DICKINSON, John Alvin, 1924-
THE ROLE OF PRACTICE IN SHORTHAND SKILL DEVELOPMENT AS RELATED TO SELECTED CLASSICAL THEORIES OF LEARNING.

The University of Oklahoma, Ed.D., 1966
Education, theory and practice

University Microfilms, Inc., Ann Arbor, Michigan

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

THE ROLE OF PRACTICE IN SHORTHAND SKILL DEVELOPMENT AS RELATED TO SELECTED CLASSICAL THEORIES OF LEARNING

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF EDUCATION

BY

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Norman, Oklahoma

1966

THE ROLE OF PRACTICE IN SHORTHAND SKILL DEVELOPMENT AS RELATED TO SELECTED CLASSICAL THEORIES OF LEARNING

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ACKNOWLEDGMENT

Gratitude is sincerely expressed to Dr. Gerald A. Porter who so very graciously served as chairman of the doctoral committee and director of this study. His sincere interest, his assistance, and his guidance have indeed been essential to the development of this research project. Also, gratitude is due for Dr. Raymond White and Dr. Henry Angelino for their critical reading and to Dr. Anthony Lis for his very valuable comments and editing.

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CHAPTER I

THE PROBLEM

Introduction

Frequently in recent years, the subject of skill development has arisen in the context of the basis for the teaching of shorthand. Interest in skill development is apparent both in the private conversations and in the discussion groups at professional business education meetings. Concern for skill development is frequently apparent in the periodical literature of business education. When discussions turn to the question of "What is skill?" or "How are the elements of skill building specifically applied to the teaching of shorthand?," few carefully formulated responses have been forthcoming. Accurate answers to such questions are not expected from shorthand teachers for the very obvious reason that very little has been done to apply formally the psychology of learning to the learning of shorthand.

Since skill building is recognized as a primary concern of shorthand teaching and learning, teachers attempt to supply the needed learning principles by adding to their own ideas and theories the suggestions from persons who are assumed to be skilled in performance or widely

experienced in the teaching of the subject. These suggestions are obtained from classes in methodology, from textbooks in the area, from lectures, and from other related sources. It is indeed probable that most of the recommended procedures for teaching shorthand are sound. Nevertheless, the soundness of each procedure is a matter of assumption rather than a comparative inference drawn from conscious intent in the examination of references that have a proved validity.

A very great deal has been said and written in connection with tricks of the trade, devices, and isolated techniques of teaching shorthand. It would not be difficult for the shorthand teacher, utilizing ideas offered by others, to perform his duties by sheer imitation. The results of this kind of teaching are limited because the teacher is only approximating the suggestions of others. Particularly, he may not develop abilities to adapt, select, and improvise within a sound framework. Such abilities may well be fostered by an appeal to psychology.

Any investigation of the material available shows that there is indeed a quantitative wealth of writing on this subject. For the most part, these writings deal with the individual experiences in uncontrolled situations, I-do-it-this-way narratives, and the like. Few attempts have been made either to formulate or to test principles. Indeed, generalizations are likely to be unsupported by evidence; and on the other hand, accumulations of statements of supposed fact fall short of reaching conclusions that can be effectively generalized.

This situation becomes significant by effectively pointing up that in shorthand, a skill area much older than any other formal and comprehensive attention to psychology, study has left a near void where there might well be a meeting of the two.

The current predominant method of preparing teachers of shorthand consists of having them learn shorthand in the same classes--and consequently under the same conditions--as those persons who expect to use the knowledge in stenographic occupations. Beyond learning to use the system, the prospective teacher is commonly given some instruction in the methodology for teaching the subject.

A problem of lack of information about the acquisition of skill exists from a two-fold source. First, the learner is presumed to develop his skill from reading and writing large amounts of shorthand material with the assumption that correct reading and writing habits will result without any formal effort to develop an understanding of how the skill is acquired. An examination of the psychological basis of the skill development or any procedural analysis is almost entirely foreign to the present methods of teaching shorthand.

After the learner is presumed to have acquired an acceptable skill in the use of shorthand, if he wishes to become a shorthand teacher, he may afterward receive instruction in the methodology for teaching the subject. Such methodology is primarily designed to acquaint the prospective teacher with procedures for the presentation of the subject matter. The time devoted to this activity consumes at most a very few days or weeks of a course meeting two or three times each week and carrying the responsibility of coverage in several business subjects. The standard textbooks for the course provide a limited amount of material which is designed for the understanding of skill development.

The one comprehensive text-reference (64)[1] is limited in both its theoretical references to the psychology of skill and descriptive information concerning controlled experimentation in the learning of shorthand. Other literature also contains only a very small amount of matter touching this subject.

The current concensus holds that shorthand is a skill which should be developed with a minimum of generalizing from rules by the learner. The shorthand teacher is generally not equipped with an understanding of the elements of skill applicable to the learning of shorthand. He commonly is not in a position to develop sound principles of teaching based on a scientific analysis of the problem as directly applicable to the learning of shorthand. Nor does he have reasonably adequate access to material in which careful theoretical inferences have been drawn between a psychological principle and an hypothesis in connection with shorthand skill development. Therefore, it now appears that some considerable attention should be given to organized attempts at relating the principles of learning to the activities which constitute the major emphases in the teaching of shorthand.

An attempt at reaching beyond the confines of the established scope of this information could be made in either of two ways. First, an investigation could attempt to point up certain psychological principles or theories in their application to other, but similar, situations.

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[1] Instead of using footnotes to indicate references, it is chosen to use a parenthetically-stated expression such as (64:15). This would mean that the work referred to is number 64 in the "References Cited in the Study," and the page referred to is 15. If the colon and final number are not shown, the reference calls attention to the work without citing a special page number.

This would provide a framework within which to operate while other evidence could be compiled. A second way to approach organized study in this area is to begin experimental investigation without the guiding framework and without the coherence of relation with similar study. This research study chooses the first approach. The most desirable eventual outcome is, of course, that a number of studies would combine to form a body of information as complete as possible.

Statement of the Problem

The problem of this research study was to determine whether authoritatively recommended practice techniques and procedures in shorthand are in accord with theories of learning applicable to practice as advanced by authorities in the field of psychology. There are three significant aspects involving

1. The fundamental psychological implications of practice in skill development.

2. The specific role of practice in shorthand skill development, and

3. The consistencies and inconsistencies between the views of psychologists and the inventors of Gregg shorthand who have in large measure established the methodology for teaching it.

This study consists of the synthesizing or reassembling of facts into comprehensive, meaningful units. Thus, it is unlike the majority of studies in business education which, through analysis, break phenomena into small, constituent parts and study in detail only the individual, or single parts.

Sources of Information

The information for this investigation was obtained by means of analysis and interpretation of materials from two sources: (1)

psychological literature and research concerning practice and effective conditions of practice and (2) material written by the inventors of Gregg shorthand.

Methods of Procedure

The first step of this study involved extensive study of published material relating to practice and to the learning of shorthand. This provided a basis for understanding of the area to be investigated.

The second step involved determination of the psychological elements essential for effective practice. Reference in this step was to information relative to connectionism (Thorndike), behaviorism (Guthrie, Skinner, Hull, Tolman), and Gestaltism (Koffka, Köhler, Wertheimer, and Wheeler).

The third step involved determination of the authoritatively recommended techniques and procedures for practice as a significant element in the learning of shorthand. Reference in this step was to information relative to the teaching of shorthand written by the inventors of the Gregg system (Gregg, Leslie, and Zoubek).

In the final step of this investigation, theoretical inferences were drawn by means of a comparison between recommended practices in shorthand methodology and representative views concerning the psychology of learning. The comparison was designed to point up that in the chosen area the authoritatively recommended shorthand methodology either does or does not make use of what a selected number of psychologists advocate about practice.

The organization of this study is such that Chapter II contains an analysis of certain classical systems of psychology as they relate

directly and indirectly to practice as a phase of skill development. An attempt is made later to compare the systems with and relate them to the matter of practice in learning shorthand.

Chapter III deals with methods of teaching advocated by the inventors of the Gregg system of shorthand. Again, the emphasis is on the direct and the indirect means of dealing with practice in how to read and write shorthand.

In Chapter IV, there is an interpretation of the significant related elements from Chapters II and III. Finally, Chapter V contains the conclusions of this study.

Summary

This investigation is concerned with representative views of psychologists, inventors' comments and recommendations concerning major practice activities which they have recognized as a part of the learning of shorthand as a skill, and theoretical implications by a comparison with recommendations in shorthand methodology and representative views concerning practice. The hypothesis of this investigation is that divergent views of the role of practice imply that procedures in shorthand instruction are not uniformly in accord with the psychologists' views concerning effective practice.

CHAPTER II

REPRESENTATIVE PSYCHOLOGICAL VIEWS CONCERNING PRACTICE AND PRACTICE CONDITIONS

This chapter deals with the literature of psychologists on matters which may relate to the theory of practice. It is the primary purpose of the chapter to accumulate information for later comparisons. Thus, the material herein from the certain selected psychological systems is devoted to an examination of those essentials which have bearing on the role of practice.

To expedite presentation of the information from the psychologists, the material is divided into six sections. These are (1) Thorndike's connectionism, (2) Guthrie's contiguous conditioning, (3) Skinner's operant conditioning, (4) Hull's systematic behavior theory, (5) Tolman's sign learning, and (6) classical Gestalt theory.

Thorndike's Connectionism

Introductory Overview

E. L. Thorndike held that the intellect, character, and skill possessed by any man is the product of certain original tendencies and the training which he has received. His eventual condition is the development of this original nature in interaction with its environment during the process of development. Thus, human nature, in general, is

the composite result of the original nature of man, the laws of learning, and the other forces with which he lives.

The original tendencies of man Thorndike described as constituting an enormous fund of connections or bonds of varying degrees of directness and strength between situations and the responses of which the human being is capable. Many of these tendencies are particularly modifiable; and some of them (such as vocalization and manipulation) are especially fertile areas for the growth of learned habits.

The connections which are most apparent are those which serve as simple links between external situations and overt responses. Sometimes they are recognized as rather independent units easily isolated from the rest of the person's behavior and learning.

Thorndike, however, indicated that while such uniformity, simplicity, and independence are desirable in experiments of the fundamental questions with which people may be concerned, it would be erroneous to get the impression that these simple links are characteristic of the actual connections which are formed in the world's learning. Rather on the contrary, these are usually varied, complicated, and influenced by their contexts. (22:353)

He also maintained that these connections lead from states of affairs within the brain as well as from external situations. They may occur in long series wherein the response to one situation becomes the situation producing the next response and so on. They may be either from parts of a situation or from the situation as a whole. Further, they may be largely determined by events preceding their immediate stimuli or by the accompanying attitude or set of the person.

Complex stimuli may lead to equally complex responses such as readiness and unreadiness, welcoming and rejecting, and emphasizing and restraining. The stimuli may lead to additional responses as states of awareness, attention, and interest.

Connection and selection cooperate in intimate ways so that the situation may evoke as its response whatever acts attain a certain result. For example, the sight of a letter to be signed is then followed by the response of signing it. The particular movements in the accomplishment may vary according to such things as whether a pen or pencil is at hand and the location of the letter. The connection is in the nature of an order to do what seems suitable until the goal of getting the letter signed is attained. If the selection is important and obvious, "problems" and "solutions" are used rather than situations and responses. There is, however, no fundamental distinction between the two types of situations. (22:354)

The connection which any situation makes depends upon the person in whom it is made. It depends upon his general nature and the particular conditions which he is in at the time. An important fraction of the mind's set any any moment is due to the activities of the preceding seconds and minutes. One's responses are guided at any point by traces of the purpose and plan or directions which started him in the first place. (22:392-393)

The original human tendencies include possibilities for learning. Thorndike thought of these original tendencies in the form of three laws: (a) the law of readiness, (b) the law of exercise, and (c) the law of effect.

The law of readiness.--Here, the idea of readiness refers to the inclination of a conduction unit to be either annoyed or satisfied when the unit either does or does not conduct. When a conduction unit is ready to conduct, such conduct is satisfying. When any conduction unit is not in readiness to conduct, the conduct is annoying. Conversely, when a conduction unit is ready to conduct, not to conduct would be annoying.

Thorndike's concept of a satisfying state of affairs is one which the being does nothing to avoid and often does something to maintain and renew. An annoying state of affairs is one which the being does nothing to preserve, but often does things to end. (21:1-2)

The law of exercise.--Thorndike maintained that all, or nearly all, learning vanishes if it is not exercised. That is, what a person knows or can do has been kept alive by relearning through exercise. This may be either open relearning or hidden relearning in the form of such practice that prevents either the knowledge or the skill from ever falling below par and needing an obvious review. (20:149)

As explained by Thorndike, this law involves the basic ideas of use and disuse. When a modifiable connection is made between a situation and a response, the strength of the connection is increased, other things being equal. When a modifiable connection is not made between a situation and a response for a length of time, the strength of the connection is decreased.

Thorndike emphasized that the vigor and the duration of each "making" of the connection affect the strength of a connection, as well as the number of times it is made. The strength of a connection is explained as roughly the probability that the connection will be made

when the situation recurs. A greater probability that a connection will be made means either a greater probability for the same time or an equal probability for a longer time. Thus, a greater strength between the situation "What is the square of 16?" and the response "256," may mean that the response is now ninety out of a hundred rather than sixty out of a hundred; or that it is ninety-nine out of a hundred for fifty days instead of ninety-nine out of a hundred for twenty days. In any case, the probability is for a recurrence of the connection on the assumption that other conditions are equal ("other conditions" may refer, for example, to general health, general or specific fatigue, interest, time of day, and distraction by competing tendencies). Sometimes when a connection may not appear to have been made, the connection still may exist with a measurable degree of strength as Thorndike said could be shown through the fact that it could be remade more easily.

Some indication is given by Thorndike that connections may not always be formed with every exercise situation, although the activity produces a likelihood that new bonds may be formed. For example, the mere exercise of any modifiable function almost always results in some variation; and whatever stimulates variation also gives the chance for a wider range of useful variation for the learner to adopt or reject. (21:213-214)

Thorndike noted that neither the selection of desirable bonds nor the elimination of undesirable ones is automatic even though bonds are implied through the exercise of a function. He said that, when the function is so exercised that the consequences to the individual are alike whether he fails or succeeds, whether he strengthens either a good bond

or a bad one, and so on, there can be only chance divergence from a confirmation of his initial status. (21:214)

The mere repetition of a situation is in and of itself unproductive for learning: it has no useful selective power and causes no adaptive changes. If the mind, under the influences of such repetition, sometimes suffers limitations in its responses, the resulting responses are fortuitous and unpredictable. In general, repetition of a situation in and of itself simply maintains the status quo, whatever it may be. Thorndike noted especially that the more frequently used connections do not grow stronger while the less frequently used connections weaken. (22:64)

The law of effect.--When a modifiable connection between a situation and a response is followed by a satisfying state of affairs, that connection's strength is increased. However, when a modifiable connection between a situation and a response is followed by an annoying state of affairs, the connection's strength is decreased. The strengthening effect of satisfyingness (or, conversely, the weakening effect of annoyingness) upon a bond was described as varying. The variation was said to be accounted for by the difference in the closeness or the intimacy among the situation, the response, and the satisfying (or annoying) event in question. The meaning of "closeness" or "intimacy" might be explained as either nearness in time or attentiveness to the situation, response, and resultant state of affairs. Thorndike pointed out that the effectiveness in all cases occurs not from the reward that is given but in the degree of satisfaction of the learner. (23:145)

It appears that, in the earlier Thorndike psychology, the strengthening and the weakening of connections depended upon the consequences. He further maintained that the action of consequences is direct and need not be mediated by ideas. However, he did not presume to know either how the after-effect of a connection strengthens it or what physiological event corresponds to a connection at any strength; however, he considered the evidence to be strong that there is some condition that favors conduction across certain synapses. (22:314)

The implicit relationship between repetition and reward is emphasized by Thorndike in his denial that he could find any reasons for ascribing any power to such other reasons as "higher powers," "forms of thought," and "transcendent systems." (22:382)

About 1930, he modified the Law of Effect by indicating that an annoying weakener of a connection is less important than a satisfying strengthener. However, it is only direct weakening that is denied; punishments do, according to Thorndike, affect learning indirectly. Their indirect effect comes from leading the person, in the presence of the annoyer, to do something which would make him less likely to repeat the original connection.

Additional work by Thorndike and others brought about evidence that after-effects were not simply attached to a single response but that other non-related responses were affected. This was called <u>spread of effect</u>. Thorndike had already changed his mind about the effectiveness of annoyers in weakening connections before the experiments in spread of effect were announced. He interpreted the results of the spread-of-effect experiments in a manner consistent with his later

concept and recognized spread in terms of spread of positive effects. He saw it as a gradient of reward in which even neighboring connections were strengthened by a rewarded connection.

He explained that a relevant satisfying after-effect not only strengthens very greatly the connection which it immediately follows and to which it belongs but also strengthens to a much lesser extent punished connections which are in close proximity. Those which came either just before or just after a rewarded connection were strengthened more than those farther removed from a rewarded connection. Those within one or two steps of a rewarded connection were strengthened more than those three or more steps removed from a rewarded connection. (23:30-32)

Thorndike made some approximation of the difference in strength of a rewarded occurrence and a punished occurrence as indicated to him by some of his experiments. Basically, one rewarded occurrence gives a strengthening ten times that of one punished occurrence remote from a reward and two and one-half times that of one punished occurrence next to a rewarded connection but not between two such. (23:32-33)

Principles Relating to Connectionism

Several principles developed by Thorndike further explain his system. These principles also serve to indicate that practice is a more involved function than the simplest operation of readiness, exercise, and effect.

Belongingness.--According to Thorndike's principle of belongingness, a connection is more easily learned if the response belongs to the situation, and an after-effect does better if the response belongs to the connection it strengthens. The following two sentences illustrate this

principle: "James is a salesman. Max is a writer." The association James-salesman is stronger than salesman-Max even though the latter is based on more nearly contiguous items. In the same way, the belongingness of either a reward or a punishment depends upon its appropriateness in satisfying an aroused motive or want in the learner and its logical relationship to the activities either rewarded or punished.

In his work, Thorndike often used the announcement of either "Right" or "Wrong" to responses to serve as either reward or punishment (satisfyingness or annoyingness); however, he found some evidence that the repetition of a belonging sequence strengthens the connection even though there is no satisfying after-effect. He found that under certain conditions making a wrong response and being told that it is wrong do not weaken but actually strengthen the connections. The connection gains more strength by occurring than it loses by announcing it as wrong. (22:112)

Polarity.--According to the principle of polarity, connections act more easily in the direction in which they were formed than in the opposite direction. If one has learned the items of a French-English vocabulary, he responds more easily to the French word by its English equivalent than to the English word by its French equivalent. Thorndike supposed that if the connection is thought of as a whole, the polarity principle ought not to be important and that it would be as easy to dissociate parts from the whole in one direction as in another. (22:152)

Availability.--The principle of availability refers to the get-at-ableness of the response. Other things being equal, connections are

easy to form in proportion to the ease with which the person can either have or make the appropriate response at will. (22:345-346)

Two cases of learning will illustrate this: first, to draw a line of specified length, with eyes closed, at the desired signal; and, second, to move the hand to the ear at a signal. In the second case, the moving of the hand to the ear is easy because the brain knows what to do to get the hand to move to the ear; however, it is much more difficult to draw a line of specified length with the eyes closed because the brain does not know precisely how to accomplish the desired result. Further, practice at drawing with the eyes closed does not show a great deal of improvement because the responses are not readily summonable or get-at-able. (22:345-346)

Identification.--The identification or placement of either a situation or a part of a situation is made so that it assumes an individualized or recognizable aspect. Much of learning consists in changes in the identifiability of situations so that their identifiability may be increased by analysis and turned into compounds or complexes of features that are easier for the mind to grasp and retain than the original situations. The first recognition of either a hexagon or an octagon may be through the counting of the sides. (22:343-345)

Identifiability may be increased through association which connects a thing with some more easily identifiable situation. Having learned to call certain things bread, butter, and so on, these may be then identified as a loaf of bread, two slices of bread with butter between, and such. (22:343-345)

A situation may conceivably become more identifiable with repetition through sheer self-establishment in the mind or brain without either

analysis or outer attachments. A person seen in a group regularly may become distinct without either an analytic treatment of his features or a name attached to his recognition. (22:343-345)

Thorndike gives two notable, special varieties of improved identifiability by analysis and association. (22:345) First, the hidden elements of situations which are hard to identify are analyzed out into relief and made identifiable by having attention directed at contrasts as in the case of times, numbers, lengths, heat, and the like. Second, the situations which are hard to identify because they are varying amounts or degrees of some one quality like length, area, weight, and the like are identified by the aid of measurement with either crude or refined scales: for example, gradations of musical pitch.

Associative shifting.--Thorndike recognized that a response connected with a certain situation may be made even though the situation is not present in its entirety. That is, when a new situation arises, man reacts to it as he would to some other situation like it or other situation like some element of it. (22:401)

This fact served for Thorndike as an explanation for what he called "associative shifting." In associative shifting, if response X is made to situation abcde, the response could be obtained from another situation by successively dropping certain elements and adding other elements until the response is obtained from the new situation entirely different from the original abcde. (22:401)

The progression of changes in the situation can be illustrated by changes from abcde to abcdef to abcfg to abfgh to afghi to fghij. The continuation of the response to each of the new modified situations

depends, of course, upon an arrangement of affairs so that the response is more satisfying in its consequences than in either balking or doing something else. (22:401)

Influence of Wants, Interests, and Attitudes

Thorndike found that the same forces of repetition and reward, occurrence and confirming reaction, which cause the strengthening of connections leading to ideas and acts also cause the strengthening of connections leading to wants, interests, and attitudes. He said that it is essential in training the emotional appetitive activities not only to induce the person to make the desired response but also to reward it. (23:212)

It is important to note, however, that Thorndike believed that the desire for knowledge as a forceful item is somewhat exaggerated in educational theories. Instead, he asserted that, if an educated adult is induced by force no matter how external to want to learn a certain thing, he can learn it provided it is within his powers. (23:135)

Thorndike explained that the learner is not prevented from learning by a lack of appeal to intrinsic interests which are caused by and in harmony with his deeper and more characteristic wants, but rather by a weakening of the want to learn due to failure to withstand the competition of other wants, such as to play, to rest, and to make progress in some other cherished enterprise. (23:153)

Thorndike's experiments supported his conclusion that a person can be taught new attitudes and tastes as surely, though not so easily, as he can be taught new facts and skills. The basic principles of learning by repetition and reward seemed to operate with wants, interests, and attitudes as they do with ideas and movements. (23:159)

One apparently puzzling set of facts occurs with the continuance of nervous irritation, worry, envy, fear, shame, and disgust as responses to certain stimuli. If reward strengthens connections leading to emotional responses, one would expect, for example, that a situation leading sometimes to worry and sometimes to peace would increasingly lead to the latter. Two things seem to supply an answer for Thorndike to this apparent puzzle. First, the pleasant response sometimes either does not occur or occurs too infrequently. Second, the unpleasant response may have secondary consequences which are satisfying. (23:189-190)

Changing a person's attitudes and interest by associative shifting is important especially because attitudes are usually not easily "available." It is theoretically possible to make any desired shift provided (1) there is anything to which he gives the desired response and (2) the shifted connections can be kept satisfying and made strong enough to overcome instinctive or acquired opposition. (23:192)

Thorndike said that common experience furnishes fairly frequent cases of diminished dislike when what is, or at least seems to be, the same situation, is repeated again and again. A composite doctrine is that the feeling tone or emotional attitude toward any often repeated stimulus has a fundamental and universal tendency toward indifference. (23:198)

In the matter of coming to like, or at least being indifferent to, those things which are repeated over and over, Thorndike believed that forces other than mere repetition are responsible for these changes. Among his bases for this contention are (1) that doing the customary may be pleasant relatively as either avoidance of or relief from the

strain of choosing a new course of action and carrying it out and (2) that the customary is likely to seem fit and proper so that doing it produces a mild but dependable satisfaction. (23:211)

Conditions of Improvement

Improvement in learning is brought about when things favor a repetition and satisfyingness of the desirable bonds and the disuse and annoyingness of the undesirable bonds. Three of these conditions are direct consequences of the laws of learning: (1) ease of identification of the bonds to be formed or broken, (2) ease of identification of the states of affairs which should satisfy or annoy, and (3) ease of application of satisfaction or annoyance to them. (21:215)

To improve in either addition or subtraction is much easier than to improve in the solution of arithmetic problem situations. In the first instance, the bonds to be either made or strengthened are rigidly defined and subjected to exclusive practice as needed. Another reason is that the results that should satisfy can also be easily identified and accompanied by some satisfier. In the solution of problems, however, the learner cannot so easily tell what particular bonds he has to form, he cannot drill himself on these alone, and he cannot know in detail what connections should content him and how to make himself feel contented with them.

Five remaining conditions are called the "interest series" and are, perhaps, less measurable in quantitative experiments. They are important and potent partly because they help to produce variations, but mostly because they reinforce the good and eliminate the bad ones. These five remaining conditions are: (1) interest in the work; (2) interest in

improvement; (3) an active, inquiring attitude; (4) attention; and (5) acceptance of the work as significant to the worker's wants.

To these five commonly accepted aids to improvement, Thorndike added these additional favorable psychological conditions for improvement; the absence of irrelevant emotional excitement and the absence of worry. (21:229)

First, he proposed that the balance of opinion with respect to the value of emotional fervor in learning was that, apart from the eager but quiet zest for the work itself and for success at it, all emotional excitement is distracting in the case of intellectual functions. Not only violent love, grief, humiliation and disgust, but also even moderate fear of onlookers, exultation at success, and anger at competitors and at oneself, are to some extent wastes of energy and preventives of improvement. However, in the case of moral functions such as learning to work energetically, to tell the truth, and so on, he proposed a balance of opinion toward the view that appropriate emotional fervor provides reinforcement. But he, himself, supported another idea. For example, the general disposition to avoid lying may be far stronger in a man who feels no excitement when a chance to lie profitably occurs than in a man who on such occasion thrills with conscious disgust or disdain.

Second, the original correlations between the inner excitements and the outer manifestations may exist independently. A man may boil with rage at idleness while being content to boil idly. He may, on the other hand, be so annoyed by idleness as never to indulge in it and always to try to cure it without the traditional sense of feeling rage, disgust, and scorn.

Third, Thorndike indicated that the mere quality of conscious excitement is astonishingly alike in all the exciting emotions. The differences turn out to be minor facts, and what mostly differentiates between them is the tendency to do different things and be satisfied by different resulting states.

Fourth, the most expert and successful learners show least emotional excitement in connection with the exercise of the function which they are improving. Further, the same individual becomes, on the average, less excited in his work as he learns the work better.

Finally, in those cases in which emotional excitement shows the greatest probability of being bound to rapid improvement, the excitement is not great, and seems to be produced by the interest and success rather than to produce them.

These same types of arguments could be applied to worry and tension. Other things being equal, tension and worry simply waste energy and distract the mind. Thorndike believed that those persons who seem to need to be made to worry in order to be led to work can be cured in the only real and economical way by arousing greater intrinsic interest and better motives rather than by more tension.

Summary of Connectionism

Practice or repetition of a situation provides the opportunity for learning to take place. Mere practice itself leads to a negligible increase in strength of a connection unless the connection is rewarded. Some strengthening of a connection is sometimes found if the after-effect belongs to the situation, and this belongingness increases the strength of a rewarded connection.

In a practice situation, the rewarding of a connection is the principal means of changing the strength of that connection; however, punishment of a connection has some less important effect. The rewarding of a connection strengthens not only that connection, but also neighboring connections. The connections themselves also weaken if they have no opportunity to recur over a long period of time.

In order that a unit may respond to a situation and establish a connection, the identification of the situation is necessary and the response must be available. Whenever a particular response is not available in a particular situation, it may be obtained later. Through associative shifting, elements of a situation successively change from those to which the response is available until a whole new situation is formed; and in the process the desired connection has been shifted to the new elements.

Wants, interests, and attitudes constitute either situations or parts of situations and determine responses to situations. However, initially, these wants, interests, and attitudes may have been developed as responses to rewarded connections. Therefore, particular wants, interests, and attitudes can be developed by rewarded connections through associative shifting.

Very succinctly, Hilgard indicates the essential elements in Thorndike's connectionism:

> Repetition of situations does not in itself modify connections. Repetition of connections leads to a negligible increase in strength, unless the connections are rewarded. Practice is important because it permits rewards to act upon connections. (11:42-43)

Guthrie's Contiguous Conditioning

Introductory Overview

Guthrie understood learning in such a way that he included changes which may either be or not be beneficial. It is true, he noted, that the changes may, in the long run, be adaptive. However, he suggested that psychology would have deserted the methods of empirical science if it assumed that all learning is good and that every action has its goal. (7:5)

Guthrie never made a formal presentation of several principles to state his system. It may have appeared that he was content with only a principle of association. However, Voeks (27) arranged Guthrie's system into four principles which seem to have been acceptable.

The Principle of Association.--The conditioned response, as it is expressed by Guthrie, is briefly: "A combination of stimuli which has accompanied a movement will on the recurrence tend to be followed by that movement." Notably absent from his explanations is any mention of reinforcement, pleasant effects, and so on. (8:23)

One of Guthrie's theses was that the so-called law of effect is reducible to and conforms with the principle of association by contiguity. He answered that although one normally does repeat behavior that leads to success when the occasion is repeated, rewarded connections do not produce associations that lead to endless repetition of successes. Rather, when a problem is solved, there is no problem left in existence and no need for repetition. (8:134)

An important feature of Guthrie's principle of conditioning is that it is confined to a simultaneous association between the stimuli

present and the response. These stimuli, by their presence as the response occurs, become future cues for the response. (8:31)

Guthrie referred frequently to "movement-produced" stimuli. He noted that movements do not always follow stimuli but that so far as is known it is true that the movements of the striped muscles which are employed either in moving the body or in thinking are always preceded by stimuli. So, stimuli are the necessary but not the sufficient conditions of movement. While the muscles of the viscera, the smooth muscles, may contract and relax in response either to chemical changes in their medium or to internal rhythms, the movements of the striped muscles follow only when motor nerves are excited. (7:27)

For the purposes of understanding learning, Guthrie defined stimuli as the changes in the physical world that occasion observable reaction on the part of the animal. He also believed that the occasion for every thought, as well as every act, is to be found in stimuli acting on receptors. (7:27-28)

It would be hopeless for one to try to keep an eye on the totality of stimulation since so many stimuli may be operant at a single time. Nevertheless, the best that can be done is to select certain outstanding and conspicuous parts of the total stimulus situation and keep some record of their consequences. Then, through particular stimuli selected for use as warnings of acts to come, it is found that combinations of stimuli may have an importance that is lacking in the component elements. Guthrie thought it possible for stimulus combinations to act as signals of a response when parts of the combination would have no effect. (7:29)

An important feature of Guthrie's psychological thought is that in the principle of conditioning the connection between stimulus and response is confined to simultaneous association. (7:33)

Guthrie avoided the term "conditioned stimulus" when he discussed conditioned responses and sometimes accepted "conditioning stimulus" as more indicative of its active role in bringing about the conditioned response. He apparently favored, however, the term "original stimulus" for the already-established stimulus and "substitute stimulus" for the new stimulus which becomes a stimulus through conditioning. (7:37)

Not all stimulus-response associations are dependent on conditioning. Rather, maturation of the nervous system appears to be the principal determiner of many classes of acts. (7:38)

The Principle of Postremity.--The principle of postremity, in some respects, involves a negative aspect of learning because it involves the detachment of responses from their cues so that the cues are then associated with other responses. The principle is not separate from, but an extension of, Guthrie's main principle of association by contiguity.

Guthrie used the term "recency" to refer to the situation in which a cue is associated with a response that inhibits its old response, thus obviously ceases to call out the old. Voeks (27:344) suggested "postremity" for this reference so that it might avoid the misunderstanding and argument that had arisen concerning whether recency indicated a nearness in time or a position in chronological sequence. Guthrie, himself, agreed that "postremity" quite possibly would be most clear.

He refers to the cat in the box as establishing a second association with some repeated situation in the box so that it responds

differently. This, then, will become its new response in that situation. (1:143) Again, he says that, if the cat does something else in the puzzle box situation after the successful movement, the puzzle box acquires new associations. If the cat is prevented from leaving the box, he is forced into new behavior and a new solution will be found. (5:111) Guthrie also says that, if the response is prevented by any means when the stimulus combination occurs, the stimulus combination loses its power to elicit the response. If the situation is repeated, the stimulus combination will acquire a positive inhibiting effect on its former response. (3:417)

In particular, Guthrie pointed out that punishment does not change the response. Rather, in the presence of the cue, if the animal is punished so that he gives a particular response, that is the response that the animal will tend to give on the recurrence of the cue. (9:452)

Guthrie not only indicates that a stimulus may become the cue for the last response made while that stimulus was present but also goes further. This, he said, is the only way in which a stimulus cue for a particular response can cease being a cue for that response. (1:145; 2:59; 10:38)

The Principle of Response Probability.--Guthrie insisted that thousands of stimuli accompany every response. (4:134) The enlistment of increasing numbers of these stimuli as conditioners provides an increased probability of the recurrence of a response rather than the strengthening of individual connections. (3:420)

The enlistment of additional conditioners is Guthrie's explanation for the purpose of practice. By a series of practice periods, when

the cue for a response is not already adequately effective, he supposed that additional conditioners would provide a higher probability that the cue would have enough support to be effective. (7:99-100)

A sort of corollary to this is that, whenever care is taken to set up again the total situation as far as possible, the response is much more likely to be a close approximation of what happened before. (6:39)

The Principle of Dynamic Situations.--Changes in stimulus patterns go on virtually continuously, and the psychologist must resign himself to the fact that no psychological event is ever really repeated. The second repetition of an event is only roughly equivalent to the original and may be assumed equivalent only for practical purposes. The second presentation of the cue may find the laboratory person engaged in something very different from the original situation. Thus, practice is necessary to the extent that the response must be elicitable from a variety of situations. (2:31-32)

In a child's learning, radical change in the child's position brings failure to remember. If he practiced in his seat and is now standing, his memory will be impaired. This is because he has not practiced in these situations. Thus, a rule of teaching appeared: "Effective practice is conducted in the general situation in which we desire the future performance to be given." So, for performance in a variety of situations, one must practice in a variety of situations. (2:32)

Change, then, is fundamental. A very brief summary of Guthrie's idea of dynamic situations is apparent in his statement that no association or conditioned response is ever a perfect repetition of a previous response. (6:39)

Factors in Conditioning

Time Factor.--While some theories of learning indicate that a response is established following a stimulus, Guthrie is emphatic in his statement that definite simultaneity is essential for conditioning. The cue must accompany the act if the association is to be formed. (8:45)

There are, however, occasions when the stimuli may apparently be somewhat removed from the response. For this situation, Guthrie explained that, whenever any new and emphatic stimulus is applied to an animal, the animal will respond to that stimulus. It will listen to a bell; in response to light, it will move its head and eyes. Every such movement is a stimulus to many sense organs in muscles, tendons, and joints, as well as the occasion for changing stimuli to the eyes, ears, and so forth. He called them movement-produced stimuli. (8:47)

Such movements as listening, looking, and so on are not over in a flash; and the movement, once started, maintains itself by the stimuli it furnishes. If on the ringing of a telephone bell one rises and makes his way to the telephone, the sound may cease long before he reaches the instrument. However, one movement starts another, that movement a third, the third a fourth; and the movements form a series. Very often these are stereotyped in the form of habit. Therefore, these movement-produced stimuli make possible a far-reaching extension of association or conditioning. (8:47)

Regardless of Guthrie's insistence of simultaneity of stimulus and response, he noted that in associative learning involving speech and thought, conditioning loses its clear time relationships. It is so difficult to observe the movements that accompany thinking that one cannot

know just when the response is present and when it is not. Therefore, an original stimulus and a substitute stimulus may be separated for days and their association would depend on mediating associations. This, he said, was true in cases in which delayed punishment is effective. He mentioned the case of a parent spanking a child for writing on the walls of the living room an hour after the offense and in a different room. In such cases, he said that well established speech provides the only possibility that the punishment will establish a new response to walls and pencil in hand. The child conjures up by its associations the tempting situation. Thus, through language the child is made to stand again before the wall with a pencil; and through the spanking, the original tendency to write is displaced by other tendencies. (7:60)

Experimentation in conditioning sometimes uses a cue or signal before the expected response. This forward association is so effective in animals and with simple movement in human beings because the cue or signal in the experiment may start its own movement series of indefinite length, and any phase of this movement series may act as a simultaneous conditioner whenever the response takes place. Guthrie said that the reason for getting better results with short intervals is that the movement series can be depended on to be more stereotyped for a short interval than for a longer interval. (7:61)

Inhibitory Conditioning.--Once conditioned to a response, the stimulus still may become a discourager or inhibitor of a response. Guthrie used the term distraction to describe the effect of either diminishing or partially impeding a response. For the prevention of either

a response or its overt expression, he used the term inhibition. However, inhibition is rarely complete. He noted that even when the overt expression is prevented, there is usually discernible minimal expression of any response for which cues have been received. (8:55)

Learning any skill depends as much on getting rid of awkward movements and useless movements as on acquiring the proper movements to the proper cues. Guthrie raised the question of how does one lose hates, loves, fears, indignations, memory of friends' names, typing errors, or enthusiasms. (7:64)

A simple way of unconditioning a response is to cause it to become a conditioner for an incompatible movement. Then, unlearning becomes merely a case of learning something else. (7:66)

The means through which this inhibitory conditioning can take place are mainly threefold: (1) a conditioned stimulus may be acting and the response fail simply because the stimulus is below the threshold; (2) the response may be eliminated through either exhaustion or fatigue; or (3) the response may be inhibited by the action of incompatible responses. In any of these three cases, a stimulus is present and a certain response fails to occur. Other responses always occur; and, as a result, the stimulus conditions the other responses and is thus an inhibitor of the response that was associated with the stimulus in the previous case. (7:69-70)

The first method of negative adaptation described can be shown through the training of a horse for riding. The trainer always keeps within the threshold of tolerance of the animal. First, a light blanket and then a sack with a little grain is put on the horse's back. The

increase is so gradual that the horse at no time either plunges or struggles. In time the saddle is introduced, the bridle, and finally the weight of the rider without exciting the horse to resistance. (7:71-72)

The second method of negative adaptation is more like the method used sometimes on the Western ranches. The horse is forcibly saddled, bridled, and mounted. The rider attempted to stay with the animal until the horse was too exhausted to struggle more. At this stage, the disturbing stimuli are present but are not reacted to, and negative adaptation is taking place. The disadvantage of this method is that traces of the first learning are likely to survive, and so reconditioning is not complete. (7:71-72)

The third way in which inhibitory conditioning or negative adaptation may be brought about is through the presentation of a stimulus when its response is inhibited by something else. Again, the stimulus is present, but the response is prevented. By calling a child only when he is very occupied, a mother can negatively adapt him to her calling voice. (7:73)

In addition to these three methods of establishing inhibitory conditioning by insuring the failure of the response, Guthrie suggested a fourth. The substitute stimulus may be applied again so soon after its response that the response is still in its refractory period. Most responses have a refractory period, an interval during which the movement cannot be elicited. Following this, there is a relative refractory period, an interval during which the stimulus must be of greater than normal intensity to elicit the response. The method of establishing

inhibitory conditioning is the result of applying the stimulus under circumstances that prevent the response. The conditioned stimulus loses its connection with the former response because it has become attached to other behavior. (7:70-71)

Generalization.--One of the characteristics of generalization is that it appears soon after the beginning of practice and disappears as practice continues. Usually, it is confined to unpracticed stimuli from the same class of sense organs. The phenomenon of generalization is very simply explained if the movement-produced stimuli presumed to be cues are actually the conditioners for a response. For example, listening to a tone different from the original tone associated with a response may involve listening movements so much like those called out by the practiced cue that these similar movements furnish the real conditioners of the action. (8:73)

Repetition.--One of the oldest laws of association has been the law that the strength of an association depends on the frequency with which it has occurred. However, it has been noted that there are exceptions to this rule. Sometimes a single occurrence is sufficient. However, the fact remains that the frequency of connection of substitute stimulus and response normally influences the associative strength of the degree of probability that the response will follow its signal. (7:93-94)

The reason that one occasion is not enough to rid a person of an annoying habit is that, although the cue succeeds in inhibiting the response, not all the possible conditioners were alienated. On each successful inhibition, some of these cues may be attached to the

inhibiting response so that eventually such a proportion of cues for the inhibiting behavior is enlisted that the annoying habit will appear only occasionally. (7:102)

There is another qualification of the law of frequency. Of two associations that have had equal practice, the more recent will prevail. Guthrie called this the law of "recency" and later, sometimes, "postremity." Assuming the rule of association to be dependent on contiguity, the last association prevails over earlier associations without reference to the number of either pairings or reinforcements of the earlier associations. (8:80)

In answer to the question, "Why should practice make the effect increasingly certain?" Guthrie asserted that it is quite possible in successive practice periods that more and more conditioners are enlisted so that after many periods there is a high probability that the cue will have enough support to be effective. (8:84)

Guthrie explained that the law of frequency is not a fundamental characteristic of conditioning. Rather, the observed effect of increased associative strength is caused by the enlistment of added conditioners as a result of the repetition. (8:85)

Emotional Reinforcement.--If emotional reinforcement is understood as a general condition of increased muscular tension leading to exaggerated action, states of excitement would lend themselves readily to accelerated learning. There is some evidence that simple learning may be facilitated by the slight addition to muscular tonus provided by gripping a dynamometer while practicing. (7:107-108)

Guthrie observed that sometimes a single telling experience takes the place of many practice periods. He accounted for this phenomenon by the fact that the behavior is attended by strong emotion that seems to cause it to undergo fixation. Exciting emotion causes the muscle affected to respond with greater contraction to the same motor impulses and by its greater contraction stimulates new fields of proprioceptor sense organs in the muscles, joints, and tendons. These added stimuli may become conditioned as well as the conditioners of movement. (8:88)

To bear out this position, Guthrie pointed out that overt action leads more readily to the stereotyping of a serial response as may be seen in experiments in which material either read aloud or recited is more quickly learned than material read silently. (8:93)

The utility of physiological excitement and of emotional reinforcement of action is two fold: excitement facilitates learning through the additional energy of movement, and the conflict that is responsible for the excitement breaks up old habits. The outcome is often an improved adjustment in the form of a new habit routine more adequate to the situation. (8:95)

Forgetting.--Laboratory studies concerned with the effects of intervening activities on forgetting have used the terms (1) associative inhibition to describe the difficulty of forming an association between A and X because of an earlier association between A and B and (2) retroactive inhibition to describe the complementary phenomenon, the loss of an association caused by intervening activities. The discussion of retroactive inhibition has turned about the question: Is retroactive inhibition the result of engaging in a similar activity during the interval?

The experimental results have been somewhat conflicting because "similarity" of intervening activity has not been defined. Some of the intervening activity has not been defined. Some of the intervening activities favor and others impede recall. Guthrie suggests that the probable explanation is that an activity in which some of the cues of the previous learning occur but are followed by different responses results in the alienation of these cues and hence in interference. On the other hand, if the common cues in the intervening activity have been followed by the same responses, there is facilitation rather than inhibition. (8:99-100)

Some laboratory-conditioned responses seem to be exempt from forgetting, and this has brought about the argument that conditioned reflexes differ fundamentally from other forms of learning. Guthrie, however, maintains that this is not the case. Rather, he says that any response whose cues have not been alienated in intervening experience will be thus preserved and protected from forgetting. The same phenomenon is apparent with the re-appearance of certain childhood habits and childhood skills as they may recur in old age if they have not been disorganized through relearning. (8:99-100)

The Role of Intention.--The intention to learn undoubtedly affects the ability to memorize and to acquire skill. Studies have brought out the difference between learning with intention and learning without intention, and it has been seen that a ritual may be repeated for years but will not always be memorized unless the subject made up his mind to learn it. Nevertheless, it is also true that some unintentional learning does take place as shown by the frequency with which people acquire habits unintentionally. (8:166)

Many types of either learnings or skills are affected either by what is called "confidence" or by the lack of it. This confidence is nothing more than preparedness for victory. On the other hand, preparedness for defeat makes winning almost impossible because one acts too soon as if defeated. (7:211)

Guthrie held a definition of intention that could be described with these four essentials:

1. The presence of some maintaining stimulus complex,

2. The blocking of direct responses which would remove the maintaining stimulus,

3. The presence of precurrent responses which "commit" us to action, and

4. The presence of a readiness for the consequences of the act; that is, anticipatory behavior of preparedness. (8:167)

Habit Formation

A threat to vital states of an organism's equilibrium, also called "homeostasis," is sometimes counterbalanced by activity to avoid the disturbance. Creatures without mind continue to react in the same way to recurring disturbance; however, the characteristic of mind is to change the form of reaction to repeated disturbance. (8:105-106)

One of the outstanding features of the changes taking place in learning is the tendency to form, in answer to repeated disturbance, a stereotyped response that is adequate to the repeated disturbance and that expends less energy than earlier performances. A recurring problem is solved when a routine and stereotyped habit has been formed that returns the person to the desired state of equilibrium from which he has been displaced. (8:105-106)

Whenever a series of movements has once taken place, it tends to be fixed without the repetition of all the series of stimuli that were responsible for it initially. The reason for this, according to Guthrie, is that movement-produced stimuli have become conditioners of the succession of movements and that the serial response is now somewhat independent of its original causes. Once started, it may maintain itself. (7:127)

There is evidence that the simple repetition of series of events in either action or thought does not in and of itself lead to the omission of any terms of the series. The dropping occurs, Guthrie suggested, only when the terms are irrelevant in the sense that they depend on stimuli that are not essential to the action series, when they are not recurrent, and when they are replaced by stimuli to incompatible movement. (8:108-109)

Acceleration of Habit Formation.--A common, but not invariable, feature of habit formation is that the practice of a stereotyped action generally results in speeding up the action. In action that has become fairly stereotyped, speed does not increase. However, in action that still includes much that is "irrelevant" to the recurring change, the elimination of irrelevant movement may result in speeding up the serial response. (8:110-111)

There is also another source of increased speed. Many stimuli that have been acting for some time become conditioners of a later movement that is, as a result, elicited at the earlier appearance of the stimuli. Our behavior in general tends to anticipate the external event through conditioning of this sort, and in the end the whole series

becomes one flowing action in which the originally separate acts are overlapped instead of distinct. (8:110-111)

Habits will not normally be accelerated by practice unless (1) irrelevant parts of a habit are eliminated, (2) overlapping stimuli set forward certain movements in the series, or (3) interference produces excitement with a resultant quickening of movement. In fact, one may correctly speak of the habitual speed of an action because excitement, which is the only internal cause of acceleration, depends on conditioning. The rate at which a movement is performed quickly becomes a habit unless it is altered in one of the ways described. (8:112)

Breaking Habits.--In answer to inquiry concerning those circumstances under which stereotyped habits disappear, Guthrie supposed that inhibitory conditioning probably furnished the answer. The mark of an established habit is smooth and highly predictable action. Each movement is a conditioner of other movements and thus accounts for its comparative independence of external variation in the situation. The stereotyping may preserve waste movement and excess movement, but it does tend to eliminate interference among movements and movements that result in disturbing stimuli. (8:113)

Guthrie pointed out that it is a mistaken notion that habit has its brain center. The simplest habit is a very complicated event and, at first, involves the whole organism. Later and only after much repetition, it is localized in a limited number of muscles. (8:114)

There are two significant observations by Guthrie in this connection. The first is that one is conscious of a feature of the situation whenever that feature is dominating the response of the whole organism.

The second observation is that, as a habit becomes stereotyped, it tends to disappear from consciousness. One may either no longer notice it or be able to recall whether he performed the act. (8:114-115)

Repetition is effective but not necessary in breaking habits and making habits. The need for repetition comes from the need for executing the act in a variety of circumstances although some habits may be established in a single excited rehearsal. The effectiveness of repetition lies in the enlistment of new conditioners and in negative adaptation toward more and more potential distractions. (8:114-115)

Guthrie recognized two means for breaking up a habit. The simplest rule is by sidetracking the habit by finding the cues that initiated the action and then practicing another response to these cues. Regardless of how well integrated a habit may be and how well it is established by practice, the habit can be avoided if the initial movements of the habit can be thus "sidetracked." It will still, however, remain a part of the behavior repertoire of the individual because it will remain integrated. The other means is through a thorough breaking up of the habit and requires the unconditioning of the cues within the habit complex that serve to integrate and to stereotype it. (8:115)

One fact concerning interference with an act that has been performed without attention is that the attention itself is frequently a disruption of the habit. Guthrie noted that attention to one of our own movements renders that movement different because it then lacks some of its cues. As an example, he said that in writing we ordinarily look at the words as they are formed. But if one attaches his attention to the finger movements, the writing changes its character and becomes disorganized.

"Attention," to Guthrie, included general movements of orientation, looking, listening, and so on. (8:122)

Habit versus skill.--It is proper to refer to certain habits as skillful; however, habit and skill refer to two very different features of behavior. Habit can theoretically be described in terms of either muscular contraction or glandular secretion. To define skill, it is necessary to refer to something outside both the organism and the stimulus situation. (8:136)

Skill consists in the ability to bring about some end result with maximum certainty and minimum outlay of either energy, time, or both. A habit may be either good or bad, either successful or unsuccessful; but in one sense of the word, however, no skill is such unless it is good. Skills consist of habits, but habits may stand in the way of skill, as well as be the essence of which skills are composed. (8:136)

One difficulty in acquiring skills is that the stimuli resulting from inadequate habits, i.e., the consequences of poor performance, do not appear in time to break up the bad habit. The thought that the performance was inadequate does not bring improvement. Rather, by watching the results of the poor performance, the person may be led to right rehearsal. If he overcorrects, he has at least broken up the pattern of action that failed to reach his goal. (8:146-147)

In discussing practice periods, Guthrie said that the only law for the distribution of practice periods is that the greatest efficiency may be gained by arranging for appropriate interruption of practice at times when the setting up of undesirable habits seems to retard practice. This leaves the specific arrangements for practice to the consideration of the task at hand, the persons involved, and so on. (8:153)

Summary of Contiguous Conditioning

Guthrie's really basic principle of learning is his theory that a stimulus pattern that once accompanies a response becomes a full-strength, direct cue for that response. This basic principle is extended by his other theory summarized in three principles of postremity, response probability, and dynamic situations. These might have been described as corollaries quite as appropriately as separate principles.

Practice is useful in the development of a skill because practice permits opportunity for the conditioning of certain stimuli and certain responses. It also permits opportunity for de-conditioning cues from responses when these interfere with the exercise of the skill.

Although the principle of association is always necessary, the other principles complete it to sufficiency. They point out that it is the last pairing that is either associated or conditioned. A response may occur when all stimuli from the stimulus pattern are not present; however, the greater the proportion of the stimuli, the greater the probability that the response will occur. Furthermore, inasmuch as the totality of a situation does not recur, continuing changes are to be expected in the association of cues to responses.

Hilgard's brief estimate of practice as one of the essential elements in Guthrie's contiguous conditioning is that

> Practice assimilates and alienates cues, until a whole family of stimulus combinations comes to evoke a whole family of responses which lead to the outcome socially described as successful performance. Because skill represents a population of habits, learning appears to accumulate with repetition, although basically each individual habit is learned at full strength in a single repetition. (11:76)

Skinner's Operant Conditioning

Introductory Overview

A very simple definition of behavior to B. F. Skinner is that it is the functioning that is engaged in either acting upon the outside world or having commerce with it. The outside situation is called a "stimulus," and that behavior that is controlled by it is called a "response." A stimulus and response so paired that there is a connection between them results in what is called a "reflex." (18:6)

When a stimulus and a response are paired so that the resulting state of affairs strengthens the behavior, the strengthening state of affairs is called "reinforcement." The reinforcement of the behavior is called "conditioning."

According to Skinner, there are two types of conditioning. One type is "respondent" conditioning. In respondent conditioning, which Skinner called Type S, in which a stimulus elicits a response, the strengthening of the reflex simply increases the magnitude of the response or shortens the time which elapses between stimulus and response. "Operant" conditioning, which Skinner called Type R, on the other hand, cannot quite be described in the same manner because operant behavior is not elicited. Rather, an operant is strengthened by making it either more probable or more frequent. Thus, an organism is conditioned when a reinforcer either (1) accompanies another stimulus or (2) follows upon the organism's own behavior. These two cases exhaust the possibilities. An event that does neither, therefore, has no effect in changing a probability of response. (18:65)

The idea of "reflex reserve" has an important place in the system. It is in a sense a hypothetical entity and is also a convenient way of representing the particular relation between the activity of a reflex and its subsequent strength. (18:26)

Laws Relating to Operant Conditioning

In describing his system, Skinner set forth a group of twenty-four "laws." The first five of these describe properties of a reflex in which latency, threshold, after-discharge, and R/S ration are detected by presenting a stimulus at various intensities and durations and observing the time of occurrence, the duration, and the magnitude of response. These he called static laws.

The law of threshold.--Skinner defined this law as the intensity with which the stimulus must either reach or exceed a certain critical value (called the threshold) to elicit a response. Stimuli acting below this level do not bring about a response. (18:12)

The law of latency.--This law is concerned with an interval of time (called the latency) between the beginning of the stimulus and the beginning of the response. Latency is variable for several reasons including the difference in the form of energy of stimulus and response. Also, an important characteristic of latency is the fact that it is usually a function of the intensity of the stimulus. The stronger the stimulus, the greater the response. (18:13)

The law of the magnitude of the response.--Skinner states this law as "The magnitude of the response is a function of the intensity of the stimulus." He said that some responses to stimuli occur in an all-or-none way; however, he classed these as exceptional cases rather than

the usual rule. Generally, the greater the stimulus, the greater the response. (18:13)

The law of after-discharge.--The response may persist for some time after the cessation of the stimulus. This refers to the total amount of activity taking place during the presence of the stimulus and also after its cessation. In general, the after-discharge increases with the intensity of the stimulus. (18:13)

The law of temporal summation.--Either prolongation of a stimulus or repetitive presentation with certain limiting rates has the same effect as increasing the intensity. Summation is often restricted to near-threshold values of the stimulus when the response would not have occurred without summation. However, the law applies as well to the magnitude of response, its latency, and so on. Thus, a subthreshold value of a stimulus that is either prolonged or repeated within a certain time or at a certain rate may affect the magnitude of the response and the after-discharge. (18:13-14)

In addition to the static laws, there are also a group of eight that Skinner called the dynamic laws.

The law of the refractory phase.--Skinner observed that immediately after elicitation the strength of some reflexes exists at a low, perhaps zero, value. Then, it returns to its former state during subsequent inactivity. The "absolute refractory phase" refers to the time during which the reflex value is below normal. (18:15)

The law of reflex fatigue.--The strength of a reflex declines during repeated elicitation and returns to its former value during subsequent inactivity. The rate of decline is a function of the rate of

elicitation and of the intensity of the stimulus and response. At high rates of elicitation, the reflex strength may reach zero. The rate of decline varies greatly among reflexes, and some reflexes are practically indefatiguable. (18:16)

The law of facilitation.--Facilitation refers to a function in which the strength of a reflex may be increased through presentation of a second stimulus that does not itself elicit the response. For example, a flexion reflex may be strengthened by the presentation of a loud sound. The loud sound, in this case, does not elicit flexion; but if it is presented simultaneously with the flexion-eliciting stimulus, the magnitude of the response is changed. (18:16-17)

The law of inhibition.--The strength of a reflex may be decreased through presentation of a second stimulus that has no other relation to the effector involved. Loosely, inhibition has been used to designate any decline in reflex strength. In Skinner's use of the term, inhibition may appear as the reverse of facilitation; however, he seems to prefer to consider them as separate entities. His explanation is that facilitation and inhibition refer to specific stimuli and specific responses. Thus, the reflex does not belong to either one but specifically to the category into which it falls. (18:17-18)

The law of conditioning of Type S.--In this law, Skinner held that the approximately simultaneous presentation of two stimuli, one of which (the "reinforcing" stimulus) belongs to a reflex existing at the moment at some strength, may produce an increase in the strength of a third reflex composed of the reinforcing stimulus and the other stimulus. That is, Stimulus A elicits Response A; Response A may still be elicited

when Stimulus A and Stimulus B are presented together; and, through conditioning, Stimulus B when presented alone elicits Response A. (18:18)

The law of extinction of Type S.--To explain extinction of a response of Type S, Skinner stated that the reflex strengthened through conditioning of Type S may be elicited without presentation of the reinforcing stimulus. When such elicitation occurs, however, the strength of the third reflex is decreased. (18:18-19)

The law of conditioning of Type R.--This law states that if the occurrence of an operant is followed by presentation of a reinforcing stimulus, the strength is increased. That is, when a historical event in terms of behavior occurs, the chance of its recurrence is greater in the sense that it will occur either sooner, oftener, more total times, or so on. (18:21)

The law of extinction of Type R.--In explaining extinction of a response of Type R, Skinner stated that if the reinforcing stimulus does not follow the occurrence of an operant already strengthened through conditioning, the strength of the operant is decreased. That is, recurrence without a reinforcing stimulus changes the future likelihood of recurrence. The operant will recur either less soon, less often, or fewer total times. (18:21)

The final eleven of the formalized laws were called the laws of interaction.

The law of compatibility.--Compatibility means that two or more responses that do not overlap topographically may occur simultaneously without interference. This seems to hold without exception for respondents. For operants, when the drive is strong through the presentation

of discriminative stimuli, there may be no overlap of topography of responses so that they may occur simultaneously. Usually, however, responses make way for one another and occur in some serial order even when there is no topographical overlap. (18:29-30)

The law of prepotency.--Two reflexes may overlap topographically with responses that are incompatible. If so, one response may occur to the exclusion of the other. Prepotency applies to both respondent and operant behavior. However, it is not easily demonstrated with operants because the precise moment of elicitation is not controlled. (18:30)

The law of algebraic summation.--The occurrence of simultaneous elicitation of two responses utilizing the same effectors but in opposite directions produces a response the extent of which is an algebraic resultant. If one reflex should be much stronger, little or no trace of the weaker may be observed. Whenever the two balance, either no response may be observed or a rapid oscillation may occur. (18:30)

The law of blending.--Blending means that two responses showing some topographical overlap may be elicited together but in necessarily modified forms. A mechanical interaction of the musculature results and resembles some modification of a response as, for example, when one moves the hand with a weight attached. (18:31)

The law of spatial summation.--This law states that, when two reflexes have the same form of response, the response to both stimuli in combination has a greater magnitude and a shorter latency. This differs from both facilitation and temporal summation. In facilitation, there is intensification of the stimulus by another stimulus and only one reflex. In temporal summation, there is intensification of stimulation by

prolongation and one reflex. In spatial summation, however, there are two stimuli and two reflexes although only one response is elicited. (18:31-32)

The law of chaining.--In chaining, the response of one reflex may constitute or produce the eliciting or discriminative stimulus of another. The stimuli involved may be either proprioceptive as in a serial reaction of throwing a ball, or they may be external by a change of position of the receptors. (18:32)

The law of induction.--Skinner described the law of induction as the dynamic change in the strength of a reflex that may be accompanied by a similar but not so extensive change in a related reflex. This is true whenever there is a relation between the two reflexes due to the possession of common properties of stimulus or response. An example of induction is the fatigue of a flexion reflex from one source or locus of stimulation through the repeated elicitation of a reflex from another locus of stimulation. (18:32-33)

The law of extinction of chained reflexes.--Extinction of chained reflexes is a function in which, in a chain of reflexes not ultimately reinforced, only the members actually elicited undergo extinction. If, subsequently elicited, the chain may remain relatively intact except for those earlier members of the chain that were extinguished. The chain is then modified to that extent. (18:105)

The law of discrimination of the stimulus of Type S.--Discrimination may be observed in that a reflex strengthened by induction from the reinforcement of a reflex possessing a similar but not identical stimulus may be separately extinguished if the difference in stimuli is

supraliminal for the organism. That is, one must be able to "tell the stimuli are different," and this difference in behavior is expressive of discrimination. (18:169-170)

The law of discrimination of the stimulus of Type R.--In discrimination of this type, the strength acquired by an operant through reinforcement is not independent of the stimuli affecting the organism at the moment, and two operants having the same form of response may be given widely different strengths through differential reinforcement with respect to such stimuli. Thus, a single form of response may occur strongly to one stimulus and weakly to another. (18:228)

The law of operant reserve.--When an operant is reinforced, the reinforcement creates a single reserve whose size is independent of the stimulating field but differentially accessible under different fields. (18:229)

Habit

A discussion of habit, in the usual terminology of Skinner, is more likely to center around a term such as "probability of response" rather than "habit," "tendency," "predisposition," and so on. Skinner holds that to say one has acquired a habit is to resort to an explanatory fiction because the only evidence of the habit is the acquired tendency to perform the act. He is more inclined to restrict himself to a statement such as "certain physical properties of behavior are observed to increase in frequency" than to conclude that one either had acquired a habit or has a tendency to do something or other. These latter expressions imply to him the reading of something more into the observation than was actually there. (19:62-64)

Reference to habitual behavior, by any verbal means, is a description of the frequency with which bits of behavior occur. The actual probability of the behavior is never observed, only the behavior itself is either observed or observable. (19:62)

In habitual behavior, one may not know that he is doing something. He may be acting, but such acting is absent-minded conduct. He may be writing, but his attention is directed elsewhere. In the same way, one may not know either that he tends to behave in a certain way or that he is going to do something; and consistent with these, he may not recognize those variables, a function of his behavior. To say that he may not be aware of his actions and so on is not to say that he always does not, but that his habits are sometimes formed without either his knowledge or his direction. (19:289)

One may spend a great deal of time in designing his own life--that is, in what might be called either developing, modifying, or breaking of habits--and he may extensively choose the circumstances in which he is to live to manipulate his daily environment on an extensive scale. While such activity may appear to exemplify a high order of self-determination, Skinner accounts for it in terms of other variables in the environment and history of the individual that provide the ultimate control. (19:240-241)

The Skinnerian view is in conflict with those traditional treatments in which self-control or self-determination are examples of personal responsibility. The difference in viewpoint is not so much one in which the polarities represent totally different extremes. Rather, Skinner's view is that all behavior is entirely accounted for by

conditioning through historical and environmental variables; and he does not include the situation in which the individual is subject to both those variables mentioned and some other independent ability to choose. (19:240-241)

Thus, one might safely conclude that habits are incidents of behavior that are exactly like all other conditioned behavior and are subject to the same laws. Therefore, one is not free either to develop, to modify, or to break habits largely through his own effort; rather, any of these would be done as a result either of environmental and historical variables or through these combined with formal educational constructions. This statement depends, of course, on whether formal educational constructions can be considered apart from other environmental influences.

Summary of Skinner's Operant Conditioning

Through his writings, Skinner presented the results of a comprehensive experimental program that forms the basis of his system or theory of behavior. His intent was that the system should be objective, descriptive, positivistic, and analytic. Especially, he avoided basing his procedures and conclusions on the hypothetico-deductive method as a procedural technique of his science.

The basic analysis of behavior flows from the stimulus and the response. The stimulus is either a part or a modification of a part of the environment; and the response is a part of behavior. The kind of behavior that is correlated with specific eliciting stimuli Skinner called "respondent" behavior. The other behavior that is not elicited, but rather emitted without prior stimulation he called "operant" behavior. The term "reflex" is used for both respondents and operants.

A conditioned reflex is shown by an increase in the rate of response following reinforcement; but if responses are made without reinforcement, the reflex reserve is depleted until extinction is complete. One reinforcement in the absence of complicating variables raises the strength of the response to a maximum. The reflex reserve is an expression of the dimension of the number of responses that will occur without reinforcement; this may be expressed as the "available activity."

Hilgard's brief estimate of practice as one of the essential elements in Skinner's operant conditioning is

> Something like a simple law of exercise (practice under conditions of contiguity of stimulus and response) is accepted for Type S conditioning. The conditioning that occurs under Type R depends upon repeated reinforcement. The possibility is favored that maximum reinforcement may occur in a single trial for the single operant, but the single operant is not achieved experimentally. In the usual case, the accumulation of strength with repeated reinforcement depends upon a population of discriminated stimuli and the related operants, more or less after the manner of Guthrie's explanation or the interpretation of the acquisition of skill with practice.
>
> The effect of a single reinforcement is greatly enhanced by the secondary reinforcement deriving from it. Hence there is no direct correspondence between the number of responses yielded in extinction and the number of responses reinforced. The schedule of reinforcements is very important, with the greatest yields in the way of resistance to extinction coming from intermittent reinforcement (interval or ratio reinforcement). (11:114)

Hull's Systematic Behavior Theory

Introductory Overview

The systematic behavior theory of Hull is a behaviorism built upon the central concept of habit. Efforts to understand learning are built around conditioned responses. In his system, he does not include any reference to consciousness.

Over the years, he systematized and revised his ideas. In his most recent full work, in 1952, he listed seventeen "postulates" of his system that are his expression of his laws or principles.

Hull pointed out that, on the whole, organisms require a rather precise set of conditions for optimal chances of individual and species survival. When these conditions deviate appreciably from the optimum, a state of need exists, and a more or less persistent stimulation arises. If none of these responses diminishes the need, the organism will either die or fail to reproduce. However, if any of the evoked movements chance to reduce the need, the stimuli and stimulus traces then operating on the organism's ability to sense need acquire some degree of connection so that if any of these stimuli recur on subsequent occasions in conjunction with the drive, the reaction will tend to be again evoked. This law of reinforcement is fundamental. (13:15-16)

Two types of learning (the simple associative or trial-and-error learning and the conditioned-reflex learning) are usually considered distinct, but Hull regards the two types as essentially identical because both are based on the same major principle--the law of reinforcement. He, nevertheless, asserts that the evidence is not yet conclusive. (13:15-16)

Principles Relating to Hull's Systematic Behavior Theory

Postulate 1. Unlearned stimulus-response connections.--Hull maintained that at birth organisms possess receptor-effector connections that, under combined stimulation and drive, have the potentiality of evoking a hierarchy of responses that either individually or in combination are more likely to terminate the need than a random selection of the

reactions resulting from the other stimulus and drive combinations. Inasmuch as these connections already exist at birth, the organism may respond so as to achieve need reduction to stimuli for which the organism has not paired and learned responses through experience. (12:5; 13:4; 14:66)

Postulate 2. The molar stimulus trace and its stimulus equivalent.--When a brief stimulus impinges upon a suitable receptor, there is initiated the recruitment phase of a self-propagating molar afferent trace impulse. The molar stimulus equivalent of the impulse rises as a power function of time elapsed since the beginning of the stimulus. The impulse reaches its maximum (and termination) when time equals .450 seconds. (12:5; 13:11)

Following the maximum of the recruitment phase of the molar stimulus trace, there supervenes a longer subsident phase, the stimulus equivalent of which descends as a power function of time (that is, that time beyond the maximum, or time elapsed minus .450 seconds). (12:5; 13:11)

The intensity of the molar stimulus trace is also mathematically expressible. It is, according to Hull, a logarithmic function of the molar stimulus equivalent of the trace. (12:5; 13:11)

Postulate 3. Primary reinforcement.--Hull held that, although there may appear to be rather superficially divergent forms of learning, actually one principle is common to all. This he called the law of primary reinforcement. When an effector activity becomes closely associated with a stimulus afferent impulse and if the connection between them is closely associated with a rapid lessening in the motivational

stimulus, a change will result in the direction of a tendency for that stimulus to evoke that response. (12:5-6)

Postulate 4. Habit strength as a function of reinforcement.--Hull held that there was a basic principle of the simple positive growth function. If reinforcements follow each other at evenly distributed intervals while everything else is constant, the resulting habit will increase in strength as a positive function of the number of trials (in accord with a mathematically expressible formula). (12:6; 13:32; 14:114)

Postulate 5. Primary drive.--There is, with every drive, a characteristic drive stimulus. (12:6-7; 13:28-40; 14:253) This primary motivation, at least that which results from food privation, consists of two multiplicative components:

(1) The drive proper which is an increasing monotonic sigmoid function of h, the number of hours of food privation; and

(2) A negative or inanition component which is a positively accelerated function of h decreasing from 1.0 to zero.

Hull found that the functional relationship of drive to one drive condition (food privation) is that during the time from $h = 0$ to about $h = 3$, drive rises in a linear manner until the function abruptly shifts to a near horizontal course, then changes to a concave upward course, gradually changes to a convex-upward course reaching a maximum at about $h = 59$; after that, it gradually falls to the reaction threshold at about $h = 100$. (12:6-7)

Furthermore, each drive condition generates a characteristic drive stimulus that is a monotonic increasing function of this state.

Postulate 6. Stimulus-intensity dynamism.--When other things are constant, the magnitude of the stimulus-intensity component of reaction potential is a monotonic increasing logarithmic function of the stimulus. (12:7; 13:46)

Postulate 7. Incentive reinforcement.--Motivation has two aspects: (1) that of drive characteristic of primary needs and (2) that of incentive. The incentive is that substance or commodity in the environment which satisfies a need (reduces a drive). Hull stated that the incentive component of reaction potential is a negatively accelerated and increasing monotonic function of the weight of food or quantity of other incentive given as reinforcement. (12:7; 13:51; 14:129)

Postulate 8. The constitution of reaction potential.--Where conditions are constant throughout learning and response-evocation, the reaction potential of a bit of learned behavior at any given stage of learning is determined (1) by the drive operating during the learning process multiplied (2) by the dynamism of the signaling trace, (3) by the incentive reinforcement, and (4) by the habit strength. (12:7; 13:8)

Postulate 9. Inhibitory potential.--When a reaction is evoked from an organism, there is left an increment of primary negative drive that inhibits, to a degree according to its magnitude, the reaction potential to that response. Then, with the passage of time after its formation, the primary negative drive spontaneously dissipates approximately as a simple decay function of the time elapsed. However, if responses occur in close succession without further reinforcement, the successive increments of inhibition to these responses summate to attain appreciable amounts of inhibitory potential. These also summate to make up an inhibitory aggregate. (12:9-10; 13:74-81)

When experimental extinction occurs by massed practice, the primary negative drive present after the successive reaction evocations constitutes a positive growth function of those responses. For constant values of superthreshold reaction potential set up by massed practice, the number of unreinforced responses producible by mass extinction is a linear decreasing function of the magnitude of the work involved in operating the manipulanda. (12:9-10; 13:74-81)

Postulate 10. Stimulus generalization.--Stimulus generalization is that reaction in which the original conditioning becomes connected with a considerable zone of stimuli other than the stimulus involved in the original conditioning. That is, not only the stimulus connected with a response acquires a capacity to evoke the response, but other adjacent stimuli on the same stimulus continuum acquire the capacity also--though to a diminishing degree. (12:10-11; 13:86-92; 14:183-199)

In the case of stimulus generalization, a situation may arise wherein a response occurs sometimes as a reinforced response (with the stimulus part already conditioned to the response and supposedly adaptive) and sometimes as an unreinforced response (with a stimulus removed on the continuum from the conditioned part and presumably unadaptive). This maladaptivity is automatically remedied because the strengthening of the reinforced connection and the weakening of the unreinforced connection will tilt the reaction-evocation power in favor of the proper section of the stimulus continuum. It will also reduce the unreinforced connection to the reaction threshold. (12:349)

Postulate 11. Afferent stimulus interaction.--When multiple stimuli act upon a receptor at close to the same time, there occurs an

interaction either between or among the afferent impulses evoked by the stimuli. The result is that a reaction potential set up on the basis of one afferent impulse will show a generalization to fall to the level of reaction potential of the modified impulse. (12:11; 13:95; 14:47)

Postulate 12: Behavioral oscillation.--Basically, behavioral oscillation means that performance varies from moment to moment. Sometimes the organism will return to unreinforced responses even after one or more successes (reinforced responses). (12:11-12; 13:97-99; 14:319)

Postulate 13. Absolute zero of reaction potential and the reaction threshold.--Hull here expresses the idea that the reaction threshold and absolute zero of reaction potential are different. A reaction potential may exist below the reaction threshold. The potential is not sufficiently high to produce a response; but, in those cases where several reinforcements are required before reaching the reaction threshold, some potential does exist. This potential is increased with each reinforcement until the threshold is reached. Then, the organism will produce a response to the simulus. (12:12; 13:102; 14:344)

Postulate 14. Reaction potential as a function of reaction latency.--Whenever a stimulus impinges on a normal receptor of an organism, there is a potential for a reaction, either learned or unlearned. Other things equal, the shorter the latency, the greater is the associated reaction potential. (12:13; 13:12-14, 107; 14:344)

Postulate 15. Reaction potential as a function of reaction amplitude.--Reaction potential is an increasing linear function of reaction amplitude. (12:13; 13:108-109)

Postulate 16. Total responses to extinction as a function of reaction potential.--Unreinforced responses for which there has been built up a reaction potential will tend toward experimental extinction. The greater the reaction potential, the greater is the number of massed unreinforced reactions required for extinction. If the reaction potential occurred from massed reinforcements, experimental extinction occurs as a negatively accelerated monotonic increasing function of the median number of massed unreinforced evocations. If the reaction potential were acquired from distributed reinforcements, extinction occurs as a positively accelerated monotonic increasing function of the median number of massed unreinforced reaction evocations. (12:13; 13:110-114)

Postulate 17. Individual differences.--Equations stating behavioral laws or principles are concerned with large groups of individuals. But if older or younger or diseased (etc.) organisms were used, rather different results would occur. Therefore, the "constants" appearing in the various equations represent primary molar behavior; but these vary from species to species, from individual to individual, from some physiological states to others in the same individual at different times; and this variation is quite apart from the factor of behavioral oscillation. (12:13; 13:115-117)

Habit

Hull based his idea of habit upon reinforcements of an activity so that the more reinforced the movements, the more strongly habituated it becomes. (12:11ff.) Sometimes a given response is conditioned to more than one stimulus on the same generalization continuum--say, first to one and later the same response is conditioned to a second stimulus.

In such an event, the habit strength is summated because of the conditioning of the responses to two different stimuli. (13:60-63)

Hull pointed out that responses are never caused by habit alone. Neither are they evoked by a stimulus intensity, incentive motivation, nor a gross drive acting alone. The response is actually evoked by all of these factors jointly making up the reaction potential. (13:123)

Summary of Systematic Behavior

Reinforcing a response a sufficient number of times to bring its reaction potential above the threshold provides the situation wherein a given stimulus will evoke that response at a later time. The number of reinforcements is basic to the habit strength produced.

There are certain variations in response-to-stimulus activity. One example is that of stimulus generalization in which adjacent stimuli on the same continuum acquire the capacity of evocation. Performance also varies from moment to moment due only to natural behavioral oscillation. Moreover, individual differences may account for much variation of behavior independently of other variations.

Habit is not described as being different in any way from any other conditioned response. It is woven throughout Hull's systematic presentations of theory.

Hilgard's brief estimate of practice as one of the essentials in Hull's behavior theory is that

> Mere contiguous repetition does nothing but generate inhibition; all improvement depends upon reinforcement. Hull is in this respect in agreement with Thorndike and Skinner, and opposed to Guthrie. Because the <u>amount</u> of reinforcement does not affect habit strength, provided some minimum amount is present, the number of reinforcements is the basic variable in acquiring habit strength. (11:174-175)

Tolman's Sign Learning

Introductory Overview

Tolman wrote of learning as referring to the phenomenon in which an individual discovers that a given type either of behavior or of social technique is, in a particular environmental set-up, instrumental to the satisfaction of his fundamental drives. When the individual discovers that the relationships no longer hold as the environmental conditions change, new learning takes place. (24:59)

The drives and aversions.--The biological drives consist of appetites (hunger drives, thirst drives, sex drives, general activity drives, play and aesthetic drives, and so on) and aversions (fright, aggression, and gregariousness). In the presence of the drives called appetites, the individual will, if possible, make consummatory responses that continue until they tend to bring about a complementary state of internal satiation. The inciting cause of an appetite is some peculiar internal metabolic condition that arises in more or less cyclical fashion and is relieved by the complementary consummatory response. When the goal-object has been reached and the consummatory response performed, the resulting state of satiation endures until the next cycle is ready to begin. (24:9-11)

The aversions are distinguished from the appetites in that they are set off by evoking environmental conditions rather than by internal metabolic conditions. Instead of a metabolically conditioned "getting-to" a final internal state, an aversion is an environmentally conditioned "getting-away-from" an actual or threatened state of sufferences. (24:11-12)

The social techniques.--In addition to the biological drives, Tolman believed that, living in groups as the gregarious species do, it has been inevitable that they should develop certain characteristic types of social behavior that he referred to as "social techniques." These were brought about partly through evolution and partly through individual experience; but their effect is to serve as techniques for insuring more food, drink, and so on and less pain and the like. (24:27)

From the experiments and observations, Tolman produced a list of social techniques that appeared and should be included at the time. The list contained four subclasses.

A. Self-assertive techniques (such as establishing dominance status, competitive acquisition, and so on)

B. Self-abasive techniques (submitting, withdrawing from competition, and so on)

C. Collective techniques (imitation, mutual help and assistance, cooperative work, and so on)

D. Collective-assertive techniques (loyalty to the group by attack on enemies of the group, and so on) (24:27)

Principles Relating to Tolman's Sign Learning

Tolman thought that much that resulted in theoretical disputes in learning psychology could be resolved by the recognition that there are several types of learning. In his opinion, each of the current theories of learning may have validity for one or more of the varieties, but difficulties arose because psychologists did not recognize that learning is not all of one type. Tolman recognized six types: (26:144)

1. Cathexes

2. Equivalence beliefs

3. Field expectancies

4. Field-cognition modes

5. Drive discriminations

6. Motor patterns

Cathexes.--A cathexis is a connection or attachment of specific responses to specific types of either final positive goal-object or of final negative disturbance-object. The learning of a cathexis means that acquisition of a connection between a given variety of either goal-objects or disturbance-objects (for example, a given type of food, a given type of drink, and so on) and the corresponding drive (hunger, thirst, and so on). That is, the learning of a cathexis is the acquisition of the organism of either positive dispositions for certain types of goal-objects or negative dispositions against certain types of disturbance-objects. (26:144)

When a type of goal has been positively cathected, it means that, when the given drive is in force, the organism will tend to apprehend and either approach or perform the consummatory reaction upon any instance of this type of goal presented in the immediate environment. When a type of disturbance object has been negatively cathected, it means that the organism will tend to apprehend and either to avoid or to get away from any instance of this type of disturbance-object presented in the immediate environment. (26:146)

Tolman believed that animals and human beings acquire positive cathexes for new goal-objects by trying out the corresponding consummatory reactions and finding that they work--that they reduce the corresponding drives. Tolman believed in the efficacy of either reinforcement or need-reduction in the development of the cathexis. He thought that

the number of repetitions and the amounts of need-reduction per repetition would turn out to be the two major causal variables in the development of cathexes. However, he said that not enough good experimental evidence was yet available for this conclusion. (26:146-147)

Once a positive cathexis is acquired, it may be de-acquired if subsequent appropriate consummatory reactions failed to be reinforced. The cathexis, with the failure of reinforcement, would weaken and eventually be broken; and de-acquisition of the cathexis would be complete. (26:147)

Does either forgetting or weakening of a cathexis take place with the mere passage of time? Tolman felt that there is no controlled evidence of this, but he supposed that it does occur, is extremely slow, and probably takes years for cathexes to disappear through mere passage of time and lack of exercise. (26:147)

The conditions for the acquisition of negative cathexes seem to be through negative reinforcement (pain or some other noxious physiological state). Experience suggested to Tolman that a single negative reinforcement may have a comparatively very strong and persistent effect. (26:147)

The de-acquisition of negative cathexes is accomplished when the individual remains in the presence of the fear-cathected type of object under conditions in which this type of object does not lead to any noxious physiological result. There is, however, very little forgetting as a result of mere passage of time and lack of exercise, and Tolman pointed out that the same old fears so often seem to endure for a lifetime. (26:148)

Equivalence beliefs.--By an equivalence belief is meant that a connection exists either between a positively cathected type of goal and a type of subgoal or between a negatively cathected type of disturbance-object and sub-disturbance-object or foyer. During any period in which such an equivalence belief holds, the individual will tend either to approach the subgoal or to avoid such a type of foyer with almost the same readiness with which he will either approach a final goal or avoid a final disturbance-object. (26:144-145)

A distinction is made between these beliefs, as such, and the apprehension of objects as appropriate means leading to positive goals. For example, a student may work for high grades in a course in order to obtain the love and respect of either a parent or a teacher. He may, however, accept these grades as the end result rather than as a means to an end. Then he has accepted as the equivalent of the goal what was originally merely a means. Thus, he experiences a drive reduction when reaching this means whereas ordinarily the drive reduction would have taken place in reaching the goal. (26:148)

Tolman said that he was in the dark as to laws for the de-acquisition of equivalence beliefs. He felt that this was especially unfortunate because he believed that a large part of clinical practice consists of an attempt to break erroneous equivalence beliefs. Therefore, while the equivalence belief is not misleading (in the sense that it actually is followed by the true goal), it probably serves some physiological economy. But when an equivalence belief persists when it no longer leads to the true goal, it then would seem bad. The individual experiences some drive reduction, but most of his actual drive remains

unsatisfied. It is not known how these equivalence beliefs are broken. (26:149)

Negative equivalence beliefs cannot be clearly differentiated from negative cathexes. The laws and the conditions for the acquisition, the de-acquisition, and forgetting are clinically important; but the evidence concerning these is not clear. (26:150)

Field expectancies.--Also called "sign-Gestalt-expectations," field expectancies mean that when an organism is repeatedly presented with an environmental set-up through which he moves and relative to which he is sensitive, he usually comes to apprehend not only each group of immediate stimuli; but, on the apprehension of the first group of stimuli, he also becomes prepared for the further stimuli. Such "sets" enable the organism to exhibit appropriate short-cuts or round-about routes not previously practiced. The acquisition of such sets also makes possible the phenomenon of latent learning. (26:145)

Earlier, Tolman had referred to either the remembered food or distant maze features as "significates" rather than sign-Gestalt-expectancies. The immediate environmental features were called "signs." He called "means-end-relations" those relations leading from commerce with the signs to commerce with the significates. (25:135-136)

When an individual is practiced in a particular set of activities in a particular environment, an essential part of whatever he acquires is an expectancy, a cognitive structure, and a cognitive map. Unless motivation is in force at this time, nc learning would take place. The presence of reinforcement in a particular locus makes that particular locus a goal that determines the performance that will take place;

however, the reinforcement does not stamp in S-R connections. Rather, it probably gives a special vividness to that locus in the total field of expectancy. (26:150-151)

To understand the acquisition of field expectancies, one must understand the perceptual sensitivity that may be expected of the individual. The field expectancies can include only those aspects of the environment that the organism can perceive. Second, one must know the facts concerning the ability of the organism under the particular conditions of motivation to connect and associate the different parts of the field so that when he is in one part of the field he will remember what was present in other parts. Third, one would need to know the facts concerning the inference abilities of the individual. Tolman believed that the specific apparatus in terms of laws and principles governing these things are not yet known. (26:151-152)

The de-acquisition of field expectancies is assumed to take place when the structure of the field is so changed that the original expectancies are no longer suitable. In this environment, de-acquisition takes place. (26:152)

True forgetting, weakening as a result of the mere passage of time, does take place with field expectancies. Neither cathexes nor equivalence beliefs are forgotten; however, particular environmental layouts that are not experienced for a long time are forgotten according to the sorts of laws that the Gestalt psychologists have uncovered. The remembered environmental layout becomes changed--either simplified or sharpened, as well as weakened by the mere passage of time. Some features may become enhanced, some either minimized or dropped, and some wholly new features may be added. (26:152)

Field-cognition modes.--The final form and range of any field expectancy is a function not only of repetition but also of perception and inference. The modes of functioning of perception, memory, and inference were called field-cognition modes by Tolman. He asserted that during a learning experiment a specific new field expectancy might be acquired, but that new ways of perceiving, remembering, and inferring might be acquired also. These new field-cognition modes will then be utilized by the given organism in still other environmental set-ups. (26:145)

The area of field-cognition modes is where Tolman said that he felt least confident; and sometimes he referred to the perceptual, memorial, and inferential modes as "lores." He discussed experiments in which subjects used slight marks, although often not consciously perceived, as signals that cards were in shadow and were actually lighter than the shadow might indicate. He thought that in so far as this tendency would transfer to new situations, it would be an example of an acquired perceptual lore. (26:152)

He thought that memorial lore is relatively simple. The principle seems to be that, if a certain sequence of events has occurred once, this same sequence of events is likely to recur on subsequent occasions. The complementary principle is that of probabilities of occurrence and enables the subject either to expect or to remember not one hundred per cent sequences but probable sequences. (26:152-153)

The inferential mode in its simplest form would be to a considerable extent innate like the perceptual mode and the memorial mode. It would consist of the simple rules of space, time, force, and quantity;

and the rules are carried around from one specific situation to another and govern our apprehensions (our specific field expectancies) for each new environmental field. (26:153)

Tolman thought that the conditions and the laws for the acquisition, de-acquisition, and forgetting of the perceptual, memorial, and inferential modes were areas in which there is as yet very little information. (26:153)

Drive discrimination.--Tolman was convinced that, from some experiments on latent learning, it was clear that individuals were often unable to discriminate between various drives--hunger and thirst, for instance. In some experiments, there were difficulties in the rats knowing whether to act so as to reduce a hunger drive or to act to reduce a thirst drive. In other experiments, the ability to discriminate was, however, learned. (26:145-146)

The difficulty shown in rats of discriminating between one drive and another, Tolman believed to be present also in human beings. He believed that similar learnings are required of human beings and that the task of psychotherapy often was to help the patient to learn to discriminate his real drives and needs. Again though, Tolman said that there are almost no experimental data for either rats or men as to how one learns, unlearns, and forgets these drive discriminations. (26:153)

Motor patterns.--Tolman does not hold, as do most behaviorists, that all learning is the attachment of responses to stimuli. Cathexes, equivalence beliefs, field expectancies, field-cognition modes, and drive discriminations are not stimulus-response connections but are central phenomena. Each can be expressed by a variety of responses, but the

actual nature of the final responses is also determined by the character of the motor patterns available to the organism. Thus, Tolman was interested in the laws and the conditions governing the acquisition of motor patterns purely as such. (26:146)

Tolman agrees with Guthrie that the conditions under which a motor pattern is acquired may be those in which the given movement gets the individual away from the stimuli that were present when the movement was initiated. Any response that goes off will get conditioned (without reinforcement) and will remain conditioned to those conditions because no other movements have a chance to occur and to displace it. Once the movement sequence gets learned in one situation, it is then available and ready to be tried in other situations. These skills are carried around as potential equipment for behavior in new situations. (26:153-154)

Motor patterns likely do not become available only in separated fashion. They may be learned in the larger setting of goal-directed activity. When specific movements do not succeed, trial and error supervene and new movements get a chance to become conditioned. (26:154)

These motor patterns may become unlearned, for example, through modifications as they occur in new environmental situations. Tolman assumes forgetting by pointing out that one's skills do seem to get rusty through lack of exercise and with the passage of time. (26:154)

Summary of Sign Learning

Learning takes place by the discovery of the individual that a certain type of response is instrumental in the satisfaction of his

fundamental drives. This learning is of several types. A cathexis occurs as a connection between specific responses and specific types of goal-objects or disturbance-objects. An equivalence belief occurs when there is a connection between a cathected goal (or disturbance-object) and a type of subgoal (or sub-disturbance-object). When the organism is repeatedly presented with a particular environmental set-up to which he is sensitive, a field expectancy develops. The ways of knowing any field expectancy are called field-cognition modes and the field expectancy is a function of repetition, perception, and inference. Tolman thought that one form of learning was drive discrimination because an individual may not always be able to discriminate among various drives. Some, but not all, learning obtains by the attachment of responses to stimuli. The learning of motor patterns is a matter of stimulus-response connections.

Hilgard's brief estimate of practice as one of the essential elements in Tolman's sign learning is that

> The law of exercise is accepted in the sense of the frequency with which the sign, the significate, and the behavioral relation between the two have been presented. Exercise is not the cause of the initial selection of the right response. Mere frequency without "belonging" does not establish a connection. After a response has been learned, overexercise tends to fix it, making it unduly resistant to change. (11:215-216)

Classical Gestalt Theory: Koffka, Köhler, Wertheimer, and Wheeler

Introductory Overview

A systematic treatment of the principles and the problems of psychology developed around the German word, Gestalt, expressing a central interest in the configuration found in psychological perception. Particularly outstanding in this development are Wertheimer, Koffka, and

Köhler; and their work and the men themselves soon became well known in American psychology.

Instead of "connections" and "bonds" describing the relationships that obtain between situations and some resulting state of affairs, the Gestaltists talked of "traces." The trace hypothesis is an involved one that Koffka required more than a hundred pages to present. (15:423-528) Essentially, the hypothesis includes assumptions

> 1. That a trace is that which persists from a prior experience so that it represents the past in the present;
>
> 2. That a present process is posited in such a way that it can either select, reactivate, or communicate in some other way with the trace;
>
> 3. That with the communication of a present process with a trace there is a resulting new process of recall or recognition.

Two words are of particular importance here: "process" and "trace." A process is that which goes on because of the present stimulating situation; the trace is the result (what is left over) of earlier processes.

Some processes are dependent on stimuli. When these occur for a second time, the organism may react differently because the second occurrence may be recognized as familiar. These processes may undergo change with a single sustained presentation.

It is to be remembered that in association as a basis for reproduction, any group of stimuli that represents a considerable fraction of the original constellation of stimuli will not necessarily reproduce those parts of the original process whose stimuli are not actually given. Rather, the missing elements may be such that the remaining parts of the constellation no longer suggest either the functional whole or the

original process; and, consequently, this new process will not be able to reproduce anything on the basis of that trace. Actually, reproduction will be restricted to those cases in which the process acting as the excitant of reproduction is sufficiently similar to a partial process of the original whole to suggest that whole. Reproduction also will be much more restricted when and if the organization of the excitant becomes foreign by being embedded in a somewhat different environment. (17:311-315)

Laws Relating to Gestaltism: The Law of Prägnanz

The general guiding principle regarding psychological organization is somewhat summed up in what was called the Law of Prägnanz. The German word, although not translated in any literature, carries with it the intent of "compact but significant." Briefly, it is formulated to state that psychological organization will always be as "good" as prevailing conditions will allow. Good is not defined, but it embraces such properties as regularity, symmetry, simplicity, and so on. (15:110)

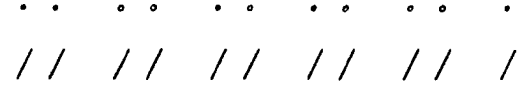
Wertheimer supposed that the Prägnanz principle was regularly in evidence in the personal, social, and political contexts as might be found in political discussion and political views. It would be realized in the almost irresistible tendency, the strong desire, to get at a simple and decisive structurization of the field. There would be an attraction toward getting at a clear-cut orientation so as to act sensibly and not be blind to the implications of the topic at hand. (28:199)

Of the laws first enunciated by Wertheimer, four in particular were accepted by Koffka. These are the laws of similarity, proximity,

closure, and good continuation. They also serve as further explanation and clarification of the Prägnanz principle.

The law of similarity.--According to the law of similarity, similar things tend to be perceived as a group. As an example, on entering a room, one sees the people within it as a group of people rather than as so many individuals who basically have no relationship with one another. They are a group of people distinct from the other objects in the room and somewhat distinct from spatial relationships. On remaining in the room for a length of time, a new organization may take place so that one now feels a part of a group that was at first external to himself. If there are circumstances (such as a notable difference in the mode of dress) that mark one as distinct from the others, he feels out of place even when no social mistake has been made. There is the constant recognition that one of the members will not fit into a group of similar individuals. That is, the organization would be more nearly "good" except for the uncomfortable dissimilarity. (15:654)

The law of proximity.--The factor of proximity, in which items that are close together tend to appear as a group, is easy to illustrate with dots and lines. Two illustrations follow. (15:164)

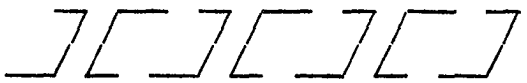


In both instances, the nearer items tend to appear as pairs. These dots and lines unite in such a way that they appear as a group of paired items and the entire group can be easily perceived at a time. By giving special attention, the more distant ones can be seen as pairs; but

this is not easy to do. Also, seeing two of the distant ones as pairs causes the observer to lose much ability to recognize other similar pairs at the same time. The nearer ones appear easily as pairs and gain in stability by increasing the number of "paired" groups. There are, of course, limits to this law: when the distances become too great, no unification occurs. Moreover, the shorter the intramembral distance, the more stable the unit will be. (15:164)

The law of closure.--This law asserts that closed areas seem to be self-sustaining, stable organizations. This could be illustrated by either an enclosure, a circle, a square, or any number of other closed figures--either geometric or other. (15:151)

Additional proof of this tendency can be shown in the reproduction of figures that produce closed organization against the factor of proximity as can be seen in the following illustration.



If the proximity factor prevailed, the vertical lines that are nearest each other should form themselves into pairs. This, however, does not take place. The vertical lines that form themselves into groups are those which are three times the distance as those which might have appeared as paired lines by their proximity. A closed space seems to be "implied," and closure takes place utilizing those lines necessary to effect it. The suggested closed space takes on organizational stability. (15:167-168)

The law of good continuation.--This law refers to the tendency of certain form to appear to continue its suggested form even beyond the

actually existent parts of the form. For example, a straight line is a more stable structure than a broken one; and, other things equal, organization will occur in such a way that a straight line will continue as a straight line. Generalizing further, a circle will continue as a circle, an ellipse will continue as an ellipse, and so on. (15:153)

An example is given in which external forces prevent good continuation. In the following figure, the result is an esthetically unpleasant impression because the proper continuation of the four semicircles is interrupted. (15:153)

The Effects of Repetition

Repetition in most situations is linked with learning. In some cases, an activity improves through practice while in another case there may not be learning. If this is true, the reason must be that the traces are different in the two kinds of practice so that the difference accounts for the difference in the effects of practice. This does not mean that the traces of the two accomplishments are different. Rather, the conditions under which the activity took place are different. For example, when a child plays with a typewriter before he can read and write, no gain in typewriting ability may be brought about. Another person's manipulating the typewriter might result in a gain in typewriting ability. (15:537)

Generally, the trace field, a remnant of a process distribution, has nothing in it that would make the process distribute itself in any

direction that is different from the one to which it owes its very existence. It is ordinarily seen in practice that the repetition of an activity will create an aggregated trace system. This trace system is such that the activity will become more stable and regular. Thus, this stability and regularity exclude variation into a very different activity--activity B rather than activity A, for example. (15:537)

It is to be noted that, generally speaking, if a particular accomplishment involves certain aspects, any improvement can occur only in those aspects which were represented in the process and thereby left in the trace system. In the performance of a particular accomplishment, an aspect which was accomplished but not actually performed will not be affected by the practice. This is true even though other aspects of the accomplishment, present in the performance, may have been greatly affected by the performance. (15:537)

Repetition of either an occasion or the same accomplishment may have two very different effects on learning. On one hand, it gives an opportunity for a particular process to occur for the first time. Until then, it has had no influence on later performance; later, it may. On the other hand, once a particular process has occurred, each repetition will add to the particular trace system or aggregate and thereby exert an influence on later performances. Thus, because repetitions have a different function before and after the occurrence of a particular aspect, mere counting of repetitions does not, of itself, provide a very valuable means for better understanding of the learning process unless it is known beforehand that the process in which one is interested occurred at the first repetition. (15:538)

Repetition can, without a doubt, be a very powerful factor in stabilizing traces. It is to be noted, however, that the repetition does not mean the strengthening of one trace, but the building up of a trace system composed of as many traces as there have been repetitions. The important thing in this case is that there is a loss of consolidation of a single individual trace, but this loss is accompanied by a gain in the stability of the trace system. In learning a particular skill, the individual lessons which took place are soon forgotten; and the clumsy movements in the early lessons will have become impossible. What has happened is that the traces of the first lessons have become changed by the aggregate traces produced by the many repetitions, and this aggregate of traces is responsible for the improvement of the skill. (15:545)

Koffka points out that there is a possible conflict between two kinds of availability of the communication between a specific trace and a process. He suggests that the question of how traces become available for such new processes cannot be answered; however, he continues, the conclusion is fairly safe that conditions that make a trace more and more available for the mere repetition of one process will often make it, at the same time, less available for other processes. Thus, cautions Koffka, an educator should be especially conscious of his aims when he decides to apply drill as a learning aid: the drill that will no doubt make the traces more and more available for one kind of activity may at the same time narrow the range of availability. (15:545)

It is noted by Koffka, as well as other psychologists, that repetition may lead to bad habits, as well as good ones. Therefore, the early incorrect learning may make it very difficult to perform in a more

desirable way later. It is difficult to learn to pronounce a word correctly after one has acquired a habit of pronouncing it incorrectly. In the acquisition of a motor skill, one may easily start "wrong" and then acquire bad habits that will prevent one from really performing the activity in the desired way. In those cases, practice does not lead to an optimum from the point of view of adjustment to a specific situation although modifications produced through such bad practice may have a direction toward the final aim. This position of Koffka in no way conflicts with Dunlap's position that a bad habit is often more easily broken by repetition. Rather, in the cases considered by Dunlap, the repetition takes place with the knowledge that it is bad; and practicing with the knowledge that a habit is bad introduces an entirely new set of conditions. (15:536)

The ease of communication between a trace and a process may not remain constant. After the learning process, that which was learned does not simply decay by the mere passage of time. Rather, a form of activity that is similar to the thing learned may cause a considerable amount of retroactive inhibition immediately after the learning period; and the learning is not so easily recalled. However, disturbances to recall that occur later do not seem to have the same effect. As the trace grows older, it does not seem as susceptible to retroactive inhibition as it does immediately following the learning period. (16:33-37, 149-156)

Köhler indicates that disturbance to retention may occur also when the disturbing activity occurs immediately before learning. He called this "proactive inhibition." Retroactive inhibition is stronger the more closely subsequent processes resemble original learning, and it

is also true that mental work which precedes learning will distrub retention the more so if there is greater similarity. (16:33-37, 149-156)

The Acquisition of Skill

In the development of the trace theory, Koffka relied rather heavily on three foundations. These foundations were temporal units, recall (reproduction), and recognition. In these three functions, the past is somehow present in the accomplishment of the moment. One fact, as a later fact (or activity, etc.), follows upon and stands in a definite relationship to preceding ones. One recalls a former experience or recognizes a present object as having been encountered in the past. In these cases, the past is continued in the present datum. This is not descriptively accurate, however, in the case of an acquired skill. The experience of a skilled performance today has a much less specific relation to the past than do the three functions just mentioned. The polished performance of the present skill is functionally related to former experience, but is not a reproduction of the clumsy performance in the past. Further, the acquisition of a skill (such as typewriting) does not mean the ability to do a specific thing but to perform in a wide variety of ways. It is not that one has learned to make a small number of very specific movements but that he can act in the proper way in a wide variety of ever-changing situations. (15:506)

After accepting the fact of improvement by practice, how does one account for this improvement in terms of trace-process dynamics? A process cannot be improved by repetition before the process has occurred. No matter how primitive the first occurrence of the process may appear in comparison with its later stages, it must occur in order that improvement may take place. (15:553)

Improvement by practice raises the question of why repetition has the effect that it does. A certain performance leaves a trace; therefore, improvement must be due to the effect of this trace. If the trace is not stable, it is under stress toward stability. Therefore, its field influence will be such as to produce a process that, in its turn, will react on the trace so as to make it more stable. That is, the trace would not favor a mere recurrence of the old process to which it owes its existence but rather the occurrence of a more stable process. In this way, the trace would lead to improvement. (15:553-555)

Koffka considered the low survival value of an unstable trace as against the high survival value of a stable trace system. Also related is the tendency of an unstable trace, before it disintegrates, to change in the direction of greater stability. This would be compatible with the fact that a performance after a period of rest is often better than at any previous learning period. If experimental work should establish this point, it would also explain one of the best established facts of learning: the advantage of distributing the repetitions over a long period of time as compared with their accumulation in a few large blocks. (15:554-555)

Wheeler (30:376) noted that, whenever the development of muscular skill is involved in learning, the first performance is both gross and awkward. This occurs because the performance is undifferentiated. Those skilled responses that are characteristic of later performance in the learning process occur because differentiation causes a greater complexity of finer muscular adjustments and because there is a greater subordination of the refined movements to the total pattern.

The Idea of Insight

Gestalt psychology is notably in contrast with some other approaches in its inclusion of insight. Wheeler (29:185) made special efforts to explain insight. Insight is, he said, "a field property of the response when viewed from the point of view of the subject."

An organized response characteristically is directed toward a remote end. When a new stimulus-pattern presents itself, movements are still directed toward a remote end; but the organization is a new one. Frequently, depending on how much the situation has been changed, the new response is correct the first time in reaching the goal because the acting organism has either a grasp or an understanding of the new situation without actual experience in that situation. (29:191-192)

Wheeler (29:191-192) gave three criteria for describing insight. First, behavior is modified and results in correct responses the first time. The second is that responses are transposable from one problem to another. Third, there must be such configurational character of the response that it is a reaction to a total pattern of stimuli. That is, responses may be made to either "the dimmer of two lights" or "the darker of two grays" rather than to either an absolute light intensity or an absolute shade of gray.

According to Wheeler (29:270-271), growth includes both maturational growth and learning that is a growth and discovery process. Growth as learning expresses itself in two ways: as insight into new situations and as the making of new muscular coordinations. Moreover, learning involves the understanding of the new problem as a whole. Behavior is said to follow laws that do not permit of learning by parts so

that the "part method" is actually an illusion. When the task is too long or too difficult to be learned by the "unmodified" whole method, a mediating method must be employed; yet all material presented for learning should contain as much logical form and coherence as possible. The problem is in the selection of conditions, under laws of wholes, for optimum learning. Further, learning is ineffective in proportion to its dependence upon sheer repetition and drill.

Summary of Gestalt Theory

The Gestalt system revolves around a system of traces that are instrumental in communication between a present process and an earlier posit. The interaction of traces and processes is such that they obey laws that have a particular central tendency toward some type of clear and decisive structurization of the field.

Learning is integrally linked with repetition, and through repetition various learnings may take place. In general, an activity associated with a trace system will become more stable and regular through repetition rather than vary into something quite different. However, repetition of the occasion tends not only toward stability on the one hand but also to make opportunity for other processes to occur for the first time; thus, a different kind of performance may occur in relation to this trace system later on. Repetition or drill that makes traces more available for one activity may also make these less available for other activity.

An acquired skill is in some ways unique. The performance of the skill is less related to specific past occasions than is generally true of other learning. The performance of the skill actually involves

facility in a wide range of changing situations rather than facility in a few specific movements.

Practice improves performance in a certain skill because it gives opportunities for new processes to communicate with traces and because the instability of certain traces in the trace field produce effects that tend toward a change for greater stability in the process.

Learning is not explained entirely by conditioning either through repetitive presentations of stimulus and response or through trial and error. The learner is often able to comprehend the field as a whole, and through this insight, he is able to respond to a new situation in a correct manner on the first try. As a matter of fact, the comprehension of relationships is fundamental in learning.

Hilgard's brief estimate of practice as one of the essential elements in Gestalt theory is that

> Changes go on within repetition, not as a result of repetition. Practically all psychologists now agree that this is so, but they differ with regard to the pertinent processes which go on within the repetitions. From the gestalt point of view, repetitions are successive exposures, bringing to light relationships to enter into restructurization. To Koffka, they also make possible the consolidation of trace systems, which is as near as any gestalt psychologist comes to saying that responses become fixed by repetition. (11:252)

CHAPTER III

INVENTORS' VIEWS CONCERNING THE ROLE OF PRACTICE IN CONNECTION WITH THE LEARNING OF SHORTHAND

The purpose of this chapter is to ascertain and combine ideas from the inventors of the Gregg system of shorthand (John Robert Gregg, Louis A. Leslie, and Charles E. Zoubek). These men have substantially influenced teaching method and, consequently, some learning conditions.

John Robert Gregg developed his first interest in shorthand at about the age of ten. He chose the Odell version (71:5) of a system by Samuel Taylor, published in 1786. Success with that system was followed by an increased and broadened interest in other systems as well. Thereupon, he not only learned other systems but also gave much study, exploration, and thought to a comparison of the merits of various systems. (71:4-6)

In 1885, at the age of eighteen, he saw his first efforts at inventing a shorthand system culminate in the publication of a system called Script Phonography. The plans had been made with another man, but Gregg received no recognition when the work appeared under the other man's name as sole author. Embittered but not stopped, Gregg continued his efforts at producing an ideal system. His own publication did appear in 1888. It was a small, 28-page pamphlet entitled "Light-Line Phonography." (71:8-12)

The first American edition of the system was published in Boston in 1893 as "Gregg's Shorthand" which later became "Gregg Shorthand." The title was changed because "Light-Line" was already registered in Washington by another non-shaded system, but Gregg did give the edition a subtitle of "A Light-Line Phonography for the Million." The system this time appeared in two parts of 36 pages each. The pamphlets were then called "Part I: The Elements" and "Part II: The Reporting Style." (34:455-458, 480)

With each revision and edition, some change was made in rules of writing; and the number of specially abbreviated words or "word signs" tended to increase so that the original group of 42 was enlarged to 159 in the revised edition in 1897. These "word signs" eventually became known as "brief forms." (34:455-458, 480)

The struggle to get the Gregg system accepted and established was a considerable task. Modern shorthand had been well developed since the sixteenth century, and some systems were strongly entrenched when Gregg began. But the eventual acceptance of the system was such that Gregg could say in 1947, near the end of his life, "The Gregg Shorthand Manual has had the largest circulation of any book in the world within the lifetime of the author and is used in thirteen different languages." (71:vi)

The Gregg system continued to achieve more and more prominence. The well-known Anniversary Edition appeared in 1929 with further revision of the system. With this edition, the system reached its maximum in memory load for the learner. The load resulted both from the number of principles and the greatly increased number of brief forms.

Leslie, a long-time employee of Gregg, became convinced of the practicality of extensive reading of shorthand notes as a learning method in the 1930's. He began to experiment with the method and won adherents to it even before either he or the Company had many teaching materials to offer. He did, however, follow through; and the "Functional Method" was published in 1936. Leslie was listed as author. The emphasis on reading may have been more apparent with Leslie but it did not belong to him alone. At about the same time, Gregg (36:15) indicated to students that they must devote much time to reading artistic shorthand notes as all expert writers had done.

The next publication containing a revision of the system appeared in 1949 under the names of Gregg, Leslie, and Zoubek. This new "Gregg Shorthand Simplified" was published after the death of Gregg, but it changed the author-image associated with the system and established Leslie and Zoubek as co-inventors with Gregg. Many significant changes took place in the Simplified edition. A number of principles were eliminated. Some were either eliminated or changed because they were infrequently needed, and some changes were made because the inventors believed that they could produce either a lighter memory load or more facile outlines even though they might be longer. The number of brief forms was reduced to 184 shorthand forms to represent 227 longhand or printed words.

The Simplified edition was followed by the most recent revision, the Diamond Jubilee Series in 1963. This was another step in the same direction established in 1949--a great simplification of the system and fewer brief forms. The brief forms were reduced to 129 forms that

represented 148 words. The name of Gregg still appears on the Manual, together with the names of Leslie and Zoubek.[1]

Basic Ideas Relative to the Teaching of Shorthand

In the evolution of the Gregg system of shorthand and the changes that occurred, there can be seen concurrently developed ideas on teaching and learning. Gregg was, of course, the mastermind behind the system and most influential in determining the teaching method. Leslie, with the approval of Gregg, assumed more and more importantance in determining teaching method. As Gregg wrote less and less, Leslie published more and more. The progression of influence and volume of writing continued from Gregg, to Gregg-Leslie, to Gregg-Leslie-Zoubek, and to Leslie-Zoubek.

This writer excludes his views in the presentation of this chapter. The material contained in the chapter is developed from extensive examination of the published statements of Gregg, Leslie, and Zoubek.

Leslie (65:377) believes that little significant research has been done in business education that affects the teaching of shorthand. He indicates that nearly all the research is done by candidates for master's and doctor's degrees and that few of the problems which concern the teaching of shorthand can be satisfactorily settled within the limits of either an ordinary thesis or a dissertation.

Leslie recognizes four major groups of shorthand learners: (1) stenographers, (2) shorthand reporters, (3) shorthand teachers, and (4)

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[1]John Robert Gregg, Louis A. Leslie, and Charles E. Zoubek, Gregg Shorthand Manual, Diamond Jubilee Series (New York: Gregg Publishing Division, McGraw-Hill Book Company, Inc., 1963).

shorthand inventors and editors. In his opinion, each of these requires a different type of learning experience to attain his different particular objectives. The easiest of these groups to train (and also the most numerous group) is composed of persons with a stenographic objective. These learners require less writing speed than the reporting group and do not need the degree of theoretical knowledge of the shorthand system required by the teacher. Leslie emphasizes repeatedly that it is not necessary for the stenographer to know every brief form, abbreviating device, and theory rule. He holds that an attempt to impose such knowledge on the average stenographic learner defeats its own purpose by hampering the development of the learner's stenographic skill. Further, he believes that there are no compensating advantages. (65:3)

Gregg (37:116) did not share this belief in this degree of freedom from observance of all principles. He believed in the advantage of mastery of "every unit, every principle, every drill." Gregg urged that such mastery virtually assures relative ease in taking unfamiliar dictation.

There is constant emphasis by Leslie and Zoubek against the teaching of careful analysis of the system even when the learner intends to become a teacher of it. Leslie argues for an order of learning that permits the development of skill first and the development of theoretical analysis of the system last--if at all. To do otherwise, Leslie maintains (65:437), is to invoke a situation in which there will be great difficulty and many failures. Zoubek remarks (81:25) that the student's skill will grow only when he is either reading or writing shorthand and that discussing shorthand adds nothing to the skill.

Apparently, a good performer need not know either how or why he succeeded. Thus, the type of learning that may be desirable for the future teacher of shorthand is not advantageous for the stenographic learner. Perhaps, even the training which is necessary for the teacher frequently prevents him from developing into a good performer. Such a situation produces very good performers who are poor teachers and good teachers who are poor performers. Leslie charges that, unfortunately, too often the teacher prevents his learners from becoming expert shorthand writers because he insists upon teaching his classes in the same analytical way in which he himself learned the theoretical implications of the system. (65:435-436)

Distinctions between learning to act according to a principle and learning to memorize a rule have been prominent in the literature of the inventors. Gregg (55:15) advocated quite early that learners know the reason for practice and that learners understand the principle to which their practice applied. He said it was sufficient with the fundamental rules or principles to explain that they represent the natural way of writing the forms. Gregg may not always have made a clear distinction between his use of "rules" and "principles," but even then, in 1916, he stated (55:25) that a practical understanding of the application of a rule is vastly more important than a knowledge of the exact wording.

Gregg later suggested (40:451) that the review or study of rules merely as rules is of little value. The value lies in the ability to picture the application of the rule in a large number of situations. The review method of applying the rules is of great value by creating word-building power. Again, he gave advice on learning shorthand by

instructing (35:281-285) that the student should not worry about the wording of the rules. Shorthand is easy to learn, he believed, by writing the outlines as they are given without wasting time to question whether or not they should be written differently.

Zoubek (76:8) expresses an opinion concerning the preparation of shorthand users. He agrees that the rules for writing shorthand outlines must not be taught to stenographic learners; but he also expresses doubt that a knowledge of rules is of any value for teachers. Leslie and Zoubek (68:55) are emphatic in their opposition to the use of rules in learning shorthand in saying that "at no time, in any way, for any reason, should the learner be given any reason to suppose that shorthand rules exist."

For adequate competence in the performance of the skill, Leslie (65:435-436) suggests that the ideal training of a shorthand teacher would be the acquisition of 100 words a minute of shorthand without conscious thought or direction. Thus, the teacher would experience the right kind of skill learning and have a chance to observe the right kind of skill teaching. (The stenographic objective is 100 to 140 words a minute.) Then, only after attaining a proper degree of competence as a performer would the teacher in training be given the additional work in shorthand analysis that may be desirable. However, that sequence is not always the case.

The inventors point out (69:2) that the attainment of shorthand skill is reached only through proper practice. Only well-directed, properly-spaced, and regular practice will enable the learner to achieve a significant degree of shorthand skill.

The shorthand teaching objective, according to Leslie (65:119, 154) is primarily that the teacher (1) have an understanding of the knowledges and skills associated with the shorthand system and (2) possess a systematic plan for directing the learner's acquisition of those knowledges and skills. That is, the teacher functions to make sure that the shorthand learner is given opportunities to make the proper growth in the use of the skill and to see that the mental organization proceeds in the right order. In this way, the teacher will know both the proper learning conditions and the principles of the system so that he may be sure that he gives the learner the right opportunity to acquire what he needs at the right time in the right way. Again and again, though, there is Leslie's emphasis upon the idea that any specific awareness, or analysis, or the rules of the system is detrimental because an awareness of these things prevents one from acquiring great skill in the art of shorthand. The emphasis is always on the "science" of shorthand for the teacher and the "art" of shorthand for the stenographic learner.

In order to report from a large variety of material in an organized manner, certain outlined items have been selected for the means of collecting ideas. Two major groupings are used. These are (a) reading as a shorthand learning activity and (b) writing as a shorthand learning activity.

Reading as a Shorthand Learning Activity

Gregg (44:171; 39:404), writing to students, asserted that the first objective with an assignment of new theory is to become acquainted with the new principle so that one understands what it is about and gets a mental picture of it. Then he should read the illustrations until he

can recognize each word instantly. Once the learner is familiar with the new principle, Gregg advises discontinuing the reading of isolated words and then beginning the reading of the connected material available. When Gregg wrote this, considerable repetitive writing was assigned in the familiarization process. The great emphasis on extended reading before writing did not become regularly recommended until about the time of Leslie's publication of the Function Method in 1936.

Gregg (45:484) believed that reading shorthand, fortunately, is an interesting and most effective way of increasing shorthand writing speed. He told learners (41:11) that all the expert shorthand writers have devoted a great deal of time to the reading of artistic shorthand notes. So, he thought, if one constantly reads the notes of the expert shorthand writers, he will not only unconsciously imitate their outlines but also rapidly enlarge the writing vocabulary and learn to read his own notes more fluently. Leslie and Zoubek (68:21) think that if sufficient time and connected reading material were available, it would be possible to learn all the characteristic joinings of the system just by reading and copying the connected matter. In many ways, they believe, this would be a better way to learn shorthand than by including other means of becoming familiar with shorthand material.

At about the time Leslie was developing his Functional Method, Gregg (53:120) wrote that, the more that one reads correctly written shorthand before he writes, the more likely he is to write correct shorthand. He held (36:16) that it is essential to get a correct picture of the outline in the mind before attempting to write. The more vividly the outline is imprinted on the mind, the easier and more quickly the mind

will tell the fingers what to do. For this reason, he recommended that the learner read every new outline and shorthand plate as rapidly as though he were reading from a newspaper. Then and only then, he argues, is one ready to write shorthand.

A variety of teaching methods have developed which are supposed to facilitate the learning of shorthand. In these methods, one area of dissent is the question of when to begin writing. Some teachers have advocated beginning the instruction with both reading and writing. Some have advocated and practiced other plans. None has been more vigorously proposed and defended than the "reading approach" first popularized by Leslie in the 1930's. In the reading approach as it is preferred by him, no writing is done until about either the twentieth lesson, or the twentieth period of instruction.

Leslie (65:458-459) is aware that many teachers feel some considerable reticence to delay writing for such a length of time. He suggested that teachers are overly concerned about a delay of this length, and he cautions that teachers are sometimes so eager to have the shorthand learner perform on the expert level that they tend to underestimate the importance of the individual shorthand symbols. He believes, further, that the shorthand symbol is the smallest whole with which the shorthand learner can deal.

Even though individual symbols of the shorthand alphabet are used only for the building of words, especially at first, each alphabetic symbol represents a whole in itself (65:458-459). Moreover, the basis of good word reading and good word building in shorthand is attributed to the connecting of shorthand alphabetic symbols. The importance of

practice in repetitive, concerted spelling from the chalkboard is considered sufficiently important for a continuation of the activity for perhaps as much as the first semester. Leslie (65:115, 458-459) indicates using repetitive, concerted spelling for 35 to 70 periods according to the developing skill of the class. Seventy lessons is a typical arrangement for the first semester course in high school shorthand. Sometimes he suggests the continuation of the rapid, repetitive spelling throughout the elementary Manual which is intended normally for the first semester in usual instructional situations.

Reading word lists.--The current inventors (68:40) place the greatest stress on the rapid, repetitive spelling before pronouncing of each outline during the chalkboard word drills. They feel that it is perhaps the most essential classroom activity because of the many learning values inherent in the rapid, repetitive spelling. Zoubek (73:133) suggests that without this type of spelling the student may run into difficulties when he eventually is called upon to write new matter and comes across words he must construct phonetically. He recommends (84:4) that this spelling procedure continue throughout the theory course.

Beginning with the first lesson, which is primarily composed of simple words, it is considered (65:91) of the utmost importance that the class spell and pronounce each word each time that it is read. This is strongly proposed because it is felt that without this spelling the student may run into difficulties when he eventually is called on to write new matter that he must construct phonetically. This is a particularly significant recommendation because of the numerous readings that take place. The normal presentation of alphabetic material is such that a

great deal of repetition and review takes place during each class period. The same list may be read on several occasions.

If taught according to Leslie's recommendations (65:91), the brief forms for words, which are constructed from alphabetic symbols but do not spell words, receive even more repetition with the presentation of a list than do the words in alphabetic material. The teacher should begin by writing on the chalkboard the character for the first brief form, give the meaning, and have the learners read it repetitively. Then he should present the second brief form and have it read repetitively. With the presentation of each new form, it is read repetitively (say, two or three times); then it is combined in a pattern of repetition in which the whole list is reviewed. In the review pattern recommended for brief forms, the list is read as the teacher points randomly to the characters with frequent recurrence placing an emphasis on the most recent brief forms. In a list of eight brief forms, the repetitive pattern is such that the final character would be presented, and the readings proceed so that the last form would have been read eight or nine times with a decreasing frequency of reading toward the beginning of the list which would cause the first form to have been read perhaps twice during this particular reading of the list.

It is frequently reiterated (e.g., 65:92) that, in the presentation of brief forms, it is extremely important that only one new form be presented at a time and that every form already presented be given a recall after the presentation of each new form. In this reiteration is found the heavy reliance of a particular type of repetitive practice in the learning of shorthand.

In the type of practice previously described, the presentation and recall of the characters presented provides not only for much repetition but also for random recurrence. Random re-presentation of the material eliminates much of the tendency for the learners to quickly memorize the order of words; so, Leslie (65:95) recommends the procedure because learners must actually recognize and read each outline.

The repetitive, random reading is also concerted reading so that each learner in the class participates during the presentation of the word lists. This assures that the dull or timid learner is included in the learning activity. Further, reading is rapid. This permits maximum use of the time available. Leslie holds (65:94-95) that if learners are allowed to spell and read slowly and sluggishly in the beginning, they tend to retain the same reactions to shorthand when they write from dictation. If the original spelling and reading are rapid, however, all shorthand reactions will be more rapid not only in reading but also in writing.

It may be said that a somewhat vigorous participation is required for best learning. Vigor is found in the rapidity with which the forms are presented and read and also in the manner recommended for student reading. Leslie (65:108) holds that this type of presentation and participation provide varied and vivid stimuli to produce better learning.

Especially at the beginning of the study of shorthand, suggests Leslie (65:97), the intensive spelling helps to give a facility in the use of the alphabetic characters. At the same time and continually thereafter, intensive spelling of the selected word lists should help the learner become accustomed to the joinings. The word beginnings and word

endings, the same as the other material such as joinings, are believed (65:90) to be most effectively presented without elaborate explanations. Leslie (65:113), as usual, urges that at no time, in no way, and for no reason should the learner be given any reason to suppose that shorthand rules exist.

One question arises as to the theoretical correctness of the outlines that occur when learners have not been taught to practice rules or principles consciously. Although it might appear that the resulting outlines would be notably divergent from the system, Leslie (65:36) promotes the idea that, when writing under stress, the writer who has not verbalized the rules makes fewer errors than the writer who has specifically learned to verbalize the principles.

A recommended practice on word lists refers especially to helping the learner establish good reading, but it is not confined to this purpose. The chalkboard work done by the teacher, according to Leslie (65:152-153), helps the learner with his writing motion through his better perception of the form and through his better perception of the writing motion because both of these are magnified.

Reading connected matter in class.--Most of the reading in class takes place with the chalkboard drill on word lists for the purpose of increasing the learner's knowledge of shorthand and, according to Leslie (65:109-110), increasing his speed in the use of that knowledge. Reading connected matter is quite another thing. The inventors feel that so little time can be spent on this type of work in the classroom that it is not possible to cover a large enough amount of connected reading to have any real effect on the learner's shorthand knowledge or skill. So, it is kept to a minimum.

When reading of connected matter is done in class, one learner at a time must read; therefore, most of the class is left without full participation in any kind of meaningful practice. Leslie (65:110-111) maintains that only four reasons justify even limited reading of connected matter in the classroom. These, he suggests, are all connected with grading and motivation and not with the kind of repetitive practice that is needed. The following is paraphrased from Leslie.

1. During the reading approach, the reading of connected matter in class gives the learners an opportunity to show how well they have done the homework; and it gives the teacher an opportunity to observe the learners' shorthand reading habits.

2. Reading some of the connected matter assigned for homework helps prevent the learners from becoming lax in their performance of the homework.

3. Some reading back of notes from dictation must be done. It has almost no learning value except that it is necessary to impress the learner with the need for legibility. This is especially needed with younger learners.

4. Occasional sight reading of the coming homework gives the teacher an opportunity to obtain some idea of how well learners handle previously unseen shorthand reading, and it gives the learners the feeling that the teacher is helping them to get their work done.

During the reading of connected matter, a potential situation of hesitation and lost time arises that Leslie (65:112) feels is quite detrimental if not handled properly. He suggests that many teachers have a tendency to allow the learner to wallow in confusion at some length in trying to figure out any forms which he finds difficult. Sometimes the learner is encouraged to try harder to discover the meaning of the form. The proper procedure is to prompt the learner with the correct word as soon as it is seen that there is more than a momentary hesitation. The difference in handling the situation revolves around the question whether the learner should be in a problem-solving or habit-forming situation. Leslie holds that learning shorthand is a habit-forming process.

There may be times, according to Zoubek (78:137; 79:172), when students will not appear to show "mastery" of the lesson. The teacher is not waiting for mastery, and students will learn material as time goes by because of the constant review which is taking place as new lessons are presented.

Reading as homework.--Advocates of a reading approach in learning shorthand attribute reading with producing all the learning outcomes which are desirable at this stage. Inasmuch as no writing is done for some time, naturally both the classwork and homework consist solely of reading. Leslie recommends (e.g., 65:33, 103) that, in the reading approach to instruction, the reading should consist, under properly controlled conditions, of 5,000 to 15,000 words of printed shorthand outlines. Typically, the learner is asked to read as homework each word in the lists of isolated words once and to read the contextual material once--or twice, if time permits. With this type of reading assignment, repetition occurs not as successive repetitions but with each element repeated in many different situations.

It is said (65:11) that problem solving should not be included as a part of the reading homework. The learner should be asked to practice his reading by using the textbook material and told to use the printed key frequently so that he need not lose time in trying to figure out a form. The use of the key is not only permitted but strongly encouraged and Leslie (65:104) asserts that the most common faulty procedure in doing the functional homework, resulting in unsatisfactory completion of the homework, is the failure to obtain from the key the full advantage that is intended.

With teachers who require writing of the notes in the early stages, Leslie (65:386) argues that reading is not only sufficient but also better. He maintains that the shorthand learner derives more benefit from reading the shorthand textbook (well-formed and nearly perfect notes) than from reading his own shorthand notes.

Writing as a Shorthand Learning Activity

Leslie (65:422) accepts as a principle of learning the concept that skill is best learned in the largest feasible wholes and subwholes. He believes that the first or any other phase of the learning of shorthand need not be perfected before proceeding to the next phase of learning. Specifically, he applies this to the writing of shorthand and indicates that there is no necessity to learn to write the first characters perfectly before going on to the next lessons and phases. Rather, the learner should proceed through the entire system quickly and then polish the shorthand skill as a whole without focusing attention on the component parts.

Early writing, according to Leslie (65:85), should not be encouraged. He argues that when shorthand writing is attempted too soon the learner displays the initial diffuse movements which are characteristic of beginning work in a motor skill. On the other hand, with a proper reading approach, the learner sees so many well-written examples of all the various shorthand symbols and joinings that he begins to observe the exact shapes and the differences between the shapes. Therefore, his recommended approach is presumed to eliminate almost entirely these initial diffuse movements because the learner has actually learned to <u>see</u> the characters rather than merely to <u>look at</u> them.

Leslie is, then, in the position of advocating, on the one hand, the practice of the entire skill before working toward refinement of it and, on the other hand, the delaying of some elements of the practice of the skill. Delay of practice of some elements of the skill Leslie calls (65:428) proper preparation for each of the sub-wholes. Some of the writers on shorthand methods have failed, so Leslie believes, to balance the various psychological laws applicable to the learning situations. In rigidly following the principle that skills are best learned by wholes, they expect learners to begin the study of shorthand by reading, writing, and taking dictation all without adequate preparation. In doing so, they ignore the fact that the learner should not be discouraged by difficulties in the beginning, as would be the case if he were asked to do two or more things at one time.

Preparation for writing begins with much work in learning to read. The great amount of chalkboard drill that is recommended, as well as practice in which single shorthand outlines are spelled and pronounced, serves to give the learner the ability to obtain good reading of connected matter. The ability to read well promotes the ability to write. Then, in writing, the repetition of the shorthand outlines in constantly different contextual material helps in forming the patterns of response and perception. Leslie emphasizes (65:453, 459) that the intensive practice of small amounts of shorthand from dictation at increasing speeds serves to give speed and skill in the application of the knowledge already gained from the other type of practice.

As in reading, no attention is given to either formalization of rules or discussion of principles as students begin writing shorthand.

The teacher's role is to continue to give the shorthand learner a good model for imitation and try to keep the learner from analyzing and verbalizing--a situation that is especially likely if any keen awareness is developed concerning his errors. Thus, writing proceeds without conscious direction of outline formation according to a rule. Further, Leslie indicates that writers who know the rules make more theoretical errors under stress of dictation than writers who do not know the rules but who have automatized their writing habits. Those variations tend to occur only because the writer either has written in full some words for which there are abbreviations or has neglected to use some standard phrases. (65:122; 73:207; 76:132)

Although Gregg probably had no greater regard for a strict adherence to every small rule than either Leslie or Zoubek, he may have had a leaning toward "vocabulary development." He felt (38:274-275) that one should drill on the more common words until their execution becomes almost mechanical.

Gregg seemed always to be concerned somewhat more than the other inventors with the hand as a writing mechanism. There does seem, however, to have been some progression of thought in the direction of the hand as servant of the mind. In 1916, Gregg (55:5) explained that the acquisition of shorthand skill involved not only an intellectual understanding of rules and principles but also a manual skill. What is more, he said that shorthand is largely manual, hence the need for plenty of opportunity to imitate and practice correctly written forms provided by the teacher at the chalkboard.

By 1930 Gregg (40:451) talked of improvement of skill in writing and said that the kind of shorthand one writes depends first upon the clearness with which he can picture the word forms. He explained that, unless one knows exactly what he wants to do, it will be impossible for his hand to do it. Three years later he showed (47:339) less interest in the physical movement of writing shorthand. He indicated that, if one could eliminate all mental hesitation from one's writing, the hand would travel from outline to outline with sufficient rapidity to enable writing 120 words a minute with ease.

Although Gregg made much of the training of the hand in writing shorthand, he did (at least in the last decade or so of his career) attach importance to the function of the mind in learning. He held (43:407) then that the need for training of the hand for more rapid execution of shorthand outlines had its place but was a less important fact than that the hand was servant of the brain. Moreover, he reminded readers that the hand was highly skillful before it began writing shorthand; hence, there was less need for training the hand.

Certain statements by Gregg may appear to contradict other statements; and, of course, some actual contradiction may have occurred. This may be seen, for example, as he changed his mind over the years about shorthand learning. At other times, a notable shift in emphasis may imply contradiction that may not be demonstrably real. This emphasis can be seen in his "speed pointer" (49:126) that the writer should, under pressure, continue writing and record something without considering the correctness of the form--although either before or after dictation he should take all the time needed to master the correct outlines and to

increase vocabulary. A couple of years before, he espoused careful deliberation during dictation, at least on outline formation, by cautioning (42:210) that speed practice that sacrifices neatness and accuracy of proportion is not beneficial.

The tendency of Gregg to change his ideas about shorthand learning provided an evolution of shorthand teaching method. The evolution tended more and more toward a dependence on reading and copying from well-written notes to provide useful learning experience. His close associates, Leslie and Zoubek, carried the evolution and other differences a considerable distance beyond Gregg's ideas. In 1936, Gregg wrote on attaining shorthand speed and summarized the discussion by mentioning seven factors of shorthand speed. They were:

> First, a well-laid foundation of theory principles and correct writing habits;
>
> Second, a faculty of writing any new word in the English language strictly in accordance with the word-building principles;
>
> Third, perfect accuracy and high speed in the writing of all brief forms and frequent phrases;
>
> Fourth, neat and well-proportioned notes;
>
> Fifth, continuous practice of prepared matter;
>
> Sixth, the development of a word-carrying ability of from twenty to twenty-five words;
>
> Seventh, endurance (31:203).

Significantly, Leslie and Zoubek discount all or part of each one of the factors except for the fifth one, practice of prepared matter. This one from the whole list they clearly accept and emphasize.

Hierarchy of writing habits.--Some reference is made to "stocking the mind with outlines" and to similar expressions. This does not,

however, mean that the shorthand outlines for every word which one may write need to be memorized. As a matter of fact, the idea of writing "whole outlines" has been abandoned because this does not give an adequate explanation of what does happen in shorthand writing. (65:166-167, 402-404)

Gregg (63:589) once suggested that shorthand speed is not achieved by the invention and memorization of more and shorter short-cuts. Rather, he supposed shorthand speed is achieved by becoming more and more familiar with the shorthand material that one already knows; speed is achieved by becoming expert in the rapid use of the simple principles of outline construction. One of the best ways to do this, according to Gregg, is to use to its fullest extent the principle of analogy.

Apparently there are three ways in which the shorthand writer produces shorthand outlines. Many words, such as the brief forms, must be written from <u>memory</u> if they are to assume the conventional outlines. Other very simple words are spelled in full and could be written with other devices; but they are also written from memory because they have occurred so often that the writer cannot avoid memorizing them. These memorized outlines constitute a very small portion of the total number written. Beyond those forms which are memorized, another group of forms are constructed by <u>analogy</u>. The writer knows a similar word and produces the unpracticed one as nearly as possible like the word that he already knows. Most forms are apparently constructed, however, from <u>unverbalized generalizations</u>. Even for those persons who have learned to

verbalize the rules, the unverbalized generalization seems to be the means of constructing outlines in actual practice.

The highest level of shorthand writing is through the production of automatized outlines. The expert writes this way most frequently and adds newly automatized forms more easily than the less skillful writer. No writer, however, produces all his outlines in this manner. Some forms are produced on the lowest level--the letter level--and are produced in this way by any writer although the more skillful writers use the letter level less frequently than either the beginner or less skilled. Moreover, many forms are constructed by a combination of the two levels. (65:407)

Copying shorthand.--Once the learner has covered the recommended amount of reading prior to writing, he begins to write--from dictation in class and by copying from the shorthand plates in the textbook. The copying from plates takes place primarily, and perhaps exclusively, as a part of the homework assignment. Until then, he had read from the plates in the textbook; now he is asked to continue with the same reading and, in addition, to copy all of the connected matter in each assignment. The notes from which he is copying are, of course, nearly perfect. Leslie believes that this activity aids in giving the learner every possible opportunity to stock his mind with good shorthand characters, every opportunity to use them correctly, and as little opportunity as possible to use them incorrectly. (65:103, 168)

Drill on single shorthand characters should be confined to carefully controlled classroom reading exercises. In the homework, where the copying takes place, the learner is asked to write only the connected

matter which is Leslie's emphasis (65:6, 448, 454) that re-creation rather than mere repetition is the cause of learning. He says that merely repeating the outline is of little value and that the value comes from having to re-create the outline in the mind each time that it occurs in the various contexts of the lesson. The ability to construct an outline for any word, teaches Leslie (61:191-193), is attained by practicing outlines for thousands of different words to obtain the greatest familiarity with the sound and symbol combinations of the language. Gregg (52:381-382), who sometimes advocated practicing isolated words, pointed out the desirability of variation by illustrating that a student will learn the word check more readily by practicing check, checks, checking, checked, than he would by practicing the word check four times.

It is currently emphasized (59:62; 69:41) that the custom of using word lists for copying practice derived from an earlier time when there was no graded connected material at all. Similarly, it is said that the custom of repetitively copying the connected material came from the insufficient supply of graded material. (The first materials significantly resembling those of today appeared as Leslie's publication of his Functional Method in 1936.) The most effective practice, minute for minute, is the copying of large amounts of graded connected material once. Only when adequate amounts of graded materials are not available is it recommended in current teachers' handbooks to use repetitive copying as practice.

Leslie and Zoubek (68:2-3) emphasize that the more shorthand plate material the learner reads and copies the more rapidly his skill will develop. Benefits ascribed to this practice are that

1. It reinforces learning of the shorthand principles presented in the assignment;

2. It provides a continuous, automatic review of word-building principles and abbreviating devices presented in previous assignments;

3. It impresses on the learner's mind the correct joinings of the alphabetic strokes in many different combinations; and

4. It exposes the learner to an ever-expanding business vocabulary.

The current recommendations of Leslie and Zoubek, that the learner should not copy lists of words, are in contrast to the earlier recommendations of Gregg. He had described (41:11-12) a rather elaborate routine for word-list practice.

Always there is the emphasis on copying (or writing) only the contextual, connected-matter, shorthand plates. Leslie emphasizes (65:345) that the way to learn to write is to write, copying from a good model; the practicing of details or groups of details is not recommended. Neither does he recommend (62:303-305; 65:345) that the learner should simulate any copying by "writing" with a dry pen or other imitative means. His writing should be actual writing from good shorthand notes that are always connected-matter notes. No repetitive practicing of the outlines is needed, claims Leslie (65:330, 449). He believes that the results of infinite successive repetition (of single forms) are such that it not only fails to teach the outline but sometimes also actually causes the learner to write worse than before the repetitions took place. Leslie asks, then, whether that type of practice modifies the response for better or worse. Zoubek (85:27) recommends substantially the same thing as Leslie does about copying word lists and urges teachers to

abandon repetitive practice of words in favor of connected-matter practice. Whatever use is made of word lists, Zoubek urges (83:171) that teachers do not ask students to write 10 lines or 5 lines or even one line of each word in the word list.

The injunction of Leslie and Zoubek to avoid the use of a dry pen was in response to an earlier practice, approved by others including Gregg (32:62-64), of practicing with a dry pen. Apparently many teachers promoted this as a productive technique for learning shorthand.

Copying, Leslie (65:90, 115) believes, has value not only for learning to recognize certain shorthand characters, but also for other purposes as well. Both learning to join the alphabetic symbols in the variously necessary ways and learning of expeditious phrasing (the joining of more than one word into a single shorthand character) are both enhanced by copying from good connected matter in a natural context. Copying may have been valued most of all by Gregg (38:273) who held that writing had a much greater effect than either reading or hearing.

Gregg (55:16) advanced the plan to instruct students to do their homework by making the forms slowly and carefully. Certain mind-changing over the years may be noted, and as early as 1916 Gregg (16:120-212) withdrew from the former position of slow and careful writing. He became convinced that his recommendation had not been pedagogically sound and began to call for writing shorthand "rapidly and accurately" from the first.

Writing from dictation of practiced material.--The habits that are used in writing shorthand are said to be best formed from copying from good shorthand plates. Then, an extension of the skill develops

through considerable practice in writing from dictation of previously-practiced material. A progression of this type is developed in accord with the principle that writing from dictation must be what Leslie (65:192-193) refers to as a "habit skill" to be effective. Students, in the early stages of shorthand skill development, are exposed to large amounts of practice material. Zoubek (72:97) points out that they are not asked to initiate new outlines because they do not have the equipment for it. Rather, they are given this early practice so they can absorb as much as possible.

The first dictation occurs about the twentieth lesson if the usual recommendations are followed. Zoubek (75:11) feels that dictation should begin when it gives the greatest psychological advantage. For example, when interest begins to lag before the full twenty lessons are accomplished, writing may be used for renewed stimulation in the class. In his preference for the long reading approach, he does emphasize (80:99), however, that the introduction of writing cannot be delayed too long provided students are faithfully doing each day's reading each day.

Dictation begins, according to Leslie (65:169), as repetitive practice on connected matter which the learner has already read and copied. The dictation in the first few days is, however, without any pressure for speed, accuracy, and legibility. The teacher dictates at a relatively slow speed for brief periods--up to thirty seconds (65:418). Obviously, a learner who cannot quite keep up with the dictation can remember what was said well enough that he can, in general, complete the dictation from memory. Leslie recommends that, after a few days, the thirty-second dictations may be combined into sixty-second dictations for

several additional days; then, he suggests that the optimum dictation length is sixty seconds. Long writings (those for five, ten, or fifteen minutes) are of little or no value in the writing development and may even hamper its development. The long writings to develop "endurance" are not used because, according to Leslie (65:186, 418), in shorthand there is no such factor as endurance.

Gregg (31:203) compared long writings in shorthand with the long distance runner who taps his reserve powers of endurance only after he gets his second wind. The stenographer, he proposed, must not only be able to write at a high rate of speed, but he also must be able to maintain this speed for several minutes at a time. To do so, Gregg felt that the writer must continue until after his hand becomes so tired that he feels he cannot write another word. Only then would his tense muscles relax so that he could cease to grip his pen and begin to allow his hand to glide over the paper with no wasted effort. Obviously there is considerable disparity between what Gregg had to say in 1936 and Leslie's comment in 1953 that there is no such factor in shorthand as endurance.

The repetitive practice that Leslie (65:418) recommends for dictation exercises involves a considerable variation of dictation rate from time to time. The speed of every dictation is announced (65:188) so that the learner always is able to measure the progress of his skill and its current state even though that skill fluctuates rapidly according to both outside conditions and the internal feeling of the performer.

Specifically, the shorthand learner should have an adequate number of shorthand plates to be read and copied; then he should have ample dictation from material that has been practiced from shorthand plates.

During this practice, errors are ignored; and, according to Leslie (64:242) they will disappear unless the teacher himself emphasizes the errors.

Writing from dictation of new or unpracticed material.--Recommendations for beginning writing from new or unpracticed material, frequently called new-matter dictation, loosely conform to starting at the first of the second semester in the usual teaching situation or an equivalent time in other settings. Nevertheless, according to Leslie (65:102-116), the writing objective of shorthand is to be able to write any word in the English language and be able to do it rapidly; and one step in that direction is the beginning of new-matter dictation.

As the learner has read, copied, and written from dictation the vast amount of material prepared for him in the first months of his shorthand practice, he has acquired a considerable acquaintance with the system. During this time he should be given no new-matter dictation because his skill has not developed to the point that he can progress to the next step without undue complications. Presumably, at this time he is writing from the simple practiced material, is repetitively practicing his writing in class from dictation, and can sustain for sixty seconds a writing rate of eight to one hundred words a minute. Leslie (65:169) asserts that, if this is true, he is beginning to approximate, under certain limited conditions, the lower speed range of his stenographic objective.

In making his transition from dictation previously practiced from his homework, the learner should be given the new material in short, easy spurts of thirty seconds. The speed should be well within the ability of

the learner, and the time should be kept short for several days before it is raised to the usual skill-building recommendation of an optimum of sixty seconds. At all times, when the new-matter dictation is for the purpose of speed development, easy material is recommended. Leslie (65:169-170) maintains that, since the purpose is habit formation, the learner is kept on easy material with a liberal preview until he writes at the terminal speed required; and then the difficulty may be gradually increased. Once the appropriate time arrives for giving new-matter dictation, no other practiced-matter dictation is ever used for the usual learning purposes.

In an instructor's handbook (70:20), it is said that dictation should be fast, easy, repetitive, and brief. More specifically, the speed recommended is the highest speed that the learner can possibly take. The material should be kept easy in order that the practice can be maintained as skill development rather than the problem-solving activity that it would be if difficult material were used. The number of repetitions required is estimated at three to five, and the duration of most practice from dictation is recommended at one minute--perhaps occasionally at 30 seconds to get higher writing speeds.

Once the learner has begun to establish himself on the more frequent words, Gregg (38:276-277) recommends work with the less frequent words. In this way, he should develop an ability to construct forms for almost any word. All during this time, the student should be kept busy at reading and writing rather than with minor points of theory--things that are of no real importance to the stenographer.

Gregg (58:431) recommended the development of a word-carrying ability, but this recommendation is made only by Gregg. He apparently thought the ability to remember dictation as one writes somewhat behind the current flow of words, perhaps twenty words or so behind, was an ability relatively distinct from other shorthand learning accomplishment.

The penmanship of shorthand writing.--The obvious qualities for most shorthand writing are that it is rapidly executed and easily read. The ability to make the proper movements that produce these qualities should, according to Leslie (65:153-154, 159), emanate primarily from the mind rather than from either the physical or the manipulative apparatus. When the hand is making the proper movements to produce rapid and easy-to-read shorthand, the resulting notes show certain symptoms that are typical of expert writers. At high speeds the angles become slightly rounded and the terminal stroke diminishes rather than stops abruptly. The learner is said (65:153-154, 159) to develop the habits that produce expert writing far better if he is not drilled on these manifestations before he is ready to appreciate their value.

Gregg appears to have been somewhat more interested in a formal effort at developing penmanship than either Leslie or Zoubek. At least he wrote to this effect over a period of years. He asserted (56:69) that a knowledge of shorthand outlines is of little value unless the knowledge can be transformed into readable outlines. So, he believed, it is essential to make a great deal of fuss over the appearance of the shorthand; and the sooner one develops the habit of intelligent self-criticism of each outline the sooner he can develop the desired shorthand writing ability.

According to Gregg, the chief elements of a good style of writing are

1. Smooth, even, and light lines, secured by writing with a free, easy movement.

2. Correct curvature, slant, and method of joining characters.

3. Correct size and proportion of outlines.

4. Close and uniform spacing between outlines. (46:69)

In addition to these elements, he advocated techniques such as

1. Attention to see that one is not pressing the pen too heavily on the paper (50:330);

2. Seeing that the end of the outlines show a gradual tapering off instead of thickening (51:274); and

3. Streamlining the corners of outlines so that no perceptible stop is apparent as revealed by very sharp angles (54:381).

For a long time Gregg (55:115) had reccommended much early repetitive practice. The way to make this interesting, he suggested, is to give it in the form of live, enthusiastic, intensive, penmanship drills supplemented by dictation.

When the recommendations of Leslie (65:151) are carried out, most of the teaching of shorthand penmanship is accomplished as a matter of incidental learning. Attempts at improvement of penmanship are attempts at producing a clearly remembered visual image rather than as conscious attention to the hand as a producing machine. Zoubek (82:5), as well as Leslie, recommends a procedure for improving the learner's ability to construct an outline: the teacher secures attention and writes an enormous copy of the outline on the chalkboard. The magnified outline will reveal to the learner, asserts Leslie (65:153), what should have been done in the proper construction of the form, and no discussion is

necessary. Similarly, the sound of chalk on the board when the room is quiet, according to Leslie, aids the development of the correct writing motion by the learner.

The principal concern about penmanship problems is avoiding their development in the first place. Leslie (65:155) believes that many problems are averted when the teacher is careful during the early writing not to insist upon rapid writing and accurate forms regardless of speed. The learners observe the teacher's writing motion at the chalkboard and copy plenty of good shorthand.

Leslie (65:363) suggests five ways to secure fluent, well-written notes without formal penmanship drills. First, a long reading approach; second, slow copying and slow dictation until the initial diffuse movements are either gone or controlled; third, observation of the teacher's writing motion for about ten minutes each day as the new theory is presented; fourth, speed-forcing dictation; and fifth, opportunity to write about twenty per cent of the dictation under ideal conditions for perfect formation of the outlines.

Current instructor's handbooks (59:35-39) provide for limited penmanship work--say, ten minutes of practice approximately once a week. In the opinion of the authors, Lesson 24 is the earliest feasible time to attempt penmanship refinement.

There are two simple devices, they indicate (59:37-38), for rapidly improving the penmanship of the learner. One of these is the magnified outline provided both by the textbook and even better by the teacher at the chalkboard. The second device for improvement of penmanship is the demonstration by the teacher of correct writing motion.

the combination of these two devices quickly brings improved penmanship; however, penmanship practice should seldom exceed ten minutes in length and should always be under the control of the teacher. Therefore, such practice is not a good subject for homework.

Much of what Leslie advocates about theory he repeats (65:152, 431-432) in discussions of penmanship. The learner should be encouraged to look at the form as a whole and improve it as a whole. Conscious direction of the mechanical details of the skill tend either to impair or to inhibit the skill. As soon as conscious direction is given to the mechanical details, it is immediately impossible to act naturally.

Complete agreement among the inventors is not apparent in the matter of penmanship. Zoubek (76:8) feels that some concern for shorthand penmanship can be justified in the training of teachers. The value of having students see the teacher write large amounts of good shorthand on the chalkboard each day is important; so, improvement of the teacher's penmanship is of value to learners. Gregg (38:274-275) believed that penmanship drills not only are valuable for writing in an accurate, fluent, legible style but also that such practice helps to establish mechanical hand control so that the shorthand forms would not become illegible in rapid writing.

Attention to the hand was more typical of Gregg than the other of these inventors; especially in his early writing. Once he said (56:7) that shorthand was largely manual, but in other, more recent writing he said (48:505) that "the hand can write no faster than the mind can think" and again (57:282) "to write quickly, one must think quickly." He also

cautioned (57:282) that what young shorthand writers consider slow-handedness in many cases is nothing more than mental hesitation.

Leslie cautions against overpractice in shorthand when the practice effort is directed toward unnecessary perfection of shorthand penmanship. Perfect writing of outlines can be detrimental to the progress of the stenographic learner although perhaps useful for the teacher. For either group, however, the learner is said to do best by keeping his mind off his mistakes in the early stages of the learning process.

In summary, Gregg produced a system of shorthand that has found wide acceptance throughout the world and especially in the United States. Later, Leslie and Zoubek participated in the revision of the system to such an extent as to become co-inventors and, as such, have also become influential in determining teaching method. While they may not be in complete agreement, there are some predominant opinions reasonably representative of the group. Among these are the ideas that shorthand is most easily learned when the learner absorbs a knowledge of the system and skill in its use mainly by much exposure to it through reading and copying large amounts of well-written, graded shorthand materials and by writing from generously previewed dictation. Especially during the early stages of shorthand learning, careful presentation and review of examples of the principles are presented on the chalkboard and are practiced without reference to verbalized rules, so that not only are verbalized rules avoided, but also their existence is concealed.

A special sequence of learning activity with typical time designations is recommended. Penmanship practice, once highly regarded, has largely given way to brief and infrequent demonstrations by the teacher.

CHAPTER IV

A COMPARISON OF THE VIEWS OF PSYCHOLOGISTS AND SHORTHAND INVENTORS AS THEY RELATE TO PRACTICE

To express concisely his basic thinking with regard to the teaching of shorthand, Leslie (65:417-423) formulated twenty principles. If expanded, these apparently should summarize the teaching of shorthand. Neither of the other two inventors formulated his theories in such a comprehensive compilation of specific ideas. Because of the long association maintained by Leslie with both Gregg and Zoubek and their close working relationship, it may be assumed that for the most part Leslie's presentation of the twenty principles coincides with the thinking of the other two inventors.

In this chapter, the principles stated by Leslie are used as the points of departure for a comparison of the views of the psychologists and the shorthand inventors as these views relate to practice in the teaching of shorthand. In some cases, differences as well as similarities are pointed up in ideas because there is no total agreement between either the two groups or among the individuals of each group.

Leslie's published statement of the twenty principles makes no distinctions as to categories into which the principles fit; however, for the purpose of this study the principles are discussed in three

groups: (1) the theoretically-based principles, (2) the functionally-based principles, and (3) the commentary principles.

The Theoretically-based Principles

Some of Leslie's principles are stated in such a way that they imply a fundamental description of skill learning. Nine of these principles given here are used as the points of origin for comparison of the views of psychologists and inventors.

Skills are best learned under the most favorable conditions.--Here is a theory particularly important to the inventors' system for teaching shorthand. They hold that shorthand skill should first be developed rapidly under the most favorable conditions, and then the skill should be toughened to withstand actual working conditions. It is presumed that the most favorable conditions are arranged by removing unnecessary obstacles from the path of the learner.

Thorndike suggested that one way in which obstacles could be removed from the path of learning is through the removal of irrelevant emotional excitement and worry. The absence of these conditions constitutes a favorable psychological condition; and, conversely, irrelevant emotional excitement and worry are deterrents to learning in one sense because they compete for the learner's attention.

In one situation, Leslie recommends the removing of obstacles from the learner's path during the reading of connected matter. To remove a problem situation effectively, he suggests immediate prompting by the teacher rather than prodding the student to coax from him a hard-to-recognize word. Then, instead of a difficult problem situation, there are substitute conditions involving dependence upon increased repetition

as an aid to habit formation. Zoubek explains that immediate mastery is not the objective a teacher should seek; rather, he should depend on constant review (specially-arranged repetition) to produce for the learner an adequate use of the system.

Either permitting or encouraging students to use the printed key is another instance of removing obstacles from the path of the learner. Both Leslie and Zoubek recommend expeditious use of the key to speed up homework reading.

It is evident from Leslie's writing that he favors introducing shorthand in four phases: reading, copying and writing the dictation from practiced material, writing the dictation from new material, and transcribing. He presumes that a student is making good progress when he performs rapidly and easily in each stage and then progresses to the next one. An example of usual progress occurs when the dictation rate on practiced matter is developed to about the lower range of the stenographic objective before any practice on new matter. When skill is developed on easy practice and then is sustained as the material gradually becomes more difficult, it follows Leslie's principle that skills are best learned under the most favorable conditions and then toughened so that they are adequate in working situations.

Inasmuch as speed is a prime factor in the usability of shorthand skill, it is important that procedures be used that permit practice in writing rapidly. Guthrie, in particular, points out that one may speak of the habitual speed of an action and that the rate at which movement is performed quickly becomes a habit.

There is some similarity between the underlying assumptions of Gregg and those of Leslie and Zoubek. According to Gregg, considerable mastery should be achieved before moving from the simple words to the more difficult words. While some assumptions are in opposition, all three men do attempt to present the easier aspects first and build some degree of skill before progressing to more difficult stages. Notable among the contrasting ideas mentioned here are the differences in opinion concerning mastery and the differences in the nature of the material to be used.

In summary, the inventors presume to create favorable learning conditions by proceeding at the beginning of each learning phase without pressure. Appropriate pressures are applied later in several types of practice. Attempts at writing at high speeds are common. Reading some of the homework in class puts a premium on legible notes. Tests check the accuracy with which learners can record rapidly from dictation. However, these pressures are never constant. Leslie recommends that about a fifth of all dictation be at confortable speeds to give relief from pressure. This is also necessary because Leslie regards shorthand competence as a "habit skill." Hence, learners must be allowed to perform for a significant portion of the time with high accuracy to develop habits that produce proper outlines.

Significant agreement is found between the theory of the psychologists and the practical recommendations of the shorthand inventors. A number of recommendations for shorthand practice are offered by the inventors as standard procedures, and these practice procedures seem to embody the essentials of relevant psychological theory. So, both the

inventors and the psychologists support the same view: learning proceeds best when the obstacles, or learning steps, are small so that the learner may proceed without undue difficulty from one phase to the next.

Skill should never be forced or strained until after it is well established.--Leslie contends that in the beginning there should not be either pressures for high rates of accuracy and speeds or long practice periods. These are applied only after the skill is well established. Thus, the content of this principle makes it perhaps more nearly a corollary of the preceding principle than a separate one; that is, that skills are best learned under the most favorable conditions. Even so, this principle should not be considered as unimportant in the inventors' recommendations for teaching although discussed only briefly here.

It is agreed by psychologists in general and specifically noted by Koffka that repetition may lead to bad habits as well as good ones. Therefore, in the early learning, if pressures are applied either inappropriately or too soon, incorrect learning may take place and the habits developed may make it difficult for the student to perform in a more desirable way later. In the development of either a motor skill, as Koffka notes, or the skill of shorthand in this case, one may easily start wrong, under forced and strained circumstances. The habits will then prevent one from really performing the activity in the desired way in either later stages of learning or the ultimate use of the skill. So, again, agreement between inventors and psychologists is seen in the establishment of skill. Pressures apparently cause damage if they divert the learner from the best kind of practice of the thing to be learned.

Skill is best developed in intensive bursts of nervous energy of perhaps 30 to 90 seconds.--In shorthand, procedures for building skill utilize short periods of effort; and the longer writings of five, ten, or fifteen minutes are said to hamper the development of speed although they may be reserved for testing. The inventors point out that the attainment of shorthand skill is reached only through proper practice. Proper practice, they suggest, is well directed, properly spaced, and regular.

Leslie's plan of using intensive bursts of energy for short periods of time was not shared by Gregg whose recommendation to practice writing for longer periods so that fatigue causes the hand to relax is in opposition to Leslie's principle. Gregg's intent of building endurance is in conflict with Leslie's contention that endurance is not a factor in shorthand skill development.

Guthrie notes that the only law for the distribution of practice periods is that the greatest efficiency may be gained by setting appropriate interruption of practice at times when the setting up of undesirable habits seems to be retarding practice, and his view is probably acceptable to the other psychologists. This leaves the question of length of practice efforts with an undetermined guideline. In shorthand, for instance, eventually one must come to the point of determining the results of various lengths of practice. In the psychology literature, these results are treated as specific phenomena that are not generalized into a comprehensive principle.

One might wish for an occasion in which the psychologists would take a closer theoretical or experimental look at the length of practice periods in situations similar to those of learning shorthand. Yet, in so

far as the various expressions of attention to these matters are concerned, no conflict is seen between the inventors and the psychologists.

Skill is not a fixed or static state.--The skill of any writer, observes Leslie, varies from minute to minute, as well as from day to day. The skill fluctuates according to outside conditions and to internal feelings of the skill learner. This idea is reminiscent of what Hull called "behavioral oscillation."

The probability of a proper response, as one would deduce from Guthrie's Principle of Response Probability, depends upon whether a sufficient number of the conditioners from the total situation are present. To the extent that these are present in varying degrees, the likelihood of obtaining a particular response varies also. In his Principle of Dynamic Situations is seen the need for practice so that a response may be elicitable from a variety of situations. So, performance differs from time to time according either to several explanations as Guthrie and Hull indicate or by observation without explanation as in the case of Leslie.

Repetition is not the cause of learning.--The real cause of learning is re-creation. Repetition gives not only the causes of learning a chance to operate but also gives opportunities for the previous learning to deteriorate if the proper learning conditions are not present.

When Gregg advocated that learners know the reason for practice, he gave emphasis to the desirability of understanding the principle to which their practice applied. The memorization of the rule was not important, and he said that the restudying of rules merely as rules is not of much value. On the other hand, applying the rules is of great value for creating word-building power.

Leslie suggests a series of learning experiences with the brief forms that consists of much greater repetitive practice than is used in other shorthand learning. While alphabetic symbols are used for brief forms and may give a clue to their meanings, no repetitive spelling is recommended. The forms would be learned primarily as wholes and mainly by the impact of repetition.

In the Leslie-Zoubek type of practice on new forms, the repetition permits the learner to involve sight, hearing, speech, and the accompanying muscular movement in response to the forms. The teacher's presentation is rapid and vigorous; thus, holds Leslie, this type of presentation and participation provides the varied and vivid stimuli needed to produce more learning.

Leslie repeatedly argues against any "elaborate explanations" during the teacher presentation and student reading in the chalkboard work with the word lists. He argues not only against the learning of rules but also against allowing the student to become aware that any rules exist. The chalkboard presentation, Leslie maintains, is an aid to the learner in getting a better perception of the writing motion; but he opposes conscious direction by the learner in imitating the teacher's writing motion. The constant emphasis against the learner's awareness of the structure of the system during practice poses a question of the extent to which Leslie provides for intention as a part of the shorthand learning procedure. Of course, there is still the possibility of some unintentional learning as is evidenced by the development of undesired habits and some awareness of the perceptive field in the sense that the field psychologists believe.

One instance of dependence on re-creation as a special form of repetition is the currently recommended reading and writing of shorthand homework. All attention is given to contextual material that provides multiple examples of the principles to be stressed. In this setting, the principle is repeated in several different and separate situations.

The classroom drill, recommended by Leslie, of randomly repeating the words from word lists, as well as the practice advocated by Gregg of writing the various forms of a word rather than precise repetition, supports the idea of re-creation as a shorthand learning principle. Leslie's attempts at providing vivid and varied stimuli in the learning process are closely related to Guthrie's theory that overt action leads more readily to the stereotyping of a serial response. Guthrie suggests that this is borne out by experiments that show that material read aloud is more quickly learned than material read silently.

Thorndike pointed out that mere repetition of a situation is not, of itself, productive of learning. Rather, mere repetition of a situation simply tends to maintain the status quo; and neither the selection of desirable bonds nor the elimination of undesirable ones is automatic. Hull also agreed that mere repetition was not adequate for learning, but suggested somewhat different consequences. Mere contiguous repetition, he believed, does not produce a maintenance of the status quo but actually does generate inhibition. Most of the behaviorists (plus Thorndike) would agree that improvement depends upon reinforcement. Nevertheless, Guthrie discounted the role of satisfiers and annoyers, reinforcers and punishers, and so on. The response becomes conditioned, he believed, by the simultaneous association between the stimuli and the response.

The role of intention in learning may be particularly significant. Guthrie reminds us that studies have been devised to bring out the difference between learning with intention and learning without intention. It has been seen, he related, that a ritual may be repeated for years but probably will not be memorized unless the subject makes up his mind to learn it. Nevertheless, some learning does take place as is evidenced by the extent to which people do have habits that they did not intend to acquire; and, of course, the experiments in latent learning indicate that some learning that is not recognized at the time may take place.

Although repetition is not the cause of learning, Guthrie comments that repetition is necessary to execute the act in a variety of circumstances although some habits may be established in a single, excited rehearsal. With Hull, the law of reinforcement is fundamental in learning. The more reinforcements of an activity, the more strongly habituated the activity becomes. Thus, Hull is in agreement with Thorndike and Skinner and opposed to Guthrie. Mere repetition, believed Hull, does nothing but generate inhibition. According to Tolman, after a response has been learned, overexercise tends to fix it and make it unduly resistant to change.

Koffka pointed out that repetition is linked with learning in most situations. However, he suggests that traces may be different in two kinds of practice so that in some cases an activity improves through practice while in another case there may be no learning. This is, changes go on within repetition, not as a result of repetition. Nevertheless, repetition can be a very powerful factor in stabilizing traces

by building up a trace system composed of as many traces as there are repetitions.

Wheeler suggests that learning is ineffective in proportion to its dependence upon sheer repetition and drill. To a Gestaltist, the comprehension of relationships is fundamental in learning; therefore, repetition without this comprehension is thought to be ineffective.

Thus, there is agreement among the inventors and the psychologists that changes go on within repetition and not as a result of repetition. No evidence of disagreement on this point is found in the literature of the shorthand inventors.

Easy practice material develops speed more effectively than difficult practice material.--While difficult practice material may help in fixing knowledges, easy practice material serves in the speeding up of habits. Obviously, one can perform on the easy practice material at a higher rate than he can perform on either more difficult or less familiar material; and although Leslie does not specifically declare it to be so, his basic proposition appears to be that the speed of the action is an integral part of what a student learns.

Guthrie notes that movements which are practiced at a rapid rate continue to be performed at the habitual speed that is set. The mark of an established habit is smooth and highly predictable action; however, the stereotyping may preserve waste movement even though it tends to eliminate interference among movements and to eliminate movements that tend to result in disturbing stimuli. Yet in the writings of both the inventors and the psychologists, substantial agreement is apparent. They indicate that easy practice material may develop speed more effectively than difficult practice material.

Perfect relaxation is necessary for the most effective skill development.--The writer learns best when the minimum amount of nervous and muscular effort is used to perform the activity. "Perfect relaxation" is probably not a good term, inasmuch as a certain amount of tension is required for the maintenance of an acceptable posture and writing motion, and a certain amount of emotional involvement is required in the motivation to write. Therefore, it must be recognized that Leslie's principle is realistic to the extent that it refers to either extraneous muscular involvement or extraneous emotional involvement. He is somewhat more realistic when he points out that teaching procedures that remove mental tension are valuable because the lack of mental tension causes nervous and muscular tension to vanish. This can, of course, refer only to unrelated tension.

The most expert and successful learners, observed Thorndike, show the least emotional excitement in connection with the exercise of the function that they are improving. The less excited one is during his work, the better he learns. Emotional excitement of the learner need not be great, and in the most successful learners it seems to be produced by the interest and success rather than to produce them. On the other hand, the observation of Thorndike is not complete as evidenced by indications that simple learning may be facilitated by the slight addition to muscular tonus provided by gripping a dynamometer while practicing. Furthermore, excitement that causes the learner to react in a more vigorous way may provide a more telling experience and more nearly complete and lasting learning. Leslie and the other inventors are doubtless right in that a certain degree of relaxation is desirable for the most effective skill

development in shorthand. The psychologists do not refute this assumption. On the other hand, the literature does not indicate clearly applicable support that perfect relaxation is necessary.

Skill is best learned in the largest feasible wholes and subwholes.--Leslie particularly emphasizes that no attempt should be made to perfect each part of the skill as it occurs. Rather, the learner should progress from one stage to another so that all the parts may be perfected together. The individual symbol of the shorthand alphabet, which is used for the building of words, represents a whole in itself if one agrees with Leslie. These wholes may later become subwholes as the learner begins to recognize combinations of the symbols. Because these are the wholes, especially in the beginning, with which the learners can deal, Leslie recommends much spelling practice through the complete presentation of the theory and perhaps for a time afterward. Mainly, this repetitive spelling and reading would be done as directed classroom activity if Leslie and Zoubek are followed.

A specific instance of an attempt to produce learning by the largest feasible wholes and subwholes occurs in the Leslie-Zoubek proposal for writing progression from lesson to lesson without waiting for greatly improved characters. The learner is to proceed through the entire system quickly and then to polish the shorthand skill as a whole without focusing attention on the component parts.

Proceeding through the entire system without waiting for mastery of the parts (an attempt at preserving the wholeness of the learning) does not imply beginning all parts of the skill at once. The reading approach delays both writing and the practice of some other elements of

the skill. According to Leslie, these delays permit proper preparation for each of the subwholes that eventually combine and form shorthand skill.

Wheeler asserted that learning involves the understanding of the new problem as a whole. Behavior, he believed, follows laws that do not permit learning by parts, and the "part method" is actually an illusion. When the task is either too long or too difficult to be learned by the "unmodified" whole method, a mediating method must be employed; yet all material presented for learning should contain as much logical form and coherence as possible. The problem, he indicates, is in the selection, under laws of wholes, of conditions for optimum learning.

The reference to "whole" learning is quite obviously an influence of Gestalt psychology. While the behaviorists may give their attention to a different approach and omit emphasis on "wholeness," they do not refute the idea.

The area of skill increases with the intensity of the skill.--Illustrating this principle, Leslie suggests that as the learner begins to write faster, he is also able to write more different and difficult words.

The implication of Leslie's theory seems to be that the learner practices for more and more speed on relatively simple material and that this ability, when developed, extends to give the learner the capability of writing both new and difficult words which he has not attempted before. Gregg appears to have reasoned that the reverse was true: the learning of more and more words tended to produce greater speed. While

the two positions are reversed, both may be accepted as emphases in which either would recognize the other as effective though comparatively less effective in producing shorthand skill. Gregg believed in building vocabulary by drilling on the more common words until the execution of them became almost mechanical. Then the vocabulary should be enlarged by adding more and more words in the less-frequent groups. The literature of the psychologists does not include attention to this theory. Thus, the question of how skill is affected by the intensity of the skill remains largely unanswered.

The Functionally-based Principles

Five of Leslie's principles are stated in such a way that they suggest a description of functions in learning shorthand rather than fundamental descriptions of skill development. The principles given here are the points of origin for a comparison of the views of the psychologists with those of the inventors.

Language arts like English, shorthand, and transcribing are best developed by extensive rather than intensive practice.--The point here is quite simple to state. Leslie believes that the learner derives more benefit by seeing and using shorthand construction in many different contexts on many different occasions than by seeing and using the same construction many times in one practice session.

Indications of dependence on extensive practice are found in a number of places. The insistence of all the inventors on copying large amounts of well-written shorthand plate material shows a reliance on this kind of practice. The currently prescribed reading and copying of homework from large amounts of prepared shorthand material and the classroom

procedure of writing only contextual material both derive from the extensive practice principle.

One can hardly fail to note that the difference between extensive practice and intensive practice is one of degree rather than a mutual exclusiveness. Therefore, when the inventors refer to extensive practice, some degree of repetition remains. But, how much and how frequently must the repetitions occur to designate an activity as intensive practice? In meeting this situation as it relates to unpracticed dictation, the inventors suggest from three to five repetitions. This recognizes the need for repetition to give learning a chance to occur and, at the same time, defines more repetitions as being identified with a degree of intensiveness too great for the most productive shorthand practice. Gregg implied a much greater affinity for intensive practice, especially when he talked about mastery of each stage as one progresses.

The Gestaltists and Tolman seem to have been more concerned with the setting within which the repetitions take place than were the stimulus-response psychologists. The Prägnanz principle, originally pronounced by Wertheimer and accepted by the other Gestaltists, supposes that there is a constant attraction toward getting a clear-cut orientation. Thus, the learner should constantly be attracted toward fitting any part of practice into a sufficiently larger setting so that the relationships become clear. This seems to refer more to a cognitive structure than to a developing motor skill; Tolman thought that motor patterns not only become available in separated fashion but also may be learned in the larger setting of goal-directed activity.

Koffka holds that the acquisition of a skill does not mean the ability to do a specific thing but rather the ability to perform in a wide variety of ways. When the learner has developed a skill, he does not merely make a small number of very specific movements; he has learned to act in the proper way in a wide variety of ever-changing situations.

Performing in a wide variety of ways may also provide for the development of insight. Although the idea of insight is not accepted by some of the psychologists involved in this study, it does seem to be compatible with some shorthand teaching. Wheeler expressed three criteria for describing insight. First, behavior is modified to result in correct responses the first time. Second, responses are transposable from one problem situation to another. Third, there must be such a configurational character in the response that it constitutes a reaction to the total pattern of the stimuli. That is, responses may be made to "the dimmer of two lights," or to "the darker of two groups," rather than to either an absolute light intensity or an absolute shade of gray.

It is undoubtedly true that successive repetitions beyond a certain point become less and less effective. The explanation may be along the lines of Hull's description of inhibitory potential. In such a case, the latter repetitions may not only be of less than maximum value themselves but also could conceivably weaken the desired effect of the earlier ones when there is a weakening reinforcement through lessening of interest, increased distraction, and so on.

Skill develops most effectively under practice conditions.--Specially arranged situations are assumed to be superior for building skill in shorthand. There is some value in arranging instructional

conditions similar to office work situations, suggests Leslie; but this is for the purpose of getting the learner accustomed to the use of the skill in an office. It is not an efficient and economical method of providing practice conditions for the development of speed and accuracy in shorthand.

The psychologists did not enunciate principles dealing with arranged practice conditions; however, Thorndike assumed practice conditions as superior means of learning when he discussed the need for definition of a situation. Definition of the desired bonds makes it possible to subject them to exclusive practice. The office-situation type of learning mentioned by Leslie makes it difficult to emphasize the stimulus-response combinations from which one might form connections. By arranging special conditions for practice, one is more likely to control learning by increasing the opportunity for responses to become attached to the desired cues and as few others as possible. Thus, the Thorndike illustration points out a basic compatibility of the ideas of the psychologists and those of the inventors.

Consciousness of or conscious direction of the mechanical details of the skill impair the skill.--In writing shorthand, the less the learner is conscious of the mechanical details of the skill, the more effectively he is able to perform. Leslie doubts the wisdom of developing any consciousness of outline construction beyond the simplest observation. Zoubek, as well as Leslie and perhaps Gregg, doubts the value of a conscious knowledge of the rules. It is apparent that the frequent mention of "unverbalized generalization" by both Leslie and Zoubek requires some knowledge of the structure of the system. However, Leslie,

in particular, so firmly rejects rules and also conscious direction of the skill that one might find it difficult to recognize precisely how a student can learn to generalize and, at the same time, have no conscious direction.

Attitudes toward penmanship are prime examples of an adherence by Leslie to the separation of conscious direction and the practice of elements of the skill. He advocates the formation of penmanship habits primarily and principally by seeing examples of good shorthand in prepared text and by observing outline formation as the teacher writes on the chalkboard. In neither instance is the learner led to a strong awareness of these activities as penmanship aids. They are presumed to be influenced by these models sufficiently so that little attention needs to be given to the improvement of outlines. This is, of course, quite different from the views of Gregg who had a high regard for penmanship practice. As a matter of fact, Gregg thought that penmanship practice was a good way to learn shorthand, a reverse position from the opinion held jointly by Leslie and Zoubek that familiarity with an abundance of shorthand outlines will produce better penmanship. Zoubek notes that perhaps some penmanship practice would be good for teachers because of the influence of teacher demonstration on the penmsnahip of the student. However, prospective teachers and prospective stenographers are not usually in separate classroom situations.

Conscious direction may be useful in some instances, nevertheless, for either modifying old habits or substituting new ones. Guthrie observed that we are conscious of a feature of our situation when that feature is dominating the response of the whole organism. When the habit

becomes stereotyped, however, it tends to disappear from consciousness and we may no longer notice or be able to recall whether we have performed the act. Guthrie also noted that one interference with an act which has been performed without attention is that attention itself is frequently a disruption of the habit. He believed that attention to our own movements renders the movements different because they then lack some of their cues. One difficulty in acquiring skills, according to Guthrie, is that stimuli resulting from inadequate habits do not appear in time to break up the bad habit. When one watches the results of poor performance, he may be led to right rehearsal. If he overcorrects, he has at least broken up the pattern of action that failed to reach the goal.

Guthrie pointed out that one may not be aware of whether he has performed an act, as is often the case in the performance of an habitual act. Skinner, moreover, reports that to say one is not aware of his actions is not to say that he always is not aware, but it does mean that his habits are sometimes formed without his knowledge or direction.

It is particularly relevant to note the interpretation of what happens when conscious attention is given to the movements of execution in writing shorthand. The psychologists indicate that attention causes a difference in the movements of the skill; Leslie wrote that it impairs the skill. In accord with the attention given the matter by the psychologists, conscious direction should sometimes cause differences that improve and sometimes cause differences that impair the skill.

Related acquired habits and information should be utilized in order to start action as though on familiar ground.--The learner in shorthand, argues Leslie, should proceed from what he already knows to

what he does not know. "As though on familiar ground" serves as recognition that the thing to be learned is new and that some special structurization of the field must be arranged if the learner is to have the advantage of a familiar situation within which to work. In some cases, the recognition of what goals will produce satisfying conditions may be made more immediately clear when the learner does not feel that he is in a totally new situation. There is, unfortunately, nothing in the literature of the psychologists directly related to this principle by Leslie. While they do not refute it, neither do they support it directly.

The learning process proceeds best when the learner has knowledge of his status and progress.--Leslie holds that the learner should know when he is doing well because such knowledge will encourage him; he should know when he is doing poorly because this will challenge him. One instance in which this is apparent is in Leslie's proposal that dictation drills should be conducted from time to time with considerable variations in dictation rates. It would be difficult and perhaps impossible for the learner to know at what speed he is taking dictation. Because he believes that the learner should always know his status and progress, Leslie indicates that the speed of every dictation should be announced. Thus, the student is always able to measure the progress of his skill and its current state even though the skill does fluctuate widely.

One problem for the learner lies in identifying and understanding something of the task that lies before him. As Thorndike suggested in connectionist terminology, the bonds either to be made or to be

strengthened need to be rigidly defined and subjected to exclusive practice as needed. Furthermore, the learner must be able to identify those results that should satisfy. This requires, of course, that the learner understand what connections should content him.

Thorndike believed that the primary way of strengthening a connection is through the effect of a resulting satisfier. The theory of Hull that reinforcement is fundamental is his agreement with the soundness of Thorndike's assertion, and the balance of opinion supports this view. Thus, when the learner immediately finds that he has been successful in his endeavor, his sense of satisfaction serves him in such a way that he ought to be more nearly able in the future to repeat the performance.

While either reinforcement or satisfying results may serve to strengthen the likelihood that a performance will be repeated in the future, it is possible that annoying consequences may serve a useful purpose, although indirectly. Annoying consequences do indirectly cause weakening of a connection because the person, in the presence of the annoyer, tends to do something else and he becomes less likely to repeat the original connection. It becomes apparent that while the annoyers may sometimes indirectly be of benefit, it is highly desirable that ample opportunity be arranged for a type of success wherein reinforcement can be found to promote the learning that is the ultimate reason for the practice.

The Commentary Principles

Six of Leslie's principles are stated in such a way that they appear to be comments on the acquisition of skill rather more than either

theoretically based or functionally based descriptions. These principles are given here and are the points of origin for a comparison of the values indicated by the psychologists and the inventors.

The obvious path to skill is not always the correct path.--Leslie believes that it may appear that to learn to write one should begin writing as soon as possible. Yet, he emphasizes that experience shows that the learner will learn to write sooner and better if he reads a large amount of shorthand before he writes. Such reading provides an opportunity to become acquainted with good models on which to base the writing.

Leslie appears mainly concerned with the promotion of one of his principal emphases--the long reading approach to the teaching of shorthand. An even broader significance underlies his pronouncement of the principle, and the other inventors are doubtless aware of it. Much has been said and done concerning various techniques of promoting learning when the technique, or gimmick, has no real validity for promoting learning. The basic significance here is that devotion to a particular technique ought to be preceded by some serious inquiry to discover whether it is psychologically sound. This is one of those situations, nevertheless, in which the literature of the psychologists does not provide directly applicable material.

A teaching procedure that is helpful in one stage of skill learning may be useless or even harmful in another stage.--Procedures that are beneficial at the initiation of a new stage of learning, Leslie reminds, may be a waste of time later. This apparently applies in part to the reading of connected matter in class after the learners have progressed beyond the reading approach. This principle is closely related to the

preceding one and emphasizes that the planned teaching must recognize that when objectives change, learning conditions (or teaching techniques) must stay in accord with them.

Probably no other writer on shorthand teaching has been more insistent than Leslie that a relatively long reading approach is beneficial in learning shorthand. He maintains that approximately four to five weeks in the typical situation should be spent without any writing. Once this time has passed and writing is introduced, reading of contextual material in class is so sharply curtailed that Leslie would permit it only under concessionary circumstances.

Gregg asserted that the first objective with an assignment of new theory is to become acquainted with the new principle so that one understands it; then the learner should read the illustrations until he can recognize each word instantly. Once the learner is familiar with the new principle in this way, Gregg advised discontinuing the reading of isolated words and beginning the reading of the connected matter available.

Leslie and Zoubek suggest a comparable progression of learning that involves reading illustrations of a new principle before proceeding to the connected matter. The reading of connected matter constitutes the bulk of the reading practice. The next progression moves from reading to writing. Leslie, in particular, recommends considerable reading before writing. After the reading has been completed, most of the attention is given to writing.

This suggestion about the teaching of shorthand either may or may not be acceptable to educators and the psychologists--it probably is acceptable. It is not, however, a matter with which the psychologists

have dealt as either a matter of a statement of principle or a description of the acquisition of skill. The idea involved in Leslie's statement of this principle is so closely akin to his preceding principle that the first is an explanation of the second.

A proper teaching treatment of the initial diffuse movements or irradiation will greatly shorten the period of skill learning.--An insistence on perfect performance from the beginning of each division of skill learning, believes Leslie, is contradictory to the natural performance of early learning. Emphasis upon premature perfection hampers the acquisition of skill and lengthens the learning period.

The tendency of early skill performance to be either generalized, clumsy, or awkward is commonly recognized among the psychologists of this study. Koffka, for example, observed that the skilled performance of the present skill is fundamentally related to former experience but is not a reproduction of the clumsy performance of the past. Guthrie called this phenomenon "generalization," accepted the characteristic as one of the factors of conditioning, and noted that it appears soon after the beginning of practice and disappears as practice continues. Wheeler also noted that where the development of muscular skill is involved in learning, the first performance is both gross and awkward. This occurs, he explained, because the performance is undifferentiated. The skill responses in later performance occur, so he indicates, because differentiation causes a greater complexity of finer muscular adjustments and because there is a greater subordination of the refined movement to the total pattern.

The skill learner is training his mind rather than his hand.--Leslie holds that when shorthand penmanship is poor, it is not that the hand has not been trained, but rather that the mind has not yet learned to direct the muscles. When the hand cannot seem to move rapidly enough in writing from dictation, the difficulty is that the mind is unable to formulate the shorthand outlines quickly.

If the earliest writings of Gregg are ignored, the inventors are in agreement on this point. However, the distinction between hand and mind poses an awkward situation in so far as the psychologists are concerned, and especially the behaviorists, because they typically do not recognize mind as an entity or recognizable separation from the total organism. The property of mind is, they might explain, an ability to react differently to disturbing stimuli until a solution is found. They generally give little heed to mind at all. Whenever a state of learning involves both hand and mind, if the terms are to be used in this way, the psychologists whose work forms a basis for this study would fail to recognize any separation that implies that the two are other than closely related ways of referring to functions of the organism; however, Leslie's principle suggests that they are virtually separate. The inventors became concerned, actually, because of attempts at training the hand as though it could operate without other associations: perceptiveness and understanding that involves the visual, aural, and so on. Either Leslie's pronouncement of the principle is poorly stated or he has shifted from an emphasis on the hand to an emphasis on the mind still without recognizing the interrelationship of the two. This writer prefers to accept the statement as representing a poor selection of words at

the time of publication and an error of which the inventors are probably aware.

With this liberty of interpretation, the problem is to arrange learning situations that provide for comprehension of the situation. This position would probably be psychologically acceptable. Thorndike in particular noted that much of learning consists in changes in the identifiability of situation. Identifiability, he explained, can be increased by some analysis that turns situations and things into compounds and complexes of features that are easier for the mind to grasp and retain. Then, this identification may be increased through association with some situation more identifiable than itself. Nevertheless, he added, a situation may also become more identifiable with repetition through self-establishment in the mind without either analysis or outer attachments.

The expert does not make rapidly the movements that the beginner makes slowly.--The movements of the expert, reports Leslie, are seldom identical to those of the beginner, and quite often they are very different. Sometimes the expert actually moves more slowly than does the beginner but with less hesitation and lost time. The movement patterns are, however, reflections of mental patterns; and the beginners should not be urged to imitate symptoms of expertness for which they are not ready.

The progression of motor patterns has been of interest to the psychologists. Guthrie points out that learning any skill depends as much on getting rid of awkward movements and useless movements as it does on acquiring the proper movements in response to the proper cues. Guthrie also asserts that there is evidence that simple repetition of

a series of events in either action or thought does not in and of itself lead to the omission of any terms of the series. The dropping occurs, he believes, only when the terms are irrelevant in the sense that they depend upon stimuli that are not essential to the action series, when they are not recurrent, or when they are replaced by stimuli to incompatible movement.

It is a common feature of habit formation, Guthrie relates, that practice of an action generally results in speeding up the action either until or unless the action has become stereotyped. If the action has become stereotyped, speed does not increase unless the action includes much that is "irrelevant." Then, the elimination of the irrelevant movement may result in speeding up the serial responses. Further, stimuli that have been acting for some time become conditioners of a later movement. Thus, the movement is elicited at the earlier appearance of the stimuli; and the series becomes a flowing action in which the originally separate acts are overlapped rather than distinct. One other way in which the action may be speeded up is through excitement and resultant quickening movement; such increased rate of movement quickly becomes a habit.

Leslie's principle is an interesting observation of a phenomenon concerning the development of shorthand. Mainly, its importance occurs because both learners and teachers sometimes expect the learner to be able to imitate at an early stage the polished movements of the expert but more slowly. In reality, the movements change and become more polished as skill increases and vice versa.

Any desired achievement on the part of the pupil must be the result of a planned teaching procedure on the part of the teacher.--It is

not sufficient, reminds Leslie, to ask learners to write more rapidly. The teacher must provide instruction and the type of skill building drills that will enable the learner to write either more rapidly or more accurately. This seems to be something of a plea from Leslie to adhere to other principles rather than an actual principle itself. It is a reminder of the importance of proper procedure since the outcome is a result of what has been practiced rather than what has been required, urged, and so on. Here, again, is an emphasis concerning practice in learning shorthand which has no direct counterpart in the literature of the psychologists.

Summary

In this chapter, twenty principles either directly or indirectly related to the psychology of practice in shorthand were reviewed in terms of three categories. With reference to the nine theoretically based principles, there is essential agreement on six. One principle, dealing with perfect relaxation, shows degrees of disagreement; and two principles, one concerned with learning in intensive bursts of energy and one concerned with relationships between the area and the intensity of the skill, remain largely unsubstantiated.

In the five functionally based principles, there is essential agreement on three. There is some agreement, but a notable difference in viewpoint, on the principle relating to conscious direction. No reference was found in the psychology literature that dealt with the principle of starting as though on familiar ground.

In the section on commentary principles, little real agreement is found between the psychologists and the inventors. Both groups do

observe that the skill movements of an expert, though related to past performance, are not speeded-up versions of the early movements. References to relationships of mind and hand to the whole organism are either so differently expressed or so differently conceived that substantial agreement cannot be assumed without accepting definitions that may not be warranted. Agreement with the remaining four principles was not found in the literature of the psychologists.

CHAPTER V

SUMMARY

The frequency with which concern for skill development in shorthand has been evidenced during the past few years, and the frequency with which it continues to be discerned currently, is made apparent in professional literature, professional gatherings, and in less formal occasions. Generally, references to skill development indicate interest and awareness of importance, but little information is available concerning definitive material that applies the psychology of learning in a formal way to the learning of shorthand.

Teachers recognize the importance of skill building in the teaching and learning of shorthand and attempt to supply the needed learning principles from their own funds of information. Indeed, it is entirely possible and probable that many of the theories that they hold with regard to skill building in shorthand are sound; however, the soundness of the theories is often a matter of assumption, and a teacher does not have regular access to a carefully studied and carefully formulated framework within which to work confidently.

Current predominant recommendations for teaching shorthand, and these most probably have a significant effect on the way that shorthand is taught, provide for the development of shorthand skill without

conscious attention to analysis of the structure of the system. Prospective teachers commonly receive some instruction in teaching methods, but the time devoted to this is ordinarily short. Then, limited research information based on psychological analogy is available. Therefore, a situation exists in which there is notable lack of information among shorthand teachers about the nature of skill and about the system itself. The problem of this study was to supply some of the needed information by pointing up the extent of agreement between Gregg shorthand inventors and a group of selected psychologists concerning practice and its relation to learning shorthand.

This study consisted of the synthesizing or reassembling of facts into comprehensive, meaningful units. Perhaps this approach to the solution of the problem and the resultant organization of material will contribute to and stimulate the thinking in this area in a way that will help teachers of shorthand. Perhaps it can also provide an organized basis for further study and experimentation.

The information for this investigation was obtained by means of analysis and interpretation of ideas from two types of sources. First, an investigation was made of psychological literature and research concerning practice and practice conditions; second, investigation was made of material by the inventors of the Gregg system of shorthand.

The first step in this study involved extensive study of published material relating to practice and to the learning of shorthand to provide an understanding of the area to be investigated. The second step involved a determination of the psychological elements essential for effective practice. Reference in this step was to information from

connectionism (Thorndike), behaviorism (Guthrie, Skinner, Hull, and Tolman), and Gestaltism (Koffka, Köhler, Wertheimer, and Wheeler). The third step involved determination of the recommended techniques and procedures for practice in the learning of shorthand, and reference was to information from writings of the inventors of the Gregg system (Gregg, Leslie, and Zoubek). In the final step of this investigation, theoretical inferences were drawn by means of a comparison between recommended practices in shorthand methodology and representative views concerning the psychology of learning. The comparison was designed to point up whether or not authoritatively recommended shorthand methodology makes use of what psychologists advocate on the matter of practice.

Findings

From the published material of the selected psychologists and also the inventors of Gregg shorthand, areas of agreement and areas of disagreement relative to practice were found. At times the psychologists and the inventors were of unanimous opinion, but on other matters they failed to agree not only between groups but also among members of a group. In the presentation of these findings, the majority opinion is indicated when there is disagreement among members of a group. To expedite the pointing up of inferences and implications for practice, material is inserted in parentheses wherein the word "practice" did not originally appear and to draw closer attention to the though of practice in reading the material.

The Theoretically-based Principles

Areas of agreement between the psychologists and the inventors.--There are six principles relating to practice on which substantial agreement is found.

1. Skills are best learned (when practiced) under the most favorable conditions.

2. Skill should never be either forced or strained (by very difficult practice) until after it is well established.

3. Skill (as revealed through ability during practice) is not a fixed or static state.

4. Repetition (practice) is not the cause of learning.

5. Easy practice material develops speed more effectively than difficult practice material.

6. Skill is best learned (through practice) in the largest feasible wholes and subwholes.

First, an area of general agreement is found in the principle that skills are best learned and practiced under the most favorable conditions. Principally, favorable conditions are conceived to be those in which unnecessary problems and irrelevant emotional excitement are removed from the path of the learner.

They further agree that the practice of a skill should never be either forced or strained until after it is well established. This is possibly an appropriate part of the discussion of favorable learning conditions; however, Leslie has established it as a separate principle.

Both groups agree that skill or the practice thereof is neither fixed nor static. Some of the psychologists have pronounced principles closely related to Leslie's principle in this regard. Probably, however, the most definite agreement occurs in the principle that repetition is not the cause of learning. Psychologically, this has been established for more than thirty years, and the inventors give special attention here also.

Leslie, with the agreement of the inventors, declares that easy practice material develops speed more effectively than difficult

material. The psychologists did not express themselves in precisely the same way, but comparable references were found and agreement seems apparent.

Agreement was found on the principle that skill is best learned and practiced in the largest feasible wholes and subwholes. This principle is clearly influenced by the Gestalt psychology. Not all the inventors and psychologists expressed themselves on this item, but they are assumed to agree.

Areas of substantial disagreement between the psychologists and the inventors.--On one of the theoretical principles, there is substantial disagreement. That principle is as follows:

> Perfect relaxation (during practice) is necessary for the most effective skill development.

Agreement is not clear cut in supporting the idea that perfect relaxation is necessary for the most effective skill development. It is generally conceded that either extraneous muscular or emotional involvement is detrimental to learning although it is not clearly specified just what tensions are acceptable. Part of the difficulty is found in Leslie's unfortunate choice of terminology in referring to "perfect" relaxation.

Areas in which the principles are not psychologically based.--Two of the theoretically-based principles were not found to have counterparts in the psychological literature.

1. Skill is best developed (that is, practice is most effective) in intensive bursts of nervous energy of perhaps 30 to 90 seconds.

2. The area of the skill (ability to practice and perform over a wide range within the skill) increases with the intensity of the skill (ability to practice or perform the skill rapidly).

It is Leslie's viewpoint that skill is best developed and practiced in intensive bursts of nervous energy of perhaps 30 to 90 seconds. Leslie and Zoubek hold to the short-period of practice and Gregg adhered to an idea that long and fatiguing periods of practice are necessary. The psychologists suggest that practice should be interrupted whenever practice seems retarded by the setting up of undesirable habits, but they do not deal with the matter in the same way as Leslie has defined.

In another principle, Leslie's observation that the area of the skill increases with the intensity of the skill was not found in the literature of the psychologists. Agreement among the inventors, however, is assumed when they do not express thoughts that reveal disagreement.

The Functionally-based Principles

Areas of agreement between the psychologists and the inventors.--There are three of these principles on which substantial agreement was found.

1. Language arts like English, shorthand, and transcribing are best developed by extensive rather than by intensive practice.

2. Skill develops most effectively under practice conditions.

3. The learning process (including practice) proceeds best when the learner has knowledge of his status and progress.

The literature supports the idea of extensive practice for learning that is to be performed under a variety of conditions; however, the precise comparisons of Leslie are not used. The same type of agreement is found relative to practice circumstances--the illustrating circumstances or terminology may differ, but the material is compatible with Leslie's statement that skill develops most effectively under practice conditions. Moreover, the literature gives special support to the idea

that the learning process proceeds best when the learner has knowledge of his status and progress through practice.

Areas of substantial disagreement between the psychologists and the inventors.--There is one of the functionally-based principles on which there is substantial disagreement. It is as follows:

> Consciousness of or conscious direction (in practice) of the mechanical details of the skill impair the skill.

Leslie's pronouncement that consciousness of or conscious direction of the mechanical details of the skill impair the skill lacks some agreement partly because more than one set of circumstances can be involved. In the formative stages, some attention may be required in ways that cause habits to change, hopefully for the better. Once a skill has been developed, constant attention during practice could conceivably cause an undesirable breaking up of some habits that comprise the skill. Leslie assumed that this breaking up always produced changes for the worse.

Areas in which the principles are not psychologically based.--One of the principles pronounced by Leslie and classified here as "functionally based" had no counterpart in the literature. It is as follows:

> Related acquired habits and information should be utilized (in practice) in order to start action as though on familiar ground.

The principle of starting action as though on familiar ground is probably generally acceptable. There was, nevertheless, nothing in the psychology literature directly related to this idea.

The Commentary Principles

Areas of agreement between the psychologists and the inventors.--One of the six commentary principles was found to have substantial agreement between the psychologists and the inventors. It is as follows:

The expert does not make (practice) rapidly the movements that the beginner makes slowly.

In both groups, examples are used to illustrate that the highly skillful action has changed not only in speed but also in the fundamental character of the movement in other respects. Both refinements of the skill and additional speed occur in practice at the same time but are not the same themselves.

Areas of substantial disagreement between the psychologists and the inventors.--Of the commentary principles, one was revealed to have marked disagreement between the inventors and the psychologists. It is as follows:

The skill learner (through practice) is training his mind rather than his hand.

The material from the inventors treating this point of theory deals with "hand" and "mind" in such a way that the definitions are not compatible with those of the psychologists. With the difference in the approaches, no real agreement could take place.

Areas in which the principles are not psychologically based.--Most of the commentary principles, four of them, have no basis in the psychology literature which was examined in this study.

1. The obvious path to skill (the obvious practice activity) is not always the correct path.

2. A teaching procedure (for a practice activity) that is helpful in one stage of learning may be useless or even harmful in another stage.

3. A proper teaching treatment of the initial diffuse movements or irradiation will greatly shorten the period of skill learning (amount of time required for practice).

4. Any desired achievement on the part of the pupil must be the result of a planned teaching procedure on the part of the

teacher (planned learning activity through practice on the part of the student).

The material in this group of Leslie's principles consists mainly of suggestions to the effect that one should take care in the selection of teaching-learning situations, including practice, because the best procedures are not always immediately recognizable. In particular, the principles emphasize that a procedure that is helpful at one time may be quite inappropriate at another time. If learning conditions are selected carefully, for example, some of the learning impediments may be mimimized as in the case of shortening the period so characterized by the initial diffuse movements that may plague beginners. At any rate, desirable learning is mainly a product of planned practice procedures rather than the product of practice conditions left to chance.

In summation, six of the nine theoretically based principles evidence significant degrees of agreement between the inventors and the psychologists. One principle is not in substantial agreement which the literature of the psychologists; and two of them are not dealt with in the psychology literature. Of the five functionally based principles, three are in accord with the psychology literature; one substantially disagrees with the psychology literature; and one is such that it is not found in the literature of the psychologists. The commentary principles show the least agreement between the inventors and the psychologists. Only one of the six principles was found to have support in the psychology literature. One principle is in substantial disagreement with the literature, and four were found to be outside the scope of the literature of the psychologists. The inventors were principally in agreement with each other although there are exception; for example, Gregg

alone leaned toward more intensive practice for mastery than either of the other two. Also, Gregg supported an idea of endurance, not recognized by either Leslie or Zoubek.

Conclusion

The evidence in this study reveals that the Gregg Shorthand inventors, in proclaiming techniques and procedures for practice in the building of skill in shorthand, have expressed certain ideas which are substantially in agreement with the principles set forth by psychologists. Significantly, however, there is disagreement between the inventors and the psychologists on a number of crucial psychological elements. This is evidenced by the instances of suggestions for shorthand practice that are neither based on nor compatible with the psychological theory. In other cases, the inventors have presented material and argued the psychology behind that material even though there is nothing in the psychological literature examined in this study which provides substantiation.

Thus, it may be concluded that authoritatively recommended practice techniques and procedures in shorthand are not either uniformly or consistently in accord with theories of learning applicable to practice as advanced by those psychologists whose literature was examined for this study.

Revealed Major Concern

Having completed this study, the writer believes that the failure of the inventors to produce a more valid and reliable treatment of the role of practice in the teaching and the learning of shorthand may be

accounted for by the fact that their viewpoints have seldom been challenged. Both the spoken and the written pronouncements of Gregg, Leslie, and Zoubek have so overshadowed the methodology for teaching Gregg shorthand that few others have made any strong attempts at the kinds of psychological analyses needed.

If very careful and competent criticism had been formulated to counteract the inventors' viewpoints, two desirable outcomes probably would have been forthcoming. First, careful criticism, based on analytical and experimental research, might have produced a valuable source of information from which shorthand teaching and learning would have been additionally improved. Second, had there been influence to more nearly rival that of the inventors, and particularly Leslie, there probably would have been accrued benefits. One of the benefits might easily have been that both Leslie and Zoubek, in recent years, would have felt the need to redefine some of their recommendations and positions and to state them in more carefully tested terms.

In view of the importance of the Gregg symbol system of shorthand and the new emphases on manual and machine alphabetic systems, it appears that there is a substantial need for more searching for sound psychology on which to base future teaching of shorthand. This is true not only in terms of the role of practice but also in terms of other important psychological aspects of learning such as capacity, retention and forgetting, motivation, and transfer. Researchers should note particularly that the recommendations of Gregg, Leslie, and Zoubek are testable in classroom situations and that further study comparing teaching procedures with psychological theory can sometimes be done in the regular classrooms of shorthand teachers.

The materials used as references for this investigation include both the cognitive and mechanistic traditions in psychology. When further study is done, it would be useful to note carefully some organized treatment of psychology which integrates the two traditions. The work of O. Hobart Mowrer, emphasizing the role of emotional involvement, is a promising field for some of this study. Also, D. O. Hebb has developed psychological theories that need to be investigated for their implications in learning shorthand. Much of the existing psychological theory is useless if Hebb is correct in his assertion that human adults learn in a different way from very young children and the usual laboratory animals.

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