent punishment
.w1; respondent extinction
.w2; deprivation
.w3; satiation
.w4; habituation
!--
.o 12.8:
!--
As a person is reading a cookbook, his mouth starts to water and his stomach contracts in a hunger pang. These responses are considered which kind of procedure.
!--
.r1; respondent conditioning
.w1; habituation
.w2; deprivation
.w3; satiation
.w4; salivary reflex
!--

.o 12.9:

!---

Which of the following effectors is most likely to work with respondent conditioning?

!---

.r1; knee-jerk of the lower leg
.w1; saluting with the forearm
.w2; playing the piano with the fingers
.w3; visual tracking reflex in a 6 year old child
.w4; using thigh muscles to jump in the air

!---

.i 13.0:

!---

We now turn our attention to <u>operant behavior</u>. It is defined generally as behavior which is susceptible to operant conditioning. This behavior often appears spontaneously rather than as a reaction to stimulation; it may or may not be evoked by a current stimulus.

The term "operant" refers to a class of responses which have particular consequences and which operate on the environment. The response class is defined, therefore, by the stimulus it produces. Operant conditioning usually involves the voluntary responses of the striped muscles or other voluntary effector organs. When the behavior is controlled by the presence of a stimulus we say the response has been evoked. It is affected by consequences and is described by the 3-term contingency: S --> R --> S.

Examples include any action of the skeletal muscles such as running, jumping, throwing, talking, playing the piano, dancing, and doing somersaults. There may be no obvious antecedent stimulus but there is always a consequent stimulus after the behavior has occurred. This consequential stimulus is said to be dependent or contingent upon the prior response. Respondent behavior is said to be elicited by a stimulus while operant behavior is said to be evoked if the antecedent stimulus is apparent.

!---

.i 14.0:

!--- These are three basic procedures designed to alter operant behavior: conditioning (or reinforcement), extinction, and punishment. <u>Operant conditioning</u> is a procedure in which behavior is increased. There are two ways to do this: positive reinforcement or negative reinforcement. Let's look at some examples:

1. Every time a 6 month old baby utters a vocal sound its mother picks him up and hugs him. The mother then finds that frequency of vocal behavior rapidly increases. This is positive reinforcement for vocal behavior.

2. When it starts raining, a man opens up his umbrella; this is negative reinforcement for staying dry and increases umbrella opening behavior.

3. When an alarm goes off in the morning a woman gets out of bed, gets dressed, and drives to work. Getting out of bed, getting dressed, and driving to work right away is negative reinforcement for not being late to work.

4. A teacher is working with an autistic child with no verbal skills. Every time the teacher says, "Look at me" and the child gives the teacher eye contact, then the teacher presents the child with a poker chip token which can be exchanged for sips of juice. This is positive reinforcement for compliance behavior.

!--
.i 15.0:
!--

The strength of operant conditioning can be measured at least four ways. Let's use the example of reinforcing a pigeon for key pecking behavior with grain. The strength of the behavior can be measured by any of the following:

1. the rate of key pecking
2. the intensity of the key pecks
3. the number of grain presentations necessary before key pecking behavior is established
4. the number of key pecks still produced after grain is removed and no reinforcement is given.

Now let's use an example of measuring the strength of behavior with people. A child is learning to tie his shoes and is reinforced by verbal praise from his parents. The strength of the behavior can be measured by any of the following:

1. the response duration or how long it takes to tie his shoes
2. the number of practice trials it takes before he can tie his shoes correctly
3. the response latency or how long it takes from the time he is

asked to tie his shoes and he starts tying them
4. the number of times he continues to tie his shoes after parental attention and praise are removed

The increase in behavior is always compared with its previously unreinforced performance, which is called the operant level.
!---
.i 16.0:
!---
It should be noted that an operant reinforcement procedure is only effective when the appropriate motivative variables are present. The same stimulus situation may or may not be reinforcing depending on the deprivation or satiation state of the organism. For example, if the pigeon was not hungry it would not be motivated to peck the disk. If the child was mad at his parents and didn't want their attention and approval, he would not want to tie his shoes.

The term "conditioning" as used here is synonymous with both "reinforcement" and "strengthening." Please remember that reinforcement is a functional definition in that the procedure is always defined by its consequences. Both positive and negative reinforcement will increase behavior in similar situations in the future. For example, if someone smiles when you say hello, you will have an increased tendency to say hello when seeing that person again. This is positive reinforcement. When you turn on the stereo and the music is so loud that it hurts your ears, turning down the volume is negative reinforcement. In the future you will have an increased tendency to immediately turn down the volume when turning on the stereo.
!---
.o 16.1:
!---
To say that a stimulus is contingent upon a response means which of the following?
!---
.r1; it depends on the response occurring first
.w1; it depends on the response occurring last
.w2; it is similar to the response
.w3; it can substitute for the response
.w4; it depends on the stimulus occurring first
!---
.o 16.2:
!---
A general definition of operant conditioning would be that an environment-

behavior relation is ____________ by arranging a consequence ____________ upon a response.

!---

.r1; strengthened, contingent
.w1; allowed, stimulus
.w2; weakened, dependent
.w3; conditioned, following
.w4; maintained, immediately

!---

.o 16.3:

!---

A woman is walking to work and suddenly it starts to rain. Since she is starting to get wet she immediately opens her umbrella to avoid getting any wetter. This is an example of which kind of procedure?

!---

.r1; negative reinforcement
.w1; positive reinforcement
.w2; operant behavior
.w3; respondent conditioning
.w4; satiation

!---

.o 16.4:

!---

Behavior that is susceptible to operant conditioning usually involves which kind of effectors?

!---

.r1; skeletal muscles
.w1; smooth muscles
.w2; glands
.w3; exteroceptors
.w4; interoceptors

!---

.o 16.5:

!---

In operant conditioning the ____________ occurs after the ___________.

!---

.r1; response, stimulus
.w1; stimulus, response
.w2; cause, effect
.w3; effect, cause
.w4; motivation, stimulation

!---

.o 16.6:

!---

In a factory with a piecerate system of pay, each employee gets paid in tokens based on the number of widgets produced per hour on an assembly line. Later he can cash in the tokens for money. A data sheet showing a steady increase in production could be attributed to which procedure?

!---

.r1; positive reinforcement
.w1; negative reinforcement
.w2; operant behavior
.w3; respondent conditioning
.w4; incentive system

!---

.o 16.7:

!---

A pigeon is being reinforced with 3 seconds access to grain every time he pecks a disk 10 times in a row. Although the bird quickly learned to make the responses it then lost interest and just wandered around the chamber and ignored the disk. This lose of interest in pecking for grain can probably be attributed to which of the following?

!---

.r1; satiation
.w1; deprivation
.w2; habituation
.w3; negative reinforcement
.w4; respondent extinction

!---

.o 16.8:

!---

In a classroom, a student increases his work rate at the end of the day in order to avoid taking it home as homework. This increased behavior is due to which of the following procedures?

!---

.r1; negative reinforcement
.w1; positive reinforcement
.w2; the 3-term contingency
.w3; the 2-term contingency
.w4; operant behavior

!---

.o 16.9:

!---

Operant conditioning is contrasted with respondent conditioning in that the former behavior is ____________ and in the latter behavior is ____________.

!---

.r1; evoked, elicited
.w1: produced, triggered
.w2; elicited, evoked
.w3; stronger, weaker
.w4; conscious, unconscious
!--
.i 17.0:
!--
Operant extinction is a procedure used to decrease behavior by the nonreinforcement of previously reinforced behavior. It usually has the side effect of increasing the variability of the response. Often the rate and intensity of the behavior will temporarily increase at the start of the extinction procedure before it starts decreasing. This phenomena is called an extinction burst and can produce some aggressive behavior.

Some examples of operant extinction are as follows:

1. You drop a quarter on the ground and immediately bend down to search for it. After many search procedures do not reveal its location you gradually become discouraged and give up looking for it.
2. A child throws a temper tantrum in order not to have to go to bed on time. The parent decides to just put the child in bed, turn off the light, close the door, and ignore the crying behavior. At first the crying becomes even louder and more insistent. But after about 15 minutes the child calms down and then goes to sleep.
3. A teacher gives out special colored stickers to elementary students who finish their work early. The whole class works extra hard to finish their work and the teacher has to buy extra stickers to keep up. After two weeks she decides the students shouldn't need extrinsic motivators anymore so she discontinues the rewards. As a result many papers are now handed in late or incomplete.

!--
.i 18.0:
!--
The fact that extinction does not permanently eliminate the behavior is seen by the following examples:

1. The child who calms down and goes to sleep may again wake up and start crying again.
2. The person who lost the quarter may again search the area whenever he walks by it.

This phenomenon of increased behavior after a rest period is known as

spontaneous recovery.

The procedure of extinction should be distinguished from forgetting in which the behavior reduction is due only to the passage of time and not the removal of a specific contingency. For example, after a time period of several months the person who lost his quarter may forget all about it.

Extinction should be distinguished from satiation. The difference can be seen by these two examples:

1. After eating a large meal a child refuses to eat any more food even when offered his favorite dessert. This type of behavior reduction is called satiation.
2. Because he didn't eat his vegetables, the parents refuse to let the child have dessert despite many requests. This type of behavior reduction is called extinction.

Both examples demonstrate elimination of dessert eating behavior. But in the first instance reinforcement is continuously available while in the second instance reinforcement is no longer available.

!--

.i 19.0:

!--

Resistance to extinction is one measure of the strength of reinforcement. Extinction does occur more rapidly following a continuous reinforcement procedure rather than a partial or intermittent procedure. For example, if a pigeon was given grain after every key peck for 10 minutes and then grain was withheld, extinction would occur rather quickly. If the pigeon was given grain after 50 key pecks for a 10 minute period, then extinction would occur more slowly.

The strength of extinction is measured by the change in the rate of responding during the procedure and the total number of responses before the behavior returns to its baseline rate prior to conditioning. In the pigeon example, the total number of key pecks that occurred during extinction would be much greater after the intermittent reinforcement schedule (FR 50) than after the continuous reinforcement (CRF) schedule.

!--

.o 19.1:

!--

How is the procedure in operant extinction different from respondent extinction?

!--

.r1; in operant the stimulus comes after the response
.w1; in operant the stimulus comes at the same time as the response
.w2; in operant the stimulus comes just before the response
.w3; reinforcement is no longer available
.w4; spontaneous recovery can occur
!---
.o 18.2:
!---
A good definition of operant extinction is that it is a procedure in which an environment-behavior relation is ____________ by no longer presenting a ____________ consequence after the response. !---
.r1; weakened, reinforcing
.w1; strengthened, punishing
.w2; neutralized, operant
.w3; eliminated, weakened
.w4; changed, negative
!---
.o 18.3:
!---
In an experiment a white rat is provided with a dipper of saccharine flavored water after pushing down a lever when a red light is on. After a steady state performance has been achieved, the experimenter stops making saccharine flavored water available for lever pressing when the red light is off. This ess delta training is called which of the following?
!---
.r1; operant extinction
.w1; respondent extinction
.w2; negative reinforcement
.w3; satiation
.w4; habituation
!---
.o 18.4:
!---
A person is trying to stop smoking and has successfully lost the urge for two weeks. He then goes on a one week vacation. When he returns to his normal routine he suddenly finds he again has a strong urge to start smoking again. This phenomenon is an example of which of the following?

!---
.r1; spontaneous recovery
.w1; response variability
.w2; extinction burst

.w3; forgetting
.w4; response latency
!--
.o 18.5:
!--
Extinction occurs more slowly following a(n) ______________ reinforcement procedure rather than a(n) ______________ procedure.
!--
.r1; intermittent, continuous
.w1; continuous, intermittent
.w2; lengthy, brief
.w3; weak, strong
.w4; respondent, operant
!--
.o 18.6:
!--
In ______________ reinforcement is available but the organism does not respond while in ______________ no reinforcement is available for responding.
!--
.r1; satiation, extinction
.w1; extinction, satiation
.w2; satiation, deprivation
.w3; spontaneous recovery, habituation
.w4; positive stimuli, aversive stimuli
!--
.o 18.7:
!--
If an animal is on a FR 10 schedule (reinforced every tenth response) and switched to a FT 10-sec schedule (reinforced every 10-sec regardless of responses made) the rate of responding eventually ______________.
!--
.r1; greatly decrease
.w1; greatly increase
.w2; stay the same
.w3; slightly decrease
.w4; slightly increase
!--
.o 18.8:
!--
In a conditioning experiment with monkeys, the delivery of food pellets changes from immediately after a chain pull to 30 seconds after the response. What is this procedure called?

!--
.r1; operant extinction
.w1; positive reinforcement
.w2; negative reinforcement
.w3; respondent extinction
.w4; deprivation
!--
.o 18.9:
!--
A child is told he cannot have a snack just before dinner and starts crying. The parent ignores these behaviors and finally they subside. However, the next evening before dinner the child starts crying again when he can't have a snack before dinner. This resumption of crying is due to which of the following?
!--
.r1; spontaneous recovery
.w1; operant extinction
.w2; respondent extinction
.w3; negative reinforcement
.w4; habituation
!--
.i 19.0:
!--
The last part of operant behavior we shall discuss involves punishment procedures. Operant punishment is a procedure which weakens behavior. Some examples of the procedure are as follows:

1. A child attempts a touch a hot stove and the parent yells "Stop!" just in time and the child turns away. Here the verbal stimulus is aversive or punishing.
2. In a classroom three students have not finished their work at recess time. The teacher decides to keep them inside as punishment for not completing their work. Here a reinforcing stimulus was taken away.
3. An autistic child persists in self-injurious behavior by biting his wrist and banging his head against a wall. In order to prevent serious injury without having to use physical restraints all the time, a psychologist arranges mild electric shocks to be given after each self-injurious episode. After several treatments the behaviors are eliminated.
4. A person is caught speeding and given a ticket by a policeman, and as a result has to pay a $25 fine. Here the reinforcing stimulus of money is taken away as punishment.

Examples 1 & 3 of presenting an aversive or punishing stimulus contingent upon a response are called positive punishment. Examples 2 & 4 of removing a reinforcing stimulus are called negative punishment.

!--

.i 20.0:

!--

Suppose we wanted to eliminate swearing from a child's verbal repertoire. We could use a punishment procedure which would present an aversive stimulus every time a swear word was used. However, the procedure would not teach what are appropriate substitute words to use on such occasions. The child may also become angry and refuse to continue coming to school. We would normally need to use a separate reinforcement procedure to teach the use of more descriptive or socially acceptable words. In fact, the punishment procedure could often be avoided by just expanding the verbal repertoire.

Thus, punishment does not teach new behaviors but only eliminates or suppresses certain behaviors in those conditions. It also is considered the procedure of last resort since it may produce aggressive or escape behavior.

!--

. 21.0:

!--

Let's make clear the distinction between punishment and extinction by the following examples:

1. A white rat is on a continuous reinforcement schedule in which every time it pushes down a bar, it receives some sucrose solution in a hopper as reinforcement. Thus bar pressing becomes a well established behavior. Then reinforcement is discontinued completely so that nothing happens after a bar press response. Gradually the rat loses interest in this behavior and stops pushing the bar.

2. Another white rat is initially on the same continuous reinforcement schedule. This time the procedure change is to produce a loud annoying noise after every bar press. Quickly the rat learns to not make bar press responses any may engage in some aggressive behavior or try to escape from the experimental chamber.

In example number one, an extinction procedure is used which has a more gradual effect. In example number two, a punishment procedure is used which has a much quicker effect. The end result of response elimination is the same.

The strength of the punishment procedure would then be measured by the change in rate of the rat's bar pressing behavior from the reinforcement procedure to the punishment procedure. Or you could count the number of bar presses made during punishment until they ceased completely. In this case the strength would vary depending on the loudness of the noise produced. Of course, an even more effective aversive stimulus would be electric shock or some nauseous odor.

!--

.o 21.1:

!--

Which of the following is an example of negative punishment?

!--

.r1; taking candy away from a child
.w1; removing a splinter from someone's foot
.w2; stepping on a splinter
.w3; trying to get candy from an empty vending machine
.w4; stealing candy from a vending machine

!--

.o 21.2:

!--

Operant punishment can be defined as a procedure in which an environment-behavior relation is ________ by arranging a consequence of responding that __________ the strength of a response.

!--

.r1; weakened, reduces
.w1; strengthened, alters
.w2; changed, punished
.w3; aversive, reinforces
.w4; reduced, prevents

!--

.o 21.2:

!--

In a program to cure alcoholics all participants take a drug called antiabuse before drinking which produces nausea when combined with alcohol. Therefore, the effect would be to decrease drinking alcoholic beverages due to which one of the following procedures?

!--

.r1; respondent punishment
.w1; operant negative punishment
.w2; operant positive punishment
.w3; aversion therapy
.w4; operant negative reinforcement

!--

.o 21.3:

!---

The strength of a punishment procedure is best measured by which of the following?

!---

.r1; it includes all of these answers
.w1; the strength of aversive vs. reinforcing stimuli
.w2; change in rate from baseline to experimental phase
.w3; total number of responses until cessation
.w4; generalization to similar stimuli

!---

.o 21.4:

!---

A policeman stops a person for speeding and makes him pay a fine of $25 right away. What type of punishment procedure is this?

!---

.r1; negative punishment
.w1; positive punishment
.w2; respondent punishment
.w3; aversive counterconditioning
.w4; negative reinforcement

!---

.o 21.5:

!---

A child accidentally touches a hot stove and quickly withdraws his hand in a flexion reflex. The next time the child enters the kitchen, he will have a decreased tendency to touch the stove. What kind of procedure is this?

!---

.r1; operant positive punishment
.w1; operant negative punishment
.w2; respondent punishment
.w3; operant negative reinforcement
.w4; reflexive behavior

!---

.o 21.6:

!---

A rat is on a reinforcement schedule in which he receives a dipper of sucrose flavored water for every 5 lever presses (fixed ratio 5 responses or FR 5). Now the schedule is changed to reinforcement for every 50 lever presses (FR 50). A initial decrease in response rate would be due to which of the following procedures?

!---

.r1; positive punishment

.w1; negative punishment
.w2; extinction
.w3; negative reinforcement
.w4; positive reinforcement
!--
.o 21.7:
!--
A monkey is in a grid chamber in which he receives a 20 volt shock for chain pulls which also produce food pellets. The shock is then reduced to 10 volts and the chain pull response increases due to which procedure?
!--
.r1; positive reinforcement
.w1; negative reinforcement
.w2; positive punishment
.w3; negative punishment
.w4; aversive counterconditioning
!--
.o 21.8:
!--
In order to prevent their infant from hurting himself, a parent decides to condition the child to respond quickly on verbal command. The parent makes a loud clapping noise and yells "Stop!" whenever the infant is about to do something dangerous. If later the infant stops immediately whenever the parent says "Stop!," then this is an example of which procedure?
!--
.r1; positive punishment
.w1; negative punishment
.w2; aversive counterconditioning
.w3; negative reinforcement
.w4; respondent conditioning
!--
.o 21.9:
!--
In the previous example, when the parent says "Stop!" the child's heart rate and breathing increases and his bronchi constrict. This effect is due to which procedure?
!--
.r1; respondent conditioning
.w1; operant positive punishment
.w2; operant negative punishment
.w3; respondent punishment
.w4; reflexive behaviors
!--

.i 22.0:

!--

You're finished! This completes the program in Basic Concepts in Psychology. You are now ready to take the posttest and preference questionnaire. In 2 weeks there will also be a delayed posttest on these concepts.

!--

Appendix I

PASS Rules + Negative Examples

```
!       BASIC CONCEPTS IN PSYCHOLOGY.Rules plus negative
!       examples
!       Author: John B. Connors
!       Affiliation: Western Michigan University
!       Terms: reflex, habituation, respondent behavior
!       (conditioning, extinction, and punishment including
!       counterconditioning and aversive counterconditioning) and
!       operant behavior (reinforcement, extinction, and punishment)
!------------------------------------------------------------
.i 1.0:
!------------------------------------------------------------
```

Welcome to Basic Concepts in Psychology. This is a Computer-Assisted Instruction (CAI) program designed to teach some of the definitions and examples of common terms used in behavioral psychology. By completing this lesson you should be able to talk (both vocal and written) more effectively about environmental events and their function in changing behavior. Precise usage of these terms will allow you to communicate effectively with other scientists when describing the prediction and control of behavior in laboratory and applied settings.

The most important terms being taught will be underlined when they are first introduced, but other supplementary terms will be used for contrast. There are 6 text sections followed by 9 questions each in multiple choice format. Corrective feedback will be given on all answers to questions, whether correct or incorrect. Please don't try to memorize what you are reading. Just read at a rate appropriate for any textbook and try to understand the concepts involved. Normally the program takes about 75 minutes to complete.

```
!------------------------------------------------------------
.i 2.0:
!------------------------------------------------------------
```

The most basic type of behavior in animals is called a <u>reflex</u>. In simple terms, a stimulus triggers a response. More formally this behavior is a stereotyped pattern of movement of a part of the body that can be reliably elicited by presenting the appropriate stimulus. The word "appropriate" refers to the fact that no training is required. There is an innate connection between a stimulus and a response. Particular reflexes are usually characteristic of all members of a species.

Another way of explaining the reflex is to say that the relation between a particular stimulus and a particular response is such that, the stimulus elicits or is correlated with the response. It is important to remember that the reflex is composed of both a stimulus component and a response

component. The relation between the two events defines the reflex. The reflex is not a stimulus, nor is it a response. Several different stimuli may produce the same response.

!--

.i 3.0:

!---

There are many examples of reflexes which occur in humans. They usually involve smooth muscles and glands. Skeletal muscle reflexes involve the use of aversive stimuli.

Instead of giving the usual examples found in most instructional programs, an attempt will be made to teach these concepts by presenting the definitions followed by examples of common errors students make in generalizing from rules about the concepts. The following nonexamples are representative:

1. The response of coughing: no mention is made of the stimulus involved.

2. A flashing bright light: no mention is made of the response involved.

3. Writing a letter in response to a telephone call received a week ago: too much time has elapsed between the stimulus and the response to be considered a reflex; writing behavior is voluntary and not reflexive.

4. A light paired with a bell: it must describe the relation between a stimulus and a response, not only the relation between two stimuli.

5. A child cries when a toy is taken away from him: the stimulus must come before the response to be considered reflexive.

6. The roots of a plant grow downward in response to gravity; this is a tropism and under hormonal control and not under neural control.

7. Saluting by a soldier in the presence of a superior officer; this is learned operant behavior using skeletal muscles.

8. Winking your eye to attract attention: the eye blink is one of those responses which can be either voluntary or involuntary; in this case it is a voluntary response which has been reinforced in the past

by social attention.

!---

.i 4.0:

!---

Related to learning, there are two types of reflexes observed in humans: unconditioned reflexes and conditioned reflexes. For example, if you salivate when food has been placed in your mouth that reflex is unconditioned because the reflex is innate and does not require any conditioning history. However, if you salivate when you smell food, see a picture of food, or just read about food, then this is learned behavior and therefore is called a conditioned reflex. The term for a stimulus producing a response is elicitation. Therefore, a stimulus elicits a reflexive response.

It can be seen that all reflexive behavior is in response to specific stimuli. Many of the more familiar reflexes, such as the pupillary contraction, the knee-jerk, and withdrawal reflexes, are called phasic reflexes and have a brief response duration. In contrast are the tonic reflexes, such as those involved in balance and posture, which consist of a continuous series of adjustments in muscle tension. Standing on one leg
requires different muscle tensions in order to not fall down and is an example of a tonic reflex.

!---

.i 5.0:

!---

A reflex may diminish through the process of habituation. If an eliciting stimulus is repeatedly presented over a period of time, the responses will decrease in size and increase in latency. For example, the loud sound of a gunshot may produce a startle reaction. After 100 gunshots, however, the startle reaction has decreased until it has disappeared completely. After a period of time during which no gunshots are heard, a sudden burst of gunshots will again produce a startle reaction. This effect of the passage of time is called spontaneous recovery. It should be noted that habituation is stimulus-specific so that even after the gunshots no longer produced a startle reaction, the sound of a dynamite explosion would produce a startle reaction.

Habituation should be distinguished from muscular and glandular fatigue. Fatigue is more temporary and a short resting period of several minutes will often restore responding. For example, the leg muscles may fatigue quickly after several dozen demonstrations of the knee-jerk reflex. However, if you wait for 10 minute resting period, the reflex will be seen again. Habituation to the hammer striking the tendon below the kneecap would not occur until perhaps a hundred trials had occurred.

!---
.i 6.0:
!---
The strength of the reflex is typically measured by response latency. In other words, how long does it take for the response to occur after the stimulus has been presented? Response latency varies inversely with stimulus magnitude. For example, the brighter the light, the faster the pupil of the eye contracts. The harder the hammer blow to the knee, the faster the leg swings forward. The size or intensity of the response (response magnitude) and its duration (how long it persists) vary directly with the stimulus magnitude. Using this same example, the brighter the light the more the pupil of the eye will decrease in size and will remain small. The rate of the reflex is not considered an important variable. In fact, a reflex occurring at a high rate will usually diminish as a function of muscular or glandular fatigue.

You will now be asked some questions about reflexes.
!---
.o 6.1:
!---
Which of the following would not be considered a reflex?
!---
.r1; rapid contraction of calf muscles results in leg flexion
.t; Yes, this example would not be considered a reflex because there is no mention of the eliciting stimulus
.w1; pupil constricts due to a flashing bright light
.t; Incorrect, this example is a reflex since the bright light is the eliciting stimulus and the pupillary constriction response
.w2; startle response caused by loud sounds
.t; Incorrect, this example is a reflex since the loud sounds are the eliciting stimulus which produces the startle response
.w3; rapid changes in muscle tension result in balancing on one leg on a tightrope to avoid falling
.t; Incorrect, this example is a reflex involving balance with the tightrope as the stimulus and the changes in muscle tension as the response
.w4; a sudden increase in heart rate and respiration right after a frightening stimulus
.t; Incorrect, this example is a reflex with the frightening stimulus producing the changes in heart beat and respiration rate
!---
.o 6.2:
!---
Check out these examples and find which one is not a reflex.

!--
.r1; pairing the sound of a tone with a light
.t; Good thinking! This example only pairs two stimuli and does not include a response
.w1; an infant puckering his lips and sucking a nipple
.t; Sorry but this example is a reflex since the nipple is the eliciting stimulus and the response is lip puckering
.w2; shivering due to cold temperature
.t; Sorry but this example is a reflex since the cold temperature is the stimulus which produces the response of shivering
.w3; sneezing several times in a row due to an allergic reaction
.t; Sorry but this example is a reflex since the allergy is the stimulus which produces the response of sneezing
.w4; withdrawing your hand after touching a hot stove
.t; Sorry but this example is a reflex since the hot stove is the stimulus which elicits the response of hand withdrawal
!--
.o 6.3:
!--
A person salivates as he chews his favorite chocolate cake. The next day he is very hungry again and sees an ad in a magazine for chocolate cake and begins to salivate. Which reflex is not involved in this example?
!--
.r1; peristaltic reflex
.t; Right, the peristaltic reflex is only involved in food regurgitation in response to an irritation in the esophagus or stomach
.w1; unconditioned reflex
.t; Wrong, since salivating when eating cake is an unconditioned reflex
.w2; hunger pangs
.t; Wrong, since feeling hungry usually means that the stomach pang reflex is felt
.w3; conditioned reflex
.t; Wrong, since salivating in response to a picture of cake is a conditioned reflex
.w4; salivary reflex
!--
.o 6.4:
!--
In the presence of a frightening stimulus, which of the following sequences are not examples of fight or flight reflexes?
!--
.r1; constriction of leg muscles so the person would run away
.t; Good answer! This example is the only one which is not part of the

activation syndrome controlled by the autonomic nervous system
.w1; constriction of the bronchi in the lungs
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w2; vasoconstriction in which the surface blood vessels constrict
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w3; the goose bump reflex in which skin papillae become erect and make the skin rough
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w4; the piloerection reflex in which the hair follicles on the skin become erect
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
!--
.o 6.5:
!--
A reflex is defined as the __________ between a particular stimulus and a particular response in such a way that the stimulus __________ the response. Choose the answers that best fill in the blanks.
!--
.r1; relation, elicits
.t; Correct, this is the standard definition of the reflex
.w1; contrast, produces
.t; Incorrect since the contrast between the stimulus and response is not relevant
.w2; interaction, maintains
.t; Incorrect since the stimulus acts more as a trigger mechanism for the response
.w3; conditioning, reinforces
.t; Incorrect, whether the reflex is conditioned or not is not relevant to its strength
.w4; behavior, connects
.t; Sorry but these terms are too vague
!--
.o 6.6:
!--
To determine the strength of a reflex, it is necessary to know what the response is in the __________ of the stimulus as well as in its __________. Choose the answers that best fill in the blanks.
!--
.r1: absence, presence

.t; Yes, both conditions are necessary to measure the strength of a reflex
.w1; vicinity, location
.t; No, proximity of the stimulus to the response is not relevant
.w2; conditioning, magnitude
.t; No, whether the reflex is conditioned or not is not relevant to its strength
.w3; magnitude, latency
.t; No, latency is only relevant to the strength of the response
.w4; environment, behavior
.t; No, these terms are too vague
!---
.o 6.7:
!---
The strength of a reflex may diminish through all of the following except one. Choose it.
!---
.r1; spontaneous recovery
.t; Right, since in spontaneous recovery the strength of a reflex is increased without any further training following a rest period
.w1; habituation
.t; Wrong, habituation involves the repeated presentation of a weak US until the response diminishes
.w2; muscle fatigue
.t; Wrong, muscular fatigue will temporarily weaken reflexive behavior
.w3; inhibition
.t; Wrong, the presentation of an aversive stimulus can inhibit or prevent the reflex from occurring
.w4; gland fatigue
.t; Wrong, glandular fatigue will temporarily weaken reflexive behavior
!---
.o 6.8:
!---
Which of the following reflexes is of continuous and not brief duration?
!---
.r1; tonic reflexes
.t; Yes, tonic reflexes occur in a continuous series of adjustments in muscle tension such as those involved in balance and posture
.w1; phasic reflexes
.t; No, phasic reflexes are brief protective movements such as the limb withdrawal reflex
.w2; righting reflex
.t; No, this is a vestibular reflex in which brief movements cause the head to assume a normal orientation to the ground when falling

.w3; flexion reflex
.t; No, in the flexion reflex a hand or foot is quickly withdrawn in response to an aversive stimulus
.w4; orienting reflex
.t; No, in a orienting reflex the head in quickly turned in the direction of a sudden stimulus
!--
.o 6.9:
!--
A young infant will grasp any object put in its hand. After a while he will start to clench his fist when he sees an object moving towards his hand. Which of the following is not related to this example?
!--
.r1; tonic reflex
.t; Good, the tonic reflex is only related to maintaining balance and posture and not this example of a grasping reflex
.w1; conditioned stimulus
.t; Wrong, the conditioned stimulus is the object the infant can see and he starts clenching his fist before he touches it
.w2; conditioned response
.t; Wrong, the conditioned response is grasping its fist when it sees an object
.w3; unconditioned stimulus
.t; Wrong, the unconditioned stimulus is any object when placed in the infant's hand
.w4; unconditioned response
.t; Wrong, the unconditioned response is the infant's grasping movement in response to an object placed in its hand
!--
.i 7.0:
!--
Let's turn to a discussion of respondent behavior. It is behavior that is elicited by a particular stimulus called the antecedent and it is not affected by consequences. Therefore, it is a reflexive type response that is triggered by an eliciting stimulus. Usually it involves the involuntary responses of the smooth muscles and glands or other involuntary effector organs. Examples include many of the reflexes we have studied such as the heart beat, gland secretion, peristaltic movement of the intestines, pupil contraction or dilation in the eye, coughing or sneezing, sweating, and milk release in lactating women. It is also involved in much of what we call emotions, feelings, and attitudes.
!--
.i 8.0:

!--
Respondent conditioning is a procedure which was first demonstrated by the Russian physiologist Pavlov at the turn of the century. Pavlov's original experiment involved a dog placed in a harness. A tube was implanted in its cheek to measure drops of saliva. When a bell tone was rung the dog pricked up its ears and turned its head towards the sound. With successive rings, however, these orienting responses diminished in magnitude and then disappeared. The sound became a neutral stimulus.

When Pavlov placed meat powder in its mouth, the dog made salivating and chewing movements. A bell tone was then rung 5 seconds before each food delivery. After several pairings the dog began to salivate and chew during the 5 second interval between the bell tone and presentation of the meat powder. Eventually (after 30 to 50 pairings), the dog salivated and chewed at the sight of the bell alone, even if on occasional trials the food was omitted.

Note that only salivating is considered respondent behavior. Chewing is performed by the skeletal muscles of the jaw and was evoked by the salivary response, not by the bell tone.
!--
.i 9.0:
!--
The procedure of respondent conditioning can be diagramed as follows:

Neutral stimulus---> NS (bell tone)---> Orienting response---> No response
Unconditioned reflex---> US (meat powder)---> UR (salivating)
Respondent
conditioning---> US (meat powder)---> UR (salivating)
CS (bell tone)---> CR (salivating)
Conditioned reflex---> CS (bell tone)---> CR (salivating)

This procedure is sometimes called stimulus substitution because the CS replaces the US in eliciting a response.
!--
.i 10.0:
!--
The strength of respondent conditioning can be measured in several ways. For the Pavlov experiment it could include the following:

1. The number of drops of saliva.
2. The elapsed time between the ringing of the bell tone and the secretion of saliva.

3. The number of pairings of the bell tone with the meat powder before the bell tone by itself would produce a measurable amount of saliva.
4. The number of times the bell tone could be later presented without following it by meat powder before the salivary response would disappear.

Any one of these could be used to determine the effect of the bell tone as a conditioned stimulus.
!--
.i 11.0:
!--
In higher-order respondent conditioning a second CS is paired with the first CS and comes to elicit the CR despite the fact that the second CS was never paired directly with the US. For example, after pairing the bell with meat powder, a light could be paired with the bell. After several pairings, the light by itself would come to elicit salivation.

An example with humans could consist of pairing a weak shock (which elicits a galvanic skin response) with the presentation of flashing lights. After several pairings, then pair the flashing lights with a musical tone of middle C. Occasionally the flashing lights would continue to be paired with the shock when the tone was not on. Eventually, the middle C tone will come to elicit a galvanic skin response by itself when no lights are present.

Let's now try to answer some questions about respondent conditioning.
!--
.o 11.1:
!--
Which of the following terms does not refer to respondent conditioning procedures?
!--
.r1; reflexive behavior
.t; Yes, reflexive behavior is innate and occurs automatically
without any training
.w1; S -- > R learning
.t; Sorry but S ---> R refers specifically to respondent conditioning procedures
.w2; stimulus substitution
.t; Sorry but stimulus substitution is another synonym for respondent conditioning
.w3; classical conditioning
.t; Sorry but classical conditioning is refers back to the original Pavlov

experiments and is a synonym for respondent conditioning
.w4; 2-term contingency
.t; Sorry but the 2-term contingency refers to the stimulus eliciting the response in respondent conditioning
!---
.o 11.2:
!---
Respondent behavior includes all of the following characteristics except which of the following?
!---
.r1; it is affected by consequences
.t; Good thinking! Respondent behavior is most often affected by antecedent and not consequent stimuli
.w1; elicited by a particular stimulus
.t; No, respondent behavior is elicited by a particular stimulus
.w2; involves smooth muscles
.t; No, respondent behavior does use smooth muscles
.w3; an involuntary response
.t; No, respondent behavior does consist of involuntary responses
.w4; two stimuli are paired together
.t; No, respondent behavior does refer to the pairing to two stimuli, usually one of them neutral, in order to produce a new conditioned stimulus
!---
.o 11.3:
!---
The strength of respondent conditioning can be best measured by all of the following except which one?
!---
.r1; magnitude of the CS
.t; Correct, the magnitude or intensity of the conditioned stimulus is not a good measure of the strength of respondent conditioning
.w1; resistance to extinction
.t; Incorrect, resistance to extinction is a good measure of the strength of respondent conditioning
.w2; number of pairings with a US necessary before a CS appears
.t; Incorrect, the number of pairings necessary before the CS first appears is a good measure of the strength of respondent conditioning
.w3; latency of the CR
.t; Incorrect, the latency of the conditioned response is an excellent measure of the strength of respondent conditioning
.w4; magnitude of the CS
.t; Incorrect, the magnitude of the CR is usually a good measure of the strength of respondent conditioning- examples would be drops of saliva or

extent of muscular movement
!--
.o 11.4:
!--
What was not a conditioned stimulus in the Pavlov experiment?
!--
.r1; the meat powder
.t; Right, the meat powder placed in the dog's mouth was an unconditioned stimulus for salivation
.w1; the light paired with the bell
.t; Wrong, the light and the bell were both conditioned stimuli
.w2; sight of the meat powder
.t; Wrong, the sight of meat powder, having been paired with the taste of meat powder, was a CS for salivation
.w3; odor of the meat powder
.t; Wrong, the odor of the meat powder, having been paired with the taste of meat powder, was a CS for salivation
.w4; the bell tone
.t; Wrong, Pavlov's experiment was to pair the bell tone with the taste of meat powder so the tone would become a Cs and elicit salivation by itself
!--
.i 11.5:
!--
Which of the following would probably not be respondent behavior?
!--
.r1; contractions of the biceps and triceps
.t; Yes, these are antagonistic skeletal muscles so that when the biceps relaxes and the triceps contracts, the arm is then extended
.w1; constriction of bronchi in the lungs
.t; No, the walls of the bronchi are lined with smooth muscles so their constriction would either be an unconditioned reflex or respondent behavior
.w2; bladder contractions
.t; No, the walls of the bladder are lined with smooth muscles so contractions would either be an unconditioned reflex or respondent behavior
.w3; secretion of adrenaline
.t; No, adrenaline is secreted into the blood system by the adrenal glands either as an unconditioned reflex or as respondent behavior
.w4; peristaltic contractions of the esophagus
.t; No, the walls of the esophagus are lined with smooth muscles so peristaltic contractions would be either an unconditioned reflex or respondent behavior
!--
.i 11.6:

!--
In second-order conditioning, which of the following procedures would not be considered an error?
!--
.r1; pairing the second CS with the first CS
.t; Great! This is the standard procedure to follow in higher-order conditioning and so it is not an error
.w1; pairing the second CS with the US
.t; Oops! In higher-order conditioning you never pair the second CS with the US so this is an error
.w2; pairing the first CS with the US
.t; Sorry but this is only used in first-order conditioning and so would be an error
.w3; pairing the second CS with a NS
.t; Sorry but this is the procedure in third-order conditioning and so would be an error
.w4; pairing two US's together
.t; Sorry but this is not standard procedure and so it is an error
!--
.i 11.7:
!--
Which of the following is not true of respondent conditioning procedures?
!--
.r1; it is affected by consequences
.t; Yes, respondent conditioning takes place by pairing antecedent stimuli
.w1; the response is elicited
.t; No, in respondent conditioning procedures the response is elicited
.w2; the response is controlled by a prior stimulus
.t; No, in respondent conditioning procedures the response is controlled by a prior stimulus
.w3; it usually involves smooth muscles and glands
.t; No, respondent conditioning does usually involve smooth muscles and glands
.w4; it pairs two stimuli
.t; No, respondent conditioning does involve the pairing of two stimuli
!--
.i 11.8:
!--
The speed of a reflex is ______________.
!--
.r1; either fast or slow
.t; Good thinking, a withdrawal reflex may occur in as little as 1/100th of a second while the constriction of the iris in response to bright light may

take 2 seconds
.w1; very fast
.t; Sorry but some reflexes can take up to 2 seconds to occur
.w2; medium fast
.t; Sorry but some reflexes can take up to 2 seconds to occur
.w3; medium slow
.t; Sorry but some reflexes can occur in as little as 1/100th of a second
.w4; impossible to predict
.t; Sorry but most reflexes occur at a characteristic speed and so can be predicted
!---
.i 11.9:
!---
Which of the following is not a good procedure to use in respondent conditioning?
!---
.r1; pair a neutral stimulus with an orientation stimulus
.t; Good, since the process of habituation would make the stimulus lose its status as an unconditioned stimulus
.w1; pair a neutral stimulus with a visual stimulus
.t; No, in fact, this is a common procedure in respondent conditioning
.w2; pair a neutral stimulus with a gustatory stimulus
.t; No, in fact, this is a common procedure in respondent conditioning and was what Pavlov used with the taste of meat powder
.w3; pair a visual stimulus with an auditory stimulus
.t; No since this is a common procedure in higher-order respondent conditioning
.w4; pair an auditory stimulus with a tactile stimulus
.t; No since this is a common procedure in higher-order respondent conditioning
!---
.i 12.0:
!---
Now that we have studied now respondent procedures can increase responding, let's look at some procedures which decrease responding.

Respondent extinction can be demonstrated by continuing the Pavlov example. If a dog is conditioned to salivate at the tone of a bell, but later the bell is repeatedly rung without pairing it with food, the bell tone will eventually cease to elicit or produce salivation. Repeatedly presenting the CS without the US describes the process of respondent extinction.

If at a later time the bell tone is again presented, some salivary responses

will again occur in a phenomenon known as spontaneous recovery.

Respondent punishment (also known as aversive counter-conditioning) can be demonstrated by pairing a bell tone with a painful electric shock. If the bell tone previously had elicited salivary responses, after several new pairings the bell tone will now inhibit or eliminate (depending on the strength of the shock) salivation by itself. It will also elicit emotional responses of increased heart rate and adrenaline secretion. This pairing of a reinforcing and an aversive stimulus produces an inhibition of the conditioned response in the presence of the reinforcing stimulus by itself. Respondent punishment is commonly used to decrease problems behaviors such as drinking, smoking, overeating, and sexual fetishes. It should not be confused with the procedure of counterconditioning in which a reinforcing stimulus is paired with a conditioned aversive stimulus as in the treatment of phobias.

Let's try some questions related to respondent procedures to decrease behavior.

!---

.o 12.1:

!---

The strength of a response may decrease by all of the following procedures except one. Which is it?

!---

.r1; conditioning

.t; Correct, the procedure of conditioning increases the response strength

.w1; muscle fatigue

.t; Incorrect, muscular fatigue may temporarily decrease the strength of a response

.w2; gland fatigue

.t; Incorrect, glandular fatigue may temporarily decrease the strength of a response

.w3; satiation

.t; Incorrect, satiation may decrease the strength of a response since the organism is physiologically unresponsive to consummatory stimuli

.w4; habituation

.t; Incorrect, habituation will decrease responding to a specific stimulus if it is presented repeatedly

!---

.o 12.2:

!---

In aversive counterconditioning a stimulus which is ____________ is paired with another stimulus which is ____________.

!--
.r1; reinforcing, aversive
.t; Exactly, this is the standard definition of aversive counterconditioning or respondent punishment
.w1; conditioned, unconditioned
.t; Sorry but this answer is too vague
.w2; reinforcing, neutral
.t; Sorry but neutral stimuli are not used in the aversive counterconditioning procedure
.w3; neutral, aversive
.t; Sorry but neutral stimuli are not used in the aversive counterconditioning procedure
.w4; aversive, aversive
.t; Sorry but only one of the stimuli paired in this procedure can be aversive
!--
.o 12.3:
!--
In a new weight reduction program, in order to get quick results every time a person tastes some favorite high-calorie foods, a rancid odor is then presented as an aversive consequence. What's wrong with this aversive counterconditioning procedure?
!--
.r1; the aversive stimulus must be presented just before the response of eating
.t; Good for you! You noticed that the aversive stimulus must be presented just before the reinforcing stimulus in order to decrease the response
.w1; the aversive stimulus must be presented at least a minute before the response of eating
.t; Wrong, there is too much time elapsed between the presentation of the aversive and reinforcing stimulus
.w2; the aversive stimulus must be presented at least a minute after the response of eating
.t; Wrong, the aversive stimulus cannot be presented after the reinforcing stimulus
.w3; the aversive stimulus must be presented simultaneously with the food eating
.t; Close but there is a more effective pairing procedure in order to reduce eating high calorie foods
.w4; the aversive stimulus must be presented immediately after the eating to pair the high calorie food and rancid order together and not as a consequence
.t; Close but there is a more effective pairing procedure in order to reduce

eating high calorie foods
!--
.o 12.4:
!--
During behavior therapy, a person trying to stop smoking is squirted in the face with a mist of water every time he takes a puff on his cigarette. However, after several weeks of treatment he still has not lost his desire to stop. Which of the following could account for this failure of treatment?

!--
.r1; the water mist was not a strong aversive stimulus
.t; Yes, it appears that the reinforcing effects of nicotine were much stronger than the weak aversive effect of the water mist
.w1; the water became a reinforcing stimulus
.t; Possibly but not likely
.w2; the person changed his mind about stopping smoking
.t; Sorry but a person's changed behavior is due to a change in the contingencies
.w3; the person was satiated
.t; Not likely since nicotine is an addictive drug and it is not easy to become satiated smoking, usually you just crave more
.w4; the person habituated to the water mist
.t; No, this is not possible since nicotine is an addictive drug and not a startle or orientation stimulus
!--
.o 12.5:
!--
A tone has been paired with lemon juice to elicit salivation. Now the tone is continually presented but is no longer paired with anything. After a period of time the tone will again become a neutral stimulus. This procedure is called which of the following?
!--
.r1; respondent extinction
.t; Good for you! In respondent extinction a CS presented without any further pairings with the US will eventually become a neutral stimulus again
.w1; respondent conditioning
.t; No, in the respondent conditioning procedure an NS is paired with a US and becomes a CS
.w2; respondent punishment
.t; No, in respondent punishment an aversive stimulus is paired with a reinforcing stimulus
.w3; habituation

.t; Close but in habituation a relatively weak US is repeatedly presented until the response diminishes
.w4; satiation
.t; Close but in satiation a consummatory US is repeatedly available until a becomes an NS for a short time period
!---
.o 12.6:
!---
In aversive counterconditioning the aversive stimulus is paired either a(n) _______________ or a(n) _______________.
!---
.r1; unconditioned stimulus, conditioned stimulus
.t; Yes, in aversive counterconditioning an aversive stimulus is paired with either a conditioned or unconditioned reinforcing stimulus in order to decrease responding. An example of a conditioned stimulus would be pornography while an example of an unconditioned stimulus would be the effect of an addictive drug
.w1; reinforcing stimulus, aversive stimulus
.t; No, there is only one aversive stimulus in this procedure
.w2; antecedent stimulus, aversive stimulus
.t; No, there is only one aversive stimulus in this procedure
.w3; weak stimulus, strong stimulus
.t; No, typically the paired stimulus is strongly reinforcing since the behavior elicited by it is difficult to stop
.w4; stereotyped stimulus, consequent stimulus
.t; No, the procedure uses only antecedent stimuli
!---
.o 12.7:
!---
Which of the following effectors would not be easily respondently conditioned?
!---
.r1; relaxation of an extensor muscle
.t; Right, these are skeletal muscles founds in the limbs and are susceptible to operant conditioning
.w1; eye blink
.t; Sorry but the eye blink reflex can be either respondently or operantly conditioned
.w2; pupillary dilation
.t; Sorry, even through the dilation of the iris is controlled by skeletal muscles, it is a protective reflex and so can be respondently conditioned
.w3; adrenal gland secretion
.t; Sorry but glandular secretions are easily respondently conditioned

.w4; knee-jerk
.t; sorry, even though the knee-jerk reflex is controlled by skeletal muscles, it is a protective reflex and so can be respondently conditioned
!---
.o 12.8:
!---In pairing a puff of air with a light, the light will eventually come to elicit the eye blink reflex. The light can also be paired with a tone and it will eventually elicit an eye blink reflex itself. This procedure is called higher-order conditioning. However, unless the ________ and _________ are still occasionally paired, the tone will lose its conditioning status.
!---
.r1; light, puff of air
.t; Exactly, unless the light as the first CS and the puff of air as the US are still occasionally paired, the light will become a neutral stimulus again
.w1; tone, puff of air
.t; No, the tone as the second CS is never paired with the US which is the puff of air
.w2; puff of air, eye blink reflex
.t; No, the US is paired with other stimuli and not with reflexes themselves
.w3; tone, light
.t; No, the light as the first CS must be paired with an unconditioned stimulus
.w4; tone, eye blink reflex
.t; No, the CS is paired with other stimuli and not with reflexes themselves
!---
.o 12.9:
!---
A weak electrical charge is paired with a tone and both then elicit a galvanic skin reflex. Another procedure is introduced and after repeated trials the reflex weakens until it can barely be detected. This phenomenon could be due to all of the following except one. Choose it.
!---
.r1; satiation
.t; Right, satiation is only possible with consummatory reinforcers and not with aversive stimuli like electric shock
.w1; habituation
.t; Close but habituation can occur with a relatively weak aversive stimulus
.w2; fatigue
.t; Sorry but repeated presentation of the US may result in muscular and glandular fatigue which could temporarily diminish the reflex

.w3; extinction
.t; Sorry but by no longer pairing the tone and electrical charge the tone will gain become a neutral stimulus
.w4; counterconditioning
.t; Sorry but by pairing a reinforcing stimulus with a weak electrical charge the reflex may diminish
!---
.i 13.0:
!---
We now turn our attention to operant behavior. It is defined generally as behavior which is susceptible to operant conditioning. This behavior often appears spontaneously rather than as a reaction to stimulation; it may or may not be evoked by a current stimulus.

The term "operant" refers to a class of responses which have particular consequences and which operate on the environment. The response class is defined, therefore, by the stimulus it produces. Operant conditioning usually involves the voluntary responses of the skeletal muscles or other voluntary effector organs. It is affected by consequences and is described by the 3-term contingency: S --> R --> S.

Examples include any action of the skeletal muscles such as running, jumping, throwing, talking, playing the piano, dancing, and doing somersaults. Operant behavior is also involved in more complex responses such as reasoning and problem-solving using language. There may be no obvious antecedent stimulus and there is always a consequent stimulus after the behavior has occurred. This consequential stimulus is said to be dependent or contingent upon the prior response. Respondent behavior is said to be elicited by a stimulus while operant behavior is said to be evoked if the antecedent stimulus is apparent.

The response component of the contingency also has the additional requirements of time and number in order to be effective. A nonexample of number is that in a FR 10 schedule, the first 9 responses are not reinforced. A nonexample of time is that in a FI 2-min schedule, a response made after 1 minute has elapsed is not reinforced. Other more complicated schedules may require a certain number of responses within a specified time period.
!---
.i 14.0:
!--- These are three basic procedures designed to alter operant behavior: conditioning (or reinforcement), extinction, and punishment. Operant conditioning is a

procedure in which behavior is increased. There are two ways to do this: positive reinforcement and negative reinforcement. Let's look at some nonexamples:

1. Positive reinforcement: Every time a 6 month old baby utters a vocal sound its mother picks him up and hugs him. However, she picks him up whether he is cooing softly or crying loudly. This is a nonexample because it is positive reinforcement for vocal behavior in general but it will not increase the frequency of the baby making cooing sounds.

2. Negative reinforcement: When it starts raining, a man remembers he forgot his umbrella so he is unable to stay dry and gets soaking wet by the time he reaches his office. This can only be considered negative reinforcement for staying dry if he has the umbrella, raincoat, so some other means to avoid getting wet.

3. Negative reinforcement: When an alarm goes off in the morning a woman gets out of bed, gets dressed, and drives to work. Getting out of bed, getting dressed, and driving to work right away is negative reinforcement for not being late to work. However, on days she forgets to set the alarm she ends up being late for work. This is negative reinforcement only when an aversive stimulus can be removed or turned off.

4. Positive reinforcement: A teacher is working with an autistic child with no verbal skills. Every time the teacher says, "Look at me" and the child gives the teacher eye contact, then the teacher presents the child with a poker chip token which can be exchanged for sips of juice. However, in order to be nice she decides that even when the child doesn't comply tokens will still be given This is not a good positive reinforcement procedure for compliance behavior since the child is only reinforced for complying and not complying.

!---

.i 15.0:

!---

The strength of operant conditioning can be measured at least four ways. Let's use the example of reinforcing a pigeon for key pecking behavior with grain. The strength of the behavior can be measured by any of the following:

1. the rate of key pecking
2. the intensity of the key pecks

3. the number of grain presentations necessary before key pecking behavior is established
4. the number of key pecks still produced after grain is removed and no reinforcement is given.

Now let's use an example of measuring the strength of behavior with people. A child is learning to tie his shoes and is reinforced by verbal praise from his parents. The strength of the behavior can be measured by any of the following:

1. The response duration or how long it takes to tie his shoes
2. The number of practice trials it takes before he can tie his shoes correctly
3. The response latency or how long it takes from the time he is asked to tie his shoes and he starts tying them
4. The number of times he continues to tie his shoes after parental attention and praise are removed

The increase in behavior is always compared with its previously unreinforced performance, which is called the operant level.

!---

.i 16.0:

!---

It should be noted that an operant reinforcement procedure is only effective when the appropriate motivative variables are present. The same stimulus situation may or may not be reinforcing depending on the deprivation or satiation state of the organism. For example, if the pigeon was not hungry it would not be motivated to peck the disk. If the child was mad at his parents and didn't want their attention and approval, he would not want to tie his shoes.

The term "conditioning" as used here is synonymous with both "reinforcement" and "strengthening." Please remember that reinforcement is a functional definition in that the procedure is always defined by its consequences. Both positive and negative reinforcement will increase behavior in similar situations in the future. For example, if someone smiles when you say hello, you will have an increased tendency to say hello when seeing that person again. This is positive reinforcement. When you turn on the stereo and the music is so loud it hurts your ears, turning down the volume is negative reinforcement. In the future you will have an increased tendency to immediately turn down the volume when turning on the stereo.

Let's try some questions to see how well you understanding operant

conditioning.

!--

.o 16.1:

!--

Which of the following is not a characteristic of operant behavior?

!--

.r1; it is elicited by a particular stimulus
.t; Right, stimuli elicit respondent behavior
.w1; it is affected by consequences
.t; Wrong, operant behavior is affected by consequences in the sense that there is an increased probability to respond similarly in the future
.w2; it may appear spontaneously
.t; Wrong, operant behavior may not have any obvious antecedent stimulus which evokes the behavior
.w3; it is described by the 3-term contingency
.t; Wrong, operant conditioning is often described by the S--->R--->S model
.w4; it involves voluntary responses of the skeletal muscle system
.t; Wrong, operant behavior is often considered "voluntary" and uses the skeletal muscles of the trunk and limbs

!--

.o 16.2:

!--

A general definition of operant conditioning would be that an environment-behavior relation is _____________ by arranging a consequence _____________ upon a response.

!--

.r1; strengthened, contingent
.t; Exactly, this is the standard definition of operant conditioning
.w1; allowed, following
.t; No, these terms are too vague
.w2; weakened, dependent
.t; No, operant conditioning does not weaken an environment-behavior relation
.w3; conditioned, following
.t; No, these terms are too vague
.w4; maintained, immediately
.t; Close but operant conditioning does more than just maintain a stimulus-response relation, it strengthens it so it is more like to reoccur in the future

!--

.o 16.3:

!--

A person turns the ignition key is his car and hears a loud buzzing noise indicating that his seat belt is not fastened. The next time he starts his car

he is more likely to fasten his seat belt first in order to avoid the noise. Although an aversive stimulus is involved, this is not an example of punishment since behavior is increased and not decreased. Choose which conditioning procedure it is.

!--

.rl; negative reinforcement

.t; Good, the removal of an aversive stimulus acts as reinforcement to increase that behavior in the future

.wl; positive reinforcement

.t; Sorry, even though behavior is increased it occurs by removing and not presenting a stimulus

.w2; operant behavior

.t; Sorry but operant behavior just refers to behavior which is susceptible to operant conditioning- it is not a procedure

.w3; respondent conditioning

.t; Sorry but this procedure uses consequent stimuli

.w4; spontaneous recovery

.t; Sorry but spontaneous recovery only follows an extinction or habituation procedure

!--

.o 16.4:

!--

Behavior that is susceptible to operant conditioning usually involves all of the following effectors except one. Choose the exception.

!--

.rl; skeletal muscle reflexes

.t; Good thinking! A small number of skeletal muscles which act in a reflex to protect the boy from aversive stimuli can only be respondently conditioned

.wl; arm flexor muscles

.t; No, flexor muscles contract when raising the arm and can be operantly conditioned

.w2; leg extensor muscles

.t; No, extensor muscles relax when extending the leg and can be operantly conditioned

.w3; antagonistic joint muscles

.t; No, antagonistic muscles in the joints alternatively contract and relax in order to move the limbs- they can be operantly conditioned

.w4; voluntary effectors

.t; No, the voluntary effectors are all susceptible to operant conditioning

!--

.o 16.5:

!--

What are the two other important factors in the 3-term contingency?
!--
.r1; time and number for the response
.t; Yes, after the response is evoked it must occur either a certain number of times and/or within or after a specified time period in order to be following by a consequating stimulus
.w1; the stimulus and response
.t; Sorry but they are already in the original 3-term contingency of S--->R-->S
.w2; cause, effect
.t; Sorry but these terms are too vague
.w3; motivation and stimulation
.t; Sorry but the stimulation is represented by the arrows in the S--->R--->S sequence
.w4; receptor and effector organs
.t; Sorry but these organs are the part of the body which detects and responds to stimulation within and outside of the body and so are what is conditioned but not responsible for causing the conditioning- a subtle point
!--
.o 16.6:
!--
Which of the following is not a measure of operant conditioning?
!--
.r1; the rate of the stimulus
.t; Correct, the properties of the stimulus itself are not a measure of operant conditioning
.w1; the magnitude of the response
.t; Incorrect, the magnitude or intensity of the response is a measure of the strength of conditioning
.w2; the rate of the response
.t; Incorrect since response rate is probably the best measure of the strength of conditioning
.w3; trials to criterion
.t; Incorrect, the number of times a consequent stimulus follows a response before the behavior is changed to a criterion level is one measure of the strength of conditioning
.w4; total number of responses during extinction
.t; Incorrect, the number of unreinforced responses during an extinction phase before the behavior returns to its baseline level is one measure of the strength of conditioning
!--
.o 16.7:
!--

In an operant conditioning procedure warm temperature is paired with a red light and cold temperature is paired with a blue light. Later when a red light is on, a person will take off his coat but when a blue light is on he will button up his coat. By the process of elimination, which procedure is this?

!---

.r1; negative reinforcement

.t; Excellent! The situation can be analyzed as removing the aversive stimuli of overly hot or cold temperatures

.w1; positive reinforcement

.t; Close since the behavior results in more comfortable temperatures, however, something else had to occur first

.w2; habituation

.t; No, although the process of habituation would eventually make a person more comfortable, it is also a passive process which the person cannot do anything to speed it up

.w3; satiation

.t; No, satiation is involved with consummatory stimuli and not temperature

.w4; 3-term contingency

.t; Sorry but this term is too vague

!---

.o 16.8:

!---

Operant conditioning is contrasted with respondent conditioning in that the former behavior is ____________ and in the latter behavior is _____________.

!---

.r1; evoked, elicited

.t; Yes, these verbs describe separate conditioning procedures

.w1; produced, triggered

.t; Sorry but these are more laymen's terms and not technical psychological terms

.w2; elicited, evoked

.t; Sorry but you seem to have confused respondent and operant procedures

.w3; stronger, weaker

.t; Sorry but the strength or weakness of conditioning procedures is dependent on many factors

.w4; conscious, unconscious

.t; Sorry but the awareness or unawareness of conditioning does not distinguish respondent and operant procedures

!---

.o 16.9:

!--

In an experiment a rat presses down a lever and gets a food pellet. In order to test if the animal really understands the connection between lever pressing and food reinforcement, the food is now delayed for 5 minutes after the response. What would you expect to happen?

!--

.r1; the rate of lever pressing will decrease
.t; Correct, the increased delay between the response and consequence acts to weaken the response-stimulus relation
.w1; the rate of lever pressing will stay the same
.t; Incorrect, the increased delay for the consequent stimulus will have an effect on behavior
.w2; the rate of lever pressing will increase
.t; Incorrect, the increased delay does not act as reinforcement
.w3; the duration of lever pressing will increase
.t; Incorrect, since the reinforcing stimulus will be further delayed until the lever is released
.w4; the latency from reinforcement to lever pressing will decrease
.t; Incorrect, the increased delay between behavior and its consequence will increase latency for the next response

!--

.i 17.0:

!--

Operant extinction is a procedure used to decrease behavior by the nonreinforcement of previously reinforced behavior. It usually has the side effect of increasing the variability of the response. Often the rate and intensity of the behavior will temporarily increase at the start of the extinction procedure before it starts decreasing. This phenomena is called an extinction burst and can produce some aggressive behavior.

Some nonexamples of operant extinction are as follows:

1. After a large meal a person is offered a variety of delicious deserts but he turns them all down. This is an example of satiation in which reinforcement is available but not valuable at the time.
2. A student in gym class can earn bonus points by doing 100 situps and 50 pushups. However, after starting quickly his behavior gradually gets slower and slower until he stops after 50 pushups and 25 situps. This decrease in responding is more likely due to muscle fatigue than operant extinction.
3. A teacher gives out special colored stickers to elementary students who complete all extra credit math problems. Most students complete all the problems in 10 minutes and get the

stickers. However, several students work very hard at first but then just stare on their papers and stop responding. The decrease in responding may be due to the increased difficulty level of the work and not due to the reinforcers not being valuable.

4. You put a quarter in a vending machine to buy a drink. The machine keeps your money but no drink is produced. Although it is true that reinforcement was withheld following the response, most people would not start putting quarters more slowly into the machine but just realize the machine was broken after the first quarter didn't work.

!---

.i 18.0:

!---

The procedure of extinction does not permanently eliminate the behavior since, after a long resting period (e.g., a day), the operant behavior will again temporarily increase in a phenomenon called spontaneous recovery. This can be seen in the following nonexamples:

1. The child cries for 5 minutes when put in bed at night; 1 minute after he stops crying he starts crying again. The time period is too short to be considered spontaneous recovery.

2. The same child cries for 5 minutes and then stops crying the briefly. The parent walks back into the room and the child starts crying again. The presence of the parent is a cue to start crying again since, in the past, the parent always picked up the child when it cried.

The procedure of extinction should be distinguished from forgetting in which the behavior reduction is due only to the passage of time and not the removal of a specific contingency. For example, a person who loses a quarter on the ground may spend some time searching for it. The next day he may look briefly for it again if he passes by the same area. But after a time period of several months the person who lost his quarter may forget all about it.

!---

.i 19.0:

!---

Resistance to extinction is one measure of the strength of reinforcement. Extinction does occur more rapidly following a continuous reinforcement procedure rather than a partial or intermittent procedure. For example, if a pigeon was given grain after every key peck for 10 minutes and then grain was withheld, extinction would occur rather quickly. If the pigeon

was given grain after 50 key pecks for a 10 minute period, then extinction would occur more slowly.

The strength of extinction is measured by the change in the rate of responding during the procedure and the total number of responses before the behavior returns to its baseline rate prior to conditioning. In the pigeon example, the total number of key pecks that occurred during extinction would be much greater after the intermittent reinforcement schedule (FR 50) than after the continuous reinforcement (CRF) schedule.

We will now try some questions related to operant extinction.
!---
.o 19.1:
!---
What is a distinctive feature that makes extinction different in an operant vs. respondent procedure?
!---
.r1; in operant extinction the reinforcing stimulus is withheld after the response
.t; Exactly, the stimulus is withheld in operant extinction while the stimulus is not paired in respondent extinction
.w1; in operant the stimulus occurs at the same time as the response
.t; No, the stimulus comes either before or after the response in operant and respondent procedures
.w2; in operant the stimulus occurs just before the response
.t; No, in operant extinction the stimulus is withheld after the response
.w3; in both procedures reinforcement is no longer available
.t; No, since in respondent extinction the US may still be available but it is no longer paired with the CS
.w4; spontaneous recovery can occur after a rest period
.t; No since spontaneous recovery can occur in either respondent or operant extinction
!---
.o 19.2:
!---
A good definition of operant extinction is that it is a procedure in which an environment-behavior relation is ____________ by no longer presenting a ____________ consequence after the response. !---
.r1; weakened, reinforcing
.t; Right, this is the standard definition of operant extinction
.w1; strengthened, punishing
.t; Wrong, this is a definition of negative reinforcement

.w2; neutralized, operant
.t; Wrong, neutralized is not a synonym for weakened
.w3; eliminated, weakened
.t; Wrong, the consequence is withheld and not just weakened
.w4; changed, negative
.t; Wrong, the consequence is withheld although its effects may be negative
!--
.o 19.3:
!--
Operant extinction differs from forgetting in which of the following ways?
!--
.r1; it removes a specific contingency
.t; Correct as forgetting only involves the passage of time
.w1; it occurs more slowly
.t; Incorrect since extinction is quicker than forgetting
.w2; it is not due to amnesia
.t; Incorrect since spontaneous recovery will occur after a resting period in extinction
.w3; it occurs due to the passage of time
.t; Incorrect as extinction is not due to the passage of time by itself
.w4; it has less side effects
.t; Incorrect as extinction usually has the side effect of increasing the variability of the response
!--
.o 19.4:
!--
The decrement in performance demonstrated during extinction is due to the _______________ of the previously _______________ behavior.
!--
.r1; nonreinforcement, reinforced
.t; Exactly! It is this contrast between the reinforced operant level and the nonreinforced baseline level which demonstrates the difference in effect
.w1; punishment, acquired
.t; No, while extinction does decrease behavior it is not considered a punishment procedure
.w2; habituation, learned
.t; No, while habituation does decrease behavior it is entirely different from the extinction procedure
.w3; satiation, deprived
.t; No, the extinction procedure will not have an effect while the organism is under the effects of satiation
.w4; forgetting, learned
.t; No, the existence of spontaneous recovery demonstrates that the

stimulus-response relation is not forgotten

!---

.o 19.5:

!---

Which of the following is not a measure of the strength of the extinction procedure?

!---

.r1; the prior rate of behavior before the extinction procedure
.t; Yes, any previous behavior rate is not a measure of the strength of extinction although it should be a steady state condition in order to obtain a valid contrast
.w1; the change in rate of behavior from the conditioning phase to the extinction phase
.t; Sorry but this change in rate from the conditioning to the extinction phase is of critical importance in measuring the strength of extinction
.w2; the amount of variability during extinction
.t; Sorry but response variability during extinction is one measure of its strength
.w3; total number of responses before the behavior returns to its baseline rate
.t; Sorry but the response total before behavior returns to is unreinforced rate is a common measure of the strength of extinction
.w4; the change in latency from conditioning to extinction
.t; Sorry but stimulus-response latency is a measure of the strength in both respondent and operant conditioning

!---

.o 19.6:

!---

Extinction occurs more rapidly following a(n) ________________ reinforcement period rather than a(n) ________________ procedure.

!---

.r1; continuous, intermittent
.t; Good, a basic principle of extinction is that it occurs much more slowly following an intermittent schedule of reinforcement
.w1; intermittent, continuous
.t; No, you have this point reversed
.w2; brief, lengthy
.t; No, the particular length of the reinforcement schedule is not anywhere as important as the type of schedule used
.w3; strong, weak
.t; No, it would be difficult to predict the speed of extinction unless you knew more about the particular type of schedule used
.w4; operant, respondent

.t; No, the speed of operant vs. respondent extinction depends on other factors

!--

.o 19.7:

!--

Which term is not appropriate to use in referring to the effect on behavior of the extinction procedure?

!--

.r1; extinct

.t; Yes, the term "extinct" only refers to a vanished species and has no meaning in behavioral psychology

.w1; extinguished

.t; No, this term is appropriate

.w2; eliminated

.t; No, psychologists commonly refer to the behavior being eliminated through extinction

.w3; terminated

.t; No, although less common behavior is also referred to as terminated through extinction

.w4; diminished

.t; No, this is a common term used to describe any behavioral weakening procedure

!--

.o 19.8:

!--

After eating a large meal and then misbehaving, a child is told he can no longer have dessert. However, his misbehaviors continue at the same intensity even through reinforcement is being withheld. What is a likely explanation for this failure of extinction?

!--

.r1; satiation makes reinforcement less effective

.t; Right, if the child was no longer hungry then food, even desert, has temporarily lost its appeal

.w1; not enough muscle fatigue has occurred

.t; Incorrect, since eating a meal does not cause muscle fatigue

.w2; the passage of time - the child forgot about dessert

.t; Unlikely as I have never known a child who "forgets" about desert- it's often the most important part of the meal

.w3; no aversive stimulus was withheld

.t; Incorrect as withholding an aversive stimulus is more of an avoidance procedure

.w4; some kind of stimulus inhibition

.t; Incorrect as desert would be an unlikely source of an inhibiting stimulus

!--
.o 19.9:
!--
Extinction does not permanently eliminate behavior since, after a rest period, there will be a temporary increase in the operant behavior- this phenomenon is called _______________.
!--
.r1; spontaneous recovery
.t; Now you've got it! Spontaneous recovery is seen in both operant and respondent extinction and demonstrates that the stimulus-response connection is not lost
.w1; remembering
.t; Sorry but there is evidence that the organism never forgot the stimulus-response relation but that it was inhibited by the removal of the reinforcement contingency
.w2; habituation
.t; Sorry but habituation diminishes behavior and doesn't increase it
.w3; conditioning
.t; Sorry but this effect occurs without any further training
.w4; extinction burst
.t; Sorry but an extinction burst usually occurs right at the beginning of the extinction phase and not following a rest period
!--
.i 20.0:
!--
The last part of operant behavior we shall discuss involves punishment procedures. Operant punishment is a procedure which weakens behavior because the consequence reduces the strength of the response. There are two distinct procedures:

1. The presentation of an aversive stimulus which follows a response is called positive punishment. This procedure can be contrasted with positive reinforcement in which the presentation of a reinforcing stimulus follows a response.

2. The removal of a reinforcing stimulus following a response is called negative punishment. This procedure can be contrasted with negative reinforcement in which an aversive stimulus is removed following a response.

Some nonexamples of punishment procedures are as follows:

1. In a classroom three students have not finished their work at

recess time. The teacher decides to keep them inside as punishment for not completing their work. However, since they are then allowed to play inside the classroom,the reinforcing stimulus of access to free play at recess was not taken away.
2. An autistic child persists in self-injurious behavior by biting his wrist and banging his head against a wall. In order to prevent serious injury without having to use physical restraints all the time, a psychologist arranges mild electric shocks to be given contingent upon each self-injurious episode. After several treatments the behaviors still persist since the child is also given too much social attention after the self-injurious behaviors.
3. A person is caught speeding and given a ticket by a policeman, and as a result has to pay a $25 fine. Here the reinforcing stimulus of money is taken away as punishment but it does not influence speeding behavior in the future since the consequence is so far removed in time from the response.

!--
.i 21.0:
!--

Suppose we wanted to eliminate swearing from a child's verbal repertoire. We could use a punishment procedure which would present an aversive stimulus every time a swear word was used. However, the procedure would not teach what are appropriate substitute words to use on such occasions. The child may also become angry and refuse to continue coming to school. We would normally need to use a separate reinforcement procedure to teach the use of more descriptive or socially acceptable words. In fact, the punishment procedure could often be avoided by just expanding the verbal repertoire.

Thus, punishment does not teach new behaviors but only eliminates or suppresses certain behaviors in those conditions. It also is considered the procedure of last resort since it may produce aggressive or escape behavior.

!--
.i 22.0:
!--

Let's make clear the distinction between punishment and extinction by the following examples:

1. A white rat is on a continuous reinforcement schedule in which every time it pushes down a bar, it receives some sucrose solution in a hopper as reinforcement. Thus bar pressing becomes a well established behavior. Then reinforcement is discontinued completely

so that nothing happens after a bar press response. Gradually the rat loses interest in this behavior and stops pushing the bar.

2. Another white rat is initially on the same continuous reinforcement schedule. This time the procedure change is to produce a loud annoying noise after every bar press. Quickly the rat learns to not make bar press responses any may engage in some aggressive behavior or try to escape from the experimental chamber.

In example number one, an extinction procedure is used which has a more gradual effect. In example number two, a punishment procedure is used which has a much quicker effect. The end result of response elimination is the same.

The strength of the punishment procedure would then be measured by the change in rate of the rat's bar pressing behavior from the reinforcement procedure to the punishment procedure. Or you could count the number of bar presses made during punishment until they ceased completely. In this case the strength would vary depending on the loudness of the noise produced. Of course, an even more effective aversive stimulus would be electric shock or some nauseous odor.

There will now be a final set of questions about operant punishment procedures.

!--

.o 22.1:

!--

Which of the following is not a side effect of punishment procedures?

!--

.r1; muscular fatigue

.t; Good, punishment procedures decrease responding so muscle fatigue should not be a factor

.w1; escape behavior

.t; No, escape behavior is a common side effect of punishment

.w2; elicited aggression

.t; No, elicited aggression is often seen if two animals are in a chamber together, even if only one of them is being shocked

.w3; emotional responses

.t; No, emotional responses of anger and aggressive are a common side effect of punishment

.w4; conditioned aversion to ambient stimuli

.t; No, the punishment procedure often will make other ambient stimuli in the animal chamber as conditioned aversive stimuli

!---
.o 22.2:
!---
Operant punishment can be defined as a procedure in which an environment-behavior relation is ________ by arranging a consequence of responding that __________ the strength of a response.
!---
.r1; weakened, reduces
.t; Exactly, this is the standard definition of operant punishment
.w1; strengthened, alters
.t; Oops! Remember that a punishment procedure never strengthens behavior
.w2; changed, punished
.t; Wrong, strength is not punished or reinforced but only increased, maintained, or decreased
.w3; made aversive, changes
.t; Wrong, only stimuli are made aversive and not stimulus-response relations
.w4; reduced, prevents
.t; Wrong, strength is not prevented but only increased, maintained, or decreased
!---
.o 22.3:
!---
Which of the following is not true of operant punishment?
!---
.r1; it does not use reinforcement
.t; That was a hard one- good for you! Remember that any punishment procedure to decrease behavior is overlaid on top on a reinforcement procedure which is maintaining the behavior in the first place- so in a sense, punishment also includes reinforcement
.w1; spontaneous recovery may occur
.t; Sorry but when mild punishment is used, after a rest period, the phenomenon of spontaneous recovery does occur
.w2; its effects may not be reversible
.t; Sorry but if severe punishment is used, the effects may not be reversible
.w3; stimuli can either be presented or removed
.t; Sorry but punishment can include either removing reinforcing stimuli or presenting aversive stimuli
.w4; it may include either positive or negative stimuli
.t; Sorry but punishment can include either removing positive stimuli or presenting negative stimuli
!---

.o 22.4:

!--

The strength of a punishment procedure is measured by all of the following except one. Choose it.

!--

.r1; contrast in rate between extinction and satiation

.t; Nice job! While extinction and satiation may have similar effects, their contrast is of no relevance to the strength of a punishment procedure

.w1; the intensity of the response to aversive vs. reinforcing stimuli

.t; Incorrect, response intensity is a common measure of the strength of a punishment procedure

.w2; change in rate from baseline to experimental phase

.t; Incorrect, the change in response rate from reinforcement to punishment is the heart of the functional relation

.w3; total number of responses until cessation

.t; Incorrect as this is a common measure of the strength of a punishment procedure

.w4; generalization to similar stimuli

.t; Incorrect, stimuli generalization to similar aversive stimuli is a common measure of punishment strength

!--

.o 22.5:

!--

All of the following except one describes a punishment procedure. Choose it.

!--

.r1; removing a neutral stimulus

.t; Yes, the presence or absence of neutral stimuli has no effect on behavior

.w1; presenting an aversive stimulus

.t; No, this is an example of positive punishment

.w2; removing a reinforcing stimulus

.t; No, this is an example of negative punishment

.w3; increasing the magnitude of the response effort

.t; No, this is an example of positive punishment since more response intensity is required

.w4; increasing the number of responses required

.t; No, this is an example of positive punishment since more effort is required

!--

.o 22.6:

!--

A flexion reflex in response to an aversive stimulus will also decrease the tendency to approach that stimulus in the future. Which procedure is this

an example of?
!--
.r1; operant positive punishment
.t; Good thinking! This is like being burnt by touching a hot stove and so decreasing the probability of touching it again
.w1; operant negative punishment
.t; Wrong since no reinforcing stimulus is removed
.w2; respondent punishment
.t; Wrong since an aversive stimulus is not paired with a reinforcing stimulus
.w3; operant negative reinforcement
.t; Close since an aversive stimulus is removed but not quite since it decreases the probability of future responding
.w4; reflexive behavior
.t; Close since it is a protective skeletal reflex but the question asks for a conditioning procedure
!--
.o 22.7:
!--
Punishment may include all but the following. Choose it.
!--
.r1; increased time delay to reinforcement
.t; Yes since this is more likely to resemble an extinction procedure
.w1; present aversive stimuli after the behavior occurs
.t; No since this is a positive punishment procedure
.w2; remove conditioned reinforcing stimuli after the behavior occurs
.t; No since this is a negative punishment procedure
.w3; increase response effort required
.t; No since this is a positive punishment procedure
.w4; present aversive stimuli just before the behavior occurs
.t; No since this is a respondent punishment procedure
!--
.o 22.8:
!--
Which of the following is not an effect of operant punishment?
!--
.r1; it teaches new behaviors
.t; Correct, punishment decreases behavior but does not teach new behaviors
.w1; it decreases current behavior
.t; Incorrect since a history of past punishment will decrease present behaviors
.w2; it suppresses future behavior

.t; Incorrect since present punishment will decrease or suppress future behaviors
.w3; it produces emotional reactions
.t; Incorrect since punishment produces angry and aggressive behaviors as a side effect
.w4; it evokes escape behavior
.t; Incorrect since past aversive stimuli will evoke escape behavior in the present
!--
.o 22.9:
!--
In distinguishing between extinction and negative punishment procedures, in the former _________________ is taken away while in the later a positive reinforcer is ______________.
!--
.r1; nothing, removed
.t; Yes this is a clear distinction between the two procedures
.w1; a positive reinforcer, taken away
.t; Sorry but you are confusing the two procedures
.w2; an aversive stimulus, not reinforced
.t; Sorry but that is negative reinforcement and extinction
.w3; the conditioned stimulus, eliminated
.t; Sorry but more information is needed on the conditioned stimulus as to whether it is reinforcing or aversive
.w4; a contingency, presented
.t; Sorry but this describes extinction and positive reinforcement
!--
.i 23.0:
!--
You're finished! This completes the program in Basic Concepts in Psychology. You are now ready to take the posttest and preference questionnaire. In one week there will also be a delayed posttest on these concepts. Check with the proctor as to the time and date you should return. I hope you found this program informative and interesting.
!--

Appendix J

PASS Rules + Positive and Negative Examples

! BASIC CONCEPTS IN PSYCHOLOGY.Rules plus positive and negative
! examples
! Author: John B. Connors
! Affiliation: Western Michigan University
! Terms: reflex, respondent behavior (conditioning,
! extinction, and punishment) and operant behavior
! (reinforcement, extinction, and punishment)
!--
.i 1.0:
!--
Welcome to Basic Concepts in Psychology. This is a Computer-Assisted Instruction (CAI) program designed to teach some of the definitions and examples of common terms used in behavioral psychology. By completing this lesson you should be able to talk (both vocal and written) more effectively about environmental events and their function in changing behavior. Precise usage of these terms will allow you to communicate effectively with other scientists when describing the prediction and control of behavior in laboratory and applied settings.

The most important terms being taught will be underlined when they are first introduced, but other supplementary terms will be used for contrast. There are 6 text sections followed by 9 questions each in multiple choice format. Corrective feedback will be given on all answers to questions, whether correct or incorrect. Please don't try to memorize what you are reading. Just read at a rate appropriate for any textbook and try to understand the concepts involved. Normally the program takes about 75 minutes to complete.
!--
.i 2.0:
!--
The most basic type of behavior in animals is called a <u>reflex</u>. In simple terms, a stimulus triggers a response. More formally this behavior is a stereotyped pattern of movement of a part of the body that can be reliably elicited by presenting the appropriate stimulus. The word "appropriate" refers to the fact that no training is required. There is an innate connection between a stimulus and a response. Particular reflexes are usually characteristic of all members of a species.

Another way of explaining the reflex is to say that the relation between a particular stimulus and a particular response is such that, the stimulus elicits or is correlated with the response. It is important to remember that the reflex is composed of both a stimulus component and a response component. The relation between the two events defines the reflex. The reflex is not a stimulus, nor is it a response. Several different stimuli may produce the same response.
!--
.i 3.0:

!--

There are many examples and nonexamples of reflexes which occur in humans which can help explain the concept:

Examples:

1) Pupillary reflex: the change in size (by contraction or dilation) of the pupil of the eye in response to a change in the intensity of light.

2) Patellar reflex: the jerking movement of the lower leg in response to a blow delivered just under the kneecap.

3) Startle reaction: increased heart rate, breathing, and secretion of adrenaline into the blood in response to a new and sudden stimulus.

Nonexamples:

1. The response of coughing: no mention is made of the stimulus involved.

2. A light paired with a bell: it must describe the relation between a stimulus and a response, not only the relation between two stimuli.

3. Winking your eye to attract attention: the eye blink is one of those responses which can be either voluntary or involuntary; in this case it is a voluntary response which has been reinforced in the past by social attention.

!--

.i 4.0:

!--

Related to learning, there are two types of reflexes observed in humans: unconditioned reflexes and conditioned reflexes. For example, if you salivate when food has been placed in your mouth that reflex is unconditioned because the reflex is innate and does not require any conditioning history. However, if you salivate when you smell food, see a picture of food, or just read about food, then this is learned behavior and therefore is called a conditioned reflex.

It can be seen that all reflexive behavior is in response to specific stimuli. Many of the more familiar reflexes, such as the pupillary contraction, the knee-jerk, and withdrawal reflexes, are called phasic reflexes and have a brief response duration. In contrast are the tonic reflexes, such as those involved in balance and posture, which consist of a continuous series of adjustments in muscle tension. Standing on one leg
requires different muscle tensions in order to not fall down and is an example of a tonic reflex.

!---
.i 5.0:
!---
A reflex may diminish through the process of habituation. If an eliciting stimulus is repeatedly presented over a period of time, the responses will decrease in size and increase in latency. For example, the loud sound of a gunshot may produce a startle reaction. After 100 gunshots, however, the startle reaction has decreased until it has disappeared completely. After a period of time during which no gunshots are heard, a sudden burst of gunshots again will produce a startle reaction. This effect of the passage of time is called spontaneous recovery. It should be noted that habituation is stimulus-specific so that even after the gunshots no longer produced a startle reaction, the sound of a dynamite explosion would produce a startle reaction.

Habituation should be distinguished from muscular and glandular fatigue. Fatigue is more temporary and a short resting period of several minutes will often restore responding. For example, the leg muscles may fatigue quickly after several dozen demonstrations of the knee-jerk reflex. However, if you wait for 10 minute resting period, the reflex will be seen again. Habituation to the hammer striking the tendon below the kneecap would not occur until perhaps several dozen trials had occurred.
!---
.i 6.0:
!---
The strength of the reflex is typically measured by response latency. In other words, how long does it take for the response to occur after the stimulus has been presented? Response latency varies inversely with stimulus magnitude. For example, the brighter the light, the faster the pupil of the eye contracts. The harder the hammer blow to the knee, the faster the leg swings forward. The size or intensity of the response (response magnitude) and its duration (how long it persists) vary directly with the stimulus magnitude. Using this same example, the brighter the light the more the pupil of the eye will decrease in size and will remain small.
You will now be asked some questions about reflexes.
!---
.o 6.1:
!---
Which of the following would be considered a reflex?
!---
.r1; withdrawing your hand after touching a hot stove
.t; Good thinking! This example includes both the stimulus of the hot stove and the response of hand withdrawal
.w1; the roots of a plant grow downward in response to gravity
.t; Sorry but plant growth is not behavior since it is not under neural control
.w2; every time a child smiles he is given an M & M candy
.t; Sorry but reflexes include only behavior elicited by a prior stimulus

.w3; covering your mouth with your hand when you cough several times in a row
.t; Sorry- even though you move your hand before you cough, your hand movement does not elicit the cough so there is no stimulus triggering the response
.w4; pairing the sound of a tone with a light
.t; Sorry but pairing two stimuli does not constitute a reflex
!--
.o 6.2:
!--
Which of the following would not be considered a reflex?
!--
.r1; rapid contraction of calf muscles results in leg flexion
.t; Yes, this example would not be considered a reflex because there is no mention of the eliciting stimulus
.w1; pupil constricts due to a flashing bright light
.t; Incorrect, this example is a reflex since the bright light is the eliciting stimulus and the pupillary constriction response
.w2; startle response caused by loud sounds
.t; Incorrect, this example is a reflex since the loud sounds are the eliciting stimulus which produces the startle response
.w3; rapid changes in muscle tension result in balancing on one leg on a tightrope to avoid falling
.t; Incorrect, this example is a reflex involving balance with the tightrope as the stimulus and the changes in muscle tension as the response
.w4; a sudden increase in heart rate and respiration right after a frightening stimulus
.t; Incorrect, this example is a reflex with the frightening stimulus producing the changes in heart beat and respiration rate
!--
.o 6.3:
!--
In the presence of a frightening stimulus, which of the following sequences are not examples of fight or flight reflexes?
!--
.r1; constriction of leg muscles so the person would run away
.t; Good answer! This example is the only one which is not part of the activation syndrome controlled by the autonomic nervous system
.w1; constriction of the bronchi in the lungs
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w2; vasoconstriction in which the surface blood vessels constrict
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w3; the goose bump reflex in which skin papillae become erect and make the skin

rough
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus
.w4; the piloerection reflex in which the hair follicles on the skin become erect
.t; No, this involuntary reflex does occur in the presence of a sudden or frightening stimulus

!--
.o 6.4:
!--
Which of the following reflexes is of continuous and not brief duration?
!--
.r1; tonic reflexes
.t; Yes, tonic reflexes occur in a continuous series of adjustments in muscle tension such as those involved in balance and posture
.w1; phasic reflexes
.t; No, phasic reflexes are brief protective movements such as the limb withdrawal reflex
.w2; righting reflex
.t; No, this is a vestibular reflex in which brief movements cause the head to assume a normal orientation to the ground when falling
.w3; flexion reflex
.t; No, in the flexion reflex a hand or foot is quickly withdrawn in response to an aversive stimulus
.w4; orienting reflex
.t; No, in a orienting reflex the head in quickly turned in the direction of a sudden stimulus
!--
.o 6.5:
!--
A reflex is defined as the ___________ between a particular stimulus and a particular response in such a way that the stimulus __________ the response. Choose the answer that best fills in the blanks.
!--
.r1; relation, elicits
.t; Yes, this is the standard definition of a reflex
.w1; contrast, produces
.t; Sorry but the contrast between the stimulus and response is not relevant
.w2; interaction, maintains
.t; Sorry but the stimulus acts as more of a trigger for the response
.w3; conditioning, reinforces
.t; Sorry but since the stimulus precedes the response it can not have a reinforcing effect

.w4; behavior, connects
.t; Sorry but these terms are too vague
!---
.o 6.6:
!---
To determine the strength of a reflex, it is necessary to know what the response is in the ___________ of the stimulus as well as in its ___________. Choose the answers that best fill in the blanks.
!---
.r1; absence, presence
.t; Yes, both conditions are necessary to measure the strength of a reflex
.w1; vicinity, location
.t; No, proximity of the stimulus to the response is not relevant
.w2; conditioning, magnitude
.t; No, whether the reflex is conditioned or not is not relevant to its strength
.w3; magnitude, latency
.t; No, latency is only relevant in terms of the response
.w4; environment, behavior
.t; No, these terms are too vague
!---
.o 6.7:
!---
The strength of a reflex may diminish through the process of ______________.
!---
.r1; habituation
.t; Correct, especially in startle and orientation reflexes in response to relatively weak stimuli
.w1; spontaneous recovery
.t; Incorrect as spontaneous recovery increases the strength of a reflex
.w2; extinction
.t; Incorrect, as a reflex occurs automatically it is not susceptible to extinction
.w3; latency
.t; Incorrect as latency is only a measure of reflex strength and not a procedure
.w4; elicitation
.t; Incorrect as elicitation only refers to the triggering mechanism in the reflex and it is not a procedure
!---
.o 6.8:
!---
A tight rope walker balances on one leg as he crosses a guy wire 100 feet above the ground. Which reflexes does he use?
!---
.r1; tonic reflexes

.t; Good memory! Tonic reflexes are involved in balance and posture and consist of a continuous series of adjustments in muscle tension
.w1; phasic reflexes
.t; Close but phasic reflexes are briefer and consist of a protective reaction to aversive stimuli
.w2; righting reflex
.t; Sorry but this is a vestibular reflex which causes the head to assume a normal orientation with respect to the ground when falling or jumping, for example as seen in cats
.w3; flexion reflex
.t; Sorry but this refers to quickly withdrawing the hand or foot in response to an aversive stimulus
.w4; orienting reflex
.t; Sorry but refers to turning the head in the direction of a new sound, for example when a dog pricks up its ears
!--
.o 6.9:
!--
A young infant will grasp any object put in its hand. After a while he will start to clench his fist when he sees an object moving towards his hand. Which of the following is not related to this example?
!--
.r1; tonic reflex
.t; Good, the tonic reflex is only related to maintaining balance and posture and not this example of a grasping reflex
.w1; conditioned stimulus
.t; Wrong, the conditioned stimulus is the object the infant can see and he starts clenching his fist before he touches it
.w2; conditioned response
.t; Wrong, the conditioned response is grasping its fist when it sees an object
.w3; unconditioned stimulus
.t; Wrong, the unconditioned stimulus is any object when placed in the infant's hand
.w4; unconditioned response
.t; Wrong, the unconditioned response is the infant's grasping movement in response to an object placed in its hand
!--
.i 7.0:
!--
Let's turn to a discussion of respondent behavior. It is behavior that is elicited by a particular stimulus called the antecedent and it is not affected by consequences. Therefore, it is a reflexive type response that is triggered by an eliciting stimulus. Usually it involves the involuntary responses of the smooth muscles and glands or other involuntary effector organs. Examples include many of the reflexes we have

studied such as the heart beat, gland secretion, peristaltic movement of the intestines, pupillary contraction or dilation in the eye, coughing or sneezing, sweating, and milk release in lactating women. It is also involved in much of what we call emotions, feelings, and attitudes.

Note that this procedure is typically conducted with smooth muscles and glands. However, there are several exceptions involving protective reflexes. An example of respondent conditioning with skeletal muscles is the eye blink reflex.

!--

.i 8.0:

!--

Respondent conditioning is a procedure which was first demonstrated by the Russian physiologist Pavlov at the turn of the century. Pavlov's original experiment involved a dog placed in a harness. When a bell tone was rung the dog pricked up its ears and turned its head towards the sound. With successive rings, however, these orienting responses diminished in magnitude and then disappeared. The sound became a neutral stimulus through the process of habituation.

When meat powder was placed in its mouth, the dog made salivating and chewing movements. A bell tone was then rung 5 seconds before each food delivery. After several pairings the dog began to salivate and chew during the 5 second interval between the bell tone and presentation of the meat powder. Eventually (after 30 to 50 pairings), the dog salivated and chewed at the sight of the bell alone, even if on occasional trials the food was omitted.

Note that only salivating is considered respondent behavior. Chewing is performed by the skeletal muscles of the jaw and was evoked by the salivary response, not by the bell tone.

!--

.i 9.0:

!--

The procedure of respondent conditioning can be diagramed as follows:

Neutral stimulus---> NS (bell tone)---> Orienting response---> No response
Unconditioned reflex---> US (meat powder)---> UR (salivating)
Respondent
conditioning---> US (meat powder)---> UR (salivating)
CS (bell tone)---> CR (salivating)
Conditioned reflex---> CS (bell tone)---> CR (salivating)

This procedure is sometimes called stimulus substitution because the CS substitutes for the US in eliciting a response.

!--

.i 10.0:

!--

The strength of respondent conditioning can be measured in several ways. For the Pavlovian experiment it could include the following:

1. The number of drops of saliva.
2. The elapsed time between the ringing of the bell tone and the secretion of saliva.
3. The number of pairings of the bell tone with the meat powder before the bell tone by itself would produce a measurable amount of saliva.
4. The number of times the bell tone could be later presented without following it by meat powder before the salivary response would disappear.

Any one of these could be used to determine the effect of the bell tone as a conditioned stimulus.

!--

.i 11.0:

!--

In higher-order respondent conditioning a second CS is paired with the first CS and comes to elicit the CR despite the fact that the second CS was never paired directly with the US. For example, after pairing the bell with meat powder, a light could be paired with the bell. After several pairings, the light by itself would come to elicit salivation.

An example with humans could consist of pairing a weak shock (which elicits a galvanic skin response) with the presentation of flashing lights. After several pairings, then pair the flashing lights with a musical tone of middle C. Occasionally the flashing lights would continue to be paired with the shock when the tone was not on. Eventually, the middle C tone will come to elicit a galvanic skin response by itself when no lights are present.

Let's now try to answer some questions about respondent conditioning.

!--

.o 11.1:

!--

Suppose we want to condition an eye blink to the sound of a buzzer. First we would check to make sure the buzzer sound is a neutral stimulus with respect to blinking and then would pair it with a US such as a puff of air. After a number of such pairings, the buzzer by itself should produce which of the following responses?

!--

.r1; blinking of the eyelid

.t; Correct, the buzzer has now become a conditioned stimulus for eliciting the conditioned response of blinking

.w1; tearing of the eye
.t; Incorrect as blinking is a separate glandular response
.w2; pupillary constriction
.t; Incorrect as the US for the pupil constricting is a bright light
.w3; pupillary dilation
.t; Incorrect as the US for the pupil dilating is a dim light
.w4; a puff of air
.t; Incorrect as the puff of air is the unconditioned stimulus and not a response
!---
.o 11.2:
!---
Which of the following terms do not refer to respondent conditioning procedures?
!---
.r1; reflexive behavior
.t; Yes, reflexive behavior is innate and occurs automatically
without any training
.w1; S -- > R learning
.t; Sorry but S ---> R refers specifically to respondent conditioning procedures
.w2; stimulus substitution
.t; Sorry but stimulus substitution is another synonym for respondent conditioning
.w3; classical conditioning
.t; Sorry but classical conditioning is refers back to the original Pavlov experiments and is a synonym for respondent conditioning
.w4; 2-term contingency
.t; Sorry but the 2-term contingency refers to the stimulus eliciting the response in respondent conditioning
!---
.o 11.3:
!---
In trace conditioning a conditioned stimulus ______________ before the unconditioned stimulus onset.
!---
.r1; occurs and disappears several seconds before US onset
.t; Good memory! Trace conditioning has only a weak effect since the CS and US are not present simultaneously
.w1; occurs and remains on for several seconds until the US onset
.t; Sorry but this procedure is short delay conditioning
.w2; occurs immediately after the US offset
.t; Sorry but this procedure is backward conditioning
.w3; occurs and disappears several minutes before US onset
.t; Sorry but there is too much time elapsed for this to be trace conditioning
.w4; occurs at a weak intensity level
.t; Sorry but the intensity level of the stimulus is not relevant to the type of

conditioning procedure

!--

.o 11.4:

!--

Respondent behavior includes all of the following characteristics except which of the following?

!--

.r1; it is affected by consequences
.t; Good thinking! Respondent behavior is most often affected by antecedent and not consequent stimuli
.w1; elicited by a particular stimulus
.t; No, respondent behavior is elicited by a particular stimulus
.w2; involves smooth muscles
.t; No, respondent behavior does use smooth muscles
.w3; an involuntary response
.t; No, respondent behavior does consist of involuntary responses
.w4; two stimuli are paired together
.t; No, respondent behavior does refer to the pairing to two stimuli, usually one of them neutral, in order to produce a new conditioned stimulus

!--

.o 11.5:

!--

What was not a conditioned stimulus in the Pavlov experiment?

!--

.r1; the meat powder
.t; Right, the meat powder placed in the dog's mouth was an unconditioned stimulus for salivation
.w1; the light paired with the bell
.t; Wrong, the light and the bell were both conditioned stimuli
.w2; sight of the meat powder
.t; Wrong, the sight of meat powder, having been paired with the taste of meat powder, was a CS for salivation
.w3; odor of the meat powder
.t; Wrong, the odor of the meat powder, having been paired with the taste of meat powder, was a CS for salivation
.w4; the bell tone
.t; Wrong, Pavlov's experiment was to pair the bell tone with the taste of meat powder so the tone would become a Cs and elicit salivation by itself

!--

.o 11.6:

!--

Skeletal muscles are attached to the skeleton and are also found in the limbs, truck, face, jaws, and eyeballs. They are involved in some reflexes in which there is a

protective response to an aversive stimulus. Which one of the following reflexes uses skeletal muscles?

!---

.r1; patellar reflex (knee-jerk)

.t; Good, the patellar reflex uses the skeletal muscles of the thigh and calf and occurs in order to prevent injury to the knee cap

.w1; lachrymal reflex (tearing)

.t; Sorry but the lachrymal reflex uses glands to secrete tears

.w2; vasoconstriction reflex (blood vessels)

.t; Sorry but the vasoconstriction reflex uses the smooth muscles which line the blood vessels

.w3; galvanic skin reflex ((electrical conductivity)

.t; Sorry but the galvanic skin reflex involves a change in the electrical conductivity in the skin in response to a weak electric current

.w4; salivary reflex

.t; Sorry but the salivary reflex uses glands to secrete saliva into the mouth in response to food or a weak acid solution and does not involve the tongue

!---

.o 11.7:

!---

Smooth muscles line the walls of all the hollow organs and are found in the walls of the digestive tract, bladder, veins and arteries, and various ducts. Which of the following reflexes use smooth muscles?

!---

.r1; vasodilation reflex

.t; Correct, the vasodilation reflex constricts the capillaries and raises the body's blood pressure

.w1; salivary reflex

.t; Incorrect as the salivary reflex uses glands

.w2; coughing reflex

.t; Incorrect as the coughing reflex uses skeletal muscles in the throat

.w3; sweating reflex

.t; Incorrect as the sweating reflex uses glands

.w4; sneezing reflex

.t; Incorrect as the sneezing or nasal reflex uses skeletal muscles in the throat

!---

.o 11.8:

!---

In second-order conditioning, which of the following procedures would not be considered an error?

!---

.r1; pairing the second CS with the first CS

.t; Great! This is the standard procedure to follow in higher-order conditioning and

so it is not an error
.w1; pairing the second CS with the US
.t; Oops! In higher-order conditioning you never pair the second CS with the US so this is an error
.w2; pairing the first CS with the US
.t; Sorry but this is only used in first-order conditioning and so would be an error
.w3; pairing the second CS with a NS
.t; Sorry but this is the procedure in third-order conditioning and so would be an error
.w4; pairing two US's together
.t; Sorry but this is not standard procedure and so it is an error
!--
.o 11.9:
!--
Which of the following is not a good procedure to use in respondent conditioning?
!--
.r1; pair a neutral stimulus with an orientation stimulus
.t; Good, since the process of habituation would make the stimulus lose its status as an unconditioned stimulus
.w1; pair a neutral stimulus with a visual stimulus
.t; No, in fact, this is a common procedure in respondent conditioning
.w2; pair a neutral stimulus with a gustatory stimulus
.t; No, in fact, this is a common procedure in respondent conditioning and was what Pavlov used with the taste of meat powder
.w3; pair a visual stimulus with an auditory stimulus
.t; No since this is a common procedure in higher-order respondent conditioning
.w4; pair an auditory stimulus with a tactile stimulus
.t; No since this is a common procedure in higher-order respondent conditioning
!--
.i 12.0:
!--
Respondent extinction is a procedure in which the CS is no longer paired with the US. It can be demonstrated by continuing the Pavlov example. If a dog is conditioned to salivate at the tone of a bell, but later the bell is repeatedly rung without pairing it with food, the bell tone will eventually cease to elicit or produce salivation. Repeatedly presenting the CS without the US describes the process of respondent extinction.

If at a later time the bell tone is again presented, some salivary responses will again occur in a phenomenon known as spontaneous recovery.

Respondent punishment (also known as aversive counter-conditioning) is a procedure in which a reinforcing stimulus is paired with an aversive stimulus. It can be demonstrated by pairing a bell tone with a painful electric shock. If the bell tone

previously had elicited salivary responses, after several new pairings the bell tone will now inhibit or eliminate (depending on the strength of the shock) salivation by itself. It will also elicit emotional responses of increased heart rate and adrenaline secretion which in turn will produce some escape or avoidance behaviors. It is often used in the treatment of alcoholism, cigarette smoking, drug addiction, obesity, and sexual fetishes. Don't confuse it with counterconditioning in which a reinforcing stimulus is paired with a conditioned aversive stimulus as in treatments for phobias.

Let's try some questions regarding respondent extinction and punishment.

!--

.o 12.1:

!--

The strength of a response may decrease by all of the following procedures except one. Which is it?

!--

.r1; conditioning

.t; Correct, the procedure of conditioning increases the response strength

.w1; muscle fatigue

.t; Incorrect, muscular fatigue may temporarily decrease the strength of a response

.w2; gland fatigue

.t; Incorrect, glandular fatigue may temporarily decrease the strength of a response

.w3; satiation

.t; Incorrect, satiation may decrease the strength of a response since the organism is physiologically unresponsive to consummatory stimuli

.w4; habituation

.t; Incorrect, habituation will decrease responding to a specific stimulus if it is presented repeatedly

!--

.o 12.2:

!--

Suppose a person has been conditioned to begin sweating when he puts on a red towel because, in the past, he always put on a red towel before he got into his sauna. A relative now gives him a present of a complete set of red towels and now he uses them on any number of occasions: to take a shower, to go swimming, walking down the hall to brush his teeth, to dry the dishes, and to dust the furniture. The fact that a red towel will no longer elicit increased sweating is an example for which of the following?

!--

.r1; respondent extinction

.t; Correct, the CS (red towel) has been paired with many other stimuli besides the sauna so the extinction process has occurred

.w1; respondent conditioning

.t; Incorrect, since no new behavior has been learned

.w2; respondent punishment
.t; Incorrect, although some behavior is decreased, there was no use of aversive stimuli
.w3; habituation
.t; Incorrect, since no startle or orientation stimuli were present
.w4; satiation
.t; Incorrect since the stimulus did not involve food, water, or any consummatory stimuli
!--
.o 12.3:
!--
In a weight reduction program, a rancid odor was paired with smelling favorite high calorie foods. After several weeks of this treatment the participants no longer salivated and actually felt nauseous when smelling these high calorie foods. This procedure is an example of which of the following?
!--
.r1; respondent punishment
.t; Good, since an aversive stimulus is paired with a reinforcing stimulus and the response is glandular, the procedure is respondent punishment or aversive counterconditioning
.w1; respondent conditioning
.t; Sorry but an aversive rather than a neutral stimulus was used
.w2; respondent extinction
.t; Sorry but there are no CS alone trials
.w3; habituation
.t; Sorry but no startle or orientation stimuli were involved
.w4; satiation
.t; Close since the effect is to reduce appetite for food but an aversive stimulus was used
!--
.o 12.4:
!--
In aversive counterconditioning a stimulus which is _____________ is paired with another stimulus which is _____________.
!--
.r1; reinforcing, aversive
.t; Exactly, this is the standard definition of aversive counterconditioning or respondent punishment
.w1; conditioned, unconditioned
.t; Sorry but this answer is too vague
.w2; reinforcing, neutral
.t; Sorry but neutral stimuli are not used in the aversive counterconditioning procedure

.w3; neutral, aversive
.t; Sorry but neutral stimuli are not used in the aversive counterconditioning procedure
.w4; aversive, aversive
.t; Sorry but only one of the stimuli paired in this procedure can be aversive
!---
.o 12.5:
!---
A tone has been paired with lemon juice to elicit salivation. Now the tone is continually presented but is no longer paired with anything. After a period of time the tone will again become a neutral stimulus. This process is called which of the following?
!---
.r1; respondent extinction
.t; Good for you! A CS presented without any further US pairings will eventually become a neutral stimulus again
.w1; respondent conditioning
.t; No, in respondent conditioning a NS becomes a CS
.w2; respondent punishment
.t; No, in respondent punishment an aversive stimulus is paired with a reinforcing stimulus
.w3; habituation
.t; Close but in habituation a relatively weak US is repeatedly presented until the response diminishes
.w4; satiation
.t; Close but in satiation a consummatory US is repeatedly made available until it becomes a NS for a short period of time
!---
.o 12.6:
!---
The sight of a black cat at night startles a woman so much that her hair stands on end and she gets goose bumps. This is an example of which type of learning?
!---
.r1; respondent conditioning
.t; Right, since the sight of black cats is not a US, it has been paired with some other US, possibly through language, and it now has become a frightening CS
.w1; habituation
.t; No since in habituation a relatively weak US is repeatedly presented until the response diminishes
.w2; respondent punishment
.t; No since no aversive US is presented
.w3; respondent extinction
.t; No since a CS is not repeatedly presented without a US

.w4; counterconditioning
.t; No since a reinforcing stimulus is not paired with an aversive stimulus
!---
.o 12.7:
!---
In order to control his habit of drinking alcohol, a man submits himself to a behavioral treatment program. A drug called antiabuse will produce nausea if taken just before alcohol consumption. This procedure is called which of the following?
!---
.r1; respondent punishment
.t; Good, this is respondent punishment or aversive counterconditioning since the antiabuse is the aversive stimulus and paired with alcohol which is the reinforcing stimulus
.w1; respondent extinction
.t; Wrong since no CS is presented by itself
.w2; deprivation
.t; Wrong since the man is not depriving himself of drinking alcohol
.w3; satiation
.t; Wrong since the antiabuse prevents much alcohol from being taken
.w4; habituation
.t; Wrong since a relatively weak US is not repeatedly presented by itself
!---
.o 12.8:
!---
In aversive counterconditioning the aversive stimulus is paired either a(n) ________________ or a(n) __________________.
!---
.r1; unconditioned stimulus, conditioned stimulus
.t; Yes, in aversive counterconditioning an aversive stimulus is paired with either a conditioned or unconditioned reinforcing stimulus in order to decrease responding. An example of a conditioned stimulus would be pornography while an example of an unconditioned stimulus would be the effect of an addictive drug
.w1; reinforcing stimulus, aversive stimulus
.t; No, there is only one aversive stimulus in this procedure
.w2; antecedent stimulus, aversive stimulus
.t; No, there is only one aversive stimulus in this procedure
.w3; weak stimulus, strong stimulus
.t; No, typically the paired stimulus is strongly reinforcing since the behavior elicited by it is difficult to stop
.w4; stereotyped stimulus, consequent stimulus
.t; No, the procedure uses only antecedent stimuli
!---
.o 12.9:

!--

In pairing a puff of air with a light, the light will eventually come to elicit the eye blink reflex. The light can also be paired with a tone and it will eventually elicit an eye blink reflex itself. This procedure is called higher-order conditioning. However, unless the ________ and _________ are still occasionally paired, the tone will lose its conditioning status.

!--

.r1; light, puff of air

.t; Exactly, unless the light as the first CS and the puff of air as the US are still occasionally paired, the light will become a neutral stimulus again

.w1; tone, puff of air

.t; No, the tone as the second CS is never paired with the US which is the puff of air

.w2; puff of air, eye blink reflex

.t; No, the US is paired with other stimuli and not with reflexes themselves

.w3; tone, light

.t; No, the light as the first CS must be paired with an unconditioned stimulus

.w4; tone, eye blink reflex

.t; No, the CS is paired with other stimuli and not with reflexes themselves

!--

.i 13.0:

!--

We now turn our attention to operant behavior. It is defined generally as behavior which is susceptible to operant conditioning. This behavior often appears spontaneously rather than as a reaction to stimulation; it may or may not be evoked by a current stimulus.

The term "operant" refers to a class of responses which have particular consequences and which operate on the environment. The response class is defined, therefore, by the stimulus it produces. Operant conditioning usually involves the voluntary responses of the striped muscles or other voluntary effector organs. When the behavior is controlled by the presence of a stimulus we say the response has been evoked. It is affected by consequences and is described by the 3-term contingency: S --> R --> S.

Examples include any action of the skeletal muscles such as running, jumping, throwing, talking, playing the piano, dancing, and doing somersaults. There may be no obvious antecedent stimulus but there is always a consequent stimulus after the behavior has occurred. This consequential stimulus is said to be dependent or contingent upon the prior response. Respondent behavior is said to be elicited by a stimulus while operant behavior is said to be evoked if the antecedent stimulus is apparent.

The response component also has the additional requirements of time and number

in order to be effective. For example, in a FR 10 schedule, only after the tenth response is made is reinforcement delivered. In a FI 2-min schedule, a response is reinforced only if it is made after the time interval has elapsed. Other more complicated schedules require a certain number of responses within a specified time period.

!--

.i 14.0:

!-- These are three basic procedures designed to alter operant behavior: conditioning (or reinforcement), extinction, and punishment. Operant conditioning is a procedure in which behavior is increased. There are two ways to do this: positive reinforcement and negative reinforcement. Let's look at some examples:

1. Every time a 6 month old baby utters a vocal sound its mother picks him up and hugs him. The mother then finds that frequency of vocal behavior rapidly increases. This is positive reinforcement for vocal behavior.

2. When it starts raining, a man opens up his umbrella; this is negative reinforcement for staying dry and increases umbrella opening behavior.

Now let's look at this same situations as nonexamples:

1. Positive reinforcement: Every time a 6 month old baby utters a vocal sound its mother picks him up and hugs him. However, she picks him up whether he is cooing softly or crying loudly. This is a nonexample because it is positive reinforcement for vocal behavior in general but it will not increase the frequency of the baby making cooing sounds.

2. Negative reinforcement: When it starts raining, a man remembers he forgot his umbrella so he is unable to stay dry and gets soaking wet by the time he reaches his office. This can only be considered negative reinforcement for staying dry if he has the umbrella, raincoat, so some other means to avoid getting wet.

!--

.i 15.0:

!--

The strength of operant conditioning can be measured at least four ways. Let's use the example of reinforcing a pigeon for key pecking behavior with grain. The strength of the behavior can be measured by any of the following:

1. the rate of key pecking
2. the intensity of the key pecks
3. the number of grain presentations necessary before key pecking behavior

is established
4. the number of key pecks still produced after grain is removed and no reinforcement is given.

Now let's use an example of measuring the strength of behavior with people. A child is learning to tie his shoes and is reinforced by verbal praise from his parents. The strength of the behavior can be measured by any of the following:

1. the response duration or how long it takes to tie his shoes
2. the number of practice trials it takes before he can tie his shoes correctly
3. the response latency or how long it takes from the time he is asked to tie his shoes and he starts tying them
4. the number of times he continues to tie his shoes after parental attention and praise are removed

The increase in behavior is called the operant level and is always compared with its previously unreinforced performance or baseline level.
!---
.i 16.0:
!---
It should be noted that an operant reinforcement procedure is only effective when the appropriate motivative variables are present. The same stimulus situation may or may not be reinforcing depending on the deprivation or satiation state of the organism. For example, if the pigeon was not hungry it would not be motivated to peck the disk. If the child was mad at his parents and didn't want their attention and approval, he would not want to tie his shoes.

The term "conditioning" as used here is synonymous with both "reinforcement" and "strengthening." Please remember that reinforcement is a functional definition in that the procedure is always defined by its consequences. Both positive and negative reinforcement will increase behavior in similar situations in the future. For example, if someone smiles when you say hello, you will have an increased tendency to say hello when seeing that person again. This is positive reinforcement. When you turn on the stereo and the music is so loud that it hurts your ears, turning down the volume is negative reinforcement. In the future you will have an increased tendency to immediately turn down the volume when turning on the stereo.

We will now try some questions concerning operant conditioning.
!---
.o 16.1:
!---
Which of the following is not a characteristic of operant behavior?
!---

.r1; it is elicited by a particular stimulus
.t; Right, stimuli elicit respondent behavior
.w1; it is affected by consequences
.t; Wrong, operant behavior is affected by consequences in the sense that there is an increased probability to respond similarly in the future
.w2; it may appear spontaneously
.t; Wrong, operant behavior may not have any obvious antecedent stimulus which evokes the behavior
.w3; it is described by the 3-term contingency
.t; Wrong, operant conditioning is often described by the S--->R--->S model
.w4; it involves voluntary responses of the skeletal muscle system
.t; Wrong, operant behavior is often considered "voluntary" and uses the skeletal muscles of the trunk and limbs
!--
.o 16.2:
!--
A general definition of operant conditioning would be that an environment-behavior relation is _____________ by arranging a consequence _____________ on a response.

!--
.r1; strengthened, contingent on
.t; Right, this is the procedure by which operant behavior is increased
.w1; allowed, depending
.t; Wrong, this answer is too vague
.w2; weakened, dependent
.t; Wrong, operant conditioning does not weaken behavior
.w3; conditioned, following
.t; Wrong, this answer is too vague
.w4; maintained, immediately
.t; Wrong, operant conditioning does more than just maintain a response
!--
.o 16.3:
!--
A person turns the ignition key is his car and hears a loud buzzing noise indicating that his seat belt is not fastened. The next time he starts his car he is more likely to fasten his seat belt first in order to avoid the noise. Although an aversive stimulus is involved, this is not an example of punishment since behavior is increased and not decreased. Choose which conditioning procedure it is.
!--
.r1; negative reinforcement
.t; Good, the removal of an aversive stimulus acts as reinforcement to increase that behavior in the future
.w1; positive reinforcement

.t; Sorry, even though behavior is increased it occurs by removing and not presenting a stimulus
.w2; operant behavior
.t; Sorry but operant behavior just refers to behavior which is susceptible to operant conditioning- it is not a procedure
.w3; respondent conditioning
.t; Sorry but this procedure uses consequent stimuli
.w4; spontaneous recovery
.t; Sorry but spontaneous recovery only follows an extinction or habituation procedure
!--
.o 16.4:
!--
Behavior that is susceptible to operant conditioning usually involves all of the following effectors except one. Choose the exception.
!--
.r1; skeletal muscle reflexes
.t; Good thinking! A small number of skeletal muscles which act in a reflex to protect the boy from aversive stimuli can only be respondently conditioned
.w1; arm flexor muscles
.t; No, flexor muscles contract when raising the arm and can be operantly conditioned
.w2; leg extensor muscles
.t; No, extensor muscles relax when extending the leg and can be operantly conditioned
.w3; antagonistic joint muscles
.t; No, antagonistic muscles in the joints alternatively contract and relax in order to move the limbs- they can be operantly conditioned
.w4; voluntary effectors
.t; No, the voluntary effectors are all susceptible to operant conditioning
!--
.o 16.5:
!--
What is the best measure of the effectiveness of operant conditioning?
!--
.r1; rate of response
.t; Correct, the response rate is considered to be the most sensitive to the strength of operant conditioning, especially when the behavior measured is brief and discrete
.w1; response duration
.t; Close, although response duration is occasionally the best measure when small samples of behavior are only available, it is not the most sensitive to conditioning changes
.w2; intensity of the response

.t; Incorrect, the response intensity may be related to other factors not related to operant conditioning
.w3; amount of reinforcement necessary before the behavior is established
.t; Incorrect, this may be related to between species differences
.w4; resistance to extinction
.t; Incorrect as this may be more related to the motivative variables present
!---
.o 16.6:
!---
.r1; time and number for the response
.t; Yes, after the response is evoked it must occur either a certain number of times and/or within or after a specified time period in order to be following by a consequating stimulus
.w1; the stimulus and response
.t; Sorry but they are already in the original 3-term contingency of S--->R--->S
.w2; cause, effect
.t; Sorry but these terms are too vague
.w3; motivation and stimulation
.t; Sorry but the stimulation is represented by the arrows in the S--->R--->S sequence
.w4; receptor and effector organs
.t; Sorry but these organs are the part of the body which detects and responds to stimulation within and outside of the body and so are what is conditioned but not responsible for causing the conditioning- a subtle point
!---
.o 16.7:
!---
A pigeon is being reinforced with 3 seconds access to grain every time he pecks a disk 10 times in a row. Although the bird quickly learned to make the responses, it then lost interest and just wandered around the chamber and ignored the disk. This lose of interest in pecking for grain can probably be attributed to which of the following?
!---
.r1; satiation
.t; Right, since the behavior was established and no extinction or punishment procedure was used, the decrease in responding can probably be attributed to a lack of motivation due to satiation
.w1; deprivation
.t; No since deprivation would increase responding
.w2; habituation
.t; No since habituation is not related to consummatory stimuli
.w3; negative reinforcement
.t; No since no aversive stimulus was removed
.w4; operant extinction
.t; No since reinforcement was not withheld

!---
.o 16.8:
!---
In a classroom, a student increases his work rate at the end of the day in order to avoid having to stay after school. This increased behavior is due to which of the following procedures?
!---
.r1; negative reinforcement
.t; Yes, by working faster now, the student removes the conditioned aversive stimulus of staying after school- it is also a fixed interval schedule
.w1; positive reinforcement
.t; Close since you could look at leaving school on time as positive reinforcement for work completed, although this is probably not the main factor
.w2; the 3-term contingency
.t; No, this answer is too vague
.w3; spontaneous recovery
.t; No since this occurs only after a resting period following extinction
.w4; operant behavior
.t; No, this answer is too vague
!---
.o 16.9:
!---
Which of the following is not a measure of operant conditioning?
!---
.r1; the rate of the stimulus
.t; Correct, the properties of the stimulus itself are not a measure of operant conditioning
.w1; the magnitude of the response
.t; Incorrect, the magnitude or intensity of the response is a measure of the strength of conditioning
.w2; the rate of the response
.t; Incorrect since response rate is probably the best measure of the strength of conditioning
.w3; trials to criterion
.t; Incorrect, the number of times a consequent stimulus follows a response before the behavior is changed to a criterion level is one measure of the strength of conditioning
.w4; total number of responses during extinction
.t; Incorrect, the number of unreinforced responses during an extinction phase before the behavior returns to its baseline level is one measure of the strength of conditioning
!---
.i 17.0:

!---

Operant extinction is a procedure used to decrease behavior by the nonreinforcement of previously reinforced behavior. It usually has the side effect of increasing the variability of the response. Often the rate and intensity of the behavior will temporarily increase at the start of the extinction procedure before it starts decreasing. This phenomena is called an extinction burst and can produce some aggressive behavior.

Some examples of operant extinction are as follows:

1. You drop a quarter on the ground and immediately bend down to search for it. After many search procedures do not reveal its location you gradually become discouraged and give up looking for it.
2. A teacher gives out special colored stickers to elementary students who finish their work early. The whole class works extra hard to finish their work and the teacher has to buy extra stickers to keep up. After two weeks she decides the students shouldn't need extrinsic motivators anymore so she discontinues the rewards. As a result many papers are now handed in late or incomplete.

Some nonexamples of operant extinction are as follows:

1. After a large meal a person is offered a variety of delicious deserts but he turns them all down. This is an example of satiation in which reinforcement is available but not valuable at the time.
2. A student in gym class can earn bonus points by doing 100 situps and 50 pushups. However, after starting quickly his behavior gradually gets slower and slower until he stops after 50 pushups and 25 situps. This decrease in responding is more likely due to muscle fatigue than operant extinction.

!---

.i 18.0:

!---

The fact that extinction does not permanently eliminate the behavior is seen by the following examples:

1. The child who calms down and goes to sleep may again wake up and start crying again.

2. The person who lost the quarter may again search the area whenever he walks by it.

This can also be seen in the following nonexamples:

1. The child cries for 5 minutes when put in bed at night; 1 minute after he stops crying he starts crying again. The time period is too short to be considered spontaneous recovery.

2. The same child cries for 5 minutes and then stops crying the briefly. The parent walks back into the room and the child starts crying again. The presence of the parent is a cue to start crying again since, in the past, the parent always picked up the child when it cried.

This phenomenon of increased behavior after a rest period is known as spontaneous recovery.

The procedure of extinction should be distinguished from forgetting in which the behavior reduction is due only to the passage of time and not the removal of a specific contingency. For example, after a time period of several months the person who lost his quarter may forget all about it.

Extinction should be distinguished from satiation. The difference can be seen by these two examples:

1. After eating a large meal a child refuses to eat any more food even when offered his favorite dessert. This type of behavior reduction is called satiation.
2. Because he didn't eat his vegetables, the parents refuse to let the child have dessert despite many requests. This type of behavior reduction is called extinction.

Both examples demonstrate elimination of dessert eating behavior. But in the first instance reinforcement is continuously available while in the second instance reinforcement is no longer available.
!--
.i 19.0:
!--
Resistance to extinction is one measure of the strength of reinforcement. Extinction does occur more rapidly following a continuous reinforcement procedure rather than a partial or intermittent procedure. For example, if a pigeon was given grain after every key peck for 10 minutes and then grain was withheld, extinction would occur rather quickly. If the pigeon was given grain after 50 key pecks for a 10 minute period, then extinction would occur more slowly.

The strength of extinction is measured by the change in the rate of responding during the procedure and the total number of responses before the behavior returns to its baseline rate prior to conditioning. In the pigeon example, the total number of key pecks that occurred during extinction would be much greater after the intermittent

reinforcement schedule (FR 50) than after the continuous reinforcement (CRF or FR1) schedule.

Let's turn to some questions concerning operant extinction.

!--

.o 19.1:

!--

How is the procedure in operant extinction different from respondent extinction?

!--

.r1; in operant extinction, the stimulus which comes after the response is withheld

.t; Yes, operant extinction is the withholding of consequent stimuli which were reinforcing

.w1; in operant extinction, the stimulus which comes at the same time as the response is withheld

.t; No, while two stimuli can occur simultaneously, it is not possible for a stimulus and a response

.w2; in operant extinction, the stimulus which comes just before the response is withheld

.t; No, you are confusing operant and respondent extinction

.w3; the reinforcing stimulus is no longer available

.t; No since this is similar for both

.w4; spontaneous recovery can occur

.t; no since this is similar for both

!--

.o 19.2:

!--

A good definition of operant extinction is that it is a procedure in which an environment-behavior relation is ____________ by no longer presenting a ____________ consequence after the response. !--

.r1; weakened, reinforcing

.t; Yes, this is the standard definition of operant extinction

.w1; strengthened, punishing

.t; No, this is negative reinforcement

.w2; neutralized, operant

.t; Sorry but there is no such word as "neutralized"

.w3; eliminated, weakened

.t; Close but extinction would preclude even a weakened consequence

.w4; changed, negative

.t; No, this is negative reinforcement

!--

.o 19.3:

!--

The decrement in performance demonstrated during extinction is due to the _____________ of the previously _____________ behavior.
!--
.r1; nonreinforcement, reinforced
.t; Exactly! It is this contrast between the reinforced operant level and the nonreinforced baseline level which demonstrates the difference in effect
.w1; punishment, acquired
.t; No, while extinction does decrease behavior it is not considered a punishment procedure
.w2; habituation, learned
.t; No, while habituation does decrease behavior it is entirely different from the extinction procedure
.w3; satiation, deprived
.t; No, the extinction procedure will not have an effect while the organism is under the effects of satiation
.w4; forgetting, learned
.t; No, the existence of spontaneous recovery demonstrates that the stimulus-response relation is not forgotten
!--
.o 19.4:
!--
A person is trying to stop smoking by snapping an elastic band on his wrist every time he has an urge to light up a cigarette. After successfully losing the urge for two weeks, he then goes on a one week vacation. When he returns to his normal routine he suddenly finds he again has a strong urge to start smoking again. This phenomenon is an example of which of the following?
!--
.r1; spontaneous recovery
.t; Right, when mild punishment is used, after a rest period, the phenomena of spontaneous recovery does occur.
.w1; response variability
.t; No, response variability is not a side effect of a punishment procedure
.w2; extinction burst
.t; No, an extinction burst is not a side effect of a punishment procedure
.w3; forgetting
.t; No, punishment does not make the person forget his previous habit but only inhibits or suppresses the behavior
.w4; response latency
.t; No, response latency is only a measure of response strength and not a procedure
!--
.o 19.5:
!--
Extinction occurs more slowly following a(n) _____________ reinforcement procedure

rather than a(n) ____________ procedure.

!--

.r1; intermittent, continuous

.t; Correct, intermittent schedules of reinforcement are more difficult to extinguish, probably because it is harder for the organism to distinguish between the reinforcement and extinction phase

.w1; continuous, intermittent

.t; Incorrect, you are confusing the extinction procedure

.w2; lengthy, brief

.t; Not necessarily, it depends on the type of schedule used

.w3; weak, strong

.t; Incorrect, although stimuli can be weak or strong, schedules are classified based on the delivery schedule of stimuli

.w4; operant, respondent

.t; Incorrect, as not enough information is given- the speed of operant and respondent extinction depends on other factors

!--

.o 19.6:

!--

In ______________ reinforcement is available but the organism does not respond while in ______________ no reinforcement is available for responding.

!--

.r1; satiation, extinction

.t; Right, this is the essential procedural difference between satiation and extinction

.w1; extinction, satiation

.t; Wrong, you are confusing the two procedures

.w2; satiation, deprivation

.t; Wrong, since in deprivation the organism is not allowed to respond

.w3; habituation, spontaneous recovery

.t; Wrong, habituation only refers to the simplest type of learned and not to operant procedures

.w4; positive stimuli, aversive stimuli

.t; Wrong, the sentence refers to procedures and not stimuli

!--

.o 19.7:

!--

Which of the following is not a measure of the strength of the extinction procedure?

!--

.r1; the prior rate of behavior before the extinction procedure

.t; Yes, any previous behavior rate is not a measure of the strength of extinction although it should be a steady state condition in order to obtain a valid contrast

.w1; the change in rate of behavior from the conditioning phase to the extinction phase

.t; Sorry but this change in rate from the conditioning to the extinction phase is of critical importance in measuring the strength of extinction
.w2; the amount of variability during extinction
.t; Sorry but response variability during extinction is one measure of its strength
.w3; total number of responses before the behavior returns to its baseline rate
.t; Sorry but the response total before behavior returns to is unreinforced rate is a common measure of the strength of extinction
.w4; the change in latency from conditioning to extinction
.t; Sorry but stimulus-response latency is a measure of the strength in both respondent and operant conditioning
!--
.o 19.8:
!--
After eating a large meal and then misbehaving, a child is told he can no longer have dessert. However, his misbehaviors continue at the same intensity even through reinforcement is being withheld. What is a likely explanation for this failure of extinction?
!--
.r1; satiation makes reinforcement less effective
.t; Right, if the child was no longer hungry then food, even desert, has temporarily lost its appeal
.w1; not enough muscle fatigue has occurred
.t; Incorrect, since eating a meal does not cause muscle fatigue
.w2; the passage of time - the child forgot about dessert
.t; Unlikely as I have never known a child who "forgets" about desert- it's often the most important part of the meal
.w3; no aversive stimulus was withheld
.t; Incorrect as withholding an aversive stimulus is more of an avoidance procedure
.w4; some kind of stimulus inhibition
.t; Incorrect as desert would be an unlikely source of an inhibiting stimulus
!--
.o 19.9:
!--
Extinction does not permanently eliminate behavior since, after a rest period, there will be a temporary increase in the operant behavior- this phenomenon is called ________________.
!--
.r1; spontaneous recovery
.t; Now you've got it! Spontaneous recovery is seen in both operant and respondent extinction and demonstrates that the stimulus-response connection is not lost
.w1; remembering
.t; Sorry but there is evidence that the organism never forgot the stimulus-response relation but that it was inhibited by the removal of the reinforcement contingency

.w2; habituation
.t; Sorry but habituation diminishes behavior and doesn't increase it
.w3; conditioning
.t; Sorry but this effect occurs without any further training
.w4; extinction burst
.t; Sorry but an extinction burst usually occurs right at the beginning of the extinction phase and not following a rest period
!---
.i 20.0:
!---
The last part of operant behavior we shall discuss involves punishment procedures. Operant punishment is a procedure which weakens behavior. Some examples of the procedure are as follows:

1. A child attempts a touch a hot stove and the parent yells "Stop!" just in time and the child turns away. Here the verbal stimulus is aversive or punishing. This is positive punishment.

2. In a classroom three students have not finished their work at recess time. The teacher decides to keep them inside as punishment for not completing their work. Here a reinforcing stimulus was taken away. This is negative punishment.

Some nonexamples of punishment procedures are as follows:

1. In a classroom three students have not finished their work at recess time. The teacher decides to keep them inside as punishment for not completing their work. However, since they are then allowed to play inside the classroom,the reinforcing stimulus of access to free play at recess was not taken away. This is a nonexample of negative punishment.

2. A person is caught speeding and given a ticket by a policeman, and as a result has to pay a $25 fine. Here the reinforcing stimulus of money is taken away as punishment but it does not influence speeding behavior in the future since the consequence is so far removed in time from the response. This is a nonexample of negative punishment.

3. A child picks up a pot of boiling water from the stove but does not get burnt because he was wearing gloves. This is a nonexample of positive punishment.

!---
.i 21.0:
!---
Suppose we wanted to eliminate swearing from a child's verbal repertoire. We could

use a punishment procedure which would present an aversive stimulus every time a swear word was used. However, the procedure would not teach what are appropriate substitute words to use on such occasions. The child may also become angry and refuse to continue coming to school. We would normally need to use a separate reinforcement procedure to teach the use of more descriptive or socially acceptable words. In fact, the punishment procedure could often be avoided by just expanding the verbal repertoire.

Thus, punishment does not teach new behaviors but only eliminates or suppresses certain behaviors in those conditions. It also is considered the procedure of last resort since it may produce aggressive or escape behavior.

!---

. 22.0:

!---

Let's make clear the distinction between punishment and extinction by the following examples:

1. A white rat is on a continuous reinforcement schedule in which every time it pushes down a bar, it receives some sucrose solution in a hopper as reinforcement. Thus bar pressing becomes a well established behavior. Then reinforcement is discontinued completely so that nothing happens after a bar press response. Gradually the rat loses interest in this behavior and stops pushing the bar.

2. Another white rat is initially on the same continuous reinforcement schedule. This time the procedure change is to produce a loud annoying noise after every bar press. Quickly the rat learns to not make bar press responses any may engage in some aggressive behavior or try to escape from the experimental chamber.

In example number one, an extinction procedure is used which has a more gradual effect. In example number two, a punishment procedure is used which has a much quicker effect. The end result of response elimination is the same.

The strength of the punishment procedure would then be measured by the change in rate of the rat's bar pressing behavior from the reinforcement procedure to the punishment procedure. Or you could count the number of bar presses made during punishment until they ceased completely. In this case the strength would vary depending on the loudness of the noise produced. Of course, an even more effective aversive stimulus would be electric shock or some nauseous odor.

Let's now try some final questions on operant punishment.

!---

.o 22.1:
!--
Which of the following is not a side effect of punishment procedures?
!--
.r1; muscular fatigue
.t; Good, punishment procedures decrease responding so muscle fatigue should not be a factor
.w1; escape behavior
.t; No, escape behavior is a common side effect of punishment
.w2; elicited aggression
.t; No, elicited aggression is often seen if two animals are in a chamber together, even if only one of them is being shocked
.w3; emotional responses
.t; No, emotional responses of anger and aggressive are a common side effect of punishment
.w4; conditioned aversion to ambient stimuli
.t; No, the punishment procedure often will make other ambient stimuli in the animal chamber as conditioned aversive stimuli
!--
.o 22.2:
!--
Operant punishment can be defined as a procedure in which an environment-behavior relation is ________ by arranging a consequence of responding that __________ the strength of a response.
!--
.r1; weakened, reduces
.t; Right, this is the generic definition for punishment
.w1; strengthened, alters
.t; Sorry, but a punishment procedure does not strengthen behavior
.w2; changed, punishes
.t; Sorry but this is awkward working and could be misinterpreted
.w3; aversive, reinforces
.t; Sorry but punishment procedures do not reinforce a response
.w4; reduced, prevents
.t; Sorry but punishment does not prevent a response from occurring although it does make it less likely
!--
.o 22.3:
!--
In a treatment program to cure alcoholics, all participants take a drug called antiabuse before drinking which produces nausea when combined with alcohol. Therefore, the effect would be to decrease drinking alcoholic beverages due to which one of the following procedures?

!--
.r1; respondent punishment
.t; Good thinking! The aversive stimulus of antiabuse is paired with the reinforcing effect of alcohol in order to eliminate the behavior
.w1; operant negative punishment
.t; No, the reinforcing stimulus is not taken away, it is just paired with an aversive stimulus
.w2; operant positive punishment
.t; No, the aversive stimulus is not presented contingent on behavior but paired with a reinforcing stimulus
.w3; aversion therapy
.t; Sorry but this answer is too vague
.w4; operant negative reinforcement
.t; No, an aversive stimulus is not removed but paired with a reinforcing stimulus
!--
.o 22.4:
!--
Which of the following is not true of operant punishment?
!--
.r1; it does not use reinforcement
.t; That was a hard one- good for you! Remember that any punishment procedure to decrease behavior is overlaid on top on a reinforcement procedure which is maintaining the behavior in the first place- so in a sense, punishment also includes reinforcement
.w1; spontaneous recovery may occur
.t; Sorry but when mild punishment is used, after a rest period, the phenomenon of spontaneous recovery does occur
.w2; its effects may not be reversible
.t; Sorry but if severe punishment is used, the effects may not be reversible
.w3; stimuli can either be presented or removed
.t; Sorry but punishment can include either removing reinforcing stimuli or presenting aversive stimuli
.w4; it may include either positive or negative stimuli
.t; Sorry but punishment can include either removing positive stimuli or presenting negative stimuli
!--
.o 22.5:
!--
The strength of a punishment procedure is measured by all of the following except one. Choose it.
!--
.r1; contrast in rate between extinction and satiation
.t; Nice job! While extinction and satiation may have similar effects, their contrast

is of no relevance to the strength of a punishment procedure
.w1; the intensity of the response to aversive vs. reinforcing stimuli
.t; Incorrect, response intensity is a common measure of the strength of a punishment procedure
.w2; change in rate from baseline to experimental phase
.t; Incorrect, the change in response rate from reinforcement to punishment is the heart of the functional relation
.w3; total number of responses until cessation
.t; Incorrect as this is a common measure of the strength of a punishment procedure
.w4; generalization to similar stimuli
.t; Incorrect, stimuli generalization to similar aversive stimuli is a common measure of punishment strength
!---
.o 22.6:
!---
A rat is on a reinforcement schedule in which he receives a dipper of sucrose flavored water for every 5 lever presses (fixed ratio 5 responses or FR 5). Now the schedule is changed to reinforcement for every 50 lever presses (FR 50). A initial decrease in response rate would be due to which of the following procedures?
!---
.r1; positive punishment
.t; Good thinking! An increase in response effort is aversive and so an aversive stimulus is being presented, therefore, behavior will probably decrease at first
.w1; negative punishment
.t; Wrong, although reinforcing stimuli are more made effortful to obtain, they are not removed contingent upon behavior
.w2; extinction
.t; Wrong since reinforcing stimuli are not withheld but just made more effortful to obtain
.w3; negative reinforcement
.t; Wrong since no aversive stimulus is removed contingent on behavior
.w4; positive reinforcement
.t; Close, although both the FR 5 and FR 50 are positive reinforcement schedules, the decrease in responding is due to the increased effort required which is slightly aversive
!---
.o 22.7:
!---
A monkey is in a grid chamber in which he receives a 20 volt shock for chain pulls which also produce food pellets. The shock is then reduced to 10 volts and the chain pull response increases due to which procedure?
!---
.r1; positive reinforcement

.t; Congratulations! This is a case in which electric shock is reinforcing because it is decreased in intensity from its previous level
.w1; negative reinforcement
.t; No, an aversive stimulus is not removed contingent on behavior
.w2; positive punishment
.t; No, although an aversive stimulus is presented contingent upon behavior, its level of intensity is decreased from before
.w3; negative punishment
.t; No, a reinforcing stimulus is not removed contingent on behavior
.w4; aversive counterconditioning
.t; Close since an aversive stimulus is paired with a reinforcing stimulus, but this example involves operant behavior
!--
.o 22.8:
!--
A flexion reflex in response to an aversive stimulus will also decrease the tendency to approach that stimulus in the future. Which procedure is this an example of?
!--
.r1; operant positive punishment
.t; Good thinking! This is like being burnt by touching a hot stove and so decreasing the probability of touching it again
.w1; operant negative punishment
.t; Wrong since no reinforcing stimulus is removed
.w2; respondent punishment
.t; Wrong since an aversive stimulus is not paired with a reinforcing stimulus
.w3; operant negative reinforcement
.t; Close since an aversive stimulus is removed but not quite since it decreases the probability of future responding
.w4; reflexive behavior
.t; Close since it is a protective skeletal reflex but the question asks for a conditioning procedure
!--
.o 22.9:
!--
Punishment may include all but the following. Choose it.
!--
.r1; increased time delay to reinforcement
.t; Yes since this is more likely to resemble an extinction procedure
.w1; present aversive stimuli after the behavior occurs
.t; No since this is a positive punishment procedure
.w2; remove conditioned reinforcing stimuli after the behavior occurs
.t; No since this is a negative punishment procedure
.w3; increase response effort required

.t; No since this is a positive punishment procedure
.w4; present aversive stimuli just before the behavior occurs
.t; No since this is a respondent punishment procedure
!--
.i 23.0:
!--
You're finished! This completes this program in Basic Concepts in Psychology. You are now ready to take the posttest and preference questionnaire. In one week there will also be a delayed posttest on these concepts. Check with the proctor to see what date and time you should return.
!--

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