Teaching Higher-Order Concepts in Philosophy
Using Siegfried Engelmann's Concept Analysis

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TEACHING HIGHER-ORDER CONCEPTS IN PHILOSOPHY
USING SIEGFRIED ENGELMANN'S
CONCEPT ANALYSIS

by

Jonathan E. Spiegel

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Jonathan E. Spiegel
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CHAPTER I

INTRODUCTION

The focus of this thesis is Engelmann's theory of concept analysis. Engelmann has developed a clearly delineated method of teaching concepts which supposedly enables a programmer to dispel ambiguity and teach previously amorphous subject matter in a specified manner.

Engelmann holds that, if a concept—no matter how complex—can be broken down into its composite parts, it can be taught. Hence, the only limitation in teaching a concept according to Engelmann's method would be the ability of the programmer to delineate the discriminations which compose the concept. Thus far, Engelmann has limited the use of concept analysis to the instruction of children.

The challenge of this investigation is: can Engelmann's concept analysis be extended to the instruction of complex concepts? More specifically, can concept analysis be used to teach the critical methods of philosophy?

The task of this investigation was twofold: first, to specify some of the critical methods of philosophy, and second, to determine the composite parts of these critical skills. The question is raised: can philosophical methodology be broken down in such a way that it can fit into Engelmann's paradigm, or is it the case that Engelmann's
theory has limitations which are manifested when an attempt is made to apply the theory to complex subject matter?

Once these analytical questions are answered satisfactorily, then and only then can an empirical comparison between Engelmann's and more traditional methods of instruction be undertaken. This study addresses itself to the analytical questions, leaving the empirical questions for future investigation. In addition, it should be noted that no attempt is made to compare Engelmann with other learning theorists. Instead, there is an attempt to take the theory as it stands and actually do a concept analysis of a higher-order concept.

The plan of this investigation is as follows: (1) a detailed explanation of Engelmann's theory; (2) a description of how the theory was applied to the present project; (3) a critique of concept analysis as it relates to this study; and (4) a demonstration of how the theory might be employed to teach critical skills.
CHAPTER II

ENGELMANN'S THEORY OF CONCEPT ANALYSIS

Justification of the Approach

Since the major task of this project was to implement Engelmann's concept analysis on a complex level, a thorough description of his theory is called for.

Engelmann begins the explication of concept analysis by separating his approach from that of other learning theorists. His interest is not the traditional one of studying how concepts are acquired; rather, he is interested in how they are best taught. This difference of perspective leads Engelmann to focus on analytical rather than empirical problems. Engelmann states that a difficulty of other learning theorists is that they confuse concepts with behavior. Instead of clarifying what concepts are, they limit themselves to a study of concept behavior. These traditional theorists try to discover what concepts are by observing how they are learned. This mode of investigation may uncover what the learning process is, but it may not be the most direct method for discovering the nature of the concepts. It is Engelmann's belief that we must first determine the nature of the concepts before they can be taught effectively. Obviously, what a person learns about a concept is correlated with what he is taught.
And, it is this tack that traditionalists often take to defend their study of concept learning. However, our success may be greater if we begin at the more primary level and first undertake an analysis of the concept itself. This analysis would take the form of translating the concept into specific discriminations which can be taught. After the concept has been analyzed, then the knowledge accrued from empirical investigation of learning can be of help in teaching the concept. Thus, at the outset, Engelmann has attempted both to justify his project and to undercut traditional concept formation theory by approaching the subject matter from a basic level.

Definitions of "Concept" and "Concept Analysis"

Once the approach itself has been justified, Engelmann proceeds with a detailed explanation of concept analysis. Concept analysis can best be understood as a method for revealing what a concept is and then teaching it in a highly organized manner. Since the term "concept" has a variety of meanings, Engelmann redefines it to fit his technical usage. His restricted definition states: "A concept is a set of characteristics that is shared by all instances in a particular set and only by those instances" (Engelmann, 1969, p. 9). Thus, the concept "red" is not an amorphous essence or universal; rather, it is simply that set of red objects presented in a particular teaching
routine. As a result, a concept becomes a function of the set of instances presented, which may change as the composition of the set changes.

Because this definition makes the concept context-dependent, it precludes the possibility of any concept being an absolute. In addition, the definition has direct implications for the method of concept teaching. If a concept is simply a set of shared characteristics in a given context, then concept learning becomes synonymous with discrimination learning. In order to teach these discriminations most efficiently, the concept must be analyzed into its component parts or essential discriminations. Engelmann holds that these component parts fall into one of three categories, which he labels "S+," "S-," and "Si."

The S+'s are stimuli or stimulus complexes which are invariably associated with instances of the concept. The S-‘s are invariably associated with non-instances of the concept, and the Si’s are variably associated with either. According to this analysis, concept learning simply involves two discriminations: (1) the discrimination of relevant characteristics of instances (S+'s) from relevant characteristics of non-instances (S-'s) and (2) the discrimination of relevant from irrelevant characteristics (Si) within a concept set. Keeping in mind that all concepts are context-dependent, concept definitions are always restricted to a particular teaching universe. Circumscribing the con-
cept in this manner enables the concept analyst to specify exactly what discriminations must be taught. In addition, this implies that no concept can be taught without also teaching the relevant characteristics of other concepts from which the given concept is to be discriminated (Becker, Engelmann, and Thomas, 1971, p. 241).

It is important to equate concept learning with discrimination learning since this restricts the task of the concept analyst to being one of identifying essential discriminations. In other words, this method allows specification of the minimum set of discriminations a learner must make in order to distinguish instances from non-instances of the concept.

Engelmann's definition of a concept is a procedural one. First, a set of stimuli with shared characteristics is identified, and then a teaching procedure is employed. The act of identifying these shared characteristics is the concept analysis. This identification of characteristics is accomplished by a rational rather than an experimental analysis of the concept within its particular context. The analysis itself is a procedure for describing a concept in terms "... that will translate into specific manipulation of environmental variables" (Engelmann, 1969, p. 6). Stated more simply, it is the transformation of a concept into specific tasks. This in turn allows for arranging the tasks in such an order that they can be set
into a sequenced program. Thus, the concept analysis is geared to reveal the essential discriminations necessary both to identify a concept and to specify the required tasks.

Performing the Concept Analysis

Now that both "concept" and "concept analysis" have been defined, the process of performing a concept analysis can be clarified. It is important to note that Engelmann views teaching as a "manipulative science" (Engelmann, 1969, p. 7) whose methods are employed to produce desired changes in behavior. Given this stance, it is not surprising that, for any teaching program, Engelmann demands that the programmer have specific objectives in mind and absolute criteria of performance. Only after these prerequisites are met can the programmer begin to develop a teaching sequence.

Engelmann holds that the whole teaching procedure is based upon two basic principles: (1) that there are observable qualitative differences between things; and (2) by treating S+'s one way and S-'s another way, we will be able to demonstrate these qualitative differences. This differential treatment (of S+'s and S-'s) basically involves reinforcing a response in the presence of an S+, and not reinforcing that same response in the presence of an S-.

The teaching procedure can be separated into four distinct
steps: (1) analyzing the concept into S+'s, S-'s, and Si's; (2) developing a series of teaching demonstrations (or battery of examples); (3) developing tasks to test the effectiveness of the teaching; and (4) ordering the tasks and examples to form a program.

As mentioned earlier, an important purpose of the first step (analyzing the concept) is to specify the characteristics which are shared among different instances of the same set. In order to do this, the concept analyst must first determine the context (teaching universe) within which the concept will appear. He can then determine the S+'s, S-'s, and Si's within that universe and which of these discriminations to focus on. One of the guidelines for determining which discriminations to teach is: "When concepts differ in many ways, only a sampling of the ways in which they differ need be taught. When there are few differences, each of the differences must be taught" (Becker et al., 1971, p. 266). This rule arises from the fact that the more shared characteristics two concepts have, the greater possibility of confusion. For example, teaching the concepts "squirrel" and "crocodile" would require teaching only a sampling of their differences, whereas teaching the concepts "alligator" and "crocodile" would require teaching their very specific differences. The teaching of a critical discrimination can best be accomplished by either talking directly about the difference
("Notice that crocodiles have a different-shaped snout than alligators") or exaggerating the difference through additional cues ("Draw a picture exaggerating the snout sizes of the different species").

Because any one concept instance is an instance of many things (e.g., an instance of the concept "car" may simultaneously be an instance of "red" and "vehicle"), the concept analyst must insure that the learner is responding to the essential characteristics of the concept. There are three ways for accomplishing this end:

1. A concept cannot be taught by presenting only one instance and one non-instance. It is necessary to present a set of both instances and non-instances. (Engelmann contends that "one trial learning" is actually a product of the combination of past experience and chance.)

2. To avoid learning misrules, the set of instances should ideally be arranged so that all instances have all essential characteristics and all non-instances have none of these characteristics.

3. Finally, it is necessary to vary the irrelevant stimuli so that they appear with both instances and non-instances.

The three guidelines mentioned above are essential for any concept teaching and demand further explanation. When a group of instances and non-instances is chosen to demonstrate a concept, the grouping is usually only a sampling of the possible universe of instances. This situation can easily lead to the learning of misrules. A misrule can be introduced by including in the sample some
characteristic which is shared by all members of the sample but not by all members of the universe.

When devising a set of concept instances, the concept analyst should attempt to rule out any extraneous variables. Simply by continuing to introduce a variety of S+’s, the shared characteristics of the group become reduced to the point where they correspond to the shared characteristics that describe the concept. Thus, the programmer must be careful not to include any irrelevant variables consistently along with his presentation of positive concept instances.

Engelmann points out that the most desirable presentations are those which have the least memory load and misrule potential. One way of reducing both memory load and misrule potential is to hold the irrelevant characteristics (S_i’s) of a concept constant across S+’s and S−’s. For example, when teaching the concept “blue,” present a blue ball (S+) and then an identical red ball (S−) and then the blue ball again. Thus, the only thing changing is the color, which is the critical discrimination being taught. Memory load can be reduced by: (1) presenting pairs of S+’s and S−’s which can be directly compared; (2) changing only one characteristic when going from an S+ to an S−, holding all other characteristics constant; and (3) presenting the sequence of instances rapidly.

It is essential that an adequate presentation include
non-instances as well as instances of the concept. Without the inclusion of S-'s, the student may not learn the "boundaries" of the concept and may identify some non-instances as instances. In order to teach the concept's boundaries, the programmer must specifically demonstrate where they lie.

At times, confining the concept to narrower boundaries than are usually associated with the concept may result in more efficient teaching. (The concept analyst is not required to teach the full concept at the outset of a teaching program.) In order to reduce a concept, a distinction must be drawn between the concepts themselves and concept words. For example, the concept "red" is the set of all red things presented in a particular teaching demonstration, and it is signaled by the concept word "red." If a concept analyst is going to reduce a concept, he must first understand how the concept word is ordinarily used. After an examination of the concept, the programmer should choose those characteristics which cover most concept instances. Although he should not get involved with the gray areas of the concept, the programmer should recognize that almost every concept has these gray regions. A gray area consists of relatively few instances which need to be included for detailed discriminations but not when a concept is being reduced. If a programmer does limit a concept, it should be done in such a way that the concept can
be modified later through additions to the program.

Task Testing

Once the programmer has completed his concept analysis, he needs some way of getting feedback from his student. The programmer must know if his student has grasped an already presented concept before proceeding with his teaching sequence. Since the programmer cannot directly observe his student's concept, he must develop a method of testing for the acquisition of the concept. This testing always takes the form of tasks to be performed. The task itself arises from the concept analysis and is geared to test for a given discrimination. Only in this way can the student's understanding be evaluated.

The testing of a concept is always very specific and asks whether or not the learner can demonstrate his ability to discriminate the designated set of characteristics. Once the concept analysis specifies a discrimination (an $S^+$, for example), it also implies a task to be performed (i.e., to discriminate between this particular $S^+$ and some other environmental variable). Although the concept analysis specifies a discrimination the learner will be asked to demonstrate, it does not specify any one particular response form. (For example, to demonstrate the concept "blue ball" the task may take the form of "Point to the blue ball, pick up the blue ball, draw a blue ball," etc.)
It is important that the task tests only those discriminations which have been specifically taught. In the example above, for instance, "draw a blue ball" may inadvertently be testing the learner's ability to draw rather than his ability to discriminate. Thus, there exists a range of acceptable response forms among which the programmer must choose. The programmer should also be careful to test for irrelevant as well as for essential characteristics. This testing is done to insure that an irrelevant rather than an essential characteristic has not been learned by mistake.

Programming

Closely tied to Engelmann's concept analysis is his concern with programing subject matter. It is his belief that this method results in more efficient teaching than is possible with traditional techniques. He defines programing as a sequencing of demonstrations and tasks in such a way that a student's mistake can be corrected by referring back only as far as the immediately preceding program section. Thus, if a student makes a mistake, the programmer knows exactly where the problem lies and what needs clarification. It is a stepwise method which teaches only one skill at a time.

The first step in developing a program is to analyze the concept and specify the terminal objectives. ("Ter-
minal objectives" are being defined as a set of tasks which the student should be able to perform upon completion of the program.) Next, the concept parts which have been analyzed must be arranged so that the concepts build upon one another to form higher-order concepts. ("Higher-order concept" is a relative term simply meaning a concept which includes a lower-order concept as a partial set of instances composing its concept universe.) For example, in the case of this particular investigation, the terminal objective for the first part of the program is for the student to be able to distinguish arguments from non-arguments. Upon analysis, the basic discrimination involves identifying premises and conclusions. But, before that can be done, a discrimination between statements and non-statements is necessary. Hence, the program evolves in three steps building in a stepwise fashion: be able to distinguish (1) statements from non-statements, (2) premises and conclusions, and (3) arguments from non-arguments.

**Generalization**

After a concept analysis has been carried out and a test devised, one might ask if the concept skills acquired will generalize to other instances. In response, Engelmann holds that if the concept has been mastered then the student should be able to respond to any member of the concept class, whether or not that particular member was pre-
presented in the program itself. This might be considered
generalization, but Engelmann would protest, saying, "From
the standpoint of programing there is no such thing as
generalization" (Engelmann, 1969, p. 49). What occurs is
not generalization; rather, it is a learning of all criti-
cal discriminations involved in the concept. Hence, if a
student is expected to demonstrate knowledge of a particu-
lar concept, he must specifically be taught all of its com-
ponent parts.

This is an important point for Engelmann, and, in
order to clarify it, he cites the water transfer problem.
In this problem, a child is presented with two identical
glasses filled to the same level with water. The child
demonstrates his ability to correctly identify the glasses
as having the same amount of water; when the water from
one glass is poured into a shorter, wider glass, however,
the child will say the glasses contain unequal amounts of
water. Engelmann demonstrates that a program can be devised
to teach that the amount of water remains the same. Engel-
mann's critics may say that the child has not learned the
underlying concept (i.e., if the amount of a substance is
fixed, changing its shape does not change the amount pres-
ent). The critic could then prove his point by taking two
identical balls of clay and flattening one into a long,
tube shape and having the child judge the amounts unequal,
even though this child can solve the water transfer problem.
Engelmann holds that this sort of criticism has no impact for concept analysis. The critic is simply testing performance of something that has not been taught. What was taught by Engelmann was the concept of water-as-fixed-unit. Engelmann says that he could easily teach the concept of compensating changes (to account for the clay problem), which is simply a broader concept. He says that his original intent was simply to teach a more limited concept, and, therefore, it is unfair to test the child on something which he has not been taught. In order to avoid criticism about lack of generalization, Engelmann suggests that the programmer specify the range of tasks the learner is expected to be able to do upon completion of the program. Thus, Engelmann has defused the issue of generalization by saying that it is only fair to test the learner on something which is in the specified range of the concept taught.

Discovery

Now that the method of concept analysis has been described, one can understand an important way in which it differs from more traditional approaches. Often, concept teaching takes the form of: "Here's the concept to be mastered. Memorize these rules and mastery will be yours." What is being taught is a series of rules which the teacher expects the student to use. If the student uses the rules correctly, it is inferred that he has
grasped the concept. His rule-following behavior is equated with concept understanding.

In concept analysis, on the other hand, the student must infer the rule from a series of presentations. He must discover what is the same over a series of concept instances. The programmer, in turn, infers what the student's rule is by viewing his behavior. The programmer does not have direct access to the student's concept rule, and vice versa. Just as it takes the student a number of presentations to discover the concept, it also involves a number of presentations before the programmer can discover a relationship between the student's response pattern and his concept.

Basically, Engelmann believes that a concept cannot be efficiently taught by saying, "Here's the concept." Concept learning involves demonstrating the discrimination to be learned. The principle being taught by concept analysis is that "... if things are the same they can be treated in the same way and that if things are treated in the same way, they are the same in some respect" (Engelmann, 1969, p. 22). Engelmann terms this method of learning "discovery," because the learner is presented with a battery of examples from which he must extrapolate the concept. The learner must discover what characteristics the positive instances have in common.
CHAPTER III

DEVELOPMENT OF THE PROGRAM

As mentioned earlier, Engelmann's method has only been used to instruct children, and this investigation focuses upon applying the Engelmann method to more complex subject matter. The chosen subject area was philosophy. This choice was made for two reasons: (1) philosophy is often considered a complex academic area, and (2) many of behaviorism's most vociferous critics are philosophers. A more efficient method of teaching philosophy derived from behavioral techniques would demonstrate some of behaviorism's strengths.

Behavioral science has already been applied to the realm of philosophy. The techniques of contingency management and programmed learning have been employed successfully to the teaching of symbolic logic. Programmed texts on symbolic logic such as Kearns's *Deductive Logic* (1969) and Schagrin's *The Language of Logic* (1969) have proven their utility as teaching aids. These texts, however, are specifically aimed at teaching symbolic logic and not critical skills. In addition, they focus on rule memorization rather than on discrimination learning. In contrast, this investigation was concerned both with teaching particular critical skills and employing the method of concept analysis.
Although Engelmann's theory presents an analytical task, this investigator was originally intrigued by an empirical problem. The problem pertains to the difficulty students often have in acquiring the critical methods of philosophy. Many instructors have lamented over their students' inability to present lucid arguments and to critique the arguments of others. In an attempt to rectify this problem, philosophy students are often required to take one or more courses in symbolic logic. It is hoped that exposure to sentential and predicate calculus will aid the students' development of critical skills. Unfortunately, there seems to be no clear, direct relationship between an expertise in symbolic logic and the concomitant skills of critical analysis. It is not unusual for a student to simultaneously exhibit a thorough grasp of traditional logic and a noticeable lack of good arguing technique. If Engelmann's method can be employed in this field, then an empirical question arises. Namely, is Engelmann's concept analysis a better method for teaching critical skills? If so, it should be able to demonstrate a capability for teaching these skills more efficiently than traditional methods. (Of course, carrying out the empirical task would involve both a method of evaluation and exact definitions of "efficiently" and "critical skills."

The empirical question is being raised here because
it directly influenced certain decisions in developing the program. For example, many professors of logic have commented on the difficulty students have in dealing with symbols. This observation is often presented as a major reason why logic skills do not generalize well to critical skills. Students often claim to see a relation between mathematics and symbolic logic, but no relation between arguing skills and symbolic logic. Recognizing this, the program was developed with a minimal amount of symbolization and, instead, a reliance upon ordinary language examples.

In order to develop this teaching program, it was necessary at the outset to delineate the subject matter and terminal objectives. Reasoning or critical thinking consists of several different skills, a basic set of which involves arguments: (1) separating them from mere dogmatic assertions and emotional appeals; (2) recognizing and distinguishing their parts; (3) being able to distinguish valid from invalid arguments; and (4) being able to refute and improve upon them. These basic skills constituted the primary target of the program. The program itself was developed through the first and second skills and partially through the third skill.

Once the range and type of skills were enumerated, they had to be arranged in hierarchies. That is, since a higher-order concept is composed of a number of lower-order
concepts, these lower-order concepts need to be identified. For example, to identify instances of the concept "argument," one must be able to distinguish between arguments and non-arguments. Since a grouping of sentences is an argument only by virtue of the relationship between its premises and conclusion, "premise" and "conclusion" must be taught. However, in order for something to be either premise or conclusion, it must first have status as a statement. Hence, the discrimination between "statement" and "nonstatement" needs to be taught. Thus, not only did the component parts of the concept need identification, but, because of their interdependence, a particular ordering of concepts was necessitated. Hence, the choice of terminal objectives resulted in a list of tasks in the order in which they should be taught. After much revision, an outline of tasks was agreed upon. (There were three investigators involved in developing the early stages of the program.) The tasks are:

1. Define "statement."
2. Distinguish statements from nonstatements.
3. Define "premise" and "conclusion."
4. List four premise indicators and four conclusion indicators.
5. Isolate premises and conclusions.
6. Define "argument."
7. Pick out arguments from non-arguments, isolating premises and conclusion.
8. Give three definitions of a valid deductive argument.

9. Give the definition of a good inductive argument.

10. Define a sound argument.

11. Explain why deductive reasoning alone cannot decide whether a given argument is sound.

12. Explain what it means to say that two arguments have the same logical form.

13. Tell whether or not two simple arguments have the same logical form.

14. List at least three connectives.

15. Distinguish simple from compound statements.

16. List four valid argument forms.

17. Judge a given example's validity by comparing it to the basic valid argument forms.

18. Explain how a complex argument may consist of a sequence of simpler arguments.

19. Tell if a given argument consists of a sequence of sub-arguments; if it does, be able to exhibit the sub-arguments, telling if they are valid.

20. Write a valid argument.

21. Write a valid argument for a given statement.

22. Demonstrate that your arguments are valid.

23. Tell if a complex argument is valid, demonstrating how it is or is not valid.

24. Write a three-page critique of a given essay—not more than one page consisting of a summary of the given essay and not more than one-half page a summary of your
essay, the rest consisting of valid arguments in support of, or critical of, the given essay.

This list of objectives is not meant to be exhaustive; rather, it is an outline allowing revision as the program is developed. This allowance for modification proved necessary because certain obstacles were not predicted. For example, the investigators discovered that the transition from one objective to another often involved intermediate steps that were not foreseen. Thus, the list of objectives was constantly being revised as complications of the concept discriminations were revealed. Since the program was only developed through the fifteenth objective, the remaining objectives evidence the need for additional tasks. That is, more objectives are necessary in order to have a smooth transition between consecutive steps.

After developing a list of terminal objectives and ordering them to form hierarchies, it was necessary to perform a concept analysis for each of the concepts involved. This required a series of steps.

First, the concept itself needed clarification. For example, should the concept "proposition" or the concept "declarative sentence" be taught as the base from which to teach the concept "argument"? Logicians often use "proposition," which becomes equated with the "meaning" of a particular sentence. But "meaning" is such an ambi-
uous term that teaching students to discriminate meanings would result in less efficient learning. This problem led the programmers to consider "declarative sentence." But "declarative" is a word many students have encountered in grammar class, indicating a particular sentence type. And, since rhetorical questions can function as assertions, confusion might easily arise. In the hope of avoiding confusion, the concept "statement" was finally decided upon.

Second, the essential discriminations composing the concept needed identification. Since simply viewing many statements to discover their shared characteristics would be overly time-consuming, the work of isolating characteristics was often reduced to examining a number of logicians' definitions of the concept in question. These definitions would then be synthesized into one definition which could then be translated into specific tasks. The resulting procedural definition would then become the $S^+$. It would be a naming of the critical attribute which all instances would necessarily contain and without which an example would be judged a non-instance. Thus, the definition would present the criterion against which all examples would be judged. Since the definition was the specification of the critical attribute, its negation would result in the definition of the $S^-$. For example, the $S^+$ definition for "statement" was, "It makes sense to say that it is either true or false." And the $S^-$ definition was, "It
does not make sense to say that it is either true or false."

The strict behaviorist may ask how this definition either pinpoints a specific attribute or implies a task. Is "it makes sense" really a characteristic of a thing? This is indeed an important question to ask, and it will be more completely answered in the critique. For now, let a partial answer suffice. At one point, Engelmann speaks of essential characteristics "residing in" objects (Engelmann, 1969, p. 48). Possibly, part of the problem involves the fact that a statement is not a tangible object in quite the same way that horses and chairs are tangible objects. As a result, characteristics may not "reside" in statements in quite the same way as they do in more tangible objects. Thus, an attribute of "statement" would have to be of a different sort than an attribute of "horse" or "chair."

In implying a task, once again a distinction in subject matter is necessary in order to judge the type of task demanded. Certainly, "statement" does not allow the same sort of task as does "horse." We cannot point to where the statement "makes sense to say it is either true or false" in the same way that we can point to "has four legs, body hair, and hooves." But there is indeed a doing involved with asking oneself, "Does it make sense to say it is either true or false?" when presented with an example.
And this *doing* is itself the task. This investigator holds that once the type of subject matter is taken into consideration, the definition given can be seen to name an attribute and to imply a task.

Third, after essential characteristics have been isolated, irrelevant characteristics must also be identified. This task usually requires that the concept analyst ask himself, "What might cause a student to confuse an instance with a non-instance?" The answering of this question relied heavily upon the analyst's own experience gained from teaching logic. Additional information was obtained from reading logic texts to determine what the logician was implicitly expecting his students to consider irrelevant by his presentation of the concept. This was a difficult operation primarily because it involved second-guessing as to what sort of error a student would be likely to make. This difficulty would be somewhat alleviated by receiving student feedback on what sort of mistakes tended to occur.

Because irrelevant stimuli are not always evident upon viewing a concept, the analysts had no real assurance that they were including all possible Si's. This, in turn, led to the possibility of inadvertently teaching misrules. Once again, alleviation of this problem would depend upon a good deal of student feedback.

One method of identifying Si's took the form of grouping them according to type. For example, the Si's for
"statement" involved the following:

1. Irrelevance of subject matter
   a) Value
   b) Intentionality
   c) Unknowables
   d) Unobservables

2. Grammatical form
   a) Simple vs. compound sentences
   b) Subjunctive mood
   c) Future tense

3. Actual truth or falsity of the statement

After specification of the S+'s, S-'s, and Si's, an example series was developed to teach the concept. When developing the example section, an attempt was made to present only one Si at a time in order to prevent the learning of misrules. The task presented some problems, however, because of the overlapping of Si's—e.g., many statements of value (Si) are also unknowables (Si). Resolving this difficulty involved incorporating a large battery of examples into the program to reduce the probability of Si confusion.

It was decided that each example series should begin with a series of S+'s containing few Si's, if any. This tactic was employed in an attempt to begin the presentation with the clearest examples of concept instances possible. The S'+s and S-'s were then presented in an increasing order of difficulty. Because the S+'s were presented and tested at the outset of the sequence before the presentation of any S-'s or Si's, it could be inferred that the
student could recognize basic examples of the concept. With this as the base, it could then be inferred that if a student made a mistake it was due to the addition of a particular Si.

Another question in developing the example section was: "How many examples should be included?" At first, it was decided that there should be at least one pairing of each Si with both an S+ and an S-. But it was soon discovered that this was unfeasible because certain S-'s could not be paired with certain Si's (e.g., the S- exclamation for "statement" could not be linked up with the Si's compound sentence, future/past tense, actual truth value, etc.). It was finally decided that there should be at least one presentation of each S+, S-, and Si. The exact number of presentations for S+’s, S-’s, and Si’s was not finalized. As a general policy, however, three presentations of each S+, S-, and Si were given, with room allowed for varying degrees of difficulty. Of course, the final decision on the number of examples necessary would depend upon an examination of error frequencies after administering the program to a number of students.

Closely tied to the development of an example series was the decision on what form the series itself should take. Since the examples were to be given in written form (instead of classroom demonstrations), the teacher could not receive immediate student feedback. Since feedback
is essential to the pacing of the teaching sequence, and the teacher's time limited, some method of self-pacing was necessary. The method chosen was branched programing. It was decided that, for this pilot project, the trunk of each S+, S-, and Si would consist of only one example and the branch of two further examples, the last example in the branch instructing the student to rework the examples or to see his professor for additional help.

In keeping with a desire to make the student more independent of the teacher, a special type of feedback was included. This special feedback was based upon Mager's (1962) approach to instructional objectives. Using Mager's method, an example is presented, and the student, based upon his answer, is directed to a particular page. On this page, the reader is met with a discussion of his answer rather than the simple indication of the right answer so common in programing. This form of feedback gives the student who makes a mistake some remedial exposure and steers him into a branch for additional work. For the student who answers correctly, the feedback allows the programmer to deal with the real possibility that the student obtained the right answer for the wrong reason by rehearsing the right reason.

Finally, an explanatory section or prose section was added to the beginning of each example section. It was soon discovered that a brief description of the salient
features of the concept greatly reduced the number of examples necessary to demonstrate the concept. It was felt that this did not negate the possibility of "discovery" learning for two reasons: (1) the student was not asked to memorize rules in the prose section, and (2) the weight of demonstrating the discriminations still fell on the examples.
CHAPTER IV

CRITIQUE

The following section is a critique of Engelmann's concept analysis, drawing its evidence both from the realm of praxis (as presented in Chapter III) and the realm of theory (as presented in Chapter II). The critique begins with a description of some of the problems faced during the development of the program.

A major focus of Engelmann's theory involves an attempt to redefine the word "concept"—that is, to go from vague philosophical definitions to concrete behavioral definitions. This investigator holds that the use of Engelmann-style operational definitions resulted in a number of difficulties which became evident during the development of the program.

One of these difficulties concerned devising the procedural definitions themselves. The critical task in teaching with Engelmann's method rests upon the ability of the concept analyst to break down the concept into its composite parts. However, there are no clear-cut rules for how the concept analyst is actually to determine a concept's essential characteristics. This becomes more of a problem with the more abstract concepts. Engelmann is aware of this difficulty and says, "The more
fewer S+ characteristics, the more abstract the concept" (Becker et al., 1971, p. 266). And along with an increased number of Si's comes an increase in misrule potential. But Engelmann offers no way of specifically determining what are the S+'s and how to isolate them from the Si's. Possibly, if Engelmann was willing to speak of stimulus properties instead of using an ambiguous term, i.e., "characteristics," this difficulty might have been reduced.

Once the problem of increased Si's involved in more abstract concepts was recognized, the question of how to reduce misrule potential in the example series as well as in the concept analysis itself had to be faced. To reduce misrule potential, Engelmann advises keeping the S+'s constant and only varying one Si at a time. In the present investigation, following this advice took the form of keeping the examples basically the same, with as little variation as possible. For example, introducing the Si "future tense" to the concept "statement" originally appeared as follows: (S+) Today is Tuesday, (Si) Tomorrow is Tuesday. This tactic resulted in an extremely tedious example section. With the belief that tedium would result in inefficient learning, the examples were varied. But once the examples varied, misrule potential increased. Thus, the programmer had to choose between a tedious example section or an example section with a high misrule potential, either choice leading to less-than-ideal
learning conditions.

The problem of abstractness presented more and more difficulty as the program was developed. It was discovered that, as the concepts began to build upon one another to form higher-order concepts, the prose section needed to be enlarged. More explanation appeared to be necessary before the example section could be introduced. The point was reached where rules were given and the prose section and example section were sharing the task of demonstrating the concept on an equal basis.

The increased use of an explanatory section can be accounted for by the increased number of Si's in the higher-order concepts. For example, the concept "validity" involves all of the Si's of the preceding lower-order concepts. But saying that the problem was due to a simple increase of Si's does not capture the essence of the difficulty. For example, the concept "validity" is actually a complex set of relations based upon an interdependence of hypothetical truth values. The student must perform a series of interrelated distinctions in order to make a judgment concerning validity. In addition, "validity" has three different formulations which were presented in the form of definitions. Each definition is a sufficient definition of validity; but each has a different verbal formulation in order to illuminate a different aspect of the concept. So, in a real sense, teaching "validity"
involved teaching three interdependent concepts of "validity."

This investigator contends that the increased use of the explanatory section can best be accounted for by the interrelatedness of the lower-order concepts which compose a higher-order concept. But whether this explanation is more or less satisfactory than an explanation in terms of increased Si's is secondary to the fact that the program-mers faced increasing difficulty in demonstrating higher-order concepts through the use of a battery of examples. The point was finally reached where it was difficult to say that the concepts were actually being taught as Engelmann envisioned.

Another explanation for the difficulties encountered involves the nature of the project itself, that is, an attempt to teach logic using ordinary language. Symbolic logic is a precise discipline akin to mathematics. Ordinary language, on the other hand, is imprecise, and difficulty was anticipated in teaching the rules of logic using ordinary language. An example of this problem revolved around synonymous meanings. There are at least two forms of synonymous meaning. One involves synonymous terms: for example, "That bachelor dated Susie" and "That unmarried male dated Susie." Another form concerns compound statements which are logically equivalent. That is, there are times when two arguments have the same logical form,
but their verbal formulations are different. For example, consider the following: "If Dave goes to the ball game, then he'll be late" and "Either Dave does not go to the ball game, or he'll be late." These two statements have equivalent logical form, but they have different topographies. When we ask the student to judge the statements the same, we are essentially asking him to recognize that they have the same "meaning" (i.e., they are both true or false under the same conditions). And the programmers were attempting to avoid the problem of teaching meanings. This difficulty could be tackled by teaching: If P then Q is equivalent to Either not P or Q. But this solution would return the programmers to teaching symbolic logic. This problem was a difficult one for which concept analysis did not provide an adequate solution.

Thus far, different explanations have been offered to account for specific difficulties in developing the program. Now, one general explanation will be offered to account for all the difficulties. One might ask: "If these are important problems, why hasn't Engelmann addressed himself to their solution?" The answer may be that, up to this point, the type of subject matter to which concept analysis was applied did not involve these problems. This present investigation concerns subject matter which is qualitatively different from the subjects previously taught using concept analysis, and different subject types would
create different problems. The difference between subject matters might best be understood not as a quantitative difference between relatively simple versus complex subject matter, but rather as a qualitative difference between perceptual and cognitive discriminations. Engelmann has focused on teaching perceptual discriminations where the student can actually see the essential characteristics that go into making up the concept. Hooves, body hair, and four legs can easily be seen when looking at a horse. But how do we see that "it makes sense to say it is either true or false"? Although the strict behaviorist would not want to agree that the difference here rests upon making a cognitive rather than a perceptual discrimination, it could seriously be argued that the seeing involved is a different sort of seeing. If the seeing is different, then the act of seeing or performing the discrimination is also different. And, if the act involved in doing the discrimination is different, then the method for teaching these different acts would also have to be different. But Engelmann only offers one method for teaching two disparate acts.

And, since Engelmann developed the method for teaching perceptual discriminations, the method would be inadequate for teaching cognitive discriminations.

The next section attempts to demonstrate that not only does the Engelmann theory fail to make allowance for cognitive discriminations, it has other weaknesses as well.
One of these weaknesses is that the theory is formulated in such a way that nothing can function as evidence to the contrary.

To begin with, Engelmann's orientation is one which tries to diminish the importance of empirical evidence. Although an analytical approach has its validity, it must ultimately be grounded in empirical evidence; but Engelmann tries to claim that empirical proof has minimal impact upon his theory. Becker realizes this, saying, "Engelmann's focus is on design of teaching programs rather than on evaluation of their effectiveness . . . " (Becker et al., 1971, p. 242). Becker's statement makes an implicit assertion that Engelmann is a theoretician who shows little concern for empirical verification of his theory. Engelmann himself makes this point explicit. Directly preceding a short outline of concept analysis, he says, "Empirical studies do not 'confirm' the analysis" (Engelmann, 1969, p. 2). If empirical studies do not confirm his analysis, then what could serve this function? Engelmann appears to be proposing a theory which does not allow the possibility of being invalidated. To say that Engelmann's concern is one of design rather than evaluation in no way solves this problem. Thus, we are dealing with a theory of concepts which cannot even be modified let alone refuted through empirical evidence.

In order to defend this position, Engelmann must hold
that, for his programing technique, generalization does not play a part. It was pointed out earlier that Engelmann does indeed take up this position. The defense functions in the following manner: If a learner is unable to perform a task closely related to the one he was taught, he has not failed to learn the original concept; rather, he has not specifically been taught the related skill. If, on the other hand, the learner can perform the task, then he was taught it (perhaps inadvertently), thus no generalization is present. Stated another way, any failure on the part of the learner cannot be a failure due to the method of concept analysis; rather, it is the critic's mistake for expecting the learner to perform the task. The weight of proof has been shifted from Engelmann to any potential critic.

Engelmann also protects himself within the delineated boundaries of any particular concept. This is accomplished through an ambiguous criterion for understanding. How do we test for understanding?—by specifying terminal objectives. If the student can perform the objective, he understands the concept, and if he cannot perform the task, then he does not understand the concept. Terminal objectives usually take the form of recognizing S+'s, S-'s, and Si's. But at what point do we say the student can perform the task? Must he correctly identify one example, two examples, or three? Thus, if the student fails to correctly
identify an instance of the concept, it is never the fault of the concept analysis; instead, the student has not as yet understood the concept. Conversely, if the student correctly identifies a concept instance, we can automatically say that he understands the concept. The result of this approach is that at no time does student performance directly reflect the concept analysis itself. Poor student performance reflects either a potential critic's inability to appreciate the boundaries of the concept or the student's inability to understand the concept.

This investigator holds that Engelmann's failure to allow empirical validation is related to additional weaknesses in the theory. These weaknesses show themselves in a variety of ways. The first weakness is that Engelmann's use of the word "concept" is ambiguous. Engelmann defines "concept" in terms of a set of shared characteristics (Engelmann, 1969, p. 9). But he never offers an exact definition of "characteristics." We must infer that "characteristics" are the equivalent of stimulus properties, but for some reason this is never explicitly stated. More importantly, Engelmann shifts between referring to a concept as simply a set of shared characteristics and implying that a concept is an existent thing which is more than a composite of its parts. (This last point will be expanded upon in a later section.)

A second weakness involves "discovery" learning.
Engelmann is careful to make a distinction between traditional methods which explicitly teach rules and his method which demands that the learner infer the rules. He proposes that his method is more desirable because the learner "discovers" the rule as opposed to merely memorizing it. But in practice there seems to be no real discovery learning. That is, the teacher is expected to give a presentation including an explanation along with the demonstration of the concept. This is done for the sake of efficiency and reduces greatly the number of examples required. Although it must be admitted that the Engelmann method does shift the emphasis from rule memorization to finding the rule, once an explanation is offered pure discovery learning is ruled out. The explanation functions as a cue for what the learner is to "discover."

Not only is there no pure discovery learning in practice, but some of Engelmann's own statements raise the question as to whether he believes in "discovery" learning at all. Engelmann says that, with sophisticated children, a teacher may use a rule to describe the characteristics of a grouping of concept instances. "Not only does this procedure reduce the memory load imposed on the child, it also provides for a less ambiguous presentation. The rule has less noise than the presentation of demonstration instances. It has no irrelevant features" (Engelmann, 1969, p. 26). It does not seem that Engelmann could both
hold this position and propound discovery learning without contradiction. He even goes so far as to say, "The verbal rule, if properly constructed, is a model of the concept" (Engelmann, 1969, p. 26), which rules out any possibility of discovery learning.

Thus far, there has been an attempt to show initially that difficulties in the development of the program were due to Engelmann's failure to separate perceptual and cognitive discriminations. Then there was an attempt to show that difficulties in Engelmann's theory are not easily revealed because the theory has been formulated in a manner which does not allow invalidation. This final group of criticisms will attempt to show that the nature of higher-order concepts is such that Engelmann's concept analysis does not offer either an adequate description or an operational definition.

At the center of Engelmann's theory is his contention that concepts are simply a composite of shared characteristics; in order to teach concepts, it is only necessary to identify and teach their component parts (S+'s, S-'s, and Si's). This approach argues against the idea of concepts being more than a composite of parts (e.g., essences) and equates concept learning with discrimination learning. Interestingly enough, an examination of his writings shows that Engelmann does not consistently uphold his theory. He often speaks of concepts being real, existent entities.
which are more than their component parts. For example, he says that "... concepts share the characteristic of 'residing in' objects" (Engelmann, 1969, p. 48). This describes concepts as real things which have the ability of being inside objects. In an earlier section, Engelmann once again demonstrates a curious usage of the word "concept," saying, "If one specifies the universe and if one is actually dealing with a concept, there is a unique set of shared characteristics" (Engelmann, 1969, p. 16). What would it mean to say "actually dealing with a concept" if concepts were other than existent quasi-tangible objects? Engelmann again uses the term "concept" very oddly if he intends to describe stimulus properties by saying, "If he [the programmer] reduces the concept to a more simplified form, he must teach the 'main idea' of the concept" (Engelmann, 1969, p. 37). In what way is a "main idea" a stimulus property? At times Engelmann is quite clear on how he views concepts. He stresses that there is a difference between concepts and concept behavior. At one point Engelmann says that concepts are "... interesting because they are there in the real world ..." (Engelmann, 1969, p. 1). He says that concepts are "there in the real world," that they "reside in objects," have "main ideas," and can "actually" be dealt with. Thus, Engelmann is describing our experience of concepts as existent entities and not an experience of discrete stimulus properties.
The notion of concepts as existent entities pervades the whole of Engelmann's work. The fact that Engelmann has to resort to describing concepts as entities implies an inadequacy in describing them as merely sets of characteristics. The inadequacy of reducing concepts to stimulus properties shows itself in other ways as well. Engelmann mentions that a concept can only be defined within a specific teaching universe or context. Thus, the definition of "horse" would be different if the teaching universe consisted of horses and birds than it would be if the teaching universe consisted of horses and dogs. This suggests a relatedness of the concepts because their juxtaposition influences their definition. But, if a concept is simply a set of shared characteristics, from where does this relatedness arise? Engelmann tries to counterbalance relatedness by introducing the notion of intent. He says that critics improperly attack concept analysis when they fail to take into account the context within which the concept was being taught, i.e., what the concept analyst intended to teach. The critic "... did not consult the intent of those who had developed the test" (Engelmann, 1969, p. 70). But this tack only exacerbates the problem. The question now arises, not only how do discrete sense data (stimulus properties) allow of relatedness, but also how do they allow of intentions? Once again we are faced with the question--if concepts are only a conglomeration
of discrete stimulus properties, how can we account for intention? Given only atoms of sense data, from where do intentions arise? As Engelmann has implied, we experience concepts as existent entities which allow of both relatedness and intentionality.

Not only do we not experience concepts as simply a composite of characteristics, but we do not even teach concepts as being simply shared characteristics. Engelmann implies that what concept analysis teaches is a range of possibilities. Since possibilities are not physical stimuli (not S+'s, S-'s, or Si's), teaching possibilities could not be equated with teaching via concept analysis. If the concept analyst teaches the concept: "blue," for example, he does not present every shade of blue and every shade of not blue. As a result, the student learns a range of possibilities. Engelmann recognizes this, saying a program is "... designed to teach the range of instances, the range of non-instances, and the range of irrelevant stimuli" (Becker et al., 1971, p. 246). If the program is designed to teach a range of instances, then it is not aimed at teaching specific stimulus properties. Thus, Engelmann is not even attempting to teach concepts as he originally defines them.

Possibly Engelmann declines to say he is only teaching students to discriminate shared characteristics because he is aware that a certain ability to discriminate is necessary
even before his particular form of concept learning can take place. For example, this particular investigation required that a certain level of rational skills be presupposed before the concept analysis could even be embarked upon. This problem involved more than simply deciding on a target population. Rather, it involved a supposition that the ability to make certain discriminations would be preexistent in any chosen target population. For example, the first concept to be learned demanded that the student ask himself, "Does it make sense to say that it is either true or false?" The example section was meant to enable the student to "discover" this rule and discriminate when the rule was satisfied. But the concept analyst was not trying to teach whether or not something "made sense." This was a rational skill which was assumed before embarking upon the teaching because of the amount of time necessary for teaching "it makes sense." It seems that there must be some base level which is supposed existent before this type of discrimination teaching can take place. Possibly the most basic level would be an ability to discriminate "same" and "different," which is obviously necessary before any discrimination learning will be successful. Thus, there is a level below which discrimination learning will not be effective. As a result, certain basic rational skills must be present before concept analysis will prove useful.
Not only is a certain base level necessary before concept analysis can benefit the student, but there is a certain prerequisite necessary before the programmer can perform the concept analysis. Engelmann indicates that the programmer must be in touch with the concept before he can perform the concept analysis. That is, he must in some sense already know what the S+'s, S-'s, and Si's are before he can teach them. Engelmann says, "To assemble a concept group that shares only the desired characteristics, the teacher must consult his knowledge of the concept" (Engelmann, 1969, p. 25). Thus, before the programmer can break down the concept into its composite parts, he must have prior knowledge of the concept itself. He must already have experienced the concept before he can perform the concept analysis. Thus, once again, experience of the concept as a unit whole is prior to the task of breaking down the concept into discrete stimulus events.

A recurring difficulty with Engelmann's theory is that there is a tension between describing concepts as composites of discrete sense data and our own experience of them as complete entities. That is, when I come to grasp a concept I grasp not simply S+'s, S-'s, and Si's, but rather the concurrent existence of all of these properties and a relatedness between them. In addition, I bring with me to the perception my intentions--i.e., I may experience the concept "horse" as a mode of transportation, a type
of mammal, a tool for farm work, etc. Engelmann himself demonstrates this tension by his inability to speak of concepts without appealing to relatedness and intentionality. Not only does the learner meet the concept as a complex experience, but the programmer himself must experience the concept as a unit before performing the concept analysis.

This chapter has offered a critical analysis of Engelmann's concept analysis. The theory's deficiencies were discovered after both a practical application of the theory to higher-order concepts and a close examination of the theory itself.

Developing a program along Engelmann's guidelines led to a set of difficulties culminating in an inability to teach the more abstract concepts without greatly distorting the original theory. This investigator contends that many of the difficulties arose because Engelmann's theory fails to differentiate between perceptual and cognitive discriminations.

Following a description of programming difficulties, Engelmann's concept analysis was critiqued from the standpoint of theory. There was an attempt to show that not only was this investigation forced to distort the theory, but that Engelmann himself does not have a consistent use of his own theory.

Finally, there was an attempt to show that the inade-
quacies and inconsistencies in the theory result from an incorrect description of the phenomena. That is, Engelmann has attempted to describe concepts as composites of discrete sense data, whereas our experience of concepts is a rich experience of unit wholes.
CHAPTER V

THE PROGRAM

Preface

The following section is an application of Engelmann's concept analysis to the critical skills of philosophy. It is divided into five subsections, which are: (1) Statement, (2) Premise and Conclusion, (3) Argument, (4) Validity, and (5) Same Logical Form. Each subsection (with the exception of "Validity") is further broken down into a prose section, a concept analysis, and an example series. The concept analysis is included for the benefit of future investigators and would not be presented to the student. In the example series, the S+'s, S-'s, and Si's are included for the purpose of clarification and would not be present in the student's copy. In addition, the negative feedback to the examples is often given in parentheses and not completely written out, for the sake of convenience. And, finally, approximations 2 and 3 of "Same Logical Form" are simply given in outline form to indicate to the reader what direction the rest of the program would take.
Sentences are usually classified by grammarians as either declarative, interrogative, exclamatory, or imperative. Of these, the logician is primarily interested in the declarative sentence, because it is this type of sentence which is used to make claims. Statements are sentences that can either be affirmed or denied. For example, it makes sense to say of the statement "It is snowing" that it is either true or false. On the other hand, it does not usually make sense to say of other sentence types, like the question "Is it snowing?" or the imperative "Close the window" or the exclamation "Wow!" that they are either true or false. There is no claim being made by the use of those sentence types.

It should be noted that, although declarative sentences are most often used to make statements, other sentence types may also be used. For example, the question "Would you buy a car from this man?" may be an indirect way of making the statement "This man is untrustworthy." Such interrogatives are called "rhetorical questions," to mark the fact that they are functioning as statements. Although such cases are less common, it should be noted that every sentence type might occasionally function as a statement. Only careful attention to the context in
which such sentences are used can provide us with a way of telling when a statement is being made. Since logicians are interested in appraising methods of reasoning from some claims of truth to others (inference), they concern themselves with statements and not with sentence types. However, they will rephrase other sentence types into declarative form in order to make explicit the statement being made.

Concept analysis

\[ S^+ = \text{It makes sense to say that it is either true or false.} \]

\[ S^- = \text{It does not make sense to say that it is either true or false.} \]

\[ S_i = \]

1. Irrelevance of subject matter
   a) Value
   b) Intentionality
   c) Unknowables
   d) Unobservables

2. Grammatical form
   a) Simple vs. compound sentences
   b) Subjunctive mood
   c) Future tense

3. Actual truth or falsity of the statement

Example series

Identify each of the following examples as either "statement" or "nonstatement":

\[ \text{Example. } -(S^+) \text{ Sally is } 5'4" \text{ tall.} \]
**Answer.--** Good, you saw that this is a clear example of a statement. It surely makes sense in this case to say that the sentence is either true or false. We can measure Sally and find out that either she is or is not 5'4" tall. (No, you're wrong. Go back and reread the definition for a statement. It surely ...)

**Example.--(S+)** I know that it will snow tomorrow.

**Answer.--** Great! You're right. This is a declarative sentence used to make a statement. The statement is "it will snow tomorrow." You may have also noticed that the fact that the sentence involves a reference to the future (tomorrow) does not affect its status as a statement.

**Example.--(S+)** Harry Sperling smokes pot.

**Answer.--** Fine, now you've got the idea. (No, you're still having problems. This would be a good time to see your instructor for additional help.) You should see that this is a statement because it is asserting something that can be either affirmed or denied.

**Example.--(S-)** Look out!

**Answer.--** Very good. (No, you're mistaken.) This is not an example of a statement, because there is nothing that is being asserted which can be affirmed or denied. Such a sentence is usually used as a warning and functions like a directive to get you to do something.

**Example.--(S-)** Oh, my gosh!

**Answer.--** Good show! (This one gave you some diffi-
This sentence is usually used as an expression of a feeling, in this case one of dismay. Such expressions of feeling or attitude cannot be said to be either true or false, although one may attempt to deceive you by putting forth such an expression insincerely. Although it may be true or false that you do actually have this feeling, a simple expression of this feeling cannot be asserted or denied.

Example.---(S-) Far out!

Answer.---Fine, you have recognized that this is not a statement. (No, you're still having trouble with this. Ask your instructor for assistance.) "Far out!" is an exclamation and it would not make sense to say that this exclamatory phrase is either true or false.

Example.---(S-) I wonder, will it rain tomorrow?

Answer.---Good. (No.) This is not an example of a statement. In fact, what would it mean to say that this sentence is being used to make a statement that is either true or false? Would you mean something like "Yes, you really do wonder"? But note, this would mean that you are interpreting the question as a statement about the questioner's mental state of wondering and not as a question about the weather. This would be an unusual interpretation of this sentence, and it would require an unusual context for its use.

Example.---(S-) Will Nixon resign?
**Answer.**—Fine, you have seen (No good, you should have seen) that this sentence which is in the form of a question does not assert anything. It would not be reasonable to say that the question itself is either true or false.

**Example.**—(Si--actual truth value) The world is flat.

**Answer.**—Yes, you're right. (No, that's wrong.) Although we know that the statement made by the use of this sentence is clearly false, the actual truth or falsity of the assertion does not interfere with its being a statement.

**Example.**—(Si--actual truth value) Suppose that the door is closed and someone says to you, "Close the door." Is the sentence "Close the door" a statement?

**Answer.**—Very good! (No, but this one was tricky.) You realized that the actual truth or falsity of the case does not affect the determination of whether or not a statement is being made. Surely it is the case that anyone asking you to close the door must be assuming that the door is open, therefore our example is one in which a false assumption is a basis for the request that you close the door. But the request itself, "Close the door," does not assert that the door is open. Therefore, no assertion is being made. You might ask yourself what it could mean to say that "Close the door" is true or that it is false.

**Example.**—(Si--actual truth value) You are the Great
Kahn.

*Answer.*—Good, you've caught on. (No, reread the explanation on statements noting that we are not concerned with actual truth or falsity.) Although in all probability you are not the Great Kahn, this is a statement. A statement can be false and still be a statement.

*Example.*—(Si--compound sentences) Today is Tuesday and it is the fifth of May.

*Answer.*—Congratulations! (Nope.) This is a statement. In fact, it is two statements. You have noticed (should have noticed) that a compound sentence can be used to make a statement that asserts more than one thing. The fact that a compound sentence asserts more than one thing does not interfere with its being either true or false. In other words, a statement can make two or more assertions.

*Example.*—(Si--compound sentences) Come here, but don't bring the cat.

*Answer.*—Good! You have noticed that no statement is being made here. (Well, no, but this one presented some problem. There is no statement being made here.) In fact, what could someone mean if he were to say that this sentence is true or false? You should notice that the fact that this is a compound sentence is irrelevant to our determination of any sentence as being a statement.

*Example.*—(Si--compound sentences) Today is June 11th, but it is not King Kamehameha Day.
Answer.—Yes, good one, this is a statement. (No, look again, this is a statement.) This sentence can be broken down into two statements, "Today is June 11th" and "It is not King Kahmehameha Day." The fact that two statements appear in the same sentence does not prevent it from making assertions and being a statement.

Example.—(Si—value) Capital punishment is morally indefensible.

Answer.—Very good (No), this is an example of a statement even though it is making a value judgment. The assertion that capital punishment is morally indefensible can sensibly be said to be either true or false. Such assertions may be difficult to justify and moral disagreements difficult to settle, but, on the surface, such language use does purport to be claiming that something is or is not true.

Example.—(Si—value) A person is picketing outside of a Planned Parenthood office with a sign reading "Stop Abortions." Is "Stop Abortions" a statement?

Answer.—Excellent! This is a statement. (No, this is a statement, but it was a tricky one.) Ordinarily such a sentence is used to solicit help, to get others to do something. As such they are examples of the directive use of language and do not purport to be asserting anything which then can be regarded as either true or false. However, in some circumstances you will find that the context
of the use of such directives is a way of making a state-
ment as well as a way of getting support. Someone picket-
ing with a sign reading "Stop Abortions" is letting it be
known that he regards abortions as morally wrong. In
other words, in this context it is an effective way of
making a value claim.

Example.—(Si—value) Draft dodgers are criminals.
Answer.—Yes, you now have the idea. (No, you're
still having trouble with this one.) Although a moral
judgment is being made, an assertion is also being made.
Remember that whether or not a value judgment is being
made is irrelevant to our purposes.

Example.—(Si—future/past tense) Will Nixon bomb
Hanoi next year?

Answer.—Beautiful, you're right. (No, you missed
this one.) This is not a statement because it makes no
assertion. That is, it poses a question rather than making
a claim. It would make no sense to say that the above
question is either true or false. You should also note
that the reference to a future event (bombing next year)
is of no importance here.

Example.—(Si—future/past tense) Ann Arbor has
repealed its marijuana laws.

Answer.—Fine, now you've got it. (No, this one is
similar to our first example.) This is a statement because
it makes an assertion. The fact that the claim makes refer-
ence to a past event is irrelevant for its classification as a statement.

Example.--(Si--future/past tense) Nixon will bomb Hanoi again next year.

Answer.--Yes, that's right. (No, you're still having some trouble, this would be a good time to see your professor for some help.) This is a statement because either Nixon will bomb Hanoi or he will not bomb Hanoi next year--thus it can be said that the statement is either true or false.

Example.--(Si--intentionality) I hope to travel to India.

Answer.--Good, you're right, this is a statement. (No, this one is a statement.) Usually such a sentence would be used to state an intention to visit India, and it is either true or false that the speaker does have that intention. However, this may be a difficult one, for we may imagine a context for the use of this sentence in which nothing more than a vague wish is being expressed by its use. In such a case, the sentence would function like the exclamation "Ah, India!" where the speaker expresses a positive attitude toward India.

Example.--(Si--intentionality) Do you wish to go swimming?

Answer.--This is clearly not a statement because it takes the form of an interrogative. Note that the inclu-
sion of an intention (wishing) is irrelevant for our purposes.

Example.—(Si—intentionality) I want to be Superman when I grow up.

Answer.—Good (No), this is indeed a statement. Either it is true that I want to be Superman, or it is false and I don't want to be Superman. Since the sentence can be considered true or false, it is a statement. You should recognize that an expression of intention (wanting) can be either true or false.

Example.—(Si—subjunctive mood) If Alan were here, I'd give him a piece of my mind.

Answer.—Excellent, this is a statement. (No, this too is a form of a statement.) We could say of this sentence that it is either true or false. Wouldn't we want to say that this statement is false if Alan arrived on the scene and the speaker did not have an altercation with him? On the other hand, if such an altercation did take place upon Alan's arrival, wouldn't we want to say that what the speaker had said was true?

Example.—(Si—subjunctive mood) If we were able to examine other solar systems, we would discover extraterrestrial life.

Answer.—Very fine, you're correct. (No, you've missed this one.) Once again, if we could meet the conditions of the first part of the sentence, we could determine
if the whole sentence was correct. The fact that we can't at this time meet those conditions does not reflect on whether or not the sentence allows affirmation.

**Example.**—(Si—subjunctive mood) If he had been on time, I would have gone to the store.

**Answer.**—Good, you've caught on. (You're still having some trouble. This might be a good time to seek some help.) Although we can only determine the truth of this sentence in a hypothetical way (i.e., if he had been on time), the fact that the sentence allows the possibility of affirmation or denial is enough to classify it as a statement.

**Example.**—(Si—unknowables) God created man in His own image.

**Answer.**—Very good (No), this is a statement. It is a statement because it makes an assertion and an implied claim of being true. Although we may never be able to verify the truth of the claim, it is nonetheless a statement.

**Example.**—(Si—unknowables) Abortions take the lives of fully conscious souls.

**Answer.**—Good, you noticed that (No, you may have failed to notice that) this is a statement, although there are not any empirical measures to determine its validity. It is a statement because it asserts that something is true. Remember that being able to determine the truth of a sentence does not affect its status as a statement.
Example.—(Si—unknownables) Man was created in order to develop the Whopper Burger.

Answer.—Very good, you see now what we've been driving at. (No, this is still giving you some difficulty.) This is a statement because, no matter how foolish, a claim is being made. Since a claim is being made, we have the prerequisites for calling this a statement.

Example.—(Si—unobservables) There is life on Pluto.

Answer.—Good, you must have realized (No, you may not have realized) that a sentence can function as a statement even though what is claimed to be true can't be observed.

Example.—(Si—unobservables) Helium atoms have one electron ring.

Answer.—Good. (No, rethink this one.) It would surely make sense to say that this sentence is either true or false and, therefore, it is a statement. In this case, what is being claimed as true is not directly observable, but we know the claim to be a true one.

Example.—(Si—unobservables) The DNA molecule has a double helix structure.

Answer.—O.K., you're on the ball. (No, this is very similar to the preceding examples.) This is indeed a statement which makes sense to say is either true or false. Remember that being able to observe what is being claimed is irrelevant to a sentence's classification as a statement.
A premise is a statement which is claimed to offer evidence for the conclusion of an argument, or a statement whose truth is offered as good reason for believing another.

A conclusion is that statement which is affirmed on the basis of the other statements of the argument. A statement is a conclusion only when it occurs in an argument in which it is claimed to follow from premises offered in that argument.

The terms "conclusion" and "premise" are relative terms. No statement, in isolation, is either a premise or a conclusion. A statement is a premise only when it is claimed to offer good reason for accepting the conclusion. And a statement is only a conclusion when it is claimed to follow from the premises assumed in an argument.

Recognizing premises and conclusions is aided by premise indicators and conclusion indicators. These are words or phrases that often precede the conclusion or premise. The most common conclusion indicators are: "therefore," "hence," "thus," "so," "consequently," "it follows that," "we may infer," and "we may conclude." The most common premise indicators are: "since," "because," "for," "as," "inasmuch as," and "for the reason that." Note that a premise or conclusion may occur without these indicators.
Concept analysis

Premise

S+ = A statement claimed to offer good reason for another.

S- = No claim (that it is offered as evidence)
Not a statement

Si = Whether or not it looks relevant
The presence of a premise indicator
Whether the premise precedes the conclusion

Conclusion

S+ = A statement, good reasons for which have been claimed to have been given

S- = No claim
Not a statement

Si = Whether or not it looks relevant
The presence of a conclusion indicator
Whether the conclusion comes at the end of the argument

Example series

In the following examples, identify each of the parts as "premise," "conclusion," or "neither."

Example. — S+

1. Compact cars have little storage space.
2. Therefore, they can't carry very much luggage.

Answer. — Just fine (No good), this was a relatively simple example where (1) is the premise claiming to offer good evidence for believing (2) the conclusion. You should notice that (1) makes a straightforward claim—compact cars have little storage space, which in turn offers good reason
for concluding that (2) they can't carry very much luggage.

Example.--S+

1. Small children can't read medical warnings.
2. Consequently, they should be kept away from medicine cabinets.

Answer.--That's right (Hmm), this one should have been easy enough. (1) is a premise because it gives good reason for reaching the conclusion (2).

Example.--S+

1. All good psychologists are behaviorists.
2. Skinner is a good psychologist.
3. So Skinner is a behaviorist.

Answer.--Good, now you have it. (No, think this one through again.) Sentences (1) and (2) claim to be giving good reason for believing the conclusion (3). Although you may not agree that sentences (1) and (2) are good enough reasons for concluding (3), the important thing is that they are being offered as good reason and therefore meet our criterion for being premises.

Example.--(Si--conclusion indicator) A salesman is attempting to sell an all-chrome Chrysler New Yorker. Upon seeing his customer eye a Datsun, he says:

1. Compact cars have little storage space.
2. They can't carry much luggage.

Answer.--Very good, you noticed (You may have failed to notice) that, although the conclusion indicator "therefore" was absent, sentence (1) still gave evidence for believing sentence (2). The important thing to notice is that the salesman intended sentence (1) to give evidence
for believing sentence (2).

Example.--(Si--conclusion indicator) A student wants to know if Skinner is a behaviorist. His professor responds to the student's question by saying:

1. All good psychologists are behaviorists.
2. Skinner is a good psychologist.
3. Skinner is a behaviorist.

Answer.--Wonderful, you saw (Well, maybe you didn't see) that the speaker was making an argument and concluding that "Skinner is a behaviorist." Although no conclusion indicator was present, statements (1) and (2) were serving as premises for conclusion (3).

Example.--Si--conclusion indicator

1. All men are mortal.
2. Socrates is a man.
3. Socrates is mortal.

Answer.--Fine, now you've seen that a statement (in this case, statement 3) can function as a conclusion without a conclusion indicator. (No, you still seem to be having some trouble. This would be a good time to see your professor. Remember that a statement can function as a conclusion without a conclusion indicator.)

Example.--(S-) Jack and Mary are taking a drive in their new all-chrome Chrysler New Yorker. Jack spots a Triumph and says:

1. Compact cars have little storage space.

Mary adds:

2. They can't carry much luggage.
Answer.--Just excellent, you saw that (This was more difficult, you failed to see that) neither sentence (1) nor (2) functioned as premise or conclusion. Notice that sentences (1) and (2) do not stand in proper relation to one another to constitute an argument. It is essential to see that statement (1) was not voiced with the intention of giving evidence for statement (2). The relationship of giving supporting evidence to reach a conclusion is not present.

Example.--(S-) A gossip points at a student and says:

1. His father drinks whiskey,

and

2. he smokes pot.

Answer.--Very good (No), it should have been fairly obvious that sentence (1) is not offered as evidence for concluding (2). What would it mean to consider this an example of premise and conclusion? It might mean something like "His father drinks whiskey because he smokes pot." In the present example, however, no such claim is being made.

Example.--S-

1. Dreams prove the existence of the subconscious.

2. Some psychologists believe that we can't know if rats dream.

Answer.--Once again, there are no premises or conclusions present because neither statement is offered as evidence for believing the other. It would even be difficult
to see how any relationship of giving evidence could be drawn.

**Example.**—(Si--relevance) The only compact cars Mary's seven-year-old son has ever seen were blue. In addition, he knows that compact cars can't carry much luggage. Upon seeing a compact car, the seven-year-old says:

1. Compact cars are blue.
2. Therefore, they can't carry much luggage.

**Answer.**—Super! You saw (Well, this was a tough one, you failed to see) that, though seemingly ridiculous, (1) is a premise and (2) a conclusion. Statement (1), regardless of its impact, is offered as evidence for believing statement (2). A claim (albeit a foolish one) is being made with direct reference to statement (2). Notice that a premise simply has to be offered as good reason for believing the conclusion. The actual impact of the statement is of no relevance to our classifying it as a premise.

**Example.**—(Si--relevance) Two drunkards are trying to determine why apple pie doesn't sell well in Montreal. One says:

1. Eating apple pie is directly related to patriotism

and,

2. therefore, deserters in Montreal don't eat apple pie.

**Answer.**—Very good, you have the idea now. (No, look at this one again.) Although both the premise and the conclusion may appear foolish, (1) is a premise because
it is intended to serve as evidence for concluding (2).

Example.—Si—relevance

1. We still have POW's in South Vietnam.
2. Consequently, we must continue the bombing until they are returned.

Answer.—All right! Now you've seen (Nope, you may have failed to see) that a statement is a premise if it is intended to give good reason for believing the conclusion. Note that we are not concerned with whether or not the statement actually gives good reason.

Example.—Si—relevance

1. Compact cars have little storage space.
2. They can't carry much luggage.
3. Therefore, I'm going to Ohio.

Answer.—Very good, you're correct. (No, but this was on the tough side.) (1) and (2) are premises offering evidence for concluding (3). We could easily imagine a situation where (3) is a sensible conclusion drawn from (1) and (2). If I own a small car and I am debating a long trip to California or a short trip to Ohio, I might well say statements (1) and (2) and conclude with statement (3). Note that whether or not a statement appears relevant does not determine its status as premise or conclusion.

Example.—S-, not declarative

1. Do you want to buy a compact?
2. You know, they can't carry much luggage.

Answer.—Very nice, very nice. (Well, that's wrong.) (1) can't be a premise because premises offer evidence and
only statements (not interrogatives) can be said to offer evidence. In addition, (2) can't be a conclusion because, in order for a statement to be a conclusion, it must have had evidence offered for it.

Example. --S--, not declarative

1. Do you want to buy a compact?
2. Many compacts have little storage space.
3. So they can't carry much luggage.

Answer. --Good show! (No.) (1) is not a premise because it takes the form of an interrogative. (2) is a premise giving evidence for concluding (3) for reasons given earlier.

Example. --(S--, not declarative) A salesman, trying to sell a '57 two-tone DeSoto with swivel seats, sees his customer eyeing a '63 Corvair. Trying to point out that the Corvair is uncomfortable, the salesman says:

1. Compact cars aren't very roomy.

His customer, attempting to understand the importance of the salesman's comment, says:

2. Therefore, they can't carry much luggage?

Answer. --Very good (Well, no, but), this one was a little more difficult. (1) is not a premise because it was not offered as evidence for (2). In addition, (2) cannot be a conclusion because it is not a declarative.
Argument

Prose

An argument is a group of statements consisting of one statement which is the conclusion and one or more statements of supporting evidence. More formally, it is a group of statements of which one is claimed to follow from the others, which are regarded as providing evidence for the truth of that one.

In this section we will be using "argument" as a technical term. It should not be confused with "disagreement" which denotes a conflict, emotional or otherwise. For our purposes, the presence of a disagreement is not sufficient reason for concluding that a group of statements is an argument.

Concept analysis

\( S^+ = \) Any group of statements of which one is claimed to follow from the others, which are regarded as providing evidence for the truth of that one.

\( S^- = \) No claim is being made. There are less than two statements.

\( S_i = \) Whether or not there is an emotional conflict. Whether or not there is a disagreement. The persuasiveness or goodness of the claim that some statements are good reasons for affirming the other. The claim need not be explicit (conclusion indicators absent).
Example series

For the following examples, indicate whether or not an argument is present.

Example.--S+

1. Men are mammals.
2. Mammals are warmblooded.
3. Therefore, men are warmblooded.

Answer.--Good. You recognized this as an example of an argument. (No. You did not recognize this as an example of an argument.) There is an explicit claim here that something is the case, i.e., men are warmblooded, and that this is so because something else is the case (statements 1 and 2). In addition, these statements are offered as evidence or good reasons for believing that claim.

Example.--S+

1. The ball is red.
2. Therefore, it must be colored.

Answer.--Good work. (Uh uh, it is an argument.) Again, there is a claim that something is true based upon a further claim that something else is true which serves as evidence for it. It is claimed that the ball is colored, based on the fact that it is red. Note that this is an argument even though there is only one statement offered as evidence.

Example.--S+

1. It usually rains on Tuesday.
2. Today is Tuesday.
3. Therefore, it probably will rain today.
**Answer.**—O.K., you recognized (No, you didn't recognize) this as an example of an argument. In this example the first two statements can be said to be giving good reasons for believing the last statement. (If you are still having problems, this would be a good time to seek out your instructor.)

**Example.**—(S-) no claim

1. It usually rains on Tuesday.
2. Today is Tuesday.
3. I guess I'll go home.

**Answer.**—Fine, you may have seen (No, you may not have seen) that there is no claim being made here. You might infer that the speaker has probably drawn the conclusion that it will rain today, but he does not necessarily do so. What he does do is simply announce his intention to go home. Notice that the last sentence is not an assertion or denial of anything. No claim is being made that sentence (3) is true because of the other statements preceding it.

**Example.**—S-

1. We need some milk.
2. Billy, go to the store.

**Answer.**—Excellent! (No, think this one through.) You should notice that there are less than two statements here, and thus no argument present. "Billy, go to the store" does not assert or deny anything as being true—it is an imperative rather than a statement. You should be careful not to read more into this than is there. For
instance, it might have been easy to think that, since they were out of milk, someone would have to go to the store. This would certainly be an argument if put this way. But the example as written above makes no such inference.

Example. — S-

1. It usually rains on Tuesday.
2. Today is Tuesday.
3. Will it rain today?

Answer. — Fine, now you seem to have the idea. (No, you are still having trouble with this one.) Remember that the premises of an argument (presumably 1 and 2 above) are to provide evidence for believing the conclusion. In the example just given, the last sentence is an interrogative and as such does not allow of truth or falsity. Since we have no conclusion, we also have no argument.

Example. — S-, less than two statements, no claim

1. John Mitchell has been indicted.
2. Wow!

Answer. — Right (No), this one should have been easy. This cannot be an argument because there is no conclusion present. It should be fairly obvious that "Wow!" does not make a claim that something is either true or false. Nor does it serve as evidence for believing (1).

Example. — S-, less than two statements, no claim

1. Are children starving in India?
2. I suppose I'll finish my dinner.

Answer. — Yep, good answer. (No, look again more closely.) In order to have an argument, we must have a
conclusion and at least one statement of supporting evidence. An interrogative cannot give evidence or function as a conclusion. Since we are either lacking a premise or a conclusion, the above grouping cannot function as an argument. (To interpret the above sentences as "If children are starving in India, then I will finish my dinner" would be reading too much into the grouping as written.)

Example.—Si, emotional conflict

1. I know you liked that movie, but I thought it stunk.
2. And you're just a sentimental slob, anyway.

Answer.—Good! (You failed to notice) You noticed that, although there is an emotional conflict over the merits of a certain movie, there is no argument present. No claim is being made that anything is true because something else is true.

Example.—Si, emotional conflict

1. My mother says I can't go out when it rains.
2. It usually rains on Tuesday.
3. Today is Tuesday.
4. But I want to go out.

Answer.—All right, you saw (Well, maybe you didn't see) that, although an emotional conflict is present, no argument is present. If we take as our conclusion in this case "wanting to go out," we notice that none of the other sentences offer supporting evidence. Since an argument must have sentences offering supporting evidence, no argument is present.

Example.—Si, emotional conflict
1. Aaron is the greatest ball player.
2. No, Mays is better.

**Answer.**--Fine, now you have the idea. (If you are still having a hard time with this, see your professor for additional help.) There is indeed an emotional conflict present, but emotional conflict is not sufficient reason for concluding that an argument is present. In the above example, neither sentence is offered as good reason for believing the other. Since the offering of evidence is essential for an argument, no argument is present.

**Example.**--Si, disagreement

1. My friend says that it usually doesn't rain on Tuesday.
2. I believe that it usually does rain on Tuesday.
3. Today is Tuesday.

**Answer.**--That's it, you're catching on. (No, that's not right. Reread the definition of an argument once again.) The fact that a disagreement is taking place is synonymous with the common usage of "argument." But for our purposes, disagreement is irrelevant to the logical conditions necessary for calling a group of sentences an argument. It should be evident that, in this instance, no one sentence is offered as evidence for concluding any other.

**Example.**--Si, disagreement

1. Light is composed of energy waves.
2. I believe you're mistaken, light is composed of particles.

**Answer.**--I believe you've got it now. (You may still
be confusing "disagreement" and "argument.""

Although there is a disagreement present, no one statement is being offered as evidence for another, hence no argument is present.

Example.--Si, rhetorical question serving as a statement

1. Isn't it better to be red than dead?
2. So we should do nothing to precipitate an atomic confrontation with the Communists.

Answer.--Beautiful, just beautiful. This is an argument. (Well, this seems to present some difficulties. This is an argument.) You should notice that the first sentence, although grammatically a question, is a rhetorical question. This rhetorical question is making the statement that it is better to be red than dead. From this statement another is said to follow. Try not to be misled by rhetorical questions which do make claims.

Example.--Si, rhetorical question serving as statement

1. Don't you know that children are starving in India?
2. So, finish your dinner.

Answer.--Good, that's the idea. (No, you were probably stumped by the presence of a rhetorical question.) (1) makes the claim that children are starving in India, which, in turn, is offered as good reason for finishing your dinner.

Example.--Si, absence of conclusion indicators

1. Hippies have long hair.
2. People with long hair can't think clearly.
3. Hippies can't think clearly.

Answer.--O.K., you may have remembered (Mmm, you may
not have remembered) that a conclusion (3) can be drawn without a word like "therefore" preceding it. Statements (1) and (2) are offered as evidence for concluding (3). As a result, we can say that an argument is present.

Example.—Si, absence of conclusion indicators

1. All men are mortal.
2. Socrates is a man.
3. Socrates is mortal.

Answer.—I suppose you were able to see (It seems that you may have failed to see) that, although a conclusion indicator is absent from sentence (3), e.g., "therefore," a claim (Socrates is mortal) is still being made. We have a claim, supporting evidence, and thus an argument.

Example.—Si, absence of conclusion indicators

1. It usually rains on Tuesday.
2. Today is Tuesday.
3. It will probably rain today.

Answer.—Got it! Now you've caught on. (No, still some problems in this area.) It should have been fairly easy to see that this is an argument even though "therefore" has been deleted. Although the claim made in the last sentence (that it will probably rain today) is now implicit, the first two sentences are still purporting to give good reasons for believing it. Remember that conclusions do not necessarily have to be preceded by terms such as "therefore" or "consequently."

Example.—Si, persuasiveness or goodness of claim

1. The earth is an oblate spheroid.
2. I am at the North Pole and I am standing right side up.
3. Obviously, then, the people on the South
Pole are standing upside down.

Answer.—Yep, you are perceptive. (No, caught you on this one.) This is an argument, although the conclusion (3) may appear foolish. The important thing is that sentences (1) and (2) are offered as reason for believing the conclusion. Note that foolishness of claims or conclusions does not determine the presence of an argument.

Example.—Si, persuasive or goodness of claim

1. Sometimes killing is justified.
2. At other times, killing is not justified.
3. Hence killing is above morality.

Answer.—O.K., that's the idea now. (Well, I think you're still hung up on the goodness of the claim being made.) This is an argument because there are statements (1) and (2) which are claiming to offer good reason for believing another statement (3). The fact that either the statements or the conclusion may appear foolish is irrelevant for our purposes.

Example.—Si, persuasive or goodness of claim

1. If the world is flat, and you sail far enough, you will fall off the edge.
2. The world is flat.
3. When you fall off the edge, the monster will eat you;
4. therefore, one should not take a long sail.

Answer.—In this instance, we do have an argument even though the premises are not persuasive. (If this is still bothering you, you should see your instructor at this time.) We have statements which are given in support of another statement (4), therefore an argument is present.
Notice that persuasiveness is not a necessary characteristic of arguments.

Validity

Arguments, of course, are not all of a piece; some are good, and some are not. In other words, some premises do offer good reasons for believing a given conclusion, and others do not. Consider the following:

A. 1. All men are mortal.
   2. Socrates is a man.
   C. Therefore, Socrates is mortal.

Argument A is obviously a good argument; moreover, it has a special kind of goodness. Specifically, if the premises of A are true, its conclusion cannot be false. This is an important point because it is a base upon which we shall be building constantly. Suppose you put all men into a large room; premise 1 says they are each mortal. Premise 2 says Socrates is a man, so he must be in the room. And if everyone in the room is mortal, and Socrates is in the room, Socrates is mortal. So AC cannot be false, given that premises 1 and 2 are true.

When the relationship between the premises and the conclusion of an argument is like that in A, we say the argument is deductively valid, or simply valid. You should understand and memorize these definitions of validity:

D1. To say that 'argument X is valid' means that "If the premises of argument X are all true, the conclusion of argument X cannot be false.'
Another way of saying this is:

D2. To say that 'argument X is valid' means that 'If the premises of argument X are all true, the conclusion of argument X must also be true.'

And yet another way:

D3. To say that 'argument X is valid' means that 'Either the conclusion of argument X is true, or one of the premises of argument X is false.' (That is, to deny the premises after accepting the conclusion would be to contradict oneself.)

It may not be clear to you that D3 says the same thing as D1 and D2. Consider this argument:

B. 1. All horses have wings.
   2. Socrates is a horse.
   C. Therefore, Socrates has wings.

Notice how similar arguments A and B are. Now, let us show that B is valid. Suppose we put all horses in a ring; premise 1 tells us that they will all have wings. Premise 2 tells us that Socrates is a horse, so he'll be in the ring, too. And if everything in the ring has wings, and Socrates is there, he has wings, too. So conclusion BC cannot be false, given that premises 1 and 2 are both true.

Of course, premises 1 and 2 are not both true. Premise 2 may be true; it is conceivable that somebody might name a horse "Socrates." But premise 1 is obviously false; not only is it not the case that all horses have wings, but no horses have wings. Still, if . . . if . . . if, now, all horses did have wings, and Socrates was a horse,
surely Socrates would have to have wings. So argument B is valid according to definitions 1 and 2. How about definition 3? Well, either Socrates has wings, or, if he doesn't, either premise 1 or premise 2 must be false. Because if both premises are true, conclusion BC must be true; in other words, you can't have the premises true and the conclusion false. And if you can't have that, and the conclusion (BC) is false, then it is not the case that premises 1 and 2 are both true. So one or the other (or both) must be false, given that BC is false. It might be helpful at this time to clarify our use of the terms "must" and "cannot." It should be noted that these terms are being used to specify a logical connectedness between premises and conclusions. When we say "If such and such is the case, then such and such also must be the case," we are stressing that this must be so because of logical necessity. And our three definitions of validity are exemplifications of this logical necessity. You should now be able to understand how definitions 1, 2, and 3 say the same thing, and be able to explain how that is so. Now, memorize them! You will need to know them very well.

One interesting point that emerges from this discussion is that an argument can be valid and still have a false premise, or a false conclusion, or both. The only thing it can't have, in fact, is a false conclusion and all true premises. Consider this example where we have
all false premises and a true conclusion:

C. 1. All winged things are men.
   2. Socrates has wings.
   C. Therefore, Socrates is a man.

The conclusion (CC) is true, and premises 1 and 2 are false. Still, C is a valid argument for, if premises 1 and 2 were true, then the conclusion would have to be true. Notice that the validity of C does not derive from the truth of the conclusion, but from the relationship between the premises and the conclusion.

It is important to understand how being valid makes an argument correct. Consider this argument:

D. 1. Two ounces of compound Z will make you intelligent.
   2. This is two ounces of compound Z.
   C. Therefore, this will make you intelligent.

Obviously, argument D is valid. We have no idea whether the premises are true or whether the conclusion is true. But we do know that if the premises (1 and 2) are true, then the conclusion is true. So, if we can find out that premises 1 and 2 are true, then we can infer that the conclusion is true, and we can do so without fear of error. There is no possibility of any mistake: given the truth of the premises, there is no way that the conclusion can be false. Thus, we see that valid arguments take us unerringly from premises to conclusion, and this is where their correctness lies.

Some valid arguments, like argument A, have only true
premises; we call them sound, and all others unsound. A sound argument is defined as one which has only true premises and is valid. Now, we can see that argument D is valid without knowing anything about compound Z, or intelligence for that matter. It is a hallmark of validity that it can be ascertained without knowing if the premises or conclusion are actually true or false. But we need to know if the premises are true before we can say an argument is sound.

Soundness is a more desirable quality than validity, because sound arguments are both valid and have true premises. Knowing that an argument is valid only tells you that the conclusion follows from the premises, i.e., is true if they are; knowing that it is sound also tells you the arguments are good in that they lead you unerringly from premises to conclusion, but if they're not sound, they're not so good in that they do not guarantee the truth of the conclusion.

It would be nice, then, always to be able to spot sound arguments. Unfortunately, deductive reasoning alone can only tell whether an argument is valid, but not whether it is sound. In all of the examples of this unit, you have seen immediately—or have been shown—that they are valid. All you had to understand was the meaning of each statement, as well as the definitions of validity. Soundness is quite another matter, for the evaluation of the sound-
ness of an argument requires so much more information. First, we need to know whether the argument is valid; as we have said, that problem is one that deductive reasoning can solve alone. Second, we must know if all the premises are true; with certain exceptions (Mathematics and Logic provide some), merely knowing the meaning of a premise doesn't tell you if it is true. Only an experiment or an observation of the natural world can settle most questions of truth. This is not a science course, so we shall not be concerned with soundness, but only with validity.

One point that has so far been implicit should be made explicit: "valid," "invalid," "sound," and "unsound" are characteristics of arguments. Although these are terms encountered in everyday language, we want to restrict their use to specific situations. You should never speak of a valid, invalid, sound, or unsound statement. Similarly, "true" and "false" are words that name characteristics of statements, so you should never speak of true or false arguments.

You may have discovered by now that there seem to be good arguments which are not valid. For example:

E. 1. Most blonds have less fun.
   2. Those who have less fun are less happy.
   3. Mary is a blond.
   C. Therefore, Mary is less happy.

Argument E is not valid; even if most blonds have less fun, and those who have less fun are less happy, and Mary is a blond, she may be the exception that actually has more fun.
and, thus, isn't less happy at all. Even if she isn't—even if EC is true—all the premises could be true while the conclusion would be false; they could be that way if Mary is an exception. So argument E is invalid.

Still, E is a pretty good argument. For, if all the premises are true, it is more likely that the conclusion is true. So, if we know that the premises are true, and nothing else about Mary, we can say that it is likely that the conclusion is true. We express this by saying that, although E is not a valid argument, it is a good inductive argument. A good inductive argument is defined as one where the premises give good reasons for believing that the conclusion is likely to be true, or probably true.

Many arguments in science are of this type. For example:

F. 1. Every time we've put X and Y together, we've gotten Z.
   C. Therefore, if we put X and Y together this time, we'll get Z.

It is clear that, just because something works many times, it doesn't mean that it has to work the next time. Still, if it has worked many times, that's a good reason for believing it's probably going to work the next time. Unlike deductive arguments, therefore, inductive arguments are not immune from error; the premises can be all true and the conclusion false. On the other hand, if the premises of a good inductive argument are all true, it is likely that its conclusion will also be true.

It is not always easy to evaluate inductive arguments.
For example:

G. 1. Fifty-one percent of American cars are Fords.
C. Therefore, this car will be a Ford.

Well, 51 percent isn't a very convincing percentage, and G is thus not a very good inductive argument. And 10 percent would have made it even worse. What about 75 percent?

Well, it's hard to say. The considerations that go into evaluating such borderline inductive arguments are very complex, and we will not deal with them here. The important thing for you to see for now is that, just because an argument isn't valid, it doesn't mean that it is worthless.

Same Logical Form

**Approximation 1**

**Purpose:** Student should be able to distinguish simple examples of same logical form.

1. Same logical form without consideration of connectives.
2. Same logical form with consideration of connectives.
3. Distinction between simple and compound statements.
4. Battery of examples so that student comes to recognize instances of same logical form.
5. Give task: prove this example valid or invalid by use of same logical form.

Concept analysis for approximation 1

\[ S^+ = \text{Changing simple statements into pictorials yields same pictorial for each argument.} \]
S- = Changing into pictorials yields different pictorials

Si = 1. How the connectives are expressed (e.g., "not" = "it is not the case that")

2. Particular form (Not all valid arguments have the same form.)

3. Variant forms of expressing compoundness

Problems with approximation 1

1. Order of premises and conclusion becomes an S- instead of an Si.

2. Doesn't allow for quantified arguments

3. Doesn't allow for order of conjuncts and disjuncts as an Si

4. Doesn't allow for different ways of saying the same thing as an Si

5. Doesn't allow for cases where arguments involving compound statements have same logical form as arguments involving only simple statements

Prose: approximation 1

One method of determining whether deductive arguments are valid or invalid is by virtue of their logical form. Actually, this refers to a way of using one argument to criticize another. That is, if a given argument is valid, then another similar argument (one having the same logical form) is also valid. On the other hand, if this latter argument is obviously invalid, then the given argument must be invalid as well. This method of comparing argu-
ments is called the method of counter-example. In order to understand how it functions, you will first have to understand the concept of "same logical form."

Our first step is to stress that an argument is judged as valid not by its subject matter, but rather by its structure or logical form. This reasserts what you have learned in the last section, i.e., validity is determined solely by the relationship between an argument's premises and its conclusion. An example may help to clarify this point. Consider these arguments:

A. 1. If we do away with welfare, then people will face hardships.
   2. We do away with welfare.
   C. Therefore, people will face hardships.

B. 1. If we allow abortions, then we allow murders.
   2. We allow abortions.
   C. Therefore, we allow murders.

Arguments A and B obviously have something in common, even though they have very different subject matters. That which they have in common we call their logical form. We can demonstrate that these two arguments have the same logical form pictorially by replacing each simple statement in the argument by a geometric figure.

A. 1. If we do away with welfare then people will suffer hardships
   2. We do away with welfare
   C. Therefore people will suffer hardships

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B. 1. If we allow abortions then we allow murders
2. We allow abortions
C. Therefore we allow murders

We remarked earlier that our concern is structure and not subject matter. Thus, if we delete subject matter, we are left with

A. 1. If then
2. 
C. Therefore

B. 1. If then
2. 
C. Therefore

In short, the parts of A and B are interchangeable. It can now be said that if we know that argument A is valid, we can conclude that argument B is also valid, because they have equivalent structures.

Now examine this example: A--Either Richard Mitchell is innocent or he will go to jail. Richard Mitchell is not innocent, therefore, he will go to jail. B--Either inflation eases or I will go broke. Inflation is not easing, therefore, I will go broke.

A. 1. Either Richard Mitchell or he will go to jail
2. Not Richard Mitchell is innocent
C. Therefore he will go to jail
B. 1. Either inflation eases or
2. Not inflation eases
C. Therefore
I will go broke

A. 1. Either or
2. Not
C. Therefore

B. 1. Either or
2. Not
C. Therefore

Once again, it can be said that, if we know that one of the above arguments is valid, we can conclude that the other argument is valid as well.

We have seen that some arguments are alike in a certain way, and we have expressed this likeness by saying that they have "the same logical form." We have defined sameness of logical form in terms of interchangeability of the parts of arguments. You may have been confused by interchangeability if you noticed that the interchangeable "parts" come in various sizes. We have tried to resolve this difficulty by using geometric figures. Thus, we represented each simple sentence by a geometric figure, and repeated that same figure wherever that particular statement occurs. In addition, we indicated the denial of one of our statements by preceding its geometric representation by a "Not" (e.g., "Not" ). The important point is that, although various kinds of compound state-
ments can be made by combining more than one simple statement, the connectives between simple statements are not pictorially represented. Connectives are instead written as expressed in ordinary language. Some common statement connectives are: "and," "if . . . then," and "either . . . or." To further clarify the importance of connectives, examine the following examples:

A. 1. If we allow abortions then we allow murder
   2. We allow abortions
   C. Therefore we allow murder

B. 1. Jackasses have feet
   2. Norman Rockwell is a Mormon
   C. Therefore Norman Rockwell is a jackass

A. 1. If then
   2. 
   C. Therefore

B. 1. 
   2. 
   C. Therefore

These two arguments do not have the same pictorial representation; thus, their parts are not interchangeable. Therefore, they do not have the same logical form. In this case, we cannot conclude anything about the second argument's validity. Even if we know that A is valid, we
cannot say that B is invalid because the two arguments do not have the same logical form.

Let us continue to further examine the role of connectives in the method of counter example. We will begin by clarifying the difference between simple and compound statements. Simple statements are what you were taught in grammar school to call simple sentences. They have one subject and one predicate. Consider:

1. John Kennedy was President.
2. China and Cuba are Communist countries.
3. Hippies smoke dope and have orgies.

Sentence 1 is an obvious case of a simple statement. Sentence 2, on the other hand, may appear simple because it has but one predicate ("are Communist countries"). But sentence 2 has two subjects ("Cuba" and "China"), and hence can be interpreted as two statements:

2a. Cuba is a Communist country.

and

2b. China is a Communist country.

Similarly, sentence 3 has one subject, but two predicates. It can be rendered into two statements as follows:

3a. Hippies smoke dope.

and

3b. Hippies have orgies.

There are, basically, five connectives: "and," "or," "not," "if . . . then," and "if and only if." Except for "not," their use is straightforward; they are used to con-
nect two or more simple statements. For example,

4. Cuba is a Communist country, and China is a Communist country.
5. If hippies smoke dope, then hippies have orgies.

The connective "not" does not really connect; rather, it hooks onto statements, affecting them logically. Therefore, we consider

6. Hippies do not have orgies

and similar sentences to consist of one statement plus the connective "not." If we return to our pictorial representations, we can render the above sentences as follows:

4. Cuba is a Communist country \(\text{and} \) China is a Communist country
5. If hippies smoke dope \(\text{then} \) hippies have orgies
6. Not hippies have orgies

We now have a provisional definition of sameness of logical form:

D1: Two arguments have the same logical form if and only if converting simple statements into pictorials results in the same pictorial representation and the same order of connectives.

We said before that there are five basic connectives; in actuality, there are five basic classes of connectives. For example, from the logical point of view, "John is smart \(\text{and} \) gets poor grades" makes the same claim as "John is smart \(\text{but} \) he gets poor grades" or "John is smart; moreover, he gets poor grades" or "John is smart; in addition, he gets poor grades."
As can be seen, there are many ways of making the same logical claim.

A similar situation exists for the other connectives. "John is not smart" makes the same claim as "John isn't smart" or "It's not the case that John is smart." "One supports the war or one is a traitor" is the same as "Either one supports the war or one is a traitor." "If you smoke dope, then you're a degenerate" is the same as "If you smoke dope, you're a degenerate" or the same as "Should you smoke dope, you'd be a degenerate." There really are no good rules for recognizing when different expressions are the same for the purposes of logic. You will encounter some drills later on which will help with this problem. But, at this point, try to remember the alternate forms presented above, and be on the lookout for other expressions with similar meanings.

Example series

In the following exercises, you will be presented with pairs of arguments, and you will be asked to say whether or not they have the same logical form, as given in Definition 1.

Example A.—S+

1. If we do away with welfare, then people will face hardships.
2. We do away with welfare.
3. Therefore, people will face hardships.
Example B.--S*

1. If you open doors for women, you're a male chauvinist pig.
2. You open doors for women.
3. Therefore, you're a male chauvinist pig.

Answer.--Good. (Wrong.) Notice that if you exchange "we do away with welfare" for "you open doors for women," and "people will face hardships" for "you're a male chauvinist pig," you get the same arguments you started with. (If you got this wrong, you did not fully understand the explanation of "same logical form." Reread that explanation and/or talk to the instructor.)

Example A.--Si, explicitness of compoundness

1. If we do away with welfare, then people will face hardships.
2. We do away with welfare.
3. Therefore, people will face hardships.

Example B.--Si, explicitness of compoundness

1. If we legalize pot, we'll increase respect for law and order.
2. We legalize pot.
3. Therefore, we'll increase respect for law and order.

Answer.--Just fine (No, you may not have seen that), exchanging "we do away with welfare" for "we legalize pot," and "people will face hardships" for "we'll increase respect for law and order" yields the same arguments. (Perhaps you were confused because statement A1 is an "if ... then" sentence, while statement B1 leaves out the "then." Recall that there are different ways of expressing connectives which, from the point of view of logic, are the same.)

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Example A.--S-
1. If we do away with welfare, people will suffer hardships.
2. We do away with welfare.
3. Therefore, people will suffer hardships.

Example B.--S-
1. If we legalize pot, we'll increase respect for law and order.
2. We'll increase respect for law and order.
3. Therefore, we legalize pot.

Answer.--Good, you saw (No, you may have failed to see) that these two arguments do not have equivalent forms. Drawing a pictorial shows us that statements 2 and 3 are not equivalent across arguments A and B.

A. 1. If [ ] then △
    2. [ ]
    3. Therefore △

B. 1. If [ ] then △
    2. △
    3. Therefore [ ]

Example A.--Si, how connectives are expressed
1. If we do away with welfare, people will suffer hardships.
2. We do away with welfare.
3. Therefore, people will suffer hardships.

Example B.--Si, how connectives are expressed
1. Should we legalize pot, we'll increase respect for law and order.
2. We'll legalize pot.
3. Therefore, we'll increase respect for law and order.

Answer.--Very good. You were able to see that (You got this one wrong, but it's a little tricky.) premise B1
means the same thing as "If we legalize pot, then we'll increase respect for law and order." Remember we said that the basic connectives can be expressed in many different ways and that, generally, if an expression means the same thing as a basic connective, it works the same way from the logical point of view.

Example A.---S---
1. If we do away with welfare, then people will suffer hardships.
2. We do away with welfare.
3. Therefore, people will suffer hardships.

Example B.---S---
1. If we do away with welfare, then people will suffer hardships.
2. If people suffer hardships, then people will revolt.
3. Therefore, if we do away with welfare, then people will revolt.

Answer.---Very fine, you must have recognized (Wrong, notice) that converting the simple statements into pictorials does not yield the same pictorials in both arguments. Notice that it cannot yield the same pictorials because argument B has more simple statements than argument A.

A. 1. If \[ \square \] then \[ \triangle \]
2. \[ \square \]
3. Therefore \[ \triangle \]

B. 1. If \[ \square \] then \[ \triangle \]
2. If \[ \triangle \] then \[ \bigcirc \]
3. Therefore, if \[ \square \] then \[ \bigcirc \]

Example A.---S+
1. Either we legalize pot or we jail millions.
2. We don't legalize pot.
3. Therefore, we jail millions.

**Example B**.--S+
1. Either we end the war or we continue to inflate the dollar.
2. We won't end the war.
3. Therefore, we continue to inflate the dollar.

**Answer**.--Fine, (Wrong, you did not see that) exchanging "we legalize pot" for "we end the war," and "we jail millions" for "we continue to inflate the dollar" results in the same pictorial representations.

**Example A**.--Si
1. If we do away with welfare, then people will suffer hardships.
2. We do away with welfare.
3. Therefore, people will suffer hardships.

**Example B**.--Si
1. If we do away with welfare, then the moon is made of green cheese.
2. We do away with welfare.
3. Therefore, the moon is made of green cheese.

**Answer**.--Excellent, you saw that these two arguments result in the same pictorials and therefore have the same logical form. (No, that’s wrong. You probably picked up on the fact that argument B is assuredly unsound, while argument A may be sound. Nonetheless, rendering into geometric figures results in the same pictorials. Thus, arguments A and B have the same form. The fact that apparently good arguments can have the same form as obviously defective ones is an important aspect of "same logical form."
Approximation 2

Purpose: Introduce the situation where premises have logical complications of compoundness which are irrelevant to the validity of the argument.

1. Introduce additional complications of connectives.
2. Introduce basic valid and invalid forms.
3. Present basic valid argument forms.
4. Present example series.
5. Task: determine the validity of given arguments by comparing sameness of form to basic valid forms.

Prose: approximation 2

(Objective: Introduce additional complications of connectives.)

Thus far we have confined our concept of same logical form to instances where there is a one-to-one substitution between each simple statement and some one geometric figure. We can show, however, that more complicated arguments can be represented by allowing the geometric figures to stand for compounds as well as for simple statements. For example, consider the following argument: "Either I will go for a walk and see the river, or I will stay home and read a book. I won't go for a walk and see the river. Therefore, I will stay home and read a book." This argument has many more simple statements than our earlier examples, but it can also be represented pictorially in the same manner. Note that we allow the geometric figures
to represent not only simple statements, but compounds as well.

1. Either [I will go for a walk and see the river]
   or [I will stay home and read a book]
2. Not [I will go for a walk and see the river]
3. Therefore [I will stay home and read a book]

Note that this has the same form as our earlier argument (Example 1), "Either Richard Mitchell is innocent or he will go to jail. Richard Mitchell is not innocent. Therefore, he will go to jail." This demonstrates that compound statements can stand in the same relation to one another as the simple statements in our earlier example. That is, although the "either . . . or" statement in this example (Example 2) is itself made up of compounds involving the connective "and," it is precisely these compounds that stand in this relationship to one another. So, whereas the second statement in Example 1 is the denial of one of the simple statements making up the "either . . . or" compound, in Example 2 the corresponding second statement is the denial of the compound "I will go for a walk and see the river," which is one part of the larger compound "Either I will go for a walk and see the river, or I will stay home.
and read a book." The importance of being able to recognize these simple argument forms, even though the particular argument may have a great many compound statements, rests upon the fact that, if a particular argument can be shown to have at least one form that is a valid argument form, then the particular argument is valid.

**Approximation 3**

**Purpose:** Shape final skill of using same logical form.

1. Introduce quantification.
2. Present example series.
3. Task: determine validity of complex arguments using same logical form.
REFERENCES


