# EFFECTS OF REPEATED STIMULATION ON COGNITIVE ASPECTS OF BEHAVIOR: SOME EXPERIMENTS ON THE PHENOMENON OF SEMANTIC SATIATION

by

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A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Doctor of Philosopy.

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April, 1962.

## ACKNOWLEDGMENTS

It is a pleasure and privilege to acknowledge the help of the following persons whose criticisms have contributed to the improvement of the research program reported in this thesis. Dr. Charles E. Osgood of the Institute of Communications Research and the University of Illinois has shown a keen interest in our work on semantic satiation and has offered many helpful suggestions in design and interpretation of results. The presentation of some of the experiments reported here profited from the criticisms of Dr. Arthur W. Melton of the University of Michigan who read them in his capacity as Editor of the Journal of Experimental Psychology. I owe my greatest indebtedness to Dr. Wallace E. Lambert of McGill University who has acted as my director throughout this research program and has been an active participant in it since its inception. This research was supported in part by the Defense Research Board of Canada.

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# CHAPTER I

## HISTORICAL BACKGROUND

### Introductory Remarks.

At the 1916 meeting of the American Psychological Association in New York City, Raymond Dodge delivered the presidential address entitled "The Laws of Relative Fatigue." His words set the tone for the historical background of this thesis.

> "Certainly few psychological subjects have so widely interested investigators in the allied sciences. Few seem to have at once such far reaching bearings on psychological theory and the conduct of human affairs. Few present such a bewildering literature, with such an array of apparently mutually contradictory experimental results. None is more confused with an equal pressure for practical working rules. Confusion and eagerness for practical results make a situation fraught with great peril to science. If anything could, they justify this attempt to clarify and systematize the fundamental concept of mental fatigue" (Dodge, 1917, p. 89).

For students of the present generation, Dodge's statement may seem very puzzling. What is this all-important and pervasive phenomenon which he does not even feel needs a definition? "The concept of mental fatigue is so familiar that a precise analysis of its differentia has seldom seemed necessary" (p. 93). One cannot find an explanation in modern textbooks. "Mental fatigue" does not appear in the index,

or for that matter, anywhere else in the body of the textbook. Our first reaction, then, might be to dismiss Dodge with a shrug and relegate his statement to the unfashionable world of mentalistic psychology. However, in the opinion of at least the present writer, it would be committing a grave error. It is the purpose of the present chapter to show that the topic of mental fatigue is very much alive and of interest today and has always occupied an important role in psychology, although its name has varied over the years, reflecting changes in theoretical biases from era to era.

A quotation from a recent paper by two modern neurologists helps to bridge the gap of the years:

> "If a drop of water falls on the surface of the sea just over the flower-like disc of a sea anemone, the whole animal contracts vigorously. If, then, a second drop falls within a few minutes of the first, there is less contraction, and finally, on the third or fourth drop, the response disappears altogether. Here, is clearly exhibited one of the most pervasive phenomena of the animal kingdom -- decrement of response with repeated stimulation. Almost every species studied, from amoeba to man, exhibits some form of response decrement when the stimulus is frequently repeated or constantly applied. The ubiquity of the phenomenon plus its obvious survival value suggests that this kind of plasticity must be one of the most fundamental properties of animal behavior" (Sharpless and Jasper, 1956, p. 655).

The reader can of course appreciate that Dodge's "mental fatigue" and Sharpless and Jasper's "habituation" both refer

to the same phenomenon. Throughout the rest of this chapter, it will become apparent that many other names have been used for what appears to be essentially the same process: inhibition (Herbart, 1824, in Boring, 1950), refractory phase and mental fatigue (Dodge, 1917; 1926a), lapse of meaning (Bassett and Warne, 1919), work decrement (Robinson and Bills, 1926), cortical inhibition (Pavlov, 1927), adaptation (Gibson, 1937), extinction (Hilgard and Marquis, 1940), satiation (Köhler and Wallach, 1940), reactive inhibition (Hull, 1943), stimulus satiation (Glanzer, 1953), reminiscence (Eysenck, 1956), verbal satiation (Smith and Raygor, 1956), and verbal transformation (Warren, 1961b).[1] Such an enumeration of terms, taken over a wide period of time, shows the interest which the problem of decreased responsiveness with repeated stimulation has claimed in psychology. To be sure, the variety itself of the terms used insures a high degree of disagreement and confusion on the subject. Many of the theories proposed over the years have been discarded for new ones, which in turn were replaced by others. In the present work, another term and supporting

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[1]The authors enumerated here are not necessarily the inventors of the specific terms quoted. They represent investigators or reviewers who have studied the effects of repeated stimulation and these are the specific terms they happened to favor to refer to the phenomenon.

theory will be added to the preceding ones in the belief that they are more appropriate and useful for interpreting various forms of behavior. Furthermore, the present theory will be stated in the language of contemporary learning theories, reflecting the recent revival of interest in higher mental processes (see Mowrer, 1960).

Mental Fatigue.

Early in the 19th century, Herbart attempted to formulate a "mechanics of ideas" which, according to Dodge (1926a), represented the most extensive use of the concept of "inhibition" up to his time. Herbart (1824, in Boring, 1950) tried to account for the basic fact that the span of consciousness was limited and could encompass only a few ideas at a time. He wrote involved mathematical equations to explain how ideas of various strengths could inhibit one another. Dodge (1926a; b) has reviewed the history of inhibition and attributes its scientific beginnings to the discovery in 1838 of the effect of the vagus nerve upon the heart, which demonstrated the inhibitory influence of higher nervous centers on reflex activity. His own work on the "refractory phase" and "mental fatigue" will introduce us to a phase of psychology which, so productive at the beginning, has itself become refractory, if one examines the amount of more recent research on the topic

done since in this area.

Dodge (1927) extensively investigated changes in the strength and amplitude of repeatedly elicited motor responses. He attributed decreases in motor outputs (e.g. amplitude of the knee jerk) to a "refractory phase" of the nerve and consistently found individual differences which he believed were the key to human variability. He also recognized a similar effect in mental processes. In his two "laws of mental fatigue" (Dodge, 1917) he sought to relate the amount of fatigue decrement of a response to the intensity of the stimulus. He also believed that the same phenomena operated at the level of society, reflecting itself in changes in art forms and science, in popular songs and fads, in the "wearing off" of novelty, and in social unrest and changes in government.

Other researchers at about the same time were working on similar problems. Thorndike (1927) noted that when subjects (Ss) were asked to write down a series of numbers, they usually did not use the same number twice in succession. He related this negative tendency to the refractory process. Thorndike (1917) and Poffenberger (1928) investigated the effects of continuous repetitive work upon the output and feelings of Ss, and found complex relationships which varied with the type of task involved. Telford (1931) examined the refrac-

tory phase in voluntary responses and argued that they exhibit the same three phases as the individual nerve fiber, namely absolute and relative refractory, and supernormal phases of excitability.[2] Robinson and Bills (1926) have attempted to show that homogeneous tasks (e.g. naming letters) suffer from greater work decrement with repetition than do heterogeneous tasks. Robinson (1934) also formulated other principles governing work decrement such as recency and frequency of stimulation,[3] number of competing responses to the same stimulus, and quantitative and qualitative changes in the stimulus situation.

At about this time, the implications of Lashley's work on the equipotentiality of brain tissue was beginning to be understood in psychology. Mary Robinson (1931) pointed out the inconsistency of a simple refractory phase theory of mental fatigue with Lashley's discovery that the locus of the

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[2]The absolute refractory phase refers to the short period immediately following stimulation during which it is impossible to elicit the same response. This period is followed by the relative refractory phase during which the response can be elicited only by a stronger than normal stimulus. During the supernormal phase that follows next, the response can be elicited by a weaker than normal stimulus. The latter is finally succeeded by the normal state of excitability.

[3]Note that the principles of recency and frequency of stimulation also play an important role in learning.

lesions in the brain is unimportant for the retention of habits, suggesting that stimulation must involve the activation of a whole set or pattern of firings rather than the excitation of single neurons. Her suggestion that mental activity represents the continued firings of integrated neuronal patterns antedates more recent theories of cortical activity (e.g. Hebb, 1949) and is corroborated by the modern methods of recording the electrical activity of the brain (e.g. EEG potentials as recorded with the electroencephalogram).

Cortical Satiation.

Mary Robinson's insight introduces the second aspect of the response decrement phenomenon, i.e. the cortical satiation theories. James Gibson in 1937 made a generalized statement of sensory adaptation which serves as a link between the refractory phase hypotheses as discussed above and the satiation phenomena to be discussed next. Gibson argued that if a sensory process is persistently active for some time, its quality will diminish. For example, continued inspection of a color patch results in a decrease of its apparent saturation and the color is seen as more neutral. Furthermore, "whenever experiential qualities fall into an opposition-series the adaptation with negative after-effect may be expected to occur" (Gibson, 1937, p. 225). Thus, if a S persistently fixates a curved line, its

curvature will decrease; then, if a straight line is presented in the same visual region, it appears curved the other way. This "adaptation" effect seems to be a general characteristic of all sensory processes (see Helson, 1947). While Gibson was unwilling at the time to speculate on the neurophysiological implications of his adaptation law, other researchers had no such inhibitions. Köhler and Wallach (1940) elaborated a cortical satiation theory in terms of non-neural electrical field forces which eventuated in the brain as a result of continued fixation in the visual field. Osgood and Heyer (1951) attempted to account for the same phenomenon in terms of differential distributions of neuronal excitation. Köhler and Fishback (1950a; b) showed that the well known Müller-Lyer illusion can be destroyed by the repeated presentation of the two-headed arrows. However, the compulsive illusion returns after a rest period during which satiation is presumed to dissipate. The decrement of the illusion which occurs after continued visual presentation has been shown by Rudel (1960) to transfer to the tactile modality when the appropriate methods of presentations are used. Wertheimer (1958) has presented data which suggests that satiation in figural after-effects can last for several months. Shapiro (1954) found that perception of apparent motion can be hindered by continued stimulation in the visual field.

In the article mentioned at the beginning of the chapter, the neurologists Sharpless and Jasper (1956) show that the arousal reaction of a sleeping cat to a specific tone can be eliminated when the tone is presented a number of times. "Habituation" to the stimulus is indicated by the fact that, after a few presentations, the tone no longer elicits a characteristic EEG potential in the sleeping cat. The habituation is specific since a tone of different frequency still elicits an arousal reaction.

The work of Karsten (1928) and Kounin (1941) introduce an important elaboration of the notion of response decrement, that is, its relation to personality variables. Anitra Karsten (1928) had her Ss repeatedly perform various tasks such as drawing, writing letters of the alphabet, reading, and turning a wheel. She noted, as one might expect under such conditions, a decrease in the quality of work and an increase in the number of errors made. But she also observed a "disintegration and loss of meaning of the tasks," and an increase in the attractiveness of different activities, as well as frequent emotional outbursts and expressions of dislike of the ongoing activity. She attributes these reactions to satiation of the ongoing activity, as distinguished from purely muscular fatigue. If the meaning of the same activity is changed through verbal

instruction, the effects of satiation immediately disappear and the S continues the task without requiring a rest. Kounin (1941) investigated the effects of chronological age and intelligence upon "cosatiation," i.e. the transfer of the satiation effect of one repeatedly performed task upon another similar task. As Deutsch (1954) puts it, continued performance on a task leads to a lowering of "tension" in the psychological "system" corresponding to that task; with increasing repetition the tension in the active system reaches a lower level than that in surrounding systems which prompts the person to turn to other activities. With time, systems which are interdependent (e.g. those underlying similar tasks) also reach a lower level of tension so that the person looks for even more novel tasks. The degree of differentiation and rigidity of tension systems is said to be related in specified ways to chronological and mental age.[4]

Various investigators have made an attempt to relate still other measures of satiation to personality variables. A review of their work leads to a discussion of the third interpretation of effects of repeated stimulation.

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[4]Shallenberger and Zigler (1961) have recently presented a contrasting view of these and similar findings which views the S's type of social motivation in the task (negative or positive) as the determining factor in cosatiation.

Eysenck (1955; 1956) has formulated a theory of personality drawn from Pavlov's notions of cortical inhibition and "types" of excitability, a matter which we will consider shortly. Eysenck's thesis is that learning and personality variables are determined by an "inhibition/excitation balance" which is said to be a unique characteristic of each person's central nervous system. He has attempted to show that various measures of satiation (e.g. reminiscence in pursuit rotor tasks, visual and kinaesthetic after-effects) are related to each other and to scores on personality inventories of "extraversion" and "introversion." Lipman and Spitz (1959) have tried with only limited success to demonstrate similar relationships. They have also found significant differences between normals and "mental retardates" on extent of satiation in kinaesthetic figural after-effects (Spitz and Lipman, 1961). It should be mentioned that several investigators (e.g. Rechtschaffen, 1958; Becker, 1960) have failed to replicate some of these relationships and do not believe that the hypotheses advanced by Eysenck are tenable. Others have advanced different but related theories, such as Wertheimer's (Wertheimer and Wertheimer, 1954) "cortical modifiability" hypothesis. Duncan (1956) has also noted the similarity between satiation and inhibition measures and believes they are different aspects

of the same phenomenon. In contrast to these conceptualizations, Glanzer's (1953) "stimulus satiation" construct refers exclusively to a sensory adaptation process and is explicitly dissociated from other inhibition processes such as response-produced reactive inhibition normally associated with reminiscence.

Inhibition and Extinction.

The effects of repeated stimulation become of interest to the more contemporary behavior theories. The most explicit and formal statement of what happens when a response is repeatedly made can be attributed to Clark Hull (1943). His Postulate 8 can be paraphrased as follows:

> Whenever a reaction is evoked in the organism there ensues a primary negative drive (D); (i) this has an innate capacity ($I_R$) to inhibit the reaction potential ($S_ER$) to that response; (ii) the amount of net inhibition ($I_R$) which is generated is a simple linear increasing function of the number of evocations (n); and, (iii) it is a positively accelerated function of the work (W) involved in the execution of the response; (iv) reactive inhibition ($I_R$) spontaneously dissipates as a simple negative function of time (t).

The reader will recall that Robinson (1934) in his principles governing work decrement had already referred to some of the same relations, and before him Dodge (1917) had also pointed out the relation of stimulus intensity to degree of refractory phase. And we have seen how several other authors have dealt with similar relationships. Hull's concept of reactive inhi-

bition is important because many of the current theories about language and concept formation use a Hullian framework as their basic learning paradigm. These newer formulations deal more explicitly and extensively with thinking and the nature of language while still retaining Hull's theoretical constructs.

Hull's thinking, in turn, is based on Ivan Pavlov's (1927) research and theory of the conditioned response. Pavlov described all learning, human and animal, in terms of two fundamental properties of the nervous system. The first of these relates to the increase in the probability of a response (conditioning), while the second is concerned with the decreased probability of responding (inhibition). It is with the latter aspect of learning that we are primarily concerned. According to Hilgard and Marquis (1940) inhibition can be defined as "the reduction in strength of response resulting from positive stimulation of some sort" (p. 104). Inhibition is thus logically allied with refractory phase and satiation. The phrase "experimental extinction" was used by Pavlov to refer to an experimental procedure whereby a conditioned response (CR) decreases in amplitude and frequency of occurrence as a result of repeated nonreinforced repetition. His explanation of extinction was in terms of an "internal inhibition" or an adaptation of neural processes and their spread in the brain. Pavlov's

physiological hypotheses of irradiation of inhibitory and excitatory "waves" in the brain reminds one of Köhler and Wallach's (1940) electrical field theories mentioned earlier, even though in detail, the two theories have little in common. Pavlov's distinction between excitable and inhibitory types of organisms, those that are easily conditionable and those that are resistant to conditioning, has been amplified by Eysenck (1955; 1956), as mentioned previously.[5]

Rather than elaborate these theories (in this connection see Hilgard and Marquis, 1940; Razran, 1939; and Wenger, 1937, for examples), the point of importance to be made here is that these various conceptualizations are logically related and contribute to a general theoretical scheme which influences most contemporary behavior theories. Razran in 1939 has criticized the various theories on the nature of the extinctive process and has reviewed in detail the available data pertaining to extinction. Today, the debate is still very much alive. For example, the relation between extinction in human subjects and the following variables are being studied: psychoticism

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[5]For the sake of completion we might mention here the Freudian concept of "repression" which has sometimes been considered a mechanism of inhibition. However, this psychoanalytic view of inhibition relates to a motivational aspect of response competition or elimination rather than response decrement through repetition, and is therefore less relevant.

(Vernables and Tizard, 1956), amount of training (Capaldi, 1958; Senko, Champ, and Capaldi, 1961) and overlearning (Murillo and Capaldi, 1961), type of interpolated activity (Liberman, 1944), degree of reinforcement (Lewis and Duncan, 1956), as well as motivational effects (Horwitz, Exline, Goldman and Lee, 1953).

Concluding Remarks.

Some of the evidence and relevant theoretical considerations concerning the effects of repeated presentation of stimuli and repeated elicitation of responses have been outlined. It was argued that, whether referred to as satiation, inhibition, or extinction, essentially the same phenomenon was being considered: a reduction in the likelihood of responding as a result of repeated stimulation of the organism. Since efficient learning, in most cases, requires practice and repeated responding, it may appear that the concomitant inhibitory process is an undesirable adjunct. After a more careful consideration of the facts, however, one can comprehend the homeostatic functions served by inhibition. This is obvious in purely motor responses where continued and unrestricted output would soon lead to irreversible tissue damage were it not for the warning signs of physiological fatigue. But this must also be true, although perhaps less obviously so, for mental activity which reflects

the neurophysiological output of brain cells. Glickman (1961) has recently reaffirmed a long standing belief that memory is a physiological entity in the form of mnemonic traces, and the experiments of Penfield and Roberts (1960) on cortical stimulation of the conscious and fully awakened patient leaves them in no doubt as to the recording of experiences in brain cells. Neal Miller (1959) and Mowrer (1960) have recently affirmed that the basic stimulus-response laws already demonstrated with more directly observable behavior must also apply to thinking processes, while Osgood's (1953) two-stage mediation theory implicitly makes the same assumption. Dodge has also held this position even though he did not have the benefit of modern evidence. He was aware of the possible survival value of mental fatigue:

> "I suppose all the phenomena of restlessness and the corresponding attractiveness of change finally reduce to competition and the relative refractory phase. They operate in work and play, in social and economic activities, in politics and religion. Without their interference in our lives, unwelcome as it often is, we must have continued indefinitely in the direction of our first activity, with the consequent loss of that vital equilibrium on which the organism as a unit of different parts depends for its continued existence. Without their interference the initial process must always work itself out to the final collapse of complete exhaustion" (Dodge, 1917, p. 112).

But in addition to this interference role, response decrement following repetition may also play an important positive role

in learning. Walker (1958) has argued that action decrement, by preventing further responding, permits memory traces to be consolidated and in this sense it helps rather than hinders response acquisition. In fact, he has argued that the greater the decrement after responding the greater also is the learning that takes place. In the chapters that follow, we shall be concerned primarily with the effects of repeated stimulation upon thinking as indexed by various measures such as the efficient use of language symbols and words, verbal learning, concept formation, and mass communication. Our plan will be to present first a contemporary behavioral model for language behavior and thinking. This model will serve as a reference for the various experiments to be reported. It will also help to integrate the evidence and point up its significance for the behavior of the organism as a whole.

# CHAPTER II

## THE PHENOMENON OF SEMANTIC SATIATION

### Verbal Satiation.

In 1907 there appeared a technical report from Titchener's laboratory on a phenomenon which, it will be seen at once, is related to our descriptions of the effects of repeated stimulation, but which actually antedates Dodge's work on refractory phase and mental fatigue. Here is how the authors introduced their findings:

> "The phenomenon is one that is familiar to most people, but has never, so far as we are aware, been made the subject of experimental study. If a printed word is looked at steadily for some little time, it will be found to take on a curiously strange and foreign aspect. This loss of familiarity in its appearance sometimes makes it look like a word in another language, sometimes proceeds further until the word is a mere collection of letters, and occasionally reaches the extreme where the letters themselves look like meaningless marks on the paper. In the present study we have attempted to observe this process in detail and under experimental control" (Severance and Washburn, 1907, p. 182).

These authors refer to these changes as the "loss of associative power in words after long fixation." Later researchers have also referred to the same process as a "lapse of meaning" and labeled it "verbal satiation."

From the present point of view it is argued that the phenomenon of verbal satiation is of major importance inasmuch as

human thinking and communication are mediated by verbal symbols.[6] In fact, the various evidence to be presented will be concerned with how the reduction in the meaningfulness of symbols through their repeated presentation affects thinking. It will therefore be profitable to briefly review the earlier studies on verbal satiation.

Two other studies carried out in Titchener's laboratory on the phenomenon of "lapse of meaning with repetition" have been reported (Bassett and Warne, 1919; Don and Weld, 1924). The interpretation of the phenomenon in all cases was in terms of Titchener's (1915) "context" theory of meaning which contends that the meaning of a word which is normally attached to the sound of a word is "detached" through repetition. It is interesting to note that Gibson, whom we have mentioned earlier in connection with "adaptation," also interpreted verbal satiation in similar terms (Gibson, 1950). In the original experiment by Severance and Washburn (1907) where the phenomenon was first reported, as well as in the study by Don and Weld (1924), reference was made to the similarity between verbal satiation and the method of "auto-hypnosis" whereby a "narrowing of the field of consciousness" is brought

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[6]Many psychologists have argued that speech is a crucial controlling factor in all psychological processes in a human being. One recent example is to be found in the book by G. A. Miller, E. Gallanter, and K. H. Pribram (1960).

about by concentration of attention upon a single visual point. Recently Wertheimer (1960) and his associates have corroborated and extended the early findings of the Titchener group on verbal satiation. They have investigated the relation between the rate of lapse of meaning of a word and its length (Wertheimer and Gillis, 1958), its "emotionality" (Wertheimer, Burns and Gillis, 1957), and the "fittingness" of its sound (Wertheimer, 1958). Mason (1941) has reported a change in GSR at the precise moment at which the meaning of a word lapses. Smith and Raygor (1956) and Wertheimer and Crow (1959) have found correlations between individual differences of the extent to which they exhibit the verbal satiation effect and other personality variables -- in the former case a factor of "permeability" as measured by a questionnaire-type personality inventory, in the latter case, a factor of "modifiability" as indexed by variability in tests of figural after-effects. Warren (1961a; b) has recently described a most interesting phenomenon which seems to be an auditory analogue of the visual reversible figure. It is obtained when a S listens to the repeated presentation of a word or short phrase produced by a closed loop of tape and played on a tape recorder. The "verbal transformation effect," as Warren calls it, is exhibited by systematic changes in the

words that the S hears. Warren (1961a) found differences between young adults and the aged in the rate and pattern of these illusory changes.

A few investigators have studied the disruptive effect of repetition in verbal learning. Peak and Deese (1937) and Gaynor (1954) have shown that repeated presentation of the stimulus member of a previously learned paired-associate list of nonsense syllables results in less efficient recall of the response members as compared to stimuli which were presented less often. Kanungo, Lambert, and Mauer (1960) have demonstrated a similar effect with repetition of the response members of meaningful paired words.[7]

Among the large number of studies in the literature on various aspects of verbal behavior only a handful are concerned with verbal satiation. It is our belief that this paucity of research on such a commonly known phenomenon[8] is

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[7]These results seem to contradict the well established principle of learning that performance increases with number of trials -- the excitation/inhibition paradox we have discussed in the preceding chapter. As will be pointed out in a later chapter, the findings of verbal satiation effects in learning require an extension of the frequency law in conditioning, perhaps in the form of a modification of the well-known learning curve into an inverted U distribution.

[8]The continuous repetition of words with the intent of noting the resulting changes in their sound and meaning is still today a popular children's game.

due not to the lack of interest of students of verbal behavior but rather to the lack of an objective instrument for the measurement of changes in the meaning of symbols. When introspection was still a respectable method of investigation in psychology, it might have been acceptable to make "the lapse of meaning of a word" the object of a scientific investigation. But following Titchener's era in American psychology such an undertaking was sure to be frowned upon by the psychological community.[9] What was needed was an objective and reliable tool to measure changes in the meaning of words. Recently, Osgood and his associates (Osgood, Suci, and Tannenbaum, 1957) have developed an instrument called the "semantic differential" which seems to meet the above need.

The Semantic Differential.

For the past three or four years this instrument has come to be known and widely used for the measurement of the meaning of stimuli, and has proven to be a useful and versatile tool for psychologists, as dozens of experiments appearing in the literature have demonstrated. As often happens with metho-

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[9] In the more recent studies on verbal satiation mentioned earlier, attempts were made to measure the effect objectively, e.g. a push of a lever at the time meaning lapses, measures of commonality of associative responses after repetition, efficiency in verbal learning, etc. However, no direct measure of degree of meaning change was available.

dological advances, the principle involved is remarkably simple. The semantic differential consists of a set of pairs of adjectival antonyms separated by seven points or degrees of appropriateness on which the S is required to rate words, concepts, phrases, objects, or in fact, any item the experimenter wants to have evaluated. The choice of the bipolar scales is determined by their appropriateness to the particular stimuli under study. An example of a typical form of the semantic differential is given in Table 1. The seven points on each scale are defined as "extremely," "very," and "slightly," on either side of the pole, with the middle position as "neutral, irrelevant, or meaningless." Each scale can be quantified by assigning a number 1 to 7 to its respective positions, or what amounts to the same thing, the numbers +3 to -3, with 0 as the middle position.[10] In this manner a person's "meaning" of a symbol or object can be indexed by his mean profile score on a set of scales appropriately chosen in accordance with the principles laid down in the book "The Measurement of Meaning" by Osgood, Suci, and Tannenbaum (1957). The great usefulness of the semantic differential is perhaps due to the fact that a substantial amount of the variance of connotative meaning can be

[10]Jenkins and Russell (1956) have shown that the degree of polarity or extremity of ratings from 0 to 3 on the semantic differential is correlated substantially (r = .71) with meaningfulness as defined by Noble's (1952) associative index, m.

TABLE 1

ILLUSTRATION OF A SEMANTIC PROFILE

| Father | | | | | | | |
|---|---|---|---|---|---|---|---|
| Good | X | Y | | | | | Bad |
| Awful | | | | | Y | X | Nice |
| Strong | | X | | Y | | | Weak |
| Soft | | | | Y | X | | Hard |
| Passive | | | | | | Y | X Active |
| Fast | | X | Y | | | | Slow |
| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |

Note.--S rates the concept "father" by indicating on each scale the position considered most appropriate. The polarity score in the present example is 13 for the X ratings and 6 for the Y ratings. The polarity-difference score for this example using one concept and 6 scales is -7, indicating that the second ratings (Ys) moved 7 scale units closer to the zero point.

accounted for by only three independent factors, identified as evaluation (good-bad), potency (strong-weak), and activity (active-passive). Osgood (1961) has presented convincing evidence that this simplicity of structure is a universal characteristic of human thinking and is exhibited by all of the cultural groups and languages so far studied.[11]

An examination of the scales in Table 1 reveals that we are dealing here with the connotative meaning of stimuli as opposed to the denotative meaning of words as presented in a dictionary. This is not necessarily a handicap, for as will be pointed out, the connotative meaning of symbols plays a major role in mediating most psychological processes. Nevertheless, it will be useful, and less confusing, to keep in mind that we are using the word "meaning" in this special sense.

The Phenomenon of Semantic Satiation.

If a S is requested to indicate the placement of a word on a semantic dimension immediately after continuously repeating that word, his ratings should fall at the middle (zero) point of the dimension if a total lapse of meaning has occurred. The semantic differential permits one to assess such decreases

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[11] It should be mentioned that at least one critic (Carroll, 1959) has contended the opposite of what is asserted here, and has argued that the small number of components limits the usefulness and validity of the semantic differential.

of meaning, not only total lapses but also smaller modifications in meaning profiles. Thus, if under normal conditions S considers the word "father" and assigns to it position +3 on an evaluative dimension ("extremely good") and then, after continuous repetition of the word "father" assigns it to position +1 ("slightly good"), we will infer, when consideration is given to various controls, that the connotative meaning of the concept "father" has decreased (in this case, about two-thirds) on this dimension (see Table 1).

Three groups of college students were tested individually under several different conditions. As each S (with the exception of those in the retest control group, see below) came to the experimental room, he was asked to fill out a booklet in which he rated five words (child, me, rich, truth, family), each on nine semantic scales (three scales for each of the three most prominent factors determined by Osgood, et. al., 1957). Then, each S, depending on the condition to which he was assigned, followed a procedure outlined below. Each of the five words and each scale was printed on a separate 5 x 3-in. card. The cards were placed in a Kardex folder so that the experimenter (E) could expose them in a predetermined order.

The following four conditions were used:

Experimental Satiation. For each of the 22 Ss in this

group, a word was first exposed for about 1 sec. and S was asked to say the word aloud for 15 sec. at a rate of 2 to 3 repetitions per second. Then E immediately exposed a scale and S made his rating by pointing to one of the positions on the 7-point dimension. This was done for all words on all scales, a total of 45 responses per S. The order of presentation maximized the separation of the reoccurrence of each word and each scale. The initial and final ratings were subsequently compared.

Silence Control. The same procedure was used with 19 other Ss with the exception of one change: the Ss did not repeat aloud the words during the 15-sec. interval which elapsed between the time of exposure of the word and the semantic rating. They were initially instructed to "sit and wait" until a dimension was presented. No reference to "thinking about" the word was made in the instructions.

Different-word Control. The same 19 Ss participating in the previous phase also took part in this second control condition. Four additional words (war, death, teacher, athlete) were added to the booklet which was filled out at the beginning of the experimental session. Using the same general procedure, the Ss repeated aloud a particular word during the time interval, but were then presented with a different word to rate.

For example, the word "key" was exposed (the words used for repetition in this case were: key, moon, shoe, and book) and S repeated it aloud for 15 sec.; then the word "war" was exposed, read out loud by S who immediately gave a semantic rating on "war." This control condition was introduced to determine what effect the act of repeating words aloud had upon the stability of the ratings. Whereas the previous condition is an "unfilled-interval" control, the present condition is a "filled-interval" control.

Retest Control. The 22 Ss in this group did not fill out a booklet at the start of the experiment. In this case, ratings were taken immediately after the exposure of the words, with no repetition or interval interposed. Furthermore, after the first 45 ratings were obtained, the same complete series was repeated, and the ratings for the two series were compared.

Results. Mean polarity-difference scores were computed for each S. These represent the changes in degree of polarization (see Table 1) from the first testing under normal conditions and the second testing under experimental or control conditions. The changes are presented as average changes per word summed over all scales (in this case, nine). Thus, one S with a mean polarity-difference of -3.6 had a total polarity score for the first testing of 102 (based on 45 ratings,

5 words on 9 scales) compared to 84 for the second testing under the satiation condition. The difference between these two totals, or 18, is 3.6 scale unit changes per word. A minus sign indicates a change from a higher to a lower score, i.e. a decrease in the intensity of association between the word and the bipolar adjective. Values of zero would indicate no change and positive scores would indicate an increase in intensity of connotative meaning.

Table 2 shows that the decrease in the intensity of meaning occurring under the experimental satiation condition was significantly greater than zero. Tests of significance between the experimental and control conditions on meaning change are presented in Table 3. The differences between the experimental and each of the three control conditions are significant, while none of the differences among the control conditions reaches significance. We conclude therefore, that the decrease of meaning (verbal satiation) obtained with the experimental treatment is attributable to the continuous repetition of the word just before semantic ratings were made, and not to either of three other possible features of the experiment, namely, the unreliability of the measuring instrument, the 15-sec. interval period, or the interpolated task of repetition, per se.

Discussion. It is not clear from the above results

TABLE 2

AVERAGE CHANGE IN POLARITY PER WORD
OVER THE SUM OF 9 SCALES

| Condition | Change in Polarity | | | |
|---|---|---|---|---|
| | N | Mean | SD | t |
| Satiation | 22 | -2.85 | 2.93 | 4.45* |
| Silence control | 19 | 0.03 | 1.41 | 0.09 |
| Diff.-word control | 19 | -0.66 | 1.91 | 1.46 |
| Retest control | 22 | -0.21 | 0.73 | 1.31 |

*Significantly different from zero beyond the .01 level.

TABLE 3

H TESTS OF SIGNIFICANCE BETWEEN CONDITIONS

| Condition | Silence Control | Diff.-Word Control | Retest Control |
|---|---|---|---|
| Satiation | 12.83 | 6.56 | 11.10 |
| Silence control | - | 0.92 | 0.69 |
| Diff.-word control | - | - | 0.03 |

Note.--If H 6.63, P .01; if H 3.84, P .05.

whether the satiation effect is restricted solely to the words which are repeated or if the effect is generalized, affecting the intensity of meaning of both the words and the bipolar adjectives, as well as the task of making a judgment. The finding of a decrease in intensity of meaning across the standard semantic scales is not inconsistent with the notion of a generalized satiation effect; if the bipolar adjectives were also satiated, they would have contributed to the decrease in the degree of association between the repeated words and the adjectival end points of the semantic scales. If it could be shown, however, that Ss were also able to perceive increases in intensity of meaning on certain scales at the time of rating, we could argue that the inhibition effect is primarily restricted to the words which are repeated. As a test, we presented another group of Ss (23 male and female public school teachers enrolled in a summer school) with two additional scales: "meaningful-meaningless" and "comprehensible-incomprehensible" and all words were rated on these scales as on the standard scales. These two scales should elicit a movement of ratings towards the "meaningless" and "incomprehensible" poles following the satiation treatment. Scores were assigned to Ss for the amount of movement of ratings, comparing the first testing under normal conditions with the experimental and different-

word control conditions during second testing, toward or away from the "meaningless" and "incomprehensible" poles. It was found that there was an average movement in the predicted direction of 1.43 scale units for the group under the satiation condition, a change which is reliably different from zero ($t = 3.25$, $P < .02$). No reliable change was noted for the control condition ($t = 0.02$).

These results also argue against a "regression" interpretation of semantic satiation according to which the decrease in meaning after repetition is due to the tendency of Ss' ratings to revert to the middle position of the scales. The fact that, with appropriate scales, an increase in the intensity of ratings is obtained, is difficult to reconcile with the regression interpretation. Another argument against such an interpretation is the fact that where regression is usually obtained, e.g. in perception, the tendency is to perceive that which has been seen most often in the past. The most frequent percept usually happens to be an object which has perceptual characteristics that are in between those seen at the time and those perceived in the past, hence one speaks of regression as a "tendency to move towards the middle." However, in the present case, the most frequent rating of a meaningful word is definitely not the middle position of the semantic differential. Hence, a tend-

ency towards the neutral point in semantic satiation cannot be looked upon as a "regression" phenomenon.

One might also question whether Ss "caught on" to the fact that repetition of a word renders it less meaningful, and consciously "played along" with E by making neutral judgments. There are several arguments against such an interpretation. Firstly, in the discussion which followed the experiment, Ss were asked whether they thought that they had changed their judgments as the experiment went on and whether repetition influenced their ratings. The typical answers were "maybe" or "slightly," but the reason given for the change was "...because I forgot which judgment I had made previously." Only one S stated that repetition rendered the word more "meaningless." Secondly, had Ss wanted to please E by making neutral judgments, it is difficult to understand why they did not go all the way and give neutral ratings in all cases. Thirdly, when Ss were retested for a third time, in another experiment to be presented in Chapter IV, only those words used under the experimental condition repeatedly exhibited the satiation effect. Since the ratings were made on experimental and control words in a mixed order, it is improbable that Ss could remember which were the satiation words and which were not. In fact, only three Ss could recall the words used for each condition when questioned after the experiment.

Summary.

The phenomenon of verbal satiation, the decrease in the meaning of symbols, was studied by having college students continuously repeat a word before rating it along scales of the semantic differential. Changes in semantic ratings, comparing normal and satiation conditions, indicate that there is a reliable movement of ratings towards the meaningless points of scales. Control group comparisons suggest that this movement is not due to the unreliability of the measuring instrument, to the time interval involved in repetition, nor to the activity of repetition, per se.

There are several advantages in measuring the effects of verbal repetition in the present manner. In the first place, as has been pointed out, one obtains a direct and objective measure of meaning change. In the second place, the degree of meaning change is quantified, and can vary from large negative scores (i.e. a great deal of satiation) to scores of zero (i.e. repetition has no effect) to positive scores (i.e. a generation of meaning). Quantification permits the study of individual differences in addition to the determination of the effects of independent variables. Studies will be described later in which we view "semantic satiability" as a personality trait exhibiting itself in tests of conceptual

rigidity, in the degree of transfer of satiation, and in the ability to learn languages. The fact that mere repetition results in increases of meaning ("semantic generation") for certain people only, also has implications for the study of personality. These problems could be discussed after consideration is given to the basic theoretical model underlying the concept of satiation.

# CHAPTER III

## SOME THEORETICAL CONSIDERATIONS

### The Psychological Meaning of Meaning.

Reviews of the problem of "meaning" have been presented elsewhere by other writers.[12] My purpose is to specify the sense in which "meaning" is used in the present theoretical framework.

If in the course of reading we encounter a new and unknown word, we ordinarily consult a dictionary for a standard definition. This usage of the term "meaning" is easily understood. However, from the psychological point of view this use of meaning poses difficulties. An important component of the properties of symbols is the attitude or feeling which an individual has towards the thing signified. The dictionary approach neglects this fact. For example, two individuals can agree perfectly that John Smith is a male representative of homo sapiens with such and such physical characteristics, and yet they may disagree completely on whether John is good, likable, sympathetic, active, etc. Furthermore, it is pre-

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[12] See Ogden and Richards (1923) and Morris (1946). For a more recent treatment of the subject see Osgood, Suci, and Tannenbaum, 1957, which represents the point of view adopted by the present writer.

cisely these individual differences in feeling-tone that determine to a great extent how others behave toward John Smith. The same relation can be shown to hold for the connotative meaning of words. Thus, the explanation for the differential behavior of the boy who proudly exhibits his newest pet and his elder sister who shrieks in horror at the sight of her brother's grass snake, is not to be found in the dictionary meaning of the word "snake" on which both of them may agree. The explanation of differences in response lies in the connotative meaning or feeling-tone which they have acquired from differential experiences. For one, "snake" means something interesting, personal, affectionate, small, etc., while for the other, it is something bad, unpleasant, frightful, disgusting, etc. In the same way, disagreements among individuals on the meaning of such words as "God," "freedom," "radical," "money," "mother-in-law," etc. cannot be resolved by consulting a dictionary. The psychological explanation of the differential behavior which such signs mediate lies in differences in "meaning" of another type.

The particular learning experiences which antedate such differences in meaning is in its own right an important problem in psychology. The fact that such learning can be duplicated in the laboratory under precise experimental conditions

has been demonstrated (see, for example, Staats, 1961). We will present a mediation theory of symbolic processes which views meaning as a pattern of learned (implicit) responses to conditioned stimuli, encompassing both linguistic and non-linguistic stimuli. The advantage of such an approach is that it treats the meaning of words in the same manner as responses to any other stimuli, and thus our present knowledge of learning phenomena can be brought to bear upon all aspects of language behavior.

Osgood's Mediation Theory of Meaning.

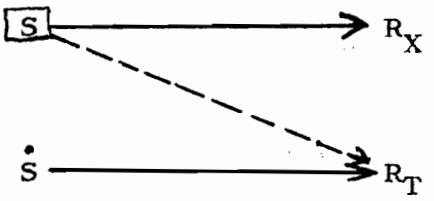
We can formulate the problem of meaning from the psychological point of view within the general framework of perception and learning. The question which arises has two parts: (a) under what conditions does an initially novel stimulus, such as the word "apple," come to elicit responses in the organism which are appropriate to the significate or actual object APPLE? and, (b) under what conditions does a verbal response such as the saying or writing of "apple" come to be emitted by an individual under certain conditions? The first part of the question relates to the problem of language decoding in particular and perceptual learning in general, while the second part poses the problem of language

encoding and has to do with instrumental conditioning.

Pavlov's classical conditioning experiment illustrates how a particular sign such as the sound of a bell acquires "food significance" for the dog when it is repeatedly paired with the presentation of food to the animal. At first, the sound of the bell elicits a pattern of particular responses, such as pricking up the ears, turning the head, etc. which are not relevant to eating behavior. When conditioning is complete, the same sound now elicits behavior which is clearly appropriate to eating, e.g. the dog salivates, swallows, etc., in addition to the previous responses of turning the head, pricking up the ears, etc., which may continue to occur. Acquisition of the meaning of visual stimuli and spoken words on the part of the young infant can be viewed to proceed along similar lines. Thus, in the beginning, the baby salivates and emits sucking responses only at the touch of the nipple or some other object applied to its mouth. Later, the sight of the bottle alone elicits responses of a similar nature. Eventually, the words "yum-yum," "bottle," "food," etc. pronounced by the mother under appropriate conditions also come to elicit responses appropriate to the

the significates (BOTTLE, FOOD, etc.). At first only the names of concrete objects can be acquired, things that can be pointed at or stimuli that can be directly perceived. Once a set of such meaningful signs are within the verbal repertoire of the organism, higher order conditioning can proceed in the sense that these signs themselves are now used to condition new signs whose significates are not present. For example, a child can learn the meaning of "zebra" as an animal that looks like a horse, but is smaller, is wild, has black stripes, etc. (the meanings of which have been developed before), and recognizes the animal without difficulty on his next visit to the zoo. It will be realized that most of our symbols are of this "assign" nature, i.e. "their meaning is literally 'assigned' to them via associations, not with the object represented, but with other signs" (Osgood, 1953, p. 698). Without the possibility of assigning meanings to new symbols we could not learn the significance of abstract signs such as "country," "time," etc., or those that refer to non-existent or mythical things such as "ghosts," "unicorn," "gnome," etc.

We can describe the standard conditioning paradigm in the acquisition of a conditioned response as follows:

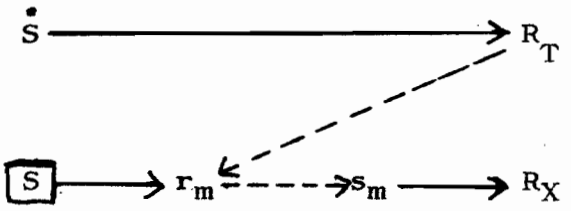



This diagram illustrates that a conditioned stimulus ( S or the sound of a bell) which initially elicits a particular response ($R_X$ or pricking up the ears), comes to elicit another response ($R_T$ or salivating) when it is repeatedly paired with a particular unconditioned stimulus ($\dot{S}$ or food powder in the mouth) that reliably elicits this response ($R_T$).

Certain serious problems arise when we attempt to apply the above conditioning paradigm to the acquisition of the meaning of symbols by humans. In the first place, the response which a meaningful sign elicits is not identical with that emitted in the presence of the significate. Thus when the reader encounters the word "Fire!" in a text he does not jump up and run out of the house as he would had he seen a real FIRE. This criticism shows the inade-

quacy of a simple substitution theory of meaning such as that of Watson. In the second place, we can listen to someone telling a story without any overt behavior on our part, which shows that the decoding process does not involve the emission of all the unconditioned responses to the things signified in the story. There is further overwhelming evidence, such as that stemming from studies of semantic and mediated generalization (see, for example, Foley and Cofer, 1943, and Riess, 1946), which require us to use a more complex or two-stage learning model in describing language behavior. This evidence has been reviewed elsewhere by Osgood (1953; 1957a, b) and will not be presented here.

A two-stage model of language behavior requires only a slight but important modification of the single-stage model. And, as will be seen, it greatly increases the theory's capacity to explain complex phenomena. The following diagram illustrates the development of the "sign process" or meaning in two stages:




An initial meaningless sign, S, such as the word "apple" is paired with the significate or object APPLE ($\dot{S}$) which elicits a complex set of unlearned responses ($R_T$) such as salivating, chewing, grasping, etc. Through the principle of contiguity, such repeated pairings result in the conditioning of a fractional and recurring part ($r_m$) of the total response to the sign. This fractional response elicits, like any other response, its own characteristic stimulus through feedback ($s_m$); this stimulus can in turn be associated with or conditioned to an instrumental response ($R_X$) such as pronouncing the word "apple," rating it on a semantic scale, writing it down, etc. Two important points should be noted here. First, the meaning of a sign, i.e. the fractional response it elicits ($r_m$), is part of, but not identical with, the original reaction to the significate. In other words, it is "representational"

of the total response. Since the unconditioned reaction to the significate varies from time to time (e.g. an APPLE is sometimes eaten, sometimes held in the hand, sometimes thrown as a ball, sometimes red and large, sometimes green and small, cooked and raw, etc.), the meaning of the sign "apple" will be a composite of all these experiences, and will vary to a certain extent from individual to individual. Given the physiological similarity of humans and the stable conditions of a particular cultural group, one would expect that certain words which refer to sensory qualities of objects would have common meanings for most individuals (e.g. "sweet," "good," "strong," "fast," etc.). On the other hand, the meaning of most other words which are less dependent upon physiological characteristics of the organism will probably vary with the idiosyncratic experiences and psychological makeup of the individual (e.g. "father," "me," "justice," "liberty," etc.). The second point to be noted is that the self-stimulation ($s_m$) from feedback of the fractional representational response ($r_m$) can be connected through reinforcement to a large variety of instrumental responses ($R_X$). Instrumental responses may take the form of verbal pronun-

ciation of a word in imitation of other members of the language group, or the emission of another verbal response (e.g. "yes" or "no" in answer to a question), or they may be non-verbal responses such as shaking hands, slapping someon's face, smiling, etc. Which of these responses will be emitted by any individual in a particular situation will depend on the specific learning and reinforcing experiences he has had in the past. In the present theoretical framework, the overt response ($R_X$) is taken as an indirect measure of the inferred implicit fractional representational response ($r_m$) or meaning.

One can now note the similarity between Osgood's "representational mediation process" ($r_m$) as described above and Hebb's (1949) concept of the "cell assembly." Both constructs are set up through learning principles and both are viewed as the basis of thinking in man. For Hebb, thinking is identified with the activation of sequences of neurological networks of cells in the brain. For Osgood, thinking involves the use of symbols which derive their meaning from the particular representational mediation

responses they elicit.[13] In thinking, the two-stage paradigm presented above is said to be short-circuited since no overt response ($R_X$) is usually emitted. Often in children this short-circuiting process is not yet very efficient as suggested by the fact that they often talk aloud to themselves. The present approach offers a theoretical plan that aids one to investigate thinking, problem solving, concept formation, and other higher mental processes from the point of view of the use of symbols and their interaction with each other, as well as from the point of view of the environmental factors (either internal (emotional) or external) which affect them.

It will be remembered that we have formulated the psychological problem of meaning in terms of two stages, a decoding and an encoding stage. Referring to the diagram on p. 44, decoding is represented by the $S \longrightarrow r_m$ relation, while encoding is described as $s_m \longrightarrow R_X$. In other words, decoding of a sign involves the elicitation of a conditioned fractional representational response ($r_m$) which is some part of the total unlearned reaction to the significate ($R_T$), while encoding involves the selective evocation of acquired overt

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[13] While Hebb's construct of the cell assembly is clearly central, the $r_m \dashrightarrow s_m$ can theoretically be either central or peripheral, or both, although the central interpretation seems at present the more probable. Evidence on this point will be presented in Chapter IV.

instrumental acts ($R_X$). The problem in the measurement of meaning is to obtain an indirect index of the implicit fractional representational responses ($r_m$) through the analysis of the overt responses ($R_X$) made to symbols. In Osgood's theoretical schema, the semantic differential is presumed to serve as an indirect measure of implicit representational meaning responses ($r_m - - - \rightarrow s_m$). The Ss' ratings ($R_X$) on each bipolar scale are said to reflect the strength and direction of the inferred fractional response which is identified with the meaning of a word. The rationale for this assertion and the evidence for the validity of the semantic differential are to be found in the work of Osgood and his associates (Osgood, 1957a; b; 1961; Osgood, Suci, and Tannenbaum, 1957).

It should be kept in mind that the present theoretical framework is hypothetical, its purpose being to help generate testable propositions at the overt behavioral level. The following excerpts from a recent paper by Cronbach and Meehl (1955) will help to clarify the status of the constructs used in the theory.

> "We shall refer to the interlocking system of laws which constitute a theory as a nomological network... To validate a claim that a test measures a construct, a nomological set surrounding the concept must exist. When a concept is fairly new, there may be few specifiable associations by which to pin down the concept. As research proceeds, the construct sends out

> roots in many directions, which attach it to more and more facts or other constructs...Unless substantially the same nomological net is accepted by the several users of the construct, public validation is impossible...Hence, the investigator who proposes to establish a test as a measure of a construct must specify his network or theory sufficiently clearly that others can accept or reject it... Construct validation takes place when an investigator believes that his instrument reflects a particular construct, to which are attached certain meanings. The proposed interpretation generates specific testable hypotheses, which are a means of confirming or disconfirming the claim...If prediction and result are in harmony, he can retain his belief that the test measures the construct. The construct is at best adopted, never demonstrated to be 'correct' (pp. 290-294).

In the following chapters we will present tests of predictions and hypotheses formulated on the basis of the nomological network surrounding the acquisition and extinction of the representational mediation response ($r_m$), or meaning. The tests we will use represent indirect measures of the operation of the hypothetical construct, $r_m$, in higher mental processes. As we proceed in our investigation and more facts become available, we will attempt to gradually extend the theoretical network around our main construct.

Changes in the Intensity of Meanings.

The experimental evidence reviewed in Chapter I documented the fact that repeated stimulation of the organism results in decreased susceptibility to responding, and in Chapter II we have shown that verbal repetition of a familiar

word results in a decrease of its meaning as measured by the semantic differential. We can now examine the problem of decreased responsiveness with repetition when meaning is viewed as an acquired representational response.

Similar to all conditioning processes, the acquisition of the meaning of a sign requires the repeated pairing of the conditioned stimulus (CS or the word) with the unconditioned stimulus (US or the significate). The first point to be noted is that the successive pairings of US and CS should be distributed over time, since massed repetitions would result in the suppression of the unconditioned response (UR), and consequently learning will be comparatively less efficient. In the second place, once learning has reached a certain point where presumably a particular sign elicits a characteristic meaning response, massed presentation of the sign will result in the inhibition of its meaning response, and the sign will consequently lose its meaning. The results of the study of semantic satiation support the predictions and the theoretical notions about the meaning response. It is not clear, however, whether this decreased responsiveness is momentary or permanent to the extent that one might have to relearn the meaning of the sign. This question calls for an inquiry into the nature of extinction and forgetting.

Semantic satiation will be considered as a cognitive form of the more general phenomenon of extinction.

Psychologists hold various views about the causes of the forgetting of a response. Most agree, however, that forgetting cannot be adequately explained as a reduction of response strength through time. There is evidence to show that interfering responses and unreinforced or unrewarded elicitations of the conditioned response (CR) play important roles. Rather than discuss this interesting problem in detail, a brief enumeration will be given of some of the conclusions reached by Hilgard and Marquis (1940) in their classic review of the literature. The reader will note the reappearance of the terms "inhibition" and "extinction" in this context.

Inhibition was previously defined as the reduction in response strength resulting from some sort of positive stimulation. A distinction can be made between "intrinsic inhibition" or "adaptation" defined as the reduction in the likelihood of responding as a result of continued elicitation of the response itself, and "extrinsic inhibition" or interference, a reduction attributable to the simultaneous elicitation of another, incompatible response. From available information, inhibition exhibits the following characteristics:

(a) it is cumulative, in the sense that the more repetitions of the response, the greater will be the decrement of responding; (b) the greater the rate of repetition, the greater the decrement; (c) there is recovery of the initial decrement after rest; (d) inhibition generalizes to other, similar responses (secondary extinction); and (e) the stimulus to an adapted response is itself inhibitory and can be used to inhibit another response (conditioned inhibition). The term "experimental extinction" was used by Pavlov to refer to an experimental procedure in which the CR decreases as a result of repeated nonreinforced repetition. It may involve either or both adaptation (internal inhibition) and interference (external inhibition). In summary, then, the reduction or elimination of a learned response may be brought about by one or more of the following: experimental extinction, adaptation or internal inhibition (called reactive inhibition by Hull), and interference or external inhibition (which has also been called forgetting or retroactive inhibition).[14] A response which is eliminated by interference or counter conditioning

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[14]There are a few other procedures which may or may not be included under these three processes, depending on one's theoretical inclinations. For example, counter conditioning, attempted elicitation during the refractory period, reduction of the intensity of the CS, administration of a depressant drug, etc.

(i.e. the conditioning of a new, incompatible response) does not recover as long as the interfering response subsists. On the other hand, both adaptation and experimental extinction are followed by "spontaneous recovery" of the response with the passage of time and rest.[15]

It will be recalled that our interpretation of meaning and the role of symbolic processes in thinking was in terms of representational mediation reactions that are presumed to follow the same principles as those of overt responses. Accordingly, information about the data on extinction processes is quite relevant and important. Through the study of overt responses, we have available a set of principles or laws which, according to our assumptions, ought also to apply to the inferred processes that are believed to go on during thinking. Thus, semantic satiation can be conceptualized as a cognitive form of inhibition. During continuous verbal repetition, the mediating reactions identified with a word's meaning are presumably repeatedly and rapidly elicited. Under such conditions we would expect that reactive inhibition or

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[15]The explanation for recovery in the two cases is different. With adaptation, we speak of "dissipation" of satiation or reactive inhibition; in the case of experimental extinction, spontaneous recovery is related in some way to the increased effectiveness of the S-R bond, but the theoretical explanation here has not been worked out in any detail.

adaptation would be generated, thereby decreasing the availability of mediators. To the extent that ratings on semantic scales accurately reflect the strength and type of meaning reactions elicited by a sign, the development of cognitive inhibition during verbal repetition should be exhibited as a decrease in the polarity of ratings on the semantic differential. Our results on the phenomenon of semantic satiation have borne out this prediction.[16] In the chapters that follow further experimental evidence will be presented supporting the notion that semantic satiation behaves like other extinction processes.

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[16]The inhibition which is developed, as a result of verbal repetition, in the motor speech areas of lips, tongue, larynx, etc. is also relevant to the general problem of repeated stimulation, but has not been investigated by the present writer.

# CHAPTER IV

## SEMANTIC SATIATION IN THINKING

### The Problem.

Whether thinking is a peripheral or central process no longer arouses the same interest it did during the behavioristic era in psychology. This change is due in part to the recognition that such "either-or" questions are usually impossible to resolve, and in part, to the influence of neurophysiological theories which argue that a central theory of thought processes can be as "behavioristic" as a peripheral one. We have noted that Osgood believes that the mediation process is the meaning of a symbol. He leaves the question open as to the possible locus (loci) of mediational responses. They may be peripheral ("muscular or glandular reactions": Osgood, 1953, p. 696) or central ("purely neural responses": Osgood, Suci, and Tannenbaum, 1957, p. 7). In this study, we presume that the mediation process that transmits significance to a symbol is inhibited by the continual verbal repetition of that symbol. The fact that the satiation effect was noted only for those experimental Ss who continuously repeated a symbol aloud before it was rated (see the experiment in Chapter II) suggests that the mediation process

may in large part be dependent on muscular reactions. In order to test the comparative importance of peripheral and central components of mediation processes, one might compare the behavior of the experimental Ss referred to above with another group of Ss who would be directed to "think about the word presented" but not to repeat it aloud. Should such a group display the semantic satiation effect, however, one could still argue that they actually had said the words subvocally and no conclusive evidence would be given either the central or peripheral possibilities.

We attempted to circumvent this ambiguity by using another procedure which indirectly tests the comparative influence of peripheral responses and a central cognitive process on semantic satiation. We assume that saying aloud a meaningful word involves both muscular-glandular activity as well as some more central cognitive response as the meaningful nature of the symbol is registered. On the other hand, saying aloud a meaningless word with low association value involves peripheral muscular responses accompanied by diversified cognitive activity, such as searching for possible significance in the word or for associations with the sound or form of the word, etc. In the case of the meaningful word, there is a relation between the peripheral and central activities

which is mediated by the meaning of the symbol. We argue that the cognitive activity is only distantly or not identifiably related to the peripheral in the case of the saying aloud of a meaningless word. The muscular reactions brought into play in the continual repetition of the words "canoe" and "nuka" (with the accent on the first syllable) are identical. (This assertion is supported by the fact that a listener cannot determine whether S is repeating "canoe" or "nuka" once the sequence of repetition is underway. The fact that the original peripheral feedback of the sequence "nu-ka-nu-ka" is different from that of the sequence "ca-noe-ca-noe" does not invalidate the present argument since the rest of the two sequences are essentially identical, and hence both should have the same effect on the peripheral responses.) The representational mediating processes which are elicited in the two situations, however, must be quite different since only one is a meaningful English word. The peripheral theory maintains that motor responses are both necessary and sufficient for thinking. Thus, the continuous repetition of "nuka" and "canoe," involving practically identical muscular reactions, should have a similar satiation effect on the meaning of the word "canoe." For Osgood, whether the mediators are peripheral or central, they are not of the same form as the overt verbal response, since

their character depends entirely upon the total reactions made to the thing signified and not the mediated verbalization. Since thinking of "canoe-canoe" and of "nuka-nuka" hypothetically involves different mediation processes, repetition of "nuka" should not lead to satiation of "canoe."

Procedure. Twenty-three Ss (male and female public school teachers enrolled in a summer school) were tested under three different conditions. These are described below.

Satiation. The procedure was identical with that used in the experimental satiation condition in the experiment described in Chapter II, except that the words and scales have been changed. The purpose of this condition was to attempt to reproduce the results obtained previously as well as to serve as a comparison condition to the other two conditions described next.

Peripheral Control. The "centrality" hypothesis was tested by requiring Ss to repeat the words "grony" (accent on second syllable) and "nuka" before semantic ratings of the words "negro" and "canoe," respectively. The procedure was thus identical with the Different-word Control in the previous experiment. At the end of the experiment each S was asked whether he had "caught on" to the fact that "grony" and "nuka" were actually "negro" and "canoe" repeated backwards.

Nonsense Control. The effect of the repetition of a nonsense word on semantic ratings was determined by having Ss repeat "troga" and "blatu" before ratings of "house" and "soldier."

There were six words used in all (two words for each condition) and eight scales, six of these representing the three standard factors, and two scales representing a "familiarity" factor (meaningful-meaningless; comprehensible-incomprehensible). The ratings given for the last factor were separately analyzed and were discussed in conjunction with the previous experiment (see Chapter II).

Each S took part in three testings, all given in one sitting. The first was an assessment of S's meaning of the words under normal conditions. The words and scales were individually exposed in the Kardex folder and responses were recorded by E (no booklets were used in this experiment). The second testing consisted of the three conditions described above, and was administered immediately after the first. The third testing, identical with the first, was given after a rest period of 5 min. to determine whether the satiation effect dissipates with time.

Results. The polarity-difference scores in Table 4 are averages for the group and represent mean changes of polarity per word on all six scales (absolute values cannot be compared

TABLE 4

AVERAGE CHANGE IN POLARITY PER WORD
OVER THE SUM OF 6 SCALES
(N = 23)

| Condition | Experimental | | | Dissipation | | |
|---|---|---|---|---|---|---|
| | Mean | SD | t | Mean | SD | t |
| Satiation | -1.95 | 2.06 | 4.43* | -1.76 | 2.11 | 3.91* |
| Peripheral control | 0.19 | 1.37 | 0.65 | -0.02 | 1.17 | 0.08 |
| Nonsense control | -0.06 | 1.22 | 0.23 | 0.45 | 2.05 | 1.02 |

* Significantly different from zero at the .01 level.

with those in Table 2 since a different number of scales was used in the two experiments). Entries under the Experimental column are differences in polarity scores between the first and second testings, whereas entries under the Dissipation column are differences in polarity scores between first and third testings. It can be seen that significant changes in meaning took place under the Satiation condition only. One might still argue that the initial polarities of words in the Peripheral control and Nonsense control conditions were already low and could not decrease further. To test this possibility, we calculated the mean initial polarity per word over the sum of six scales, as measured during the first testing, for all three conditions. These were: 8.89 for the Satiation condition, 8.76 for the Peripheral control, and 9.17 for the Nonsense control. None of these means was significantly different from any other when a signed rank test was applied. It is evident, then, that differences in initial polarity of the ratings cannot account for the obtained results.

Table 5 shows that there is no significant difference between the Experimental and Dissipation scores under the Satiation condition, suggesting that the loss of meaning as a result of repetition persisted after a 5-min. rest (the mean dissipation score for the group obtained by subtracting the

TABLE 5

H TESTS OF SIGNIFICANCE BETWEEN CONDITIONS

| Condition | Satiation, Exp. | Peripheral Control, Exp. | Nonsense Control, Dissip. |
|---|---|---|---|
| Satiation, Exp. | - | 13.78 | - |
| Satiation, Dissip. | 0.21 | - | 10.14 |
| Peripheral control, Dissip. | - | 0.71 | 0.75 |
| Nonsense control, Exp. | 11.96 | 0.81 | 1.35 |

Note.--If $H \geqslant 6.63$, $P < .01$; if $H < 3.84$, $P > .05$.

Experimental from the Dissipation scores is 0.19 ($t = 0.35$). The other differences in Table 5 are in harmony with a centrality hypothesis of meaning.

All but one of the 23 Ss reported that they became aware of the fact that "grony" and "nuka" were actually "negro" and "canoe" repeated backwards. It appears from Ss' reports that repetition of "grony," even though it involves the same muscular reactions, was not the same task as repetition of "negro." As one S put it, "When I was repeating 'grony' I was trying not to think of 'negro.' But when I was repeating 'father' I kept on thinking of 'father'." Translating this into our terminology, we can say that, given instructions to repeat "grony," the mediating processes identified with "negro" were not consistently and reliably elicited. In view of these findings, we contend that in order to satiate the meaning of a symbol through continuous repetition one must consistently call into play some particular cognitive activity which is related to the symbol.

Discussion. Since present physiological techniques do not permit one to measure directly the cellular activity of the brain, it is technically impossible to "prove" the central theory of thought. Hence, as was pointed out by Osgood in his evaluation of central and peripheral theories of thinking

(1953, p. 654), the only way of possibly resolving the controversy is to present evidence which would render the peripheral theory (the only one testable by our present means) untenable. We view the present findings as supporting evidence for a central interpretation of representational mediation processes.

The results also indicate that the effects of the semantic satiation treatment do not dissipate completely within the 5-min. rest interval tested. Although the satiation score during the third testing was less than that immediately after repetition (-1.76 vs. -1.95), the difference is not significant, indicating that spontaneous recovery is not complete.

Summary.

An experiment was described which sheds light on the nature of the meaning response, presenting evidence that it depends more on central than peripheral-muscular activities. In order to satiate the meaning of a symbol through continuous repetition, some particular cognitive activity which is related to the symbol must consistently be called into play. Evidence was also presented which shows that semantic satiation persists for at least several minutes.

# CHAPTER V

## SEMANTIC SATIATION IN PROBLEM SOLVING

### Concept Formation Task.

A concept has been defined as "a common response (usually verbal) made to a class of phenomena the members of which display certain common characteristics" (Osgood, 1953, p. 666). Several investigators have demonstrated that verbal mediating responses play an important role in concept formation (e.g. Fenn and Goss, 1957; Kendler and D'Amato, 1955; Underwood and Richardson, 1956a), and recently, Goss (1961) has attempted a theoretical integration of these facts along Hullian lines. Previous studies have been concerned with the transfer of a verbal response acquired prior to the concept formation task so that its solution is facilitated. Thus in one experiment (Mednick and Freeman, 1960), Ss were given a paired-associate list whose response members were Kent-Rosanoff stimulus words for the concept to be developed later in the experiment. Underwood and Richardson (1956a) have shown that ease of concept attainment depends on the associative strength existing between the verbal mediating response representing the concept or class and the stimulus members of that class. These studies indicate that the availability of the appropriate mediating

response is a determining factor in the probability of occurrence of the solution. The purpose of the present study is to investigate whether the reduction in the availability of particular verbal responses would affect difficulty of a concept formation task.

Method. Suppose, for example, that a S is given 12 cards on which the following words are printed: playing, sitting, climb, remain, travel, running, walking, stroll, lie, rest, standing, sleeping. The S is told to classify the 12 cards into two piles of six cards each. College students, confronted with the above task, typically categorize them as follows: playing, running, walking, climb, travel, stroll, as one group, and sitting, standing, sleeping, remain, lie, rest, as the other. Upon questioning, it becomes evident that these Ss have utilized the concept of "motion" to categorize some words and the concept of "inactivity" to categorize the others. Children, on the other hand, when confronted with the same task and instructions, tend to make up the following two groups: playing, sitting, running, walking, standing, sleeping, in one pile, with climb, remain, travel, stroll, lie, rest, in the second. Upon questioning, it is clear that they have made a generalization on the basis of the physical attributes of the words such as sound ("Some rhyme together, others don't").

It might be convenient to refer to the latter as a "phonetographic" classification based on generalization along physical dimensions of the stimuli, and the former as a "semantic" classification based on generalization along semantic dimensions of the stimuli.[17] Only a few of the Ss, when confronted with the above task do not use one or the other of the two types of classifications mentioned above. The basis of classification in such cases is usually a highly idiosyncratic one. For example, Ss might make the separation in terms of agreeableness-disagreeableness of words, short vs. long words, etc. We shall refer to these as "idiosyncratic" classifications.

It was hypothesized that semantic satiation of the verbal response which defines the concept would reduce its availability as a mediating response in the categorization task. Hence, a decrease in the number of semantic classifications available to Ss should become apparent. At the same time it was expected that satiation of the verbal concept would decrease the likelihood of Ss perceiving semantic relations between the stimulus words, thereby increasing the probability of phonetographic solutions to the problem since such solutions are particularly dependent upon purely physical characteristics of words. The

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[17] Razran (1949) has previously used these terms.

rationale of idiosyncratic solutions is not clear and no specific predictions could be made as to the effect of satiation on their likelihood of occurrence.

Materials. Seven sets of 12 words were prepared in such a way that each set could be classified into two subsets on either a semantic or a phonetographic basis. These are presented in Table 6. The words were not selected in any systematic fashion. An attempt was made, however, to vary the difficulty of the classification task by changing the degree with which the words in any one subset tend to go together. For example, both subsets in task 1 (see Table 6) are made up of synonyms, whereas in task 7, the words in only one subset tend to go together. It should also be noted that the degree of constraint toward a semantic versus a phonetographic classification also varies with each task. Thus in task 1 there is a high constraint toward a semantic solution since there are two sets of synonyms that do not rhyme and all words are of two syllables. In tasks 3, 5, and 7 there is a high degree of phonetographic constraint since the words in both subsets within each task rhyme with each other. In task 7, rhyme, number of syllables, and low dominance level (see Underwood and Richardson, 1956b), all tend to increase the phonetographic constraint.

TABLE 6

WORDS USED IN THE CONCEPT FORMATION TASKS AND IN THE SEMANTIC SATIATION TREATMENT

| Task | Words | Inferred Mediation Response | Satiated Words* | |
|---|---|---|---|---|
| | | | Exper. | Cont. |
| 1.a. | Fearless, Valiant, Gallant, Dauntless, Unawed, Daring, | bold | (bold): fearless | (book): fearless |
| b. | Horrid, Dreadful, Shocking, Gruesome, Awful, Ghastly. | | | |
| 2.a. | Chicken, Zebra, Lion, Dog, Cat, Pig, | animal | (animal): dog | (practice): dog |
| b. | Door, Roof, Wall, Garden, Cupboard, Window. | | | |
| 3.a. | Irritating, Annoying, Aggravating, Troublesome, Tiresome, Irksome, | anger | (anger): annoying | (country): annoying |
| b. | Twosome, Threesome, Foursome, Adding, Subtracting, Dividing. | | | |
| 4.a. | Rearrange, Reconstruct, Reorganize To build, To order, To pile, | to change | (to change): rearrange | (pencil): rearrange |
| b. | To come, To go, To jump, Reascend, Return, Recross. | | | |
| 5.a. | Catastrophy, Leprosy, Robbery Suffer, Murder, Disaster, | bad | (bad): disaster | (statue): disaster |
| b. | Jester, Porter, Clever, Chivalry, Machinery, Symphony | | | |
| 6.a. | Climb, Travel, Stroll, Playing, Running, Walking, | motion | (motion): running | (sky): running |
| b. | Standing, Sleeping, Sitting, Lie, Remain, Rest. | | | |
| 7.a. | Reflection, Dispersion, Refraction, Beam, Gleam, Stream, | ray | (ray): refraction | (city): reflection |
| b. | Steam, Scheme, Seem, Permission, Discursion, Attention | | | |

*The word given in parenthesis is first repeated, then, the rating is given to the second word only.

Procedure. The general procedure consisted of administering the semantic satiation treatment individually to each S, then, to present him with the seven classification tasks, one by one, in the order given in Table 6. It was evident from the literature on concept formation that the specific words used, the order of presentation of tasks, and the specific instructions given would all influence Ss' behavior. It was decided, therefore, to use two groups of Ss drawn from the same population, and to treat them in an identical manner in every respect except for the particular words which were to be repeated by the Ss during the semantic satiation treatment. The procedure described in Chapter II for the different-word control condition was also used here. Briefly, S repeats a word shown to him on an index card for a period of 15 sec. Immediately after, he is shown a second word, and is required to rate the second word only on a semantic differential scale. As can be seen in Table 6, the experimental and control groups differed with respect to the semantic relation between the word repeated and the word rated. In the experimental group, the word repeated (satiated) was identical to one of the inferred verbal mediating responses required for a semantic classification of the concept formation tasks given after the satiation treatment. For the control group, the satiated word was irrelevant to the

concept formation task. The rated or second word was the same for both groups and consisted of one of the stimulus words in the task. Specifically, it was argued that if the concept "motion" was made unavailable through semantic satiation, the S should subsequently make a phonetographic classification in task 6. Furthermore, satiation of "motion" should generalize to the semantically related word "running," whereas repetition of "sky" should not generalize to "running" (see Table 6). Hence, it was also expected that the experimental group would exhibit a satiation effect on the semantic differential ratings as well as on the concept formation task.

Seven words (corresponding to the seven tasks) were rated on four scales (pleasant-unpleasant; nice-awful; strong-weak; fast-slow), the 28 responses being given in the same random order for all Ss in the two groups. The fact that there were unequal time intervals between the satiation treatment and the presentation of the various concept formation tasks was not thought to be crucial in view of the fact that the semantic satiation effect has been shown to last for at least several minutes (see Chapter IV).

Subjects. The Ss were 32 public school teachers enrolled in a summer course who volunteered to participate in the experiment. They were assigned to either the experimental or

control groups on an "every-other-one" basis as they arrived at the laboratory.

Instructions. The following instructions were read to each S after the completion of the semantic satiation treatment:

"I am going to give you a series of 12 cards. There is a word written on each card. For each series, you are required to make up two piles, placing six cards in each pile. Read all 12 words before starting to make up the two piles. There may be several ways of making up the two piles, but some ways are better than others. You choose the way you think best. Work as rapidly as you can. You will be timed to see how fast you can do it. You are not allowed to ask any questions once we have started."

E thoroughly shuffled each set of cards (5 x 3 in., white) before giving it to S. Latency measures were taken by means of a stop watch in order to obtain additional data on the classification responses.

Results. The main results can be found in Table 7 which presents the distribution of classifications per type for the seven tasks, as well as the latency scores in seconds. Looking first at the overall scores, it is apparent that the frequency distribution of the three types of classifications

TABLE 7

DISTRIBUTION OF CLASSIFICATIONS PER TYPE (S = SEMANTIC, P = PHONETOGRAPHIC, I = IDIOSYNCRATIC) AND LATENCIES IN SECONDS FOR THE SEVEN TASKS FOR BOTH GROUPS

| Group | Type | Task | | | | | | | Total | Mean Lat. | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | |
| | S | 15 | 16 | 13 | 3 | 9 | 7 | 3 | 66 | 32.95 | |
| Exper. | P | 0 | 0 | 3 | 12 | 6 | 8 | 10 | 39 | 34.15 | 0.77[1] |
| | I | 1 | 0 | 0 | 1 | 1 | 1 | 3 | 7 | 49.43 | |
| | Lat. | 41.50 | 28.37 | 27.50 | 30.44 | 38.56 | 30.12 | 44.31 | 112 | 34.40[3] | 9.52[2] |
| | S | 12 | 15 | 14 | 2 | 10 | 4 | 2 | 59 | 37.07 | |
| Cont. | P | 0 | 0 | 0 | 8 | 4 | 8 | 8 | 28 | 32.78 | 3.83[1] |
| | I | 4 | 1 | 2 | 6 | 2 | 4 | 6 | 25 | 55.04 | |
| | Lat. | 57.12 | 27.44 | 31.87 | 37.81 | 40.06 | 37.37 | 48.37 | 112 | 40.01[3] | 3.07[2] |

[1]Overall F indicating effect of type of classification upon latency within each group. $P < .01$ for Cont., n.s. for Exper.

[2]Overall F indicating effect of particular task upon latency within each group. $P < .01$ for both groups.

[3]The difference between these two means is not significant ($t = 1.28$).

is different for the two groups. A three by two analysis of the total number of classifications yields a highly significant chi square value of 12.32 ($P < .01$). This finding indicates that the experimental treatment influenced the subsequent concept formation tasks. On the other hand, individual *t* tests between the two groups ($N = 16$) yield insignificant values for the semantic classification ($t = 0.96$) and the phonetographic classification ($t = 1.23$), but a significant difference for the idiosyncratic classifications ($t = 2.63$; $P < .02$, two-tailed test). However, in view of the nature and distribution of scores in the present analysis, it is possible that the *t* test may not be an adequate measure of difference. It would be appropriate in the present instance to ask whether the proportion of phonetographic classifications in the experimental group is greater than in the control group. Table 8 gives the answer to this question. It can be seen that the experimental *S*s gave a significantly larger proportion of phonetographic classifications (39/112 or about 35% versus the control group's 28/112 or 25%), as indicated by a one-tailed test of proportions (Ferguson, 1959). The comparable analysis for the semantic classifications yields an insignificant difference. For the idiosyncratic responses the difference is again highly significant, with the experimental

TABLE 8

2X2 TABLES SHOWING DISTRIBUTION OF PHONETOGRAPHIC (P), SEMANTIC (S) AND IDIOSYNCRATIC (I) CLASSIFICATIONS FOR THE EXPERIMENTAL (E) AND CONTROL (C) GROUPS

| | P | Other | S | Other | I | Other | Total |
|---|---|---|---|---|---|---|---|
| E | 39 | 73 | 66 | 46 | 7 | 105 | 112 |
| C | 28 | 84 | 59 | 53 | 25 | 87 | 112 |
| | $z = 1.67$; $P < .05$ | | $z = 0.30$; n.s. | | $z = 5.37$; $P < .001$ | | |

Note.--z refers to the normal deviate for tests of significance between uncorrelated proportions, one-tailed (Ferguson, 1960).

group giving a smaller proportion of them than the control.

One can also determine whether more Ss in the experimental group show a preponderance (i.e. four or more on the seven tasks) of phonetographic solutions as compared to Ss in the control group. Table 9 shows that a significantly greater proportion of experimental Ss gave phonetographic responses as indicated by a one-tailed test.

The findings indicate that (a) the experimental satiation treatment influenced the overall distribution of classifications in the concept formation tasks. (b) The satiation treatment reduced the number of idiosyncratic solutions and increased the proportion of phonetographic classifications. Contrary to prediction, the number or proportion of semantic classifications was not affected to a significant extent. (c) A greater proportion of experimental than control Ss gave a preponderance of phonetographic responses over the seven tasks.

With respect to the latency data presented in Table 7, the following can be noted: (d) There is a highly significant overall task effect for both groups indicating that the various tasks were of unequal difficulty. (e) There is a significant type of classification effect for the control group but not for the experimental. Individual comparisons of the mean latencies for the control group indicate that the mean for the

TABLE 9

NUMBER OF Ss IN THE EXPERIMENTAL (E) AND CONTROL (C) GROUPS SHOWING A PREPONDERANCE OF PHONETOGRAPHIC VERSUS OTHER (SEMANTIC OR IDIOSYNCRATIC) CLASSIFICATIONS

| | P | Other | Total |
|---|---|---|---|
| E | 6 | 10 | 16 |
| C | 1 | 15 | 16 |
| | $z = 2.09$; $P < .02$ | | |

idiosyncratic classifications is significantly larger than that for either semantic ($t = 4.15$; $P < .001$) or phonetographic classifications ($t = 4.44$; $P < .001$), but the difference between these last two is not significant ($t = 1.03$).

The overall difference in latency between the two groups for all seven tasks (irrespective of type of response) is not significant.

Finally, Table 10 presents the data obtained on the semantic satiation treatment. The overall satiation score for the seven words does not depart significantly from zero for either group, and the means for the two groups are not significantly different from each other. Thus, the prediction that the satiation effect would generalize from one word to another related word in the experimental group was not supported by the data. Separate analyses of variance yield a significant word effect for the experimental group but not for the control, suggesting that the generalization of the effect of repetition of one word upon another related word depends on the specific semantic relation between the two words. This finding is in agreement with other findings on semantic generalization (see Osgood, 1953) as well as the results reported by Underwood and Richardson (1956a) that ease of verbal concept learning depends on the dominance level or strength of the associative relation

TABLE 10

SATIATION SCORES PER WORD OVER THE SUM OF 4 SCALES FOR THE TWO GROUPS

| Group | Words | | | | | | | Mean | $F^2$ | P |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | |
| Exper. | 0.00 | -1.06 | 0.19 | 0.94 | 0.81 | 0.75 | -0.31 | 0.18[1] | 2.82 | .05 |
| Cont. | 0.44 | 0.62 | 0.00 | 0.06 | -0.38 | 0.06 | 0.06 | 0.12[1] | 0.39 | n.s. |

1. These two means are not significantly different from zero: $t_E = 0.74$; $t_C = 0.35$. Also, they are not significantly different from each other ($t = 0.14$).

2. Separate analyses of variance for word effect.

between the concept and its class items (cf. also Staats, 1961). These results point to the desirability of a systematic procedure for the selection of words in the investigation of generalization of the semantic satiation phenomenon.

Since the two groups in the present experiment did not differ with respect to the overall generalization of the satiation effect, we must attribute their differential behavior in the concept formation tasks to the different concepts which each group repeated during the satiation treatment. And since the satiation effect on these words was not directly measured, the reduced availability of the verbal mediating response hypothesized for the experimental Ss remains at the inferred level.[18]

Problem Solving.

The solution of arithmetic computational problems involves the use of mathematical symbols just as speaking involves the use of language symbols. We shall assume that certain mediation processes constitute the meaning of mathematical symbols and that these processes are called into play when the symbols are perceived. Repeated consideration of a mathematical sym-

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[18]An experiment is now being planned which is designed to investigate more precisely the specific points of difficulty raised in the above discussion.

bol prior to a computation task which involves that same symbol should inhibit the mediation processes identified with it and lead either to inability on the part of the S to solve the mathematical problem or to a loss in efficiency in its solution.

The present experiment has been designed to test the validity of the above prediction. The mathematical problems used were simple addition tasks and the semantic satiation effect was measured as an increase in latency of response of the addition task. Osgood et. al. (1957) established that intensities of semantic ratings are negatively related to latencies of semantic judgments. In the present case, we assume that the increased latencies for solutions result largely from decreases in the symbols' meanings. This decrease in the meanings of symbols would be manifested in behavior as a difficulty in utilizing their full significance for solutions, in the sense that they have become less meaningful.

In order to measure the satiation effect upon a S's latency of response, the same addition tasks were presented under two conditions. One was an experimental condition in which S repeated a number aloud for 15 sec. prior to an addition task in which that number entered as one of the two additives. The other or control condition was exactly the same

except that the number which was repeated aloud was different from the two numbers in the addition task. The two conditions can be schematized as follows:

Experimental: (7) 7 + 4 = ?

Control: (2) 7 + 4 = ?

where the number in parenthesis is repeated for 15 sec. immediately preceding the presentation of the addition task.

In comparing latencies under the two conditions, the crucial difference would be the interval between the presentation of the last number ("4" in the above example) and the end of the correct response ("11"). The difference between the experimental and control latencies is referred to later as the "Satiation Score"; it is this score which constitutes the measure of the semantic satiation effect. It was predicted that the increase in the difficulty of the task, resulting from the decrease in the meaningfulness of the mathematical symbol, should be reflected in an increase in latency of solution.

Material. Seventy-two slides (excluding those used in practice trials) were prepared and arranged in 24 series of three numbers each, representing 12 pairs of control and experimental responses. The 24 series were systematically mixed in such a manner that half of the experimental series came before their control counterparts, while half came after.

These were, in order of presentation, as follows:

(1) 7 + 7; (8) 8 + 8; (1) 9 + 4; (7) 7 + 5; (2) 8 + 6;
(9) 9 + 9; (2) 7 + 4; (8) 8 + 4; (9) 9 + 5; (1) 7 + 6;
(8) 8 + 5; (3) 9 + 6; (7) 7 + 7; (9) 9 + 4; (2) 8 + 8;
(3) 7 + 5; (3) 9 + 9; (8) 8 + 6; (7) 7 + 4; (2) 9 + 5;
(3) 8 + 4; (7) 7 + 6; (1) 8 + 5; (9) 9 + 6.

It will be noted that there are about equal intervals between experimental and control counterparts no matter which of the conditions came first. This counterbalancing procedure was necessary in view of the fact that a marked improvement effect with practice was observed in a pilot study.

Apparatus. The 24 series of three numbers were presented visually to S. These were projected on a ground-glass screen by means of a Kodak automatic slide projector. Ten electric keys were connected in series to an Esterline-Angus Operation Recorder (Model AW). The keys, numbered 0 to 9, were $\frac{1}{2}$ in. wide and arranged in a straight line separated from each other by $1\frac{1}{2}$ in. spaces. They were placed on the table in front of the screen where the seated S could easily reach them. The slide projector and the operation recorder, located out of S's view behind the ground-glass screen, were connected to a time circuit in such a manner that each change of slide was recorded on the chart. The time circuit was made to change a consecutive

series of three slides as follows: first number (15 sec.); second number ($\frac{1}{2}$ sec.); third number ($\frac{1}{2}$ sec.); blank -- rest period (15 sec.). The S was instructed to "look at and repeat aloud" the first number of each series for as long as the number remained exposed on the screen, then, to make his response as soon as possible after the third number by pressing down the two keys corresponding to the answer. Thus, for the series (2), 7, 4, S would press the key numbered "1" twice. The index finger of the preferred hand was used for all responses. The time interval between the exposure of the third number and the pressing of the second key was taken as the latency measure.

Since the projector was automatic, all E had to do was to change the trays containing the slides. As there were three trays, the experiment was stopped twice, and the time required to change trays and allow cooling of the projector lamp (about 2 min.) was considered as a rest period.

Subjects. The Ss formed a heterogeneous group of 33 people composed of high school students and adults. They were told that the purpose of the experiment was to determine their speed of adding small numbers. The importance of speed was emphasized three times, when giving initial instructions and again when changing the trays of the projector.

Scoring. Each S's record chart was analyzed by means of a ruler which was calibrated to units of .08 sec. Thus, the average error of precision attributable to the measuring instrument was .02 sec. The error attributable to observation, i.e. scoring reliability, was checked by having a second judge (who was unaware of the purpose of the experiment) analyze a random sample of 100 responses, and the product-moment correlation coefficient between the two judges was found to be +.95.

Results. The 12 pairs of experimental and control latencies yielded 12 difference (satiation) scores for each S. Since control latencies were subtracted from the corresponding experimental ones, a positive difference score indicates a larger latency for the experimental responses. For each S an average as well as a median difference score was computed, and the means for both these scores are presented in Table 11. It can be seen that the mean increase in latency of response of the experimental versus the control series is 0.063 sec., which is significant beyond the .02 level of confidence. This change in response latency represents an increase of a little over 3%. It should be made clear that this result is not invalidated by the fact that the mean increase is smaller than the unit of measurement for individual scores. By averaging over several observations one reduces the error in measurement considerably

TABLE 11

AVERAGE AND MEDIAN SATIATION SCORES FOR THE GROUP
($N$ = 33)

| Latency Measure | Control Series | | Satiation Score | | |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | t |
| Average | 1.970 | 0.324 | 0.063 | 0.135 | 2.63* |
| Median | 1.921 | 0.324 | 0.084 | 0.117 | 4.04** |

* Significant beyond the .02 level, two-tailed test.

** Significant beyond the .001 level, two-tailed test.

over what it is on a single observation. Hence the possibility of obtaining a significant mean increase of less than .08 sec. is not surprising. The mean change indexed by the alternate or median measure is 0.084 sec., a highly significant increase of about 4%. It is apparent from these results that our hypothesis concerning the decrease in efficiency with which mathematical symbols can be used as a result of their continued presentation has been confirmed. As in the case of semantic satiation with verbal symbols, we interpret this decrease in the availability of the symbol as a direct result of the rapid and continued elicitation of the mediation processes identified with the meaning of the numerical symbol. It is also apparent, however, that the satiation effect demonstrated here is relatively small (even though significant). One must keep in mind that the addition tasks used were extremely simple problems (practically no errors were made), and it would be difficult to disrupt them much in view of the fact that verbal repetition usually leads to only partial inhibition of the mediators (see Chapters II and VI). It is expected that with more difficult tasks the disruptive effect of semantic satiation would be appreciably larger.

Summary.

Two experiments were described which demonstrate the opera-

tion of semantic satiation in concept formation and problem solving tasks. In the first study, a verbal mediating response necessary for the solution of a concept formation task was satiated and the effects upon solution of the problem were noted. It was found that the semantic satiation treatment influenced the type of solutions given by the Ss, but other predictions originally made were only partially confirmed. In the second study, a number was satiated just before that number was to be added to a second number. It was shown that satiation of numbers in this manner increased the difficulty of the addition task, as measured by speed of solutions. The effect, although significant, was small, and it was suggested that the semantic satiation effect would likely have greater disruptive effects in more complicated tasks.

# CHAPTER VI

## MEDIATED SATIATION IN SYMBOLIC PROCESSES

### Generalization of Semantic Satiation.

In the present chapter two experiments will be described in which the generalized effects of semantic satiation are made the explicit object of study. Compared to the large number of investigations concerned with positive transfer in verbal learning, relatively few have touched on inhibitory processes. Theoretically, all the generalizations drawn from studies using positive transfer designs should have their complements when examined with negative transfer designs. We have chosen two rather different approaches to demonstrate the generalized effects of inhibition, referred to as "secondary extinction" in the literature on conditioning. The first deals with the disruptive effects of semantic satiation in a normally facilitory verbal transfer design. The second study is concerned with cross-linguistic generalization of semantic satiation from one to the other of a bilingual's two languages.

### Mediated Inhibition in Verbal Transfer.

Although the role of mediation in associative processes has long been recognized by psychologists (e.g. Howe, 1893;

Atherton and Washburn, 1912), it is only recently that it has been demonstrated conclusively in the laboratory (Russell and Storms, 1955; McGehee and Schulz, 1961). The design of the present study was parallel to those of Russell and Storms and McGehee and Schulz. In Group E (experimental), Ss learned two paired-associate lists: the learning of List 1 established A-B connections between nonsense syllables (A) and meaningful words (B); List 2 was composed of A-D pairs, where the relation between B and D was such that D was the most common verbal associate to C and C was the most common verbal associate to B. The middle element, C, acts as the mediating link in the forward association chain, B → C → D, and provides facilitation in the acquisition of the A-D list. In the present case, however, the C word was satiated according to the technique described in Chapter II. It was expected that the decreased meaningfulness of the C word would reduce its effectiveness as a mediator in the B → C → D chain, reducing the facilitation effect during the subsequent acquisition of the A-D pairs.

In Group C (control), Ss also learned two lists: the learning of List 1 established A-X associations between the nonsense syllables (A) and meaningful words (X); List 2 was composed of the same A-D pairs as used for Group E. However,

no associative relation existed between the X and D words. The words were the same as those used in the Russell and Storms study where a complete description of the procedure for selecting words can be found.

The overall design is illustrated in Table 12. The Ss in Group E received the Mediator Nonsatiated and the Mediator Satiated conditions. Each of these conditions consisted of the learning of five paired associates. The $A_1$-$B_N$ and $A_1$-$D_N$ correspond to the second half of the A-B and A-D pairs respectively in Table 3 of the Russell and Storms study. The $A_2$-$B_S$ and $A_2$-$D_S$ pairs correspond to the first half of the A-B and A-D pairs respectively in their study. The 10 A-B pairs formed List 1 in the present study, while the 10 A-D pairs formed List 2. Three different random orders of the 10 pairs in each list were presented in a standard memory drum at a 3-sec. presentation rate with a 6-sec. intertrial interval. The instructions given were the same as those described in detail by Storms (1958). Each S saw List 1 for a maximum of 27 trials or until he met the criterion of three errorless repetitions, whichever came first. (All Ss met the lesser criterion of one errorless repetition, but 10 failed to meet the criterion of three errorless repetitions within the maximum of 27 trials.) Eight minutes elapsed between

TABLE 12

ILLUSTRATION OF THE DESIGN USED IN THE EXPERIMENT

| Condition | List 1 | List 2 | Inferred Action |
|---|---|---|---|
| Mediator Non-satiated | $A_1$-$B_N$ | $A_1$-$D_N$ | $A_1 \rightarrow B_N \rightarrow C_N \rightarrow D_N$ |
| Mediator Satiated | $A_2$-$B_S$ | $A_2$-$D_S$ | $A_2 \rightarrow B_S \rightarrow C_S \rightarrow D_S$ |
| Nonmediated Control | $A_1$-$X_1$ | $A_1$-$D_N$ | $A_1 \rightarrow X_1 \rightarrow ?$ $\quad D_N$ |
| | $A_2$-$X_2$ | $A_2$-$D_S$ | $A_2 \rightarrow X_2 \rightarrow ?$ $\quad D_S$ |

EXAMPLES OF THE ABOVE CONDITIONS IN THE SAME ORDER

| List 1 | List 2 | Inferred Action |
|---|---|---|
| GEX - JUSTICE | GEX - WAR | GEX → JUSTICE → PEACE → WAR |
| YOV - SOLDIER | YOV - NAVY | YOV → SOLDIER → ARMY → NAVY |
| GEX - HOUSE | GEX - WAR | GEX → HOUSE → ? $\quad$ WAR |
| YOV - CHEESE | YOV - NAVY | YOV → CHEESE → ? $\quad$ NAVY |

Note.--The notations $A_1$ and $A_2$ refer respectively to the first five and second five stimulus members of the ten item lists. Similarly, $B_N$ or $D_N$ and $B_S$ or $D_S$ refer to the first and second half of the response members.

the last presentation of List 1 and the first presentation of List 2. During this period, Ss of Group E received the semantic satiation treatment for the five $C_S$ words of the Mediator Satiated conditions ($A_2$-$B_S$), as well as for the five filler words (actually, the second half of the X words in the Russell and Storms Table). First, S rated the 10 words (randomly mixed) on three scales of the semantic differential (pleasant-unpleasant; strong-weak; and fast-slow). Then S repeated aloud each word for 20 sec. before rating it again on the same three scales. Differences in intensity of ratings before and after repetitions represent the semantic satiation scores to be presented below. Following the satiation treatment, List 2 was presented and S learned it to a criterion of three errorless repetitions and in this case all Ss reached the criterion in less than 27 trials.

The Ss in Group C received the Nonmediated Control condition shown in Table 12. The five $A_1$-$X_1$ pairs and the five $A_2$-$X_2$ pairs formed List 1 which corresponds to the A-X column of the Russell and Storms Table. The $A_1$-$D_N$ and $A_2$-$D_S$ pairs which formed List 2 were the same as those for Group E. The procedure used with Group E was duplicated here except for the fact that no satiation treatment was administered, and Ss were engaged in neutral conversation during the

8 min. which separated the two lists.

In summary, the following comparisons can be noted: the Mediator Nonsatiated condition in the present study corresponds to the "Chained" condition of Russell and Storms (1955) or the "Mediated" group in McGehee and Schulz (1961). The Nonmediated Control condition corresponds to the "Unchained" or "Nonmediated" conditions respectively in those two studies; the Mediator Satiated condition represents the proactive interference design of the present study. The results are presented in terms of differences in acquisition scores of List 2 under the three conditions.

Subjects. The Ss were 50 male English-speaking cadets of the Royal Canadian Air Force enrolled in a training course at a base near Montreal. They were asked to volunteer for the experiment by their instructor. The testing was done individually at the training base during regular work hours.

Results. Comparison between the two groups on the number of trials required to reach the criterion of one errorless repetition (met by all Ss) for their particular first list is presented at the top of Table 13. There is no significant difference between the two groups, indicating that they are of equal learning ability. This conclusion is correct unless the materials in the two lists are not of

TABLE 13

COMPARISON BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS ON THE VARIOUS CONDITIONS

| Number of Trials to Reach Criterion | | | | | | |
|---|---|---|---|---|---|---|
| | Group E | | Group C | | t Betw. Groups | P |
| | Mean | SD | Mean | SD | | |
| $A_1$-$B_N$ and $A_2$-$B_S$ (List 1) | 19.80[1] | 5.09 | - | - | | |
| | | | | | 1.26 | n.s. |
| $A_1$-$X_1$ and $A_2$-$X_2$ (List 1) | - | - | 17.95[2] | 4.22 | | |
| $A_1$-$D_N$ and $A_2$-$D_S$ (List 2) | 10.77[1] | 4.85 | 17.30[2] | 5.16 | 4.45 | .001 |
| $A_1$-$D_N$ | 7.77 | 3.45 | 15.25 | 5.14 | 6.13 | .001 |
| $A_2$-$D_S$ | 10.30 | 4.74 | 14.45 | 5.16 | 2.86 | .01 |

[1] The difference between these two means is significant ($t = 11.73$; $P < .001$).

[2] The difference between these two means is not significant ($t = 0.64$; n.s.).

equal difficulty which is unlikely in view of the particular selection procedure used by Russell and Storms and the fact that McGehee and Schulz, using the same meaningful words but other nonsense syllables of comparable association values, found no such difference. The two groups differ significantly on the acquisition of the second list, with Group E showing a marked superiority over Group C. This finding is a replication of the McGehee and Schulz and other studies in which the mediated condition was found to be superior to a non-mediated condition. The same finding is pointed up by the fact that the acquisition of List 2 by Group E is significantly faster than the acquisition of List 1, whereas no such facilitation effect is noticeable for Group C (see note to Table 13). Breaking down the analysis of List 2 acquisition into $A_1$-$D_N$ and $A_2$-$D_S$ pairs, it can be seen that in both cases Group E is significantly superior to the control. This means that the predicted proactive inhibition effect of the Mediator Satiated condition ($A_2$-$D_S$) did not result in absolute negative transfer. In fact, facilitation was noticed, although significantly less than in the case of the Mediator Nonsatiated condition ($A_2$-$D_N$), as will be indicated below.

The mean semantic satiation score for Group E on all 10 words was -3.07 (SD = 6.64; $t = 2.49$; $P < .02$). For the

five $C_S$ words the mean was -2.27 (SD = 3.82; t = 3.20; $P < .01$); the mean for the five filler words was -0.80 (SD = 4.09; t = 1.05; n.s.). This difference in amount of semantic satiation shown on the two sets of words approaches significance (t = 1.84; $P < .10$), even though the product moment correlation coefficient between the two sets is significant (r = .43; $P < .02$). It is possible that the difference noted is due to the fact that the $C_S$ words are related to the B words seen in List 1, whereas the filler words are not so related. To the extent that the former have similar meaning responses to the words in List 1, the mediation processes involved in the $C_S$ words were elicited as a whole more often than the filler words, which might have resulted in larger satiation scores. Another hypothesis, not necessarily antagonistic to the previous one, is that the degree of semantic satiation exhibited with equal amounts of repetition varies with the particular words used.

Let us now turn to a comparison of the acquisition scores between the $A_1$-$D_N$ and $A_2$-$D_S$ pairs of List 2 for Group E. Russell and Storms, making a similar comparison in their study, used two separate criteria. One of these was an analysis of the first five different correct responses made by the Ss, used to determine whether the response terms of the A-D pairs, for which associative chaining was possible

(here, the $A_1$-$D_N$ pairs), were more easily elicited during the early trials. In the present study, these were compared to the $A_2$-$D_S$ pairs where the mediator was satiated. The other analysis involved subtracting the total number of correct anticipations made by each S for the Mediator Satiated pairs ($A_2$-$D_S$) from the corresponding total for the Mediator Nonsatiated pairs ($A_1$-$D_N$). If there is inhibition during learning of the Mediator Satiated pairs (i.e. S has a smaller number of correct anticipations for the $A_2$-$D_S$ than the $A_1$-$D_N$ pairs), this difference will be positive. In view of Weitz's (1961) argument that conclusions based on verbal learning data often depend on the type of criterion measure used, it was decided to add four other measures in the present analysis and these are presented in Table 14. It can be seen that all six measures used in the comparison support the conclusion that semantic satiation of the mediator (C) increases the difficulty with which an A-D list is acquired after having established A-B connections. Furthermore, the proactive inhibition effect is noticeable not only as an increase in the number of trials required for acquisition, but also as an increase in both the number of intrusions and omissions made during acquisition. The same analysis for Group C is also given in Table 14. It will be remembered

TABLE 14

COMPARISON BETWEEN THE MEDIATOR NONSATIATED ($A_1$-$D_N$) AND MEDIATOR SATIATED ($A_1$-$D_S$) CONDITIONS OF LIST 2 FOR GROUPS E AND C[1]

| Measures | Means for Group E | | | Means for Group C | | |
|---|---|---|---|---|---|---|
| | $A_1$-$D_N$ | $A_2$-$D_S$ | Diff. | $A_1$-$D_N$ | $A_2$-$D_S$ | Diff. |
| First Five Diff. Correct Responses | 3.13 (0.62) | 1.87 (0.62) | 1.26** (1.72) | 2.45 (1.07) | 2.55 (1.07) | -0.10# (2.18) |
| Trials Required for 1 Errorless Repet. | 7.77 (3.47) | 10.30 (4.73) | -2.53** (3.28) | 15.25 (5.14) | 14.45 (5.15) | 0.80# (4.05) |
| Total Correct Anticipations[2] | 33.07 (15.40) | 26.70 (11.83) | 6.37** (6.41) | 43.30 (17.10) | 44.10 (15.50) | -0.80# (14.52) |
| Total Number of Intrusions[2] | 3.97 (3.43) | 6.30 (4.60) | -2.33* (3.50) | 12.30 (6.45) | 12.80 (7.65) | -0.50# (8.07) |
| Total Number of Omissions[2] | 17.67 (11.43) | 21.71 (13.83) | -4.04** (4.78) | 30.25 (7.55) | 28.95 (8.85) | 1.30# (7.98) |
| Total Correct Anticipations[3] | 47.90 (16.20) | 40.83 (11.83) | 7.07** (7.37) | 56.10 (14.85) | 57.25 (13.75) | -1.15# (13.19) |

[1] Numbers in parenthesis stand for the standard deviation.

[2] To a criterion of one errorless repetition.

[3] To a criterion of three errorless repetitions or 27 trials.

** *t*-Test significant beyond the .001 level, two-tailed.

* *t*-Test significant beyond the .01 level, two-tailed.

# *t*-Test not significant.

that Group C established A-X connections before making A-D connections, and no satiation treatment was given. It can be seen that none of the six measures indicate differential difficulty of acquisition of the $A_1$-$D_N$ and $A_2$-$D_S$ pairs.

A closer examination of the data lends support to the main finding. If the $A_1$-$B_N$ pairs of List 1 had been originally better learned than the $A_2$-$B_S$ pairs by the experimental Ss, then the $A_1$-$D_N$ pairs of List 2 would have been easier to acquire than the $A_2$-$D_S$ pairs. Analysis of the total number of correct anticipations of the $A_1$-$B_N$ pairs minus the corresponding number for the $A_2$-$B_S$ pairs during learning of List 1 (to a criterion of one errorless repetition) yielded a mean of -2.47 (SD = 15.51; t = 0.88; n.s.). Thus, not only is there no reliable difference in the learning of $A_1$-$B_N$ and $A_2$-$B_S$ pairs in List 1, but also the $A_1$-$B_N$ pairs were somewhat more difficult to learn as indicated by the minus value of the mean difference. Consequently, the differential difficulty of A-D pairs under the satiation and non-satiation treatments cannot be attributed to the initial differential difficulty of A-B pairs. Also, the fact that the control group did not exhibit superiority of the $A_1$-$D_N$ over the $A_2$-$D_S$ pairs of List 2 (see Table 14) indicates that there was no intrinsic difference between the two sets

of A-D pairs.

Finally, the product moment correlation coefficient between the degree of semantic satiation shown by each experimental S on the satiated mediators ($C_S$) and the extent of inhibition shown in acquisition of $A_2$-$D_S$ pairs relative to the $A_1$-$D_N$ pairs was .42 ($P < .02$). This is a most interesting finding since it shows that the extent of proactive inhibition for individual Ss caused by satiation of the mediator is related to the degree of decreased meaningfulness of the mediator itself. In other words, the spread of inhibition is related to the degree of extinction on the original stimulus, an effect which is well known in positive generalization gradients (Osgood, 1953).

Discussion. The finding that a significant facilitation effect is obtained in List 2 with Group E, but not with Group C, is a replication of the positive transfer effect of the mediation paradigm reported by several authors and need not be discussed further in detail. The specific contribution of this experiment concerns the other finding reported, namely that significantly less facilitation is obtained when the mediator is satiated. Two possible mechanisms might be operating here: perhaps the availability of the mediator is reduced, making the completion of the mediation sequence

B→C→D less probable; or possibly, given the assumption (see Staats, 1961) that some of the mediation reactions in the mediator C are also involved in B and D, the inhibition process might generalize to these two terms as well. As a result of either of these two processes, the subsequent acquisition of D will have been made more difficult. Furthermore, the amount of generalized inhibition or secondary extinction might be expected to be proportional to the degree to which the original stimulus word was inhibited. The significant positive correlation reported above is consistent with this expectation.

Semantic Satiation Among Bilinguals.

The phenomenon of bilingualism has been studied by linguists long before psychologists considered it of special interest. Weinreich (1953) in an exhaustive review of the literature on this topic reports several studies in which two forms of bilingualism have been identified. Following Osgood's development of a theory of meaning, Ervin and Osgood (1954) have formulated a psychological theory of meaning which uses a mediation principle as its main concept and incorporates the linguist's notion of two forms of bilingualism, accounting for the differences in types in terms of the manner in which bilinguals acquire and use their two languages. They define

a "compound" bilingual as one having two functionally dependent linguistic systems, in contrast to the "coordinate" bilingual who makes use of two functionally independent language systems. The compounds are presumed to have a common mediation process for translated symbols in their two languages, while the coordinate bilinguals are believed to have relatively distinct mediation processes for translation-equivalent symbols in each of their languages. Lambert, Havelka, and Crosby (1958) have provided behavioral evidence in support of this theory.

Semantic satiation becomes particularly relevant to the functional dependence or independence of the language systems of compound and coordinate bilinguals. When a compound bilingual continuously repeats a word, say "house," the mediation process corresponding to that word should be suppressed, making for a loss of meaning of that word as well as the meaning of its translated equivalent, "maison," since both words bear the same relation to the suppressed mediators. However, for the coordinate bilingual, translated "equivalents" function relatively independently so that the cross-linguistic satiation effect (hereafter called cross-satiation) should not be exhibited at all or, at least, should be exhibited to a lesser extent than in the contrasting

compound case. Here, then, is a potential differentiator of the two types of bilinguals. The experiment which is described below has been specifically designed to test the validity of these theoretical speculations.

Materials and Procedure. The method used here to measure semantic satiation was essentially the same as that described in Chapter II. The words (see Table 15) and scales were printed on 3 x 5 in. white index cards and placed in a Kardex folder in such a manner as to enable E to expose them in a predetermined randomized order. Five semantic scales were used in English for the English words and their French equivalents for the French words. These were: good-bad (bon-mauvais), pleasant-unpleasant (agréable-désagréable), large-small (grand-petit), strong-weak (fort-faible), active-passive (actif-passif). The S made his ratings by pointing with a stylus to one of the seven positions along each scale and his responses were recorded. The various treatment conditions which were used are described below and summarized in Table 15.

Normal Semantic Differential. The experiment started with the determination of S's ratings under normal conditions for eight words each rated along five scales (making a total of 40 responses in random order). For example, E would expose

TAPLE 15

SCHEMATIC REPRESENTATION OF THE PROCEDURE

| Condition | Description | Words Used | Examples[1] |
|---|---|---|---|
| Normal Semantic Differential | Ratings given under normal conditions | FATHER, COP, VILLE, GARÇON, CUISINE, HOUSE, FLEUR, HATE | "FATHER": "HOUSE": |
| Satiation | 15-sec. repetition of a word followed by rating of that word. | FATHER, COP, GARÇON, VILLE | (FATHER): "FATHER" (GARÇON): "GARÇON" |
| Cross-satiation | 15-sec. repetition of a word followed by rating of its translated equivalent. | CUISINE, HOUSE | (KITCHEN): "CUISINE" (MAISON): "HOUSE" |
| Diff.-word control (diff. language) | 15-sec. repetition of a word followed by rating of an unrelated word in the other language. | FLEUR, HATE | (SKY): "FLEUR" (BATEAU): "HATE" |
| Diff.-word control (same language) | 15-sec. repetition of a word followed by rating of an unrelated word in the same language. | MONEY, VÉRITÉ | (SMOKE): "MONEY" (PAYSAN): "VÉRITÉ" |

[1] In the examples, the words in parentheses are repeated for 15 sec. and the words in quotation marks are rated.

the word "father" which S pronounced aloud once; then E exposed a scale (e.g. good-bad) and S made his rating. This procedure was followed until all words were rated on all scales. These 40 ratings served as points of comparison for the various treatment conditions described below.

Satiation Condition. Four of the words rated above (two in English and two in French) were presented again (20 responses). E first exposed a word which S repeated aloud for 15 sec. at a rate of about two repetitions per sec. Then E exposed a scale, a signal to S to stop repeating and make his response.

Cross-satiation Condition. Two other words among those rated under the initial normal condition (one in English and one in French) were presented again (making a total of 10 responses). E first exposed a word such as "kitchen" and S repeated it aloud for 15 sec. Then E exposed a second word which was the translated equivalent word for the first, in this case "cuisine." The S pronounced this second word once, after which E immediately exposed a scale and S made his rating. The S had previously been instructed to "always make your response to the second word, not to the first." By comparing the ratings under the present condition with those made under the initial normal condition, the effect of the repetition of its translated equivalent upon the semantic

ratings of a particular word (cross-satiation) was determined.

Different-word Control Condition. Two other words among those rated under the initial normal condition were presented again. E first exposed a word such as "sky" which S repeated aloud for 15 sec. Then E exposed a second word in the other language ("fleur") and S pronounced it once, after which E immediately exposed a scale and S made his response to the second word. This condition was therefore parallel to the cross-satiation condition except that the word repeated and the word rated did not bear the relationship of translated equivalents, but were semantically unrelated words. This condition was intended to serve as control for the cross-satiation condition and was introduced to determine the effect of the task of repetition per se upon the rating of another word.

It should be mentioned here that the compound group was recalled to the laboratory and tested a second time for reasons to be discussed below. During this second testing a different-word control condition was administered in which the word repeated ("smoke") was in the same language as the word which was rated ("money").

Subjects. The Ss were a heterogeneous group of 62 English-French bilinguals (college students, graduate students, housewives) who were paid for their cooperation. An attempt

was made to use "balanced" bilinguals by asking for volunteers who felt "equally proficient in both languages." However, to insure this requirement, Lambert's (1955) automaticity measure was administered to every S. This measure involves the use of eight finger keys, the stems of which are differently colored, an exposure apparatus which directs S to depress a particular key with directions appearing randomly in either language (e.g. "yellow, right"), and a chronoscope measuring latency of response. A significance test can be applied to test the hypothesis that balanced bilinguals will show a mean differential latency of response which is not significantly different from zero. Two bilinguals who were not balanced were excluded from further analysis of results.

In order to determine compoundness or coordinateness among bilinguals, detailed information was obtained from each S concerning how, when, and where his languages were acquired. The variables which have been shown by Lambert, et. al. (1958) to be relevant were used as a basis for classification, i.e. whether S had learned the two languages in the same cultural setting or not, whether he has used both languages interchangeably inside and outside the home, etc.[19]

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[19]A detailed questionnaire relevant to the present classification scheme can be found in Jakobovits (1960).

On the basis of this interview, Ss were classified as either compound or coordinate, and their results analyzed separately. Two groups, 30 compounds and 32 coordinates, were thus obtained.

Results. The initial polarity scores given in Table 16 were derived by totaling each S's ratings along the four-point intensity scale and determining a group mean. Thus, 16.67 (cross-satiation) is a group mean calculated for 10 ratings per S. Since the initial polarity scores could range from 0 to 30, it will be noted that all of the actual scores fall near the median, ranging from 13.94 to 18.07. Consequently it is unlikely that these initial differences influenced the experimental treatment effects to be noted below.

Table 16 also presents the mean change scores which are the differences between initial and final polarity scores. For example, the mean change for the compound group after the satiation treatment was -1.27 which indicates a change from an initial polarity score of 16.50 to a final polarity score of 15.23.

Tests of significance are given for departure from zero of each group's mean change, and for differences between mean changes for the compound and coordinate groups on each of the three conditions. It can be seen that the two groups

TABLE 16

INITIAL SEMANTIC DIFFERENTIAL POLARITY AND MEAN CHANGE IN POLARITY OVER THE SUM OF TWO WORDS AND FIVE SCALES FOR THE COMPOUND AND COORDINATE GROUPS

| Condition | Compounds N = 30 | | | | | Coordinates N = 32 | | | | | $t^1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Initial Polarity | | Mean Change | | | Initial Polarity | | Mean Change | | | |
| | Mean | SD | Mean | SD | $t^2$ | Mean | SD | Mean | SD | $t^2$ | |
| Satiation[3] | 16.50 | 3.90 | -1.27 | 2.74 | 2.54** | 15.03 | 4.96 | -0.25 | 2.04 | 0.69 | 1.64 |
| Cross-satiation | 16.67 | 4.97 | -3.27 | 3.23 | 5.45*** | 13.94 | 5.23 | 1.16 | 2.75 | 2.37** | 5.74*** |
| Diff.-word control | 18.07 | 4.99 | -1.30 | 3.42 | 2.06** | 17.47 | 4.88 | 0.53 | 4.00 | 0.75 | 1.89 |

[1] t for average change in polarity between compounds and coordinates.

[2] t for departure from zero, two-tailed.

[3] Since there were two English and two French words under this condition, the mean of each pair was used to permit comparisons with the scores in the other conditions.

**$P < .05$.

***$P < .01$.

differ significantly from each other under the cross-satiation condition but not under the other two conditions. This finding substantiates our prediction that compound and coordinate bilinguals will react differently to the cross-satiation treatment. We will now examine the results with respect to each group's behavior under the three different conditions.

Satiation. The compound group has a negative mean which departs significantly from zero, whereas the coordinate group has a negative mean which fails to reach statistical significance. The result is ambiguous since there is no significant difference between the two groups.

Cross-satiation. The significant negative mean for the compounds is as expected. The significant positive mean for the coordinates was not anticipated. According to the original hypothesis, it was predicted that coordinates will either satiate cross-linguistically to a lesser extent than compounds or will not be affected by the cross-satiation treatment. It now appears that the coordinate group behaves in exactly the opposite manner from the compounds, exhibiting "generation" of meaning instead of satiation.

Different-word Control. The coordinate group seems to exhibit no systematic effect or change under this condition, whereas the compounds have a negative mean which departs

significantly from zero. However, the difference between the two groups does not reach statistical significance.

A post-experimental interview revealed that none of the Ss were aware of the purpose of the experiment. Most of them believed that E was investigating "the differences in my reactions in English and French." The Ss who stated that their ratings changed (from normal to treatment conditions) thought this was due to the fact that "I forgot what I had done before," or that "I thought of something else the second time." Only one S stated that his ratings became less extreme under repetition conditions (including control) and attributed this effect to his "confusion." It appears, then, that the semantic satiation effect operates without explicit awareness on the part of the S of the purposes of the experiment or of the fact that his ratings change in a systematic manner.

Discussion. Although our main prediction has been borne out, namely that compounds cross-satiate while coordinates do not, it is apparent from the pattern of results in Table 16 that our original account of the effect of the three different conditions is incomplete and that our theoretical model requires extension. We shall formulate the following two hypotheses which suggest themselves from the present

results, but which are also in agreement with other findings to be mentioned below.

Hypothesis A. Bilinguals as a group are less susceptible to the satiation effect than are monolinguals.

In a pilot study with 27 bilinguals we have used essentially the same method and procedure as that described in the present investigation except that the automaticity measure was not administered and therefore no statements can be made as to the bilinguals' comparative proficiency in the two languages. The combined mean for the 27 bilinguals under the satiation condition was found to be 0.16 (SD = 2.07) which is not significantly different from zero (t = 0.40). In the present study, when we combine the scores of both compounds and coordinates under the satiation condition (N = 62) we obtain a negative mean of -0.76 (SD = 2.46) which is also not significantly different from zero (t = 0.77). These findings are in striking contrast with our experiments using monolingual Ss in which a significant satiation effect was repeatedly obtained.

Added support for this hypothesis comes from evidence of a slightly different kind, and which will be presented in more detail in Chapter VIII. Carroll's (Carroll and Sapon, 1955, Test V) paired-associate test was administered

to 18 Ss used in the experiment described in Chapter IV and their scores on this test were correlated with their polarity-difference scores under the semantic satiation treatment. A product-moment correlation coefficient of -.66 ($P < .01$) was obtained. This finding suggests that efficient verbal learning (of the paired-associate type) depends on an ability to resist the semantic satiation effect. Bilinguals, and especially balanced bilinguals, have demonstrated their skill in verbal learning and it is likely that they represent a sample of Ss who resist satiation of this type.

Hypothesis B. An experimental situation in which the bilingual is required to switch from one language to the other is inefficient and inhibitory for the compound, facilitative for the coordinate.

This hypothesis seems to contradict the position taken by Ervin and Osgood (1954) who state that "theoretically, decoding from a foreign language should be facilitative for the compound system, since different inputs are associated with the same representational reactions or meanings" (p. 143). It seems equally possible, however, that the facilitation provided by the similarities of the mediators is counteracted by the interference effects produced when the two languages are to be used separately, as in ordinary life

situations. This is partly recognized by Ervin and Osgood in their statement that "interference is most likely to occur when the languages are closely related and the cultures and experiences associated with the languages are alike" (1954, p. 141). It seems that in order to reach bilingual fluency, the compound must develop an inhibitory mechanism which would reduce the availability (and therefore the potential interference) of the second language while the first is being used. Then if he is required to switch from one language to the other, he will behave less efficiently than when he is permitted to function with one or the other of his languages.[20]

The cross-satiation and different-word control conditions used in the present experiment represent a language switching situation. As the compound bilingual repeats a word in one language (e.g. "sky"), and is then presented with a word in the other language ("fleur"), the decoding of this second word will be inefficient, reflected as a systematic change toward less intense positions or toward the middle or meaningless point on the semantic scales. The coordinate bilingual, however, will behave more efficiently

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[20]These interference hypotheses are more directly investigated in an experiment now being carried out in our laboratory.

in the same situation since the two language systems are relatively independent and less subject to interlingual interference. It even appears that the switching process is facilitative, as indicated by the increased polarization of the ratings under language switching situations (i.e. different-word control and cross-satiation). In the case of compounds, the cross-satiation treatment has a neutralizing effect on the meanings of translated equivalents, whereas for the coordinates the repetitive elicitation of mediators in one language appears to "liberate" the mediators of translated equivalents. The latter effect reminds one of disinhibition in extinction phenomena. It is conceivable that for the coordinate bilingual presentation of a word in language B after its translated equivalent in language A has been satiated (extinguished) acts as a disinhibitor and results in a stronger than normal response to the originally inhibited word. Why this should be so with the coordinate and not the compound bilingual is not clear at the moment and further experimental work is needed to clarify this point.

The following deductions can be made from the two hypotheses presented above: (a) Since the cross-satiation treatment for the compounds involves both the inhibition of mediators as a result of their repeated presentation and the

inhibition of the decoding process of the second language, the negative mean under this condition should be greater than either the mean of the satiation condition or that of the different-word control in which only one effect is operating at a time. Correlated *t* tests between these three conditions revealed that the cross-satiation condition has a significantly greater negative mean than that of the satiation condition ($t = 2.25$; $P < .05$) as well as that of the different-word control ($t = 3.28$; $P < .01$), thus supporting the first deduction. Furthermore, it appears that the satiation and different-word control treatments have equal effects since the two means are not significantly different ($t = 0.03$). (b) Since language switching is facilitative for the coordinate group, there should be a significant difference between both cross-satiation and different-word control conditions and the satiation treatment (which does not involve language switching). Correlated *t* tests show that while the difference between the cross-satiation and satiation treatments is significantly different in the predicted direction ($t = 2.14$; $P < .05$), the difference between different-word control and satiation conditions does not reach an acceptable level of significance ($t = 1.18$; $P < .30$). The deduction is thus only partially confirmed. The cross-satiation and

different-word control conditions seem to have equal effects ($t = 0.68$). (c) If a different-word control condition is administered to the compounds in which the word repeated and the word rated are in the same language, no systematic effect should be observed. As mentioned earlier, the compound bilinguals were recalled to the laboratory about five weeks after the first testing and the new different-word control condition (same language) was administered using the same standard procedure as before. The results of this testing as well as those obtained previously with this group are presented in Table 17. It can be seen that both types of different-word control conditions are significantly different from the cross-satiation condition, but they are not significantly different from each other. Although the difference is in the predicted direction (greater negative mean under the different language control), this deduction is not supported to a reliable degree by the present results.

Summary.

Two experiments were described in which generalization of the semantic satiation effect was demonstrated. In the first study, a proactive interference paradigm was arranged in which Ss first learned an A-B list, then, an A-D list, where a mediation sequence of the type B → C → D is assumed

TABLE 17

AVERAGE CHANGES IN POLARITY OVER THE SUM OF TWO WORDS AND FIVE SCALES FOR THE COMPOUND GROUP ON THREE DIFFERENT CONDITIONS

| Condition | Compounds (N = 28)[1] | | | t's Between Conditions | |
|---|---|---|---|---|---|
| | Mean | SD | t[2] | Same Lang. | Cross Satiation |
| Diff.-word control Diff. Language | -1.29 | 3.48 | 1.93* | 1.50 | 2.89*** |
| Diff.-word control Same Language | -0.79 | 3.14 | 1.32 | -- | 3.98*** |
| Cross-satiation | -3.14 | 3.30 | 4.98*** | -- | -- |

[1]Two Ss were not available for this part of the testing.

[2]t for departure from zero, two-tailed.

*P < .10.

***P < .01.

to exist. However, before the second list was presented, the inferred mediator, C, was reduced in availability by the satiation procedure. It was shown that satiation of the mediator resulted in generalization of inhibition during acquisition of the A-D list. In the second study, it was shown that generalization of satiation from one language to another (cross-satiation) takes place with compound bilinguals, those having interdependent language systems, but not with coordinate bilinguals, those having functionally independent language systems. Some additional analyses were also discussed which have a further bearing upon the differences in the language structures of these two types of bilinguals.

# CHAPTER VII

## STIMULUS CHARACTERISTICS AS DETERMINANTS OF SEMANTIC SATIATION

Statement of the Problem.

Two basic dimensions underlie the theoretical discussion presented so far: in the first phase, it is assumed that words derive their meaning from the implicit representational mediation responses they elicit, and in the second phase, it was suggested that these implicit mediational responses are subject to the same basic principles of behavior as are overt responses. Research has established (see Razran, 1939) that the extinction of overt responses is affected by characteristics of the conditioned response and the complexity of the stimulus situation. If it could be shown that semantic satiation is similarly affected by the same variables, then the operational and logical relationship between extinction and semantic satiation would be made more convincing. The experiment to be described was designed to demonstrate this relationship, namely, that "extinction is inversely related to stimulus complexity" (Razran, 1939).

Materials. There are of course a great many ways in which stimulus complexity can be varied. Since semantic

satiation has been demonstrated with words, it was decided to use words as a basis for defining one continuum among the many possible along which various stimuli differ. Words in the form of the names of objects and the actual objects themselves obviously differ in that objects are specific instances whereas the names of objects are actually category labels which encompass a large number and variety of specific stimuli all differing from each other in many details. Thus the word "pencil" does not identify idiosyncratic characteristics of the referent, such as size, color, specific detail, as much as a particular pencil does. In the present context, these two types of stimuli represent two ends of a "specificity-generality" continuum, analogous to the dimension of "abstractness" proposed by Karwoski, Gramlick, and Arnott (1944). Black and white photographs of objects fall roughly between these two points since they are less specific than the objects themselves in that they are two dimensional and have no color, but are more specific than words because they reveal shape and size. In the same sense it was argued that underexposed photographs are less specific than clear photographs since small detail such as indentation, shadowing, inequalities or roughness are eliminated. Table 18 illustrates how the four types of stimuli discussed differ on

TABLE 18

RELEVANT (+) AND NON-RELEVANT (-) DIMENSIONS FOR THE FOUR TYPES OF STIMULI USED

| Stimulus | Visual Characteristics | | | | Non-visual |
|---|---|---|---|---|---|
| | Depth | Color | Detail | Size | Utility |
| Objects | + | + | + | + | + |
| Clear photographs | - | - | + | + | + |
| Underexposed photographs | - | - | - | + | + |
| Words | - | - | - | - | + |

some common dimensions. It can be seen that objects represent the most complex set of stimuli and contain the largest number of relevant visual dimensions, whereas words, being most general, contain no relevant visual characteristics. Accordingly, it was predicted that repeated presentation of each of the four sets of stimuli would result in semantic changes that would be inversely related to stimulus complexity. Thus, words should show semantic satiation (as previously), while photographs and objects should exhibit progressively smaller satiation effects. The exact relationship between semantic change as a result of repeated presentation and each of the four types of stimuli used could not be predicted since the present classification does not permit the assumption that the stimuli differ from each other by equal steps on the complexity continuum.

Nine small objects were selected from among those previously used in a study by Wimer and Lambert (1959). These are described in Table 19. Two black and white high gloss prints (5 x 3 in.) of each object were prepared by a commercial photographer. One of these was a near perfect reproduction, the other was underexposed by about 20% making the object appear light and washed out, although still recognizable.

TABLE 19

DESCRIPTION OF PROCEDURE AND MATERIALS USED FOR GROUP 1*

| Condition | Description | Objects Used |
|---|---|---|
| Initial normal | Ratings given to objects exposed for about one sec. | large plain black button, un-notched gold key, small wheel with four axes, short red pencil, gold-colored ring, oval hand mirror. |
| Experimental inspection | 15-sec. inspection of an object followed by semantic rating of that object. | (button) : button; (key) : key; (wheel) : wheel. |
| Different-stimulus-control | 15-sec. inspection of an object followed by semantic rating of a different object. | (nickel coin) : pencil; (unburnt wooden match): ring; (hairpin) : mirror. |

*The object in parenthesis is inspected, while the object that follows it is rated on semantic scales. The stimuli for Group 2 were clear photographs of the objects; for Group 3, underexposed photographs of the objects; and for Group 4, the names of the objects (underlined in the Table) printed on white index cards.

Procedure. Each of the four classes of stimuli was presented to a different group of Ss. The objects were used as stimuli for Group 1. Three objects (button, key, wheel) were administered under an experimental inspection condition. Three other objects (pencil, ring, mirror) served as control. Each object was pasted on a 5 x 3 in. white index card and inserted in a Kardex folder where E could expose the stimuli in a predetermined random order. Six semantic differential scales (pleasant-unpleasant; nice-awful; large-small; heavy-light; fast-slow; sharp-dull) were presented on separate cards and also inserted in the Kardex unit. Ss were tested individually under each of the following conditions.

Initial Normal. At the beginning of the experimental session S was required to rate each object on every scale by pointing to one of the seven positions on the scale. His responses were recorded by E. For the three objects subsequently used as experimental inspection stimuli, E would first expose the stimulus, for example the button, for about a second, by lifting the flap of the Kardex folder twice in quick succession; then, immediately after, he would expose a scale, and S would make his rating. For the three objects subsequently used as control stimuli, E would first expose the object once (e.g. the nickel, see Table 19)

and this would be quickly followed by the exposure of a second object (e.g. the pencil), and S would make his rating to the second stimulus. The reason for this procedure was to make the initial condition exactly similar to the "different-stimulus control" condition described below. The order of the 36 ratings (6 stimuli on 6 scales) was systematically randomized for half of the group; this order was then reversed for the other half of the group.

Experimental Inspection. Following a short rest period, each of the three objects used in this condition was exposed a second time for a period of 15 sec. before S rated it on a scale. As there were six semantic scales, each stimulus was seen for six 15 sec. periods.

Different-stimulus Control. For this condition, E exposed a stimulus for 15 sec.; then, he exposed a second stimulus for about one sec., and S gave his rating to the second stimulus. Since the exposure time for the rated (second) stimulus was the same as under the initial normal condition, no systematic changes in ratings were expected here, and this condition was intended to serve as a control for the 15 sec. inspection task in the experimental condition.

The 36 final ratings under these two inspection conditions were systematically randomized for half of the group,

and the reverse order was used for the other half. A summary of the procedure used for Group 1 is given in Table 19. The present procedure was exactly duplicated for each of the other three groups, the only difference being the type of stimuli used. Group 2 received the clear photographs, Group 3 the underexposed photographs, and Group 4 received the words or names of the objects themselves.

Subjects. The Ss were 88 students enrolled in various courses at McGill University who volunteered to participate. Each of the four groups was composed of 22 people. The first 22 names on the list of volunteers were placed in Group 1, the subsequent 22 in Group 2, etc. The same E tested all Ss and they were given identical instructions, except, of course, for the reference to the type of stimuli used with each group.

Results. Tests of significance were applied to the polarity-difference scores between the first and second half of each group to determine the effect of the presentation order of the stimuli. None of the four t values were significant (the largest, for Group 3, was 1.26, n.s.). The results for the two halves of each group were therefore combined.

Table 20 summarizes the various analyses carried out.

TABLE 20

MEAN POLARITY SCORES (INITIAL, FINAL, AND DIFFERENCE) PER STIMULUS OVER THE SUM OF SIX SCALES FOR ALL FOUR GROUPS (N = 22 FOR EACH GROUP)

| Polarity Score | Group 1 | | Group 2 | | Group 3 | | Group 4 | |
|---|---|---|---|---|---|---|---|---|
| Experimental | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Initial | 6.79 | 3.11 | 5.98 | 4.23 | 6.55 | 3.63 | 6.20 | 4.16 |
| Final | 8.39 | 4.87 | 5.75 | 5.03 | 6.00 | 4.82 | 5.29 | 4.90 |
| Difference* | 1.60 | 2.06 | -0.23 | 2.15 | -0.55 | 1.63 | -0.91 | 1.28 |
| | (3.55) | | (0.49) | | (1.54) | | (3.25) | |
| Control | | | | | | | | |
| Initial | 7.97 | 4.07 | 7.56 | 4.28 | 7.95 | 3.02 | 6.76 | 4.70 |
| Final | 8.01 | 4.33 | 8.24 | 6.37 | 8.74 | 3.89 | 6.63 | 5.33 |
| Difference* | 0.04 | 1.83 | 0.68 | 2.71 | 0.79 | 1.79 | -0.13 | 1.19 |
| | (0.10) | | (1.15) | | (2.02) | | (0.50) | |
| *t* (Exper.-Diff.) vs. (Cont.-Diff.) | 2.69 | -- | 1.25 | -- | 2.63 | -- | 2.11 | -- |

*The number in parenthesis is the *t* value for departure from zero. Values of 2.08 are significant at the 5% level, values of 2.51 are significant at the 2% level, two-tailed tests.

For each group, the mean initial normal and final (after inspection) ratings and their standard deviations are given. The mean score represents the average intensity of rating per stimulus (object, photographs, or word) over the sum of six scales; it was obtained for each S by dividing the sum of his 36 ratings by 3. Also given are the mean polarity-difference scores for each group and their significance level for departure from zero, the point of no change. It can be seen that Group 1 (objects) has a significant positive difference score, indicating a "semantic generation" effect, while Group 4 (words) has a significant negative difference score, indicating a semantic satiation effect. The difference means for Groups 2 and 3 are both negative, but neither is significantly different from zero.

Comparison between polarity-difference scores for experimental and control conditions within each group reveals that all except Group 2 are significantly different from each other.

The data in Table 20 are plotted in Figures 1 and 2. It can be seen in Fig. 1 that the initial extremity of ratings for the control stimuli are consistently and significantly (except in the case of Group 4) higher than that of the experimental stimuli. These differences could be due

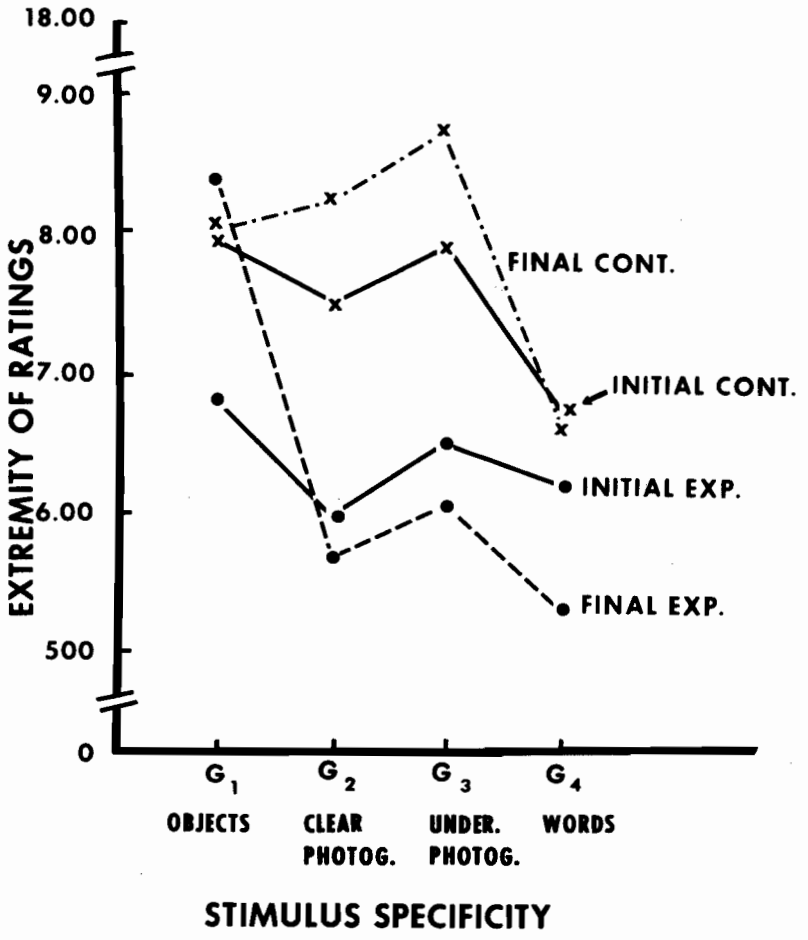


FIGURE 1. Mean initial and final extremity of ratings for each of the four groups (entries are averages per stimulus over the sum of six scales).

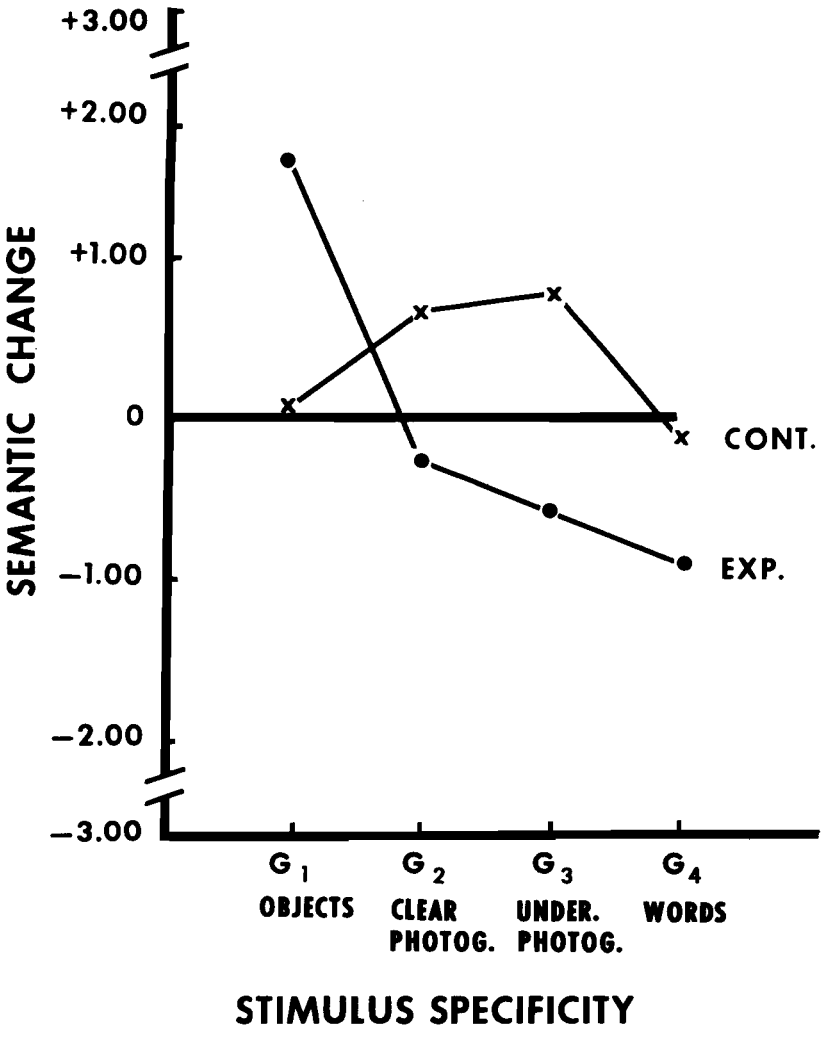


FIGURE 2. Direction and amount of semantic changes with repeated presentation as a function of stimulus specificity (entries are averages per stimulus over the sum of six scales).

to the different procedures for presenting stimuli used in the two conditions or, possibly, to the stimuli actually used for each condition. It is unlikely, however, that initial differences between experimental and control stimuli influenced the experimental effects to be noted in Fig. 2 since all scores fall within the middle range of the extremity continuum and since no systematic relation is noted between initial and final polarity scores.

The differences in extremity of initial ratings for the four types of stimuli within either the control or experimental condition is not significant as indicated by a one-way analysis of variance by ranks ($H = 1.48$; n.s., for the initial experimental curve; and $H = 3.62$; n.s., for the initial control curve).

The main experimental finding is plotted in Fig. 2. A one-way analysis of variance for the experimental data revealed a highly significant effect ($F = 7.95$; $P < .001$). The comparable analysis for the control data showed an insignificant effect ($F = 0.81$).

Discussion. The main purpose of the present experiment was to show that extinction is inversely related to stimulus complexity. It is apparent, however, that the results of this study show that our theoretical position needs further

elaboration. One conclusion is evident from the present findings: the type and degree of semantic changes that take place with repeated presentation depend on the characteristics of the stimuli involved. The following hypothesis suggests itself: the direction and strength of semantic change following repeated presentation is a function of the total number of representational mediation responses which can potentially be brought into play by a particular stimulus during the time of its inspection. If this number is large, the strength and number of mediation processes which are elicited will increase in proportion to the extent of inspection time, promoting semantic generation; if the number is relatively small, repeated elicitation will quickly lead to neural reactive inhibition or semantic satiation. Table 18 illustrates how the four types of stimuli used in the present experiment likely differ with regard to certain visual characteristics such as depth, detail, and size. In each case, the relevant characteristics are potential elicitors of representational (meaning) responses. Theoretically, the semantic differential should be able to index these differences among the four types of stimuli. It is likely that if appropriate scales were chosen, differences in terms of two or three dimensionality, redness or greenness, roughness or

smoothness, length, etc., would emerge. When the stimulus is a word, few if any of the visual dimensions are specifically relevant and the semantic ratings along such dimensions should approach the neutral point. With photographs, some are relevant, others are not, and with objects, all of the dimensions are relevant. Hence, in accordance with the above hypothesis, repeated presentation should promote semantic satiation with words as stimuli and semantic generation with objects as stimuli, while photographs should promote some intermediary degree of change, depending on the number of potentially relevant stimuli inherent in the particular photographs.

It is evident that the status of this ex post facto hypothesis is as yet untested, and further empirical work is necessary to determine whether it adds to our understanding of representational meaning responses. At the present stage, we can only suggest some testable predictions which follow from our hypothesis. Thus, if the inspection time of objects is increased beyond some empirically determined point, semantic satiation should manifest itself since the number of potential meaning responses that can be elicited may be large but not infinite. Similarly, if the inspection time for words is decreased sufficiently, before inhibition occurs,

semantic generation should be noted at the early stages.[21] Furthermore, meaning responses which are initially "strong" i.e. with high reaction potential) will be more resistant to semantic change. Such responses could be elicited during high drive states (e.g. food related words presented to hungry Ss). Similarly, responses that tend to be dominant for a particular individual (e.g. words selected from a S's dominant value area as measured by the Allport-Vernon scale of values, or words chosen from a bilingual's mother tongue, etc.) should also be more resistant to extinction.

Summary.

The present study has investigated the effects of repeated stimulation of different types of stimuli upon their meaning change. Four types of stimuli were used. These were conceptualized as varying along a stimulus complexity continuum from highly specific and complex (objects) to least specific and simple (words), with clear and underexposed photographs falling in between these two points. These four types of stimuli were each administered separately to four different groups of Ss under an experimental inspec-

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[21] In a recent study, Johnson, Thomson, and Frincke (1960) have provided evidence of semantic generation of verbal stimuli presented at frequencies well below those used in our experiments which produce semantic satiation.

tion condition as well as under a control condition. Comparison of the semantic changes obtained with each of the four groups showed that they differed significantly on the inspection condition, but not on the control. These differences were related to the characteristics of the stimuli used with each group and a general hypothesis to account for the data was formulated.

# CHAPTER VIII

## THE EFFECTS OF REPETITION IN COMMUNICATION AND SOME CONSIDERATIONS OF INDIVIDUAL DIFFERENCES IN SUSCEPTIBILITY TO SATIATION

### The Molar Approach.

In the introduction a basic paradox was posed: repeated stimulation of the organism leads both to an increase in response probability (learning) and a decrease to susceptibility to respond (extinction). In the preceding chapters we have presented experimental evidence of various sorts in which the presumed operation of semantic satiation following repeated presentation of stimuli was illustrated. In all of these studies emphasis was placed upon the experimental isolation of stimuli and precise measurement of the extinction effects. As a consequence, the materials used were simple, discreet, well-defined stimuli such as individual words, numbers, or objects presented on index cards. Furthermore, our interest so far has been with the effects of experimental treatments upon whole groups of Ss, disregarding individual differences. In the present chapter we shall examine the effects of repeated stimulation in real life situations such as those occurring in the mass media where the Ss' environment is made up

of a complex set of stimuli, which are most often difficult to specify. We shall also pay closer attention to some personality variables which seem to mediate individual differences in reactions to repeated stimulation. It will soon become apparent from the tentative nature of the conclusions that our efforts in this area are less successful than in the cases where we could freely manipulate experimental and control variables. Nevertheless, the present attempt represents a step in the direction of determining the importance of semantic satiation in the more molar aspects of human behavior.

Repetition in Mass Media.

Part of the current interest in opinion and attitude change can be traced to the development of the mass communication media in this century. It is surprising to find that among the many variables which have been investigated in this area, the effects of repeated presentation of communications upon attitude and opinion change has received almost no attention from investigators. In fact, an examination of the pertinent literature has revealed less than half a dozen studies which bear upon this point. In a recent review in the flow of information among scientists published by the National Science Foundation (1960), the desirability of investigating the effects of repetition in communication was also expressed

as follows: "From the point of view of the consumer of information it seems sometimes necessary to be exposed to the information repeatedly, before it will make an impact" (p. 49). Hollingworth (1935) has summarized the work of Jersild (1928; 1929) on the effects of speech emphasis, and the following three conclusions are worth noting: (1) "Among the special devices usable in oral delivery by way of emphasis, the most effective, though not the most economical, is repetition, to the extent of three or more assertions." (2) "The effect of repetition follows a law of diminishing returns." (3) "Repetitions are most effective when they are spaced or distributed rather than massed at one point of the discourse" (p. 107). These conclusions should be taken with caution inasmuch as another investigator (Ehrensberger, 1945) subsequently found that massed repetitions are more effective than distributed ones, and in view of the fact that Cantril and Allport (1935) have presented evidence which suggests that the effect of repetition varies with the type of communication involved.[22]

A more recent study by Cromwell and Kunkel (1952) examined the cumulative effects upon attitude change of a propaganda

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[22] For example, repetition improves comprehension and retention for factual material but not for news and ads. Also, the authors report that repetitious materials were rated less interesting by the audience.

message presented twice within a 30 day period and reported positive results, corroborating Gardner's (1935) earlier findings.

Despite the lack of experimental data on this variable, it is evident that, as Abelson remarks, "we don't have to look far -- about as far as the living room radio or television -- for evidence that persuasion by repetition has an army of proponents" (1959, p. 48). Indeed, a cherished principle in mass media advertising seems to be that of repetition, to the great distress, we might add, of many consumers. As we have pointed out before, all learning depends on repeated presentation of certain stimulus materials. It is then of both theoretical and practical importance to determine under what conditions such repeated stimulation is constructive, as in learning, or disruptive, as in satiation. To do so, the researcher would have to systematically study the effects upon meaning and attitude of different amounts of presentation of particular stimuli. In fact, three independent variables are apparently involved in such a plan: number of presentations of the stimulus materials, the type of stimulus materials used, and the characteristics of the individuals tested, their past experiences, attitudes and other relevant features of personality.

The meaningfulness of words appears to be a direct

function of familiarity or number of previous presentations, i.e. the more familiar the word, the more meaningful it is (see Noble, 1953; Underwood and Schulz, 1960). However, from our studies on semantic satiation one realizes that if the number of presentations is increased beyond a certain point, meaningfulness decreases, as is the case, for example, with very frequently used "fad words" which lose their original meaningfulness. We have also verified the fact that concepts lose meaning through repetition and that this effect tends to persist for at least several minutes.[23] These findings suggest that the relation between frequency of presentation of a stimulus and its meaningfulness is of the type represented by an inverted U distribution. We have referred to the rising part of the curve (which denotes increase in meaning) as "semantic generation" and the descending part (which denotes loss of meaning) as "semantic satiation;" the point where the curve changes inflection might appropriately be called the "critical point."

The extension of this curve to mass communication suggests that if a message is transmitted through a communication

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[23] Karsten (1929) has measured substantial satiation effects of a line drawing task eight days after the last repetition of the task, and Wertheimer (1958) measured the persistence of satiation in kinesthetic figural after-effects up to half a year after original inspection.

system, its meaningfulness and effectiveness will increase as the frequency of transmission is increased until the critical point is reached (cf. the cumulative effects upon retention of repetition reported above). If frequency of transmission is then further increased, not only will there be diminishing returns in effectiveness, but also the meaningfulness of the message will gradually decrease, as will its effectiveness for inducing further changes in attitude and behavior.[24] This line of argument also applies to educational and informational messages. It is of major interest, then, to determine the forms of such curves for various stimuli as materials.

An experimental design investigating the present problem should incorporate variations in amount of repetition of stimulus materials, content of the communications presented, and personality characteristics of the audience. Using a number of groups of Ss drawn randomly from some specified population (e.g. college students, housewives, high school middle class males), the same stimulus materials could be presented various numbers of times to different groups, comparing differences in amount of meaning and attitudinal change for various groups. For example, one group would be given a particular

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[24] A concommitant factor worth investigating here is the increase in negative affective responses to repetitious materials.

communication once, another group five times, a third ten times, and a fourth group twenty times. Meaning and attitude changes would be measured in each case immediately after the last presentation, and at various time intervals thereafter, to determine the permanence of changes.

Ss should be chosen who vary in their social values as measured by some sort of scale, such as the Allport-Vernon Scale of Values (Vernon and Allport, 1931). For example, Ss who are theoretically oriented (the theoretical scale being prominent for them) would be presented stimulus materials which are consonant with their values in one condition, or materials which are dissonant with their values in another condition. Thus a group of highly theoretical Ss would be given materials which are favorable to theoretical issues in one case and materials which are anti-theoretical in the other case. Subgroups within each condition would be presented either consonant or dissonant communications for various numbers of times.

In addition to varying the consonance of materials in accordance with value patterns, the stimulus materials should be varied in complexity ranging from simple words to more complex communicational messages. At the simple level, single words, chosen to be consonant or dissonant with the value areas

of individuals, would be subjected to the semantic satiation treatment. Changes in meaning will be related to variations in the number of presentations given. It is likely that different locations of "critical points" will emerge when consonant and dissonant materials are compared.

At a second level of complexity, other subgroups of Ss could be given short messages involving consonant and dissonant themes, and the same messages would be repeated for various numbers of trials. Meaning change for key words would be examined and critical points compared for subgroups receiving different numbers of re-presentations. Comprehension and retention measures could also be taken.

Finally, complex messages could be constructed varying in actual message content and wording but having a common theme which recurs in each presentation. The real-life analogue of this condition is regularly encountered in television communication where a series of programs with a common theme is offered to viewers (e.g. themes such as the state of affairs in a communist country, episodes of experiences with Germans and Japanese in World War II, violence and aggression in standardized serial programs, general content of educational courses, and advertisements). Here the reinforcing or interference effects of joint auditory and visual repetitions ought

to be investigated. Again the common theme should be consonant for some groups and dissonant for others. Key words which reflect the theme could be measured for connotative meaning before presentations and again after the particular series of re-presentations assigned each group.

In summary, our plan calls for a survey of the fate of meanings and attitudes of communicational materials as they are presented a number of times. The design pays attention to variations in the complexity of materials presented, the number of presentations given to determine the point where meanings and attitudes are most extreme, and the personality characteristics of Ss who will serve as audiences for the communications. Efforts are now being made in our laboratory to carry out a plan as presently outlined. Its outcome will be a major test of the usefulness of the theoretical model of semantic satiation presented in this thesis.

A Study on Hit Parade Songs.

A familiar feature of any radio station in Canada and the United States today is the Hit Parade program, the playing of the nation's most popular songs. Normally, these songs are arranged in rank order in terms of their popularity. Each week the ranks are adjusted to reflect changes in popular demand and taste. Weekly surveys are made by various agencies

and are based on various measuresincluding one or more of the following: record sales, disk jockey ratings, and frequency counts on juke boxes in restaurants, dance halls, etc. A prediction concerning the ups and downs of song popularity in terms of the principle of semantic satiation comes to mind. It was argued that the rate at which any particular song disappeared from the Hit Parade would be related to the frequency with which it was heard by the public during the time just preceding its "downfall." The more frequently a song would be played within a short span of time (i.e. it has high "saturation"), the more it would be subject to semantic satiation, and the faster it should lose popularity as indexed by the weekly rankings. Accordingly, a significant relation was predicted between the rate at which a song would lose popularity and its "saturation" value just preceding the decline. It was realized that semantic satiation would be only one among the many variables that could influence relative standings of these songs.[25] Furthermore, the prediction does not take into account interaction factors such as the "appeal value"

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[25] One other important variable which would tend to reduce the size of the predicted relationship is the degree to which disk jockeys tend to "push" particular records, a widespread activity which became known during recent congressional hearings on "payola" in the United States.

of particular songs and the artists who introduce them, the number of other records on the Hit Parade by the same artist (i.e. his "exposure" value), the degree of semantic satiation exhibited by the other songs, etc. Despite these shortcomings, however, it will be seen that our prediction received support from the analysis to a surprising degree.

Method. This attempt was handicapped by the difficulty of obtaining the type of frequency data necessary for a complete analysis. The most comprehensive data available were the listings of popular songs in the United States published by Variety, a weekly magazine which deals with show business. Tables in this magazine list the first 45 songs in rank order with title, artist, and publisher. They are compiled on the basis of weekly surveys of disk jockeys at radio stations throughout the country and purport to reflect the relative frequencies with which the 45 songs are heard on the air. On the basis of these listings we devised measures of "saturation," and rate of decline and rise for the songs as follows. (a) Rise: the period of rise was arbitrarily defined as the number of weeks between the time a song was first listed in the tables and the point at which it fell below the tenth rank. Two considerations determined the choice of this measure: first, the "Top Ten" is a regular program

on many stations, and thus this cut off point seemed to have some face validity; second, a particular song typically fluctuates from week to week within the top ten, whereas once it has gone below the tenth rank, its decline is much smoother. For reasons mentioned below, only those songs were analyzed which were listed in the tables for at least ten consecutive weeks. In a minority of cases, some of these songs did not reach the top ten. For these songs, the period of rise was defined as the interval of time between the moment it was first listed in the tables and the week it reached its highest rank. (b) Decline: the period of decline was defined as the number of weeks a song was listed in the tables after its period of rise. The rate of decline was defined as the period of decline divided by the song's total life span (i.e. total number of weeks it was listed in the tables). The smaller this proportion, the greater rate of decline it indicates. In order to make the subsequent interpretation of the data simpler, we subtracted this proportion from 1, so that high scores indicate high rate of decline or fast decline. (c) Saturation: this score was defined as the proportion of time a song is in the top ten during its rise. It is a measure of how frequently a song is heard during its introduction to the public. The greater this proportion, the

the greater saturation it indicates.[26]

It is apparent that we have attempted to define our measures of saturation and rate of decline as relative scores or proportions since these seem to reflect more adequately the index we want, given rank order data instead of frequencies. However, even in the latter case, we would want to consider not just the absolute number of times a given song was heard, but also how concentrated the presentations were. Thus, for two songs that have the same frequency value, the one which has a shorter life span develops greater semantic satiation. Given the measures defined above, our prediction was that the greater the saturation score, the greater should be the rate of decline. The reverse, however, does not necessarily follow from the satiation prediction, i.e. if the saturation score is low, the rate of decline will not necessarily be low. This is so since there may be other, independent factors affecting period of rise (e.g. its appeal value for the public). Our prediction does imply, however, that no matter how high the appeal value of a song is, satiation will develop with high saturation, and consequently, its rate of decline will be high.

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[26] This measure indexes what disk jockeys often refer to as "terrific jump."

To insure against the possibility that we have artificially built in a correlation by our particular measures, we decided to make several other comparisons using the raw and unadjusted data. One of these, for example, is the relation between the time in top ten rankings and the period of decline. Here, the semantic satiation principle predicts a negative relation: the longer a song remains in the top ten, the more frequently it will be heard, and the less time it should remain in the bottom 35 during its decline. Other relationships such as period of rise compared to period of decline (predicted relation: negative), time in top ten versus time in bottom 35 (predicted relation: negative), have also been examined and these will be presented below.

One might say that these predictions follow from common sense and we need not refer to the operation of the semantic satiation principle. However, unless the "common sense" explanation invokes a similar process (e.g. "people get bored with a song that is played too often"), the opposite relationships could be equally well predicted (e.g. "the faster a song reaches the top ten and the longer it stays there, the better it is and the longer it should take to disappear from the listings," i.e. the slower its rate of decline).[27]

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[27]In fact, an informal survey among the writer's colleagues favored this last prediction two to one.

The six-month period of January to June 1959 was examined in Variety magazine, and the course of each song was recorded. A total of 335 different songs were listed during the 24-week period. There were large variations in the regularity and life span of these songs. Most of them never reached the top ten and stayed in the listings for only four or five weeks. Others disappeared for several weeks before reappearing again for a couple of weeks. It was felt that in order to test our satiation prediction adequately only those songs should be analyzed which were listed in the tables for at least ten consecutive weeks. This criterion would insure a certain degree of regularity as well as sufficient time to observe the operation of systematic changes. Furthermore, it was felt that semantic satiation would not be a determining factor unless the songs were heard for several consecutive weeks. Thirty-three songs during the six month period (or about 10%) met the above criterion, and the analysis was based on these only.

Results and Discussion. Table 21 presents the raw data obtained on the 33 songs as well as the two measures of saturation and rate of decline. The intercorrelations among the seven variables are presented in Table 22. It can be seen that our prediction of a significant relation between saturation and rate of decline is substantiated at well below

TABLE 21*

RAW DATA ON HIT PARADE SONGS[1]

| Period of Rise | Period of Decline[2] | Total Life Span | Time in Top Ten[3] | Time in Bottom 35 | Saturation[4] | Rate of Decline[5] |
|---|---|---|---|---|---|---|
| 7 | 4 | 11 | 7 | 4 | 1.00 | .74 |
| 7 | 5 | 12 | 7 | 5 | 1.00 | .59 |
| 10 | 4 | 14 | 9 | 5 | .90 | .72 |
| 5 | 5 | 10 | 4 | 6 | .80 | .50 |
| 3 | 7 | 10 | 0 | 10 | .00 | .30 |
| 8 | 2 | 10 | 7 | 3 | .88 | .80 |
| 3 | 7 | 10 | 1 | 9 | .33 | .30 |
| 11 | 3 | 14 | 10 | 4 | .90 | .79 |
| 8 | 3 | 11 | 7 | 4 | .88 | .73 |
| 13 | 3 | 16 | 10 | 6 | .76 | .82 |
| 5 | 5 | 10 | 0 | 10 | .00 | .50 |
| 5 | 6 | 11 | 4 | 7 | .80 | .46 |
| 7 | 6 | 13 | 2 | 11 | .28 | .54 |
| 4 | 6 | 10 | 0 | 10 | .00 | .40 |
| 7 | 3 | 10 | 6 | 4 | .85 | .70 |
| 12 | 2 | 14 | 2 | 12 | .16 | .86 |
| 5 | 5 | 10 | 1 | 9 | .20 | .50 |
| 8 | 5 | 13 | 2 | 11 | .25 | .62 |
| 8 | 3 | 11 | 6 | 5 | .75 | .73 |
| 11 | 3 | 14 | 9 | 5 | .81 | .79 |

*Continued on next page.

TABLE 21 (Continued)

RAW DATA ON HIT PARADE SONGS[1]

| | Period of Rise | Period of Decline[2] | Total Life Span | Time in Top Ten[3] | Time in Bottom 35 | Saturation[4] | Rate of Decline[5] |
|---|---|---|---|---|---|---|---|
| | 8 | 2 | 10 | 6 | 4 | .75 | .80 |
| | 9 | 4 | 13 | 7 | 6 | .77 | .70 |
| | 12 | 4 | 16 | 9 | 7 | .75 | .75 |
| | 10 | 3 | 13 | 7 | 6 | .70 | .77 |
| | 8 | 4 | 12 | 4 | 8 | .50 | .67 |
| | 4 | 8 | 12 | 1 | 11 | .25 | .34 |
| | 5 | 7 | 12 | 1 | 11 | .20 | .50 |
| | 6 | 4 | 10 | 2 | 8 | .33 | .60 |
| | 9 | 3 | 12 | 6 | 6 | .66 | .75 |
| | 8 | 3 | 11 | 7 | 4 | .88 | .73 |
| | 9 | 2 | 11 | 7 | 4 | .77 | .82 |
| | 8 | 2 | 10 | 6 | 4 | .75 | .80 |
| | 10 | 0 | 10 | 7 | 3 | .70 | 1.00 |
| Mean | 7.61 | 4.03 | 11.64 | 4.92 | 6.72 | .60 | .65 |
| SD | 2.57 | 1.78 | 3.22 | 3.09 | 7.76 | .31 | .17 |

[1]Entries refer to number of weeks.

[2]A zero in this column indicates that the song dropped out completely from the Top Ten.

[3]A zero in this column indicates that the song never reached the Top Ten.

[4]Obtained by dividing Period of Rise into Time in Top Ten. High scores indicate high frequency of presentation during the song's introduction to the public.

[5]Obtained by dividing Period of Decline into Total Life Span, and then subtracting from 1, so that high scores indicate fast decline.

TABLE 22

PRODUCT-MOMENT CORRELATION COEFFICIENTS BETWEEN THE VARIOUS MEASURES USED FOR THE HIT PARADE SONGS (N = 33)*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Period of Rise | -- | .78 | .61 | -.69 | .44 | .87 | -.91 |
| 2. Time in Top Ten | | -- | .88 | -.66 | .18 | .76 | -.82 |
| 3. Saturation | | | -- | -.56 | .18 | .62 | -.90 |
| 4. Period of Decline | | | | -- | -.06 | -.95 | .71 |
| 5. Total Life Span | | | | | -- | .32 | .11 |
| 6. Rate of Decline | | | | | | -- | -.65 |
| 7. Time in Bottom 35 | | | | | | | -- |

*A coefficient value of .35 is significant at the 5% level, and one of .45 is significant at the 1% level of confidence.

the 1% level of significance. Furthermore, the following additional relationships emerge, all of which further support the satiation prediction: (a) the longer the time spent in the top ten, the shorter the period of decline, the higher the rate of decline, and the less the time spent in the bottom 35; (b) the higher the saturation, the shorter the period of decline, the faster the rate of decline, and the less time spent in the bottom 35; (c) the longer the period of rise, the shorter the period of decline, and the less time spent in the bottom 35.[28]

The other significant correlations in Table 22 reflect the similarity between the measures used. For example: the longer the period of rise, the more time spent in the top ten, and the higher the saturation; also, the shorter the period of decline, the higher the rate of decline, the less time spent in the bottom 35. In general, the variable of total life span does not seem to be related to the other measures, a finding which suggests that other variables are operating in this complex situation.

Despite these favorable results one must exert caution

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[28]This last relationship is meaningful in the light of the fact that, as can be seen in Table 21, a song, during its period of rise, spends most of its time in the top ten. The correlation of +.78 between these two variables also reflects this fact.

in the conclusions which might be based on them. In the first place, as has been mentioned above, the analysis was limited to a sample of songs that stayed in the listings for at least ten weeks in a row. This might limit the generality of the results. In the second place, the results are based on rank data, while a true test of the satiation hypothesis should be based on actual frequency data, preferably the counter frequencies on juke boxes. Also, it is entirely possible that the relationships demonstrated here reflect the satiation curve of the disk jockey himself, not that of his audience, or even, the deliberate policies of publishing companies.[29] These alternate possibilities for explaining the results clearly point to the desirability of replicating the above analysis with a different set of data, including not only Hit Parade songs, but also other mass media phenomena where the principle of satiation may operate (e.g. television serials, popular books, fads in clothing and dances, etc.).

Individual Differences in Semantic Satiability.

We have pointed out at the beginning of this chapter that when investigating the effects of repeated stimulation,

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[29] For example, if a record has had great initial success and most of the buyers have already acquired it, the publisher may deliberately attempt to "push" new records (for more sales), which would result in a faster decline of the hit record.

the personality characteristics of the Ss may be important determinants of the degree or extent of semantic satiation actually exhibited in any particular situation. The importance of individual differences in susceptibility to conditioning and extinction has been noted by many investigators. We have mentioned previously (Chapter I) the work of Eysenck (1955; 1956) and Wertheimer (1954) who have made an attempt to relate satiation measures to personality variables (e.g. conditionability, extraversion-introversion) and have formulated separate theories which view these individual differences in terms of innate cortical excitation-inhibition (or modifiability) characteristics. The results which will be presented below represent an attempt on our part to deal with the problem of personality correlates of "semantic satiability."[30] This unsystematic attempt can only be taken as a preliminary effort in this direction and, as will soon become apparent, it actually raises more questions than it answers.

Reliability.

A primary consideration in an attempt to relate semantic satiability to other personality variables is its reliability as an index of an individual's reactions to repeated presenta-

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[30] I am indebted to Jerry Sepinwall for assisting me in the gathering and analysis of these data.

tion of verbal material. Hence, our first step was to try to assess this reliability. For this purpose, two forms of the semantic differential (A and B) were prepared by selecting two different sets of six words and scales that appeared superficially equivalent in terms of familiarity, meaningfulness, and scale-concept relevance. The semantic satiation treatment using Form A was administered to a group of 30 male tenth grade high school students. A week later, Form B was given, using the same procedure. During the third week, Form A was administered again to the same Ss. Since we had previous reasons to suppose that semantic satiability was related to success in language learning (see p. 113), we also obtained from the school principal oral and written French (foreign language) grades for these Ss as well as their IQ scores (Henmon-Nelson). The resulting set of intercorrelations among the six variables is given in Table 23. It can be seen that the only significant correlations are among oral and written French grades and IQ. Test retest reliability coefficients for either the same or different forms on the semantic satiation test are not significant. If anything, they seem to be negatively related.

It is worth noting that, although none of the correlations between French grades and satiation scores were signi-

TABLE 23

INTERCORRELATIONS AMONG TEST-RETEST SEMANTIC SATIATION SCORES, SUCCESS IN FRENCH, AND IQ (N = 30)

| Variables | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Satiation $A_1$ | -- | -.32 | -.16 | .31 | .14 | .09 |
| 2. Satiation $B_1$ | | -- | .22 | -.06 | -.20 | -.03 |
| 3. Satiation $A_2$ | | | -- | -.10 | -.07 | -.00 |
| 4. Oral French | | | | -- | .70* | .50* |
| 5. Written French | | | | | -- | .63* |
| 6. IQ | | | | | | -- |

*Significant at beyond the 1% level of confidence.

ficant, the hypothesis of a relation between semantic satiability and success in language learning received support from a different analysis of the data. When the Ss were separated on the basis of success in oral French into two groups, one high (first class standing, i.e. 80% or above), the other group low (i.e. below 80%), it was found that the high group ($N = 12$) had a mean polarity-difference score during the first satiation treatment of 5.33 (i.e. a semantic generation effect), while the lower group ($N = 18$) had a mean polarity-difference score of -1.83 ($t = 2.17$; $P < .05$) (a semantic satiation effect). This is support for our previously stated hypothesis that semantic satiability is negatively related to success in second language acquisition.

The lack of test retest reliability of semantic satiability is reminiscent of the low reliability of other satiation measures such as kinaesthetic and figural after effects. This lack of reliability has been attributed to the persistence effects observed with satiation phenomena (cf. Wertheimer and Leventhal, 1958) which obviate attempts to demonstrate test retest reliability. However, split-half reliabilities have fared better inasmuch as they are less subject to distortion effects. In the present case the split-half reliability coefficients for odd-even responses on the three

semantic satiation tests were .53, .55, and .57, respectively, all three being significant at beyond the 1% level of confidence. Examination of the satiation scores for the three testings suggests the presence of persistence and cumulative effects of the semantic satiation treatment; these means were, in order of testing sessions, as follows: 0.03 ($t = 0.60$; n.s.), 0.01 ($t = 0.13$; n.s.), and -0.08 ($t = 2.44$; $P < .05$).[31] This shows that only on the third successive testing (or the second testing with the same form) did the group as a whole exhibit a significant semantic satiation effect. This is in striking contrast with the large significant satiation effects obtained on the first testing with college students and adults in our previous studies. These differences suggest that age might perhaps be related to susceptibility to the semantic satiation effect. Warren (1961a) has found in connection with his "verbal transformation effect" that his younger group (aged 18-25, i.e. similar to our college population) exhibit less stable perceptions with repetition of auditorily presented verbal stimuli than an older group (aged 62-86). If lack of stability in Warren's situation can be interpreted as a phenomenon akin to semantic satiation, then the hypothesis

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[31] These means represent polarity-difference scores per individual rating.

suggests itself that the relation between age and semantic satiability is of an inverted-U type, with middle aged Ss exhibiting larger satiation effects than both children and the aged. For the present, however, we have no data that bear upon this point.

Repeated Testing with the Semantic Differential.

The possibility of the existence of systematic effects in repeated testing with the semantic differential should be examined inasmuch as it, together with the persistence and cumulative effects of the satiation treatment, may also affect test retest reliability. Both problems were further studied by administering the semantic differential a number of times to several groups of Ss under repetition conditions (semantic satiation) as well as under normal conditions. The polarity of ratings during each testing was recorded and the results are presented in Fig. 3. Group A received the semantic satiation treatment twice, separated by a one-week interval; Group B received the semantic satiation treatment twice separated by a three-week interval. Testings I and III represent polarity ratings prior to verbal repetition, while testings II and IV represent post-repetition ratings. Group C received three adminstrations of the semantic satiation treatment; this

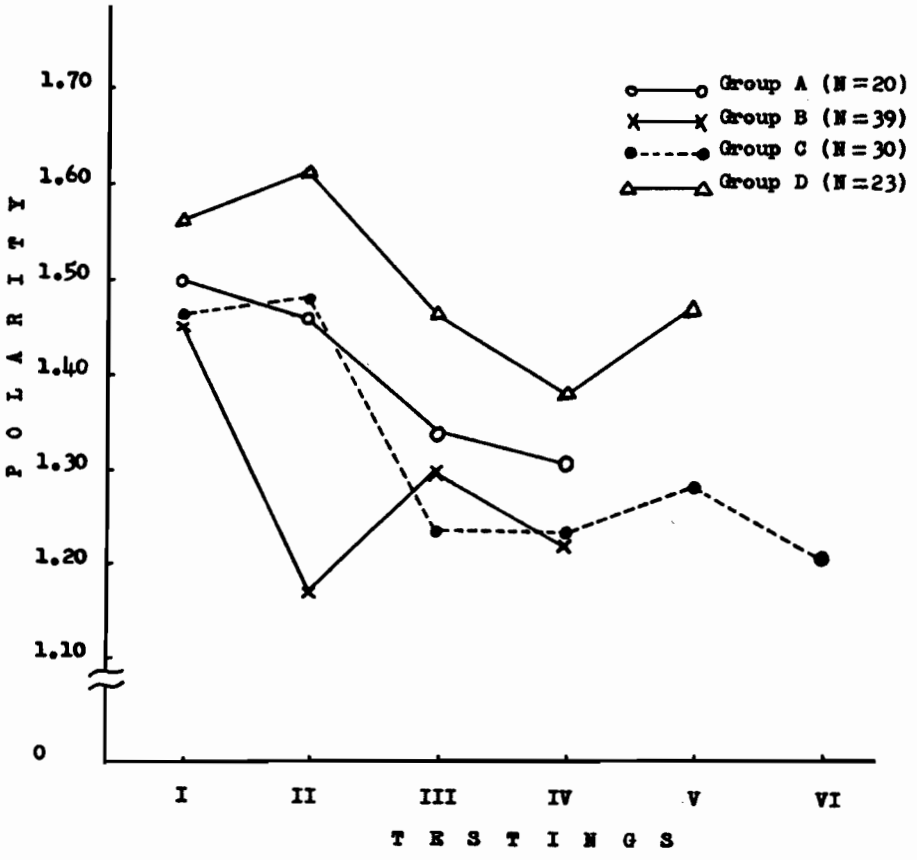


FIGURE 3. Polarity scores as a function of repeated testing with the semantic differential (high school males).

group has already been mentioned in the previous section (see Table 23). Testings I, III, and V represent pre-repetition ratings, while testings II, IV, and VI represent post-repetition ratings. Group D simply filled out a semantic differential booklet five times at weekly intervals. One form was used during testings I, III, and V, while a different form was used for testings II and IV. Inspection of Fig. 3 reveals a general trend of decrease in polarity of ratings with repeated administration of the semantic differential task. The effect is noticeable not only with semantic satiation treatments with identical forms (Groups A and B), but also with semantic satiation treatment with alternate forms (Group C) as well as with normal semantic differential ratings (no semantic satiation treatment) with alternate forms (Group D). Two separate interpretations of these results can be offered. One relates to the argument of Osgood and Tannenbaum (1955) that the degree of polarity of ratings on the semantic differential is inversely related to S's sophistication. It is possible that with repeated testings Ss become more sophisticated with the instrument and tend to give less extreme ratings. The other interpretation is in terms of persistence and cumulative effects of responses to repeated stimulus conditions of a similar nature. This effect may be both specific

to the particular words and scales used (in the case of semantic satiation treatment with identical forms), and/or generalized to the rating task itself (in the case of alternate forms with or without verbal repetition). It is not unlikely that both effects referred in these two interpretations operate in the testing situations summarized in Fig. 3.

A Replication Attempt.

In the previous section we have presented some data which bears upon the possible relationship between semantic satiability and success in second language acquisition. We have attempted to investigate this relationship further by administering to a group of male tenth grade high school students two paired-associate tasks along with the semantic satiation treatment, on the assumption that these learning tasks represent a particular skill necessary in foreign language acquisition which may be more closely dependent upon semantic satiability than other aspects of language learning skills (see Carroll, 1960). Paired-Associates I consisted of 14 pairs of unrelated meaningful words presented in a standard memory drum at a 1:1 exposure rate with a 3-sec. intertrial interval. The Ss' scores represent the number of trials necessary to reach a criterion of one errorless repetition. Thus, low scores on this task represent fast learning.

Paired-Associates II consisted of Test V of the Foreign Language Aptitude Battery (Carroll and Sapon, 1955) which consists of 24 pairs of nonsense syllables and meaningful words. These appear on a single sheet of paper and Ss are given four minutes to study it, after which they are handed a test sheet on which they have to underline the correct English alternative to each of the nonsense syllables. Here, high scores represent many correct recognitions or high success.

In addition to the two paired-associate learning tasks four other measures were administered to the same group. These were included because it seemed from the psychological literature that they may have something to do with individual differences in "satiability." One was the California F Scale (Adorno, Frenkel-Brunswick, Levinson, and Sanford, 1950) which has been used by other investigators as a measure of "authoritarianism" (the higher the score on this questionnaire, the more authoritarian the person is considered). A second measure was a Persuasibility test specially devised for the present experiment. Ss were asked to fill out an attitude form of the semantic differential (i.e. evaluative scales only) on five persons who were likely to be well known to a Montreal high school population (Sugar Ray Robinson, John Diefenbaker, Nikita Khrushchev, Fidel Castro, and Maurice

"Rocket" Richard). Then, each S was given a written propaganda statement about the first three people designed to change the attitude of the Ss toward them. The statements were unfavorable toward Robinson and Diefenbaker, and favorable toward Khrushchev. Then, the Ss were given the semantic differential booklet a second time, and the degree of change in ratings toward the advocated evaluative poles was subsequently analyzed. The greater these changes were, the more persuasible the Ss were considered.[32] Another variable (Polarity I) was the polarity score for each S on the initial ratings of the concepts used in the semantic satiation treatment ("snail," "money," and "anger"). The last variable (Polarity II) was the polarity of the initial ratings given to the five social controversial figures used in the persuasibility test. The reason for including the last two variables was that one investigator (Mogar, 1960) has recently reported significant positive relationships between the F Scale and the tendency to give extreme ratings on the semantic differential, more so in the case of controversial

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[32] As a check on the effectiveness of the "propaganda" we calculated the difference between the mean amount of change on the three experimental concepts and the amount of change on the two other concepts, and the former was found to be significantly greater than the latter ($t = 4.67$; $P < .001$).

social concepts (here, Polarity II) than in the case of noncontroversial concepts (here, Polarity I). It was our feeling that both extremity of ratings and the F Scale might be related to persuasibility and semantic satiability.

The Ss were tested individually over a two-month period. For some, the testing program was completed in two sessions of a little over an hour each, while for others, three shorter sessions were necessary. Not all Ss completed the whole testing program so that N for the intercorrelations given in Table 24 varies from a low of 9 (r between variables 3 and 4) to a high of 52.

Inspection of Table 24, which presents the intercorrelations among the seven variables, reveals the following points: (1) Semantic Satiability and Paired-Associates I are negatively related, indicating that Ss who are prone to exhibit semantic satiation with verbal repetition are less successful in a standard paired-associate learning task than are Ss who are less semantically satiable; this finding is, then, in agreement with our previously stated hypothesis. (2) The intercorrelations between the F Scale, Paired-Associates II, Persuasibility, and Polarity II indicate that the more authoritarian a S is, the more persuasible he is, the more extreme his ratings are on social controver-

TABLE 24

INTERCORRELATIONS AMONG SEVEN VARIABLES USED WITH MALE HIGH SCHOOL STUDENTS[1]

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Semantic Satiability[2] | -- | .13 | -.34* | .20 | .09 | .14 | .14 |
| 2. F Scale | | -- | -.14 | -.48* | .40** | .16 | .32* |
| 3. Paired-Associate I | | | -- | -.40 | -.08 | -.02 | -.15 |
| 4. Paired-Associate II | | | | -- | -.55* | -.12 | -.49* |
| 5. Persuasibility | | | | | -- | .02 | .44** |
| 6. Polarity I | | | | | | -- | .59** |
| 7. Polarity II | | | | | | | -- |

[1]Not all Ss were available for each test; as a consequence, N varies from 9 to 52.

[2]One of the 41 Ss for whom this measure was available had an abnormally high polarity-difference score (i.e. beyond three standard deviations from the mean) and he was excluded from the analysis.

*Significant at beyond the 5% level of confidence.

**Significant at beyond the 1% level of confidence.

sial concepts, and the less successful he is on a paired-associate task of a particular nature.[33] (3) Ss who give extreme ratings on social controversial concepts also tend to give extreme ratings on noncontroversial concepts. (4) Semantic Satiability is not significantly related to Authoritarianism, Persuasibility, Paired-Associates II, and extremity of ratings. (5) The two paired-associate tasks are not significantly correlated with each other. The correlation of -.40 is in the proper direction, however, since a small number of trials to reach criterion on task I and a high recognition score on task II both indicate efficient learning. This lack of significance is difficult to evaluate since the number of Ss who were given both tasks was only 9.

In an attempt to verify the generality of the above findings we have administered a similar testing program to a group of 32 male and female public school teachers (whose

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[33]The instructions on the Paired-Associate II task which are taken from Carroll and Sapon (1955) introduce the material as an English-Kurdish vocabulary. It is possible that Ss' attitudes toward "Kurdish" or "Foreign Language" may have contaminated the task as an index of verbal learning ability. This may account for the relation between this task and the F Scale (i.e. the more authoritarian a S is, the more ethnocentric, the more negatively oriented he is toward "foreign" objects, and the less willing he is to acquire the "Kurdish" vocabulary; see Lambert, 1962).

mean age was 23 years) enrolled in various courses in summer school. The results obtained with this group were essentially the same as those just described with the high school group: semantic satiability was again negatively related to paired-associate learning ($r = -.31$; $P < .10$), but not to authoritarianism ($r = .23$) or persuasibility ($r = .10$); the latter two measures were significantly related to each other ($r = .40$; $P < .05$) and with extremity of ratings on the social controversial concepts ($r = .46$; $P < .05$, and $r = .58$; $P < .01$, respectively).[34] In addition, age was found to be negatively related to efficiency in paired-associate learning ($r = -.43$; $P < .02$).

It would appear from the results on the two groups that the negative relation between semantic satiability and verbal learning of the paired-associate type is stable and can be replicated on samples of two different populations. On the other hand, the other personality correlates used in this study (authoritarianism, persuasibility, tendency to give extreme ratings) do not seem to be related to semantic satiability. This conclusion is necessarily limited to the

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[34] These concepts for the present group were: James Coyne and Donald Fleming, two figures involved in a lively political controversy at the time of testing. The propaganda statements were favorable to Coyne and unfavorable to Fleming.

particular methods we have used in the present attempt to index these personality variables. This limitation is especially noteworthy in the case of "persuasibility" for which there is not a single reliable measure of any certain validity available. The persuasibility test used here has been devised by the present investigator and he has no data on its reliability or objective validity beyond the knowledge of the stability of semantic differential ratings and the instrument's face validity.

Summary.

In the present chapter we have investigated the role of semantic satiation in mass media and communication as well as the problem of individual differences in susceptibility to the satiation effect (semantic satiability). We have shown how a prediction concerning the role of semantic satiation in song popularity was supported by an analysis of the fate of Hit Parade songs. It was also found that semantic satiability is negatively related to success in verbal learning of the standard paired-associate type. The results on the relation between semantic satiability and other personality characteristics (authoritarianism, persuasibility, tendency to give extreme judgments with the semantic differential) were generally negative. It was

suggested that the findings presented in this chapter are to be looked upon as tentative pending further investigation.

# CHAPTER IX

## SUMMARY AND OVERVIEW

Chapter I.

The effects of repeated stimulation on behavior have previously been interpreted as developing either "inhibition," when a response decrement occurs following repeated elicitation, or "satiation," when sensory adaptation takes place following continuous stimulation. Several authors have advanced various theories which view the phenomena related to both inhibition and satiation as different manifestations of an innate characteristic of the organism, namely the extent to which the central nervous system exhibits neural fatigue under continuous activity.

Chapter II.

Researchers in Titchener's laboratory have reported that when a word is continuously repeated by a subject the word's meaning lapses. This phenomenon, which came to be known as "verbal satiation," is logically one example of the effects of repeated stimulation, but it was not extensively investigated by psychologists. The paucity of experiments on verbal satiation is puzzling in view of the

importance generally attributed to symbolic processes, language, and thinking by many theorists. Researchers likely felt uneasy about studying meaning or changes in meaning because no objective tool was available for measuring these phenomena. The recent development of the semantic differential has opened up the possibility of experimentally investigating meaning changes under repeated presentation. An experiment was described in which it was shown that verbal repetition of familiar words results in a decrease in the intensity of their meaning as measured by the semantic differential. This effect was labeled "semantic satiation." Chapter III.

Psychologists are interested in two aspects of language behavior: the learning of the meaning of signs (decoding), and their use in speaking and thinking (encoding). Decoding can be viewed as the elicitation by a sign of a learned implicit "representational mediation response" which is identified with the meaning of that sign. Encoding relates to the problem of instrumental conditioning whereby an overt response (either verbal or nonverbal) is conditioned to the inferred meaning response. The problem in the measurement of meaning is to obtain an indirect measure of representational mediation responses. To the extent that

the semantic differential indexes the strength and type of representational mediation responses elicited by a sign, it can serve to test hypotheses about the characteristics of meaning responses. The assumption that implicit meaning responses follow the same behavioral principles as overt responses offers the possibility of experimentally studying the higher mental processes.

Studies of extinction reveal that repeated elicitation of a response leads to its inhibition. If this principle is applied to meaning responses, one would expect that their rapid and continued elicitation would also lead to their inhibition. Consequently, a word which is repeated should lose its meaning. Semantic satiation can be viewed as a cognitive form of the more general phenomenon of extinction.

Chapter IV.

An experiment was carried out to throw light on the following two questions: 1. Are the representational mediation responses peripheral (muscular or glandular reactions) or central (purely neural) processes? 2. Is the reduction in meaning involved in semantic satiation temporary or permanent? The experimental procedure required subjects to give semantic ratings of the words "canoe" and "negro" immediately after verbal repetition of "nuka" and

"grony," respectively. These two disyllables are actually "canoe" and "negro" pronounced backwards, and thus involve the same or approximately the same muscular responses when continuously repeated. It was argued that if meaning responses are mainly peripheral then repetition of "nuka" and "grony" should be reflected in the semantic ratings of "canoe" and "negro," respectively. If, on the other hand, meaning responses are mainly central, repetition of the nonsense paralogs should not affect the meaning of "canoe" and "negro." The results clearly supported the central interpretation of meaning. With respect to the second question, evidence was presented which indicates that the semantic satiation effect persists for at least several minutes. The upper limit was not actually tested.

Chapter V.

The role of verbal symbols in thinking has been emphasized by several writers. Thus, concept formation has been described as the making of a common verbal mediating response to a class of stimuli the members of which have some characteristics in common. A card sorting problem was devised in which subjects were required to categorize a set of words into two classes. The basis of classification could be either semantic (i.e. the abstraction of a common meaning for one

subset of the words) or phonetographic (i.e. a division on the basis of rhyming or word length). It was predicted that semantic satiation of the concept representing the common meaning element for a particular subset of words should decrease the likelihood of semantic solutions and increase the number of phonetographic ones. The results supported the second part of the prediction, but not the first.

In a second experiment, subjects were required to repeat a number aloud just before they were given an addition task in which the repeated number was one of the two additives. The results confirmed the hypothesis that semantic satiation of a number increases the difficulty of a computation task which involves that number.

Chapter VI.

A well known characteristic of extinction is its spread or generalization to other responses that are similar to the one which is directly extinguished. This effect is known as "secondary extinction." If it could be shown that semantic satiation also has this generalization tendency, then its identification as a special instance of extinction would be made more convincing. The following two experiments were designed with the above purpose in mind.

In the first, subjects learned a paired-associate list

consisting of A-B members. Subsequently, they learned a second list consisting of A-D pairs. The relation between the two lists was such that D was the most common verbal associate to C which, in turn, was the most common associate to B, e.g. soldier → army → navy. Previous investigators have shown that the learning of the A-D list was facilitated by prior acquisition of the A-B list. This facilitation effect was attributed to the mediation of the C words. In the present experiment, the C words were satiated after acquisition of the A-B list and prior to learning of the A-D list. The results showed that satiation of the mediators (i.e. the C words) significantly reduced the facilitation effect during learning of the A-D list, thus supporting the hypothesis of a generalization of the effects of semantic satiation from C to D words.

In the second experiment, French-English bilingual subjects were required to repeat a word in one language prior to rating its translated equivalent in the other language. It was predicted that "compound" bilinguals (i.e. those that have interdependent language systems) would exhibit a cross-linguistic semantic satiation effect (cross-satiation), while "coordinate" bilinguals (i.e. those having independent meaning systems) would not show the effect. The prediction was

confirmed in that cross-linguistic generalization of satiation took place for the compound bilinguals, while the opposite effect (disinhibition) occurred with the coordinates. Chapter VII.

It has been shown by several investigators that extinction is inversely related to stimulus complexity. The purpose of the present experiment was to show that semantic satiation varies inversely with stimulus complexity as defined by a "specificity-generality" continuum. Four points on this continuum were arbitrarily chosen as follows: objects, black-and-white photographs, underexposed photographs, and words. Each of the four types of stimuli was presented to a separate group of subjects under both an experimental inspection condition (involving a series of 15-sec. exposures) and a control condition (involving normal semantic differential ratings). Comparison of ratings before and after the inspection conditions revealed that the kind and degree of meaning changes that took place were significantly affected by the type of stimuli presented. Words exhibited a semantic satiation effect while objects showed the opposite effect ("semantic generation"). The semantic changes exhibited with photographs were of an intermediary nature. A more detailed hypothesis was formulated to account for the inverse relation-

ship between semantic satiation and stimulus complexity.

Chapter VIII.

The study of the effects of repeated presentation of stimuli upon their meaning can be extended to include the mass communication media. Some of the variables which can be investigated include the relation between amount of repetition of messages and the degree of opinion and attitude change of listeners who vary in terms of personality characteristics. The operation of semantic satiation in mass media was illustrated by an analysis of the behavior of popular songs on the Hit Parade. It was predicted that the rate at which songs lose popularity would depend upon the frequency with which the song is played during its popular period: the higher this frequency, the greater the satiation developed, and the faster the song should lose popularity. Intercorrelations among various measures of gain and loss in popularity of a sample of songs fully supported the above prediction.

The problem of individual differences in susceptibility to the semantic satiation effect was investigated by attempting to relate semantic satiability to other personality variables. The only significant finding so far has been a negative relation between satiability and success in learning a standard paired-associate task. This positive finding, as

well as the negative results, should be looked upon as tentative only until further investigations are conducted.

Overview.

The role of verbal symbols in higher mental processes has often been emphasized by psychologists. Nevertheless, the effects of repeated presentation of verbal materials upon behavior have not been extensively studied. Repeated presentation of verbal stimuli results in a decrease of their meaning. This effect, referred to as semantic satiation, was objectively measured by means of the semantic differential. A series of experiments was described in which the role of semantic satiation was investigated in concept formation, addition tasks, verbal paired-associate learning, and in cross-linguistic interference among bilinguals. At a different level of inquiry, the operation of semantic satiation in mass media was illustrated by an analysis of the fate of popular songs. An attempt was also made to relate semantic satiation to properties of the stimulus materials presented and personality characteristics of subjects. A theoretical interpretation was offered which views semantic satiation as a cognitive form of the more general phenomenon of extinction.

Direction of Future Research.

The experiments reported in this thesis can be conveniently

divided into three classes: (A) Generalization or transfer of semantic satiation (Chapters IV, V, and VI). (B) The operation of semantic satiation in communication and mass media (Chapter VIII, first part). (C) Semantic satiability viewed as a personality characteristic (Chapter VIII, second part). Further research on the phenomenon of semantic satiation could be initiated within each of these areas.

(A) Generalization of Semantic Satiation. The transfer effects involved here can logically operate at three levels: (i) From verbal stimuli to other verbal stimuli. This was demonstrated in the generalization of inhibition from one to the other of a bilingual's two languages (Chapter VI). One would expect that the extent of secondary satiation should be proportional to the degree of semantic similarity between the primary and secondary stimuli as measured by some index such as the semantic differential, or the extent of overlap in free association responses, or rated similarity of the stimulus series. (ii) From verbal to nonverbal stimuli. The effect of verbal repetition upon concept formation and problem solving is an example of this type of investigation (Chapter V). It is possible to extend this line of research to include purely motor tasks that need not be mediated by

verbal responses, e.g. driving an automobile, visual tracking of an object on a radar screen, knitting and basket weaving, playing a musical instrument, etc. The possibility exists that, with such tasks, the tendency to make verbal mediating responses (verbalizations) hinders efficient performance. One would then expect that semantic satiation of these verbal mediating responses would increase efficiency of performance. (iii) From nonverbal to verbal stimuli. This is the reverse effect of the previous one and its experimental study would involve an inquiry into the affective and attitudinal changes that take place during performance of repetitive tasks.

(B) Semantic Satiation in Communication and Mass Media. A research program in this area has already been outlined in some detail (see pp. 141 ff.).

(C) Individual Differences in Semantic Satiability. Several writers have contended that individual differences in susceptibility to satiation, as measured by reminiscence and visual and kinaesthetic after-effects, represents an innate characteristic of the central nervous system that determines important aspects of the personality structure of an individual. The method developed here to measure

semantic satiation could serve as a useful tool in testing the above hypothesis.

Finally, little is known about the relation of rote learning ability to intelligence and other personality aspects of the individual. In this connection, our finding of an inverse relation between semantic satiability and paired-associate learning is most interesting and warrants further investigation.

# BIBLIOGRAPHY

Abelson, H. I. Persuasion. New York: Springer Publishing Co., 1959.

Adorno, T. W., Frenkel-Brunswick, E., Levinson, D. J., and Sanford, R. N. The authoritarian personality. New York: Harper, 1950.

Atherton, M. V. and Washburn, M. F. Mediate associations studied by the method of inhibiting associations: an instance of the effect of 'Aufgabe.' Amer. J. Psychol., 1912, 23, 101-109.

Bassett, M. F. and Warne, C. J. On the lapse of verbal meaning with repetition. Amer. J. Psychol., 1919, 30, 415-418.

Becker, W. C. Cortical inhibition and extraversion-introversion. J. abnorm. soc. Psychol., 1960, 61, 52-66.

Boring, E. G. A history of experimental psychology. New York: Appleton-Century-Crofts, 1950.

Cantril, H. and Allport, G. W. The psychology of radio. New York: Harper, 1935, pp. 196-200.

Capaldi, E. J. The effects of different amounts of training on the resistance to extinction of different patterns of partially reinforced responses. J. comp. physiol. Psychol., 1958, 51, 367-371.

Carroll, J. B. The prediction of success in intensive foreign language training. Cambridge, Mass: Author, 1960.

Carroll, J. B. Review of C. E. Osgood, G. J. Suci, and P. H. Tannenbaum, The measurement of meaning. Language, 1959, 35, 58-77.

Carroll, J. B. and Sapon, S. M. Psi-lambda foreign language aptitude battery. Cambridge, Mass.: Author, 1955.

Cromwell, H. and Kunkel, R. An experimental study of the effect on the attitude of listeners of repeating the same oral propaganda. J. Soc. Psychol., 1952, 35, 175-184.

Cronbach, L. J. and Meehl, P. E. Construct validity in psychological test. Psychol. Bull., 1955, 52, 281-302.

Deutsch, M. Field theory in social psychology. In Handbook of Social Psychology, G. Lindzey (Ed.), Cambridge, Mass.: Addison-Wesley Publishing Co., 1954, Ch. 5, p. 203.

Dodge, R. Elementary conditions of human variability. New York: Columbia Univer. Press, 1927.

Dodge, R. The problem of inhibition. Psychol. Rev., 33, 1926a, 1-33.

Dodge, R. Theories of inhibition, Part II. Psychol. Rev., 1926b, 33, 168-187.

Dodge, R. The laws of relative fatigue. Psychol. Rev., 1917. 24, 89-113.

Don, V. J. and Weld, H. P. Lapse of meaning with visual fixation. Amer. J. Psychol., 1924, 35, 446-450.

Duncan, C. P. On the similarity between reactive inhibition and neural satiation. Amer. J. Psychol., 1956, 69, 227-235.

Ehrensberger, R. An experimental study of the relative effectiveness of certain forms of emphasis in public speaking. Speech Monog., 1945, 12, 94-111.

Ervin, S. M. and Osgood, C. E. Second language learning and bilingualism. In C. E. Osgood and F. Seboek (Eds.), Psycholinguistics. (Suppl.), J. abnorm. soc. Psychol., 1954, 49, 139-146.

Eysenck, H. J. Reminiscence, drive, and personality theory. J. abnorm. soc. Psychol., 1956, 53, 328-333.

Eysenck, H. J. Cortical inhibition, figural after-effect, and theory of personality. J. abnorm. soc. Psychol., 1955, 51, 94-106.

Fenn, J. D. and Goss, A. E. The role of mediating verbal responses in the conceptual sorting behavior of normals and schizophrenics. J. genet. Psychol., 1957, 90, 59-67.

Ferguson, G. A. Statistical analysis in psychology and education. New York: McGraw-Hill, 1959.

Foley, J. P., Jr., and Cofer, C. N. Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients. J. exp. Psychol., 1943, 32, 168-175.

Gardner, I. C. The effect of a group of social stimuli upon attitudes. J. educ. Psychol., 1935, 26, 471-479.

Gaynor, Miriam. An effect of satiation on recall. Unpublished Ph.D. Dissertation, New School for Social Research, New York, 1954.

Gibson, J. J. The perception of the visual world. Cambridge, Mass.: The Riverside Press, 1950.

Gibson, J. J. Adaptation with negative after-effect. Psychol. Rev., 1937, 44, 222-244.

Glanzer, M. Stimulus satiation: An explanation of spontaneous alternation and related phenomena. Psychol. Rev., 1953, 60, 257-268.

Glickman, S. E. Perseverative neural processes and consolidation of the memory trace. Psychol. Bull., 1961, 58, 218-233.

Goss, A. E. Early behaviorism and verbal mediating responses. Amer. Psychol., 1961, 16, 285-298.

Hebb, D. O. The organization of behavior. New York: John Wiley and Sons, 1949.

Helson, H. Adaptation level as a frame of reference for prediction of psychophysical data. Amer. J. Psychol., 1947, 60, 1-29.

Hilgard, E. R. and Marquis, D. G. Conditioning and learning. New York: Appleton-Century, 1940.

Hollingworth, H. L. The psychology of the audience. New York: American Book Co., 1935.

Horwitz, M., Exline, R., Goldman, M., and Lee, F. Motivational effects of alternative decision-making processes in groups. Office of Naval Research Technical Report, June, 1953.

Howe, H. C. "Mediate" association. Amer. J. Psychol., 1893, 6, 239-241.

Hull, C. L. Principles of behavior. New York: Appleton-Century-Crofts, 1943.

Jakobovits, L. A. Semantic satiation among bilinguals. Unpublished M.A. Thesis, McGill University Library, 1960.

Jenkins, J. J. and Russell, W. A. Annual technical report: Basic studies on individual and group behavior. Contract No. N8 onr-66216 between Office of Naval Research and University of Minnesota, 1956 (Mimeo.).

Jersild, A. Primacy, recency, frequency, and vividness. J. exp. Psychol., 1929, 41, 58-70.

Jersild, A. Modes of emphasis in public speaking. J. Appl. Psychol., 1928, 12, 611-620.

Johnson, R. C., Thomson, C. W., and Frincke, G. Word values, word frequency, and visual duration thresholds. Psychol. Rev., 1960, 67, 332-342.

Kanungo, R., Lambert, W. E. and Mauer, S. M. Semantic satiation and paired-associate learning. Dept. of Psychology, McGill University, 1960 (Mimeo.).

Karsten, Anitra. Psychische sättigung. Psychol. Forsch., 1928, 10, 142-154.

Karwoski, T. F., Gramlick, F. W., and Arnott, P. Psychological studies in semantics: I. Free association reactions to words, drawings and objects. J. soc. Psychol., 1944, 20, 233-247.

Kendler, H. H. and D'Amato, May F. A comparison of reversal shifts in human concept formation behavior. J. exp. Psychol., 1955, 49, 165-174.

Köhler, W., and Fishback, J. The destruction of the Müller-Lyer illusion in repeated trials: I. An examination of two theories. J. exper. Psychol., 1950a, 40, 267-281.

Köhler, W. and Fishback, J. The destruction of the Müller-Lyer illusion: II. Satiation patterns and memory traces. J. exp. Psychol., 1950b, 40, 398-410.

Köhler, W. and Wallach, H. Figural after-effects. Proc. Amer. phil. Soc., 1944, 88, 269-357.

Kounin, J. S. Experimental studies of rigidity: I. Charact. Pers., 1941, 9, 251-272.

Lambert, W. E. Psychological approaches to the study of language. Paper prepared for the Seminar on Language Teacher Training, held at the University of Washington, Summer, 1962 (Mimeo.).

Lambert, W. E. Measurement of the linguistic dominance of bilinguals. J. abnorm. soc. Psychol., 1955, 50, 197-200.

Lambert, W. E., Havelka, J. and Crosby, C. The influence of language-acquisition contexts on bilingualism. J. abnorm. soc. Psychol., 1958, 56, 239-244.

Lewis, D. J. and Duncan, C. P. The effect of partial reinforcement and length of acquisition-series upon resistance to extinction of a motor and a verbal response. Amer. J. Psychol., 1956, 69, 644-646.

Liberman, A. M. The effect of interpolated activity on spontaneous recovery from experimental extinction. J. exp. Psychol., 1944, 34, 282-301.

Lipman, R. S. and Spitz, H. H. An experimental test of the similarity between Hull's inhibition constructs and Köhler's satiation construct. Paper read at the EPA Meeting, Atlantic City, April 3, 1959.

Mason, Molly. Changes in the galvanic skin response accompanying reports of changes in meaning during oral repetition. J. genet. Psychol., 1941, 25, 353-401.

McGehee, N. E. and Schulz, R. W. Mediation in paired-associate learning. J. exp. Psychol., 1961, 62, 565-570.

Mednick, S. A. and Freedman, J. L. Facilitation of concept formation through mediated generalization. J. exp. Psychol., 1960, 60, 278-283.

Miller, N. E. Liberalization of basic S-R concepts: extensions to conflict behavior, motivation, and social learning. In Psychology: A study of a science, S. Koch (ed.), Vol. 2, New York: McGraw Hill, 1959.

Miller, G. A., Gallanter, E., and Pribram, K. H. Plans and the structure of behavior. New York: Henry Holt and Co., 1960.

Mogar, R. E. Three versions of the F scale and performance on the semantic differential. J. abnorm. soc. Psychol., 1960, 60, 262-265.

Morris, C. W. Signs, language and behavior. New York: Prentice-Hall, 1946.

Mowrer, O. H. Learning theory and the symbolic processes. New York: John Wiley, 1960.

Murillo, N. R. and Capaldi, E. J. The role of overlearning trials in determining resistance to extinction. J. exp. Psychol., 1961, 61, 345-349.

National Science Foundation. Review of studies in the flow of information among scientists. Prepared for the National Science Foundation by the Bureau of Applied Social Research, Columbia University, January, 1960 (Mimeo.) (Director, Bernard Berelson).

Noble, C. E. An analysis of meaning. Psychol. Rev., 1952, 59, 421-430.

Noble, C. E. The meaning-familiarity relationship. Psychol. Rev., 1953, 60, 89-98.

Ogden, C. K. and Richards, I. A. The meaning of meaning. New York: Harcourt, Brace, 1923.

Osgood, C. E. Studies on the generality of affective meaning systems. Paper presented at the American Psychological Association Meeting, September, 1961 (Mimeo.).

Osgood, C. E. Motivational dynamics of language behavior. In Nebraska symposium on motivation, M. R. Jones (Ed.), University of Nebraska Press, 1957a.

Osgood, C. E. A behavioristic analysis of perception and language as cognitive phenomena. In Contemporary approaches to cognition, Bruner, J. S. et. al., Cambridge, Mass.: Harvard University Press, 1957b.

Osgood, C. E. Method and theory in experimental psychology. New York: Oxford University Press, 1953.

Osgood, C. E. and Heyer, A. W. A new interpretation of figural after-effects. Psychol. Rev., 1951, 59, 98-118.

Osgood, C. E. and Tannenbaum, P. H. The principle of congruity in the prediction of attitude change. Psychol. Rev., 1955, 62, 42-55.

Osgood, C. E., Suci, G. J., and Tannenbaum, P. H. The measurement of meaning. Urbana: University of Illinois Press, 1957.

Pavlov, I. Conditioned Reflexes. (trans. Anrep). London: Oxford University Press, 1927.

Peak, Helen and Deese, Louise. Experimental extinction of verbal material. J. exp. Psychol., 1937, 20, 245-261.

Penfield, W. and Roberts, L. Speech and brain mechanisms. Princeton: Princeton University Press, 1959.

Poffenberger, A. T. The effects of continuous work upon output and feelings. J. Appl. Psychol., 1928, 12, 459-467.

Razran, G. Semantic and phonetographic generalizations of salivary conditioning to verbal stimuli. J. exp. Psychol., 1949, 39, 642-652.

Razran, G. The nature of the extinctive process. Psychol. Rev., 1939, 46, 264-297.

Rechtschaffen, A. Neural satiation, reactive inhibition, and introversion-extraversion. J. abnorm. soc. Psychol., 1958, 57, 283-291.

Riess, B. F. Genetic changes in semantic conditioning. J. exp. Psychol., 1946, 36, 143-152.

Robinson, E. S. Work of the integrated organism. In Handbook of general exper. psychol., C. A. Murchison (Ed.), Clark University Press, 1934, Ch. 12.

Robinson, E. S. and Bills, A. G. Two factors in the work decrement. J. exp. Psychol., 1926, 9, 415-443.

Robinson, Mary F. Is the refractory phase theory adequate to explain mental fatigue? Psychol. Rev., 1931, 38, 229-241.

Rudel, Rita G. Decrement of the Müller-Lyer illusion: A study of intermodal transfer. Paper read at the EPA Meeting, April, 1960.

Russell, W. A. and Storms, L. H. Implicit verbal chaining in paired-associate learning. J. exp. Psychol., 1955, 49, 287-293.

Senko, M. G., Champ, R. A. and Capaldi, E. J. Supplementary report: resistance to extinction of a verbal response as a function of the number of acquisition trials. J. exp. Psychol., 1961, 61, 350-351.

Severance, Elisabeth and Washburn, Margaret. The loss of associative power in words after long fixation. Amer. J. Psychol., 1907, 18, 182-186.

Shallenberger, Patricia, and Zigler, E. Rigidity, negative reaction tendencies, and cosatiation effects in normal and feebleminded children. J. abnorm. soc. Psychol., 1961, 63, 20-26.

Shapiro, M. B. A preliminary investigation of the effects of continuous stimulation on the perception of 'apparent' motion. Brit. J. Psychol., 1954, 45, 58-67.

Sharpless, S., and Jasper, H. Habituation of the arousal reaction. Brain, 1956, 79, 655-680.

Smith, D. E. P., and Raygor, A. L. Verbal satiation and personality. J. abnorm. soc. Psychol., 1956, 52, 323-326.

Spitz, H. H., and Lipman, R. S. A comparison of mental retardates and normals on kinaesthetic figural after-effects. J. abnorm. soc. Psychol., 1961, 62, 686-687.

Staats, A. W. Verbal habit-families, concepts, and the operant conditioning of word classes. Psychol. Rev., 1961, 68, 190-204.

Storms, L. H. Apparent backward association: A situational effect. J. exp. Psychol., 1958, 55, 390-395.

Telford, C. W. The refractory phase of voluntary and associative responses. J. exp. Psychol., 1931, 14, 1-36.

Thorndike, E. L. The refractory period in associative processes. Psychol. Rev., 1927, 34, 234-236.

Thorndike, E. L. The curve of work and the curve of satisfyingness. J. Appl. Psychol., 1917, 1, 265-267.

Titchener, E. B. A beginner's psychology. New York: Macmillan, 1915.

Underwood, B. J. and Richardson, J. Verbal concept learning as a function of instructions and dominance level. J. exp. Psychol., 1956a, 51, 229-238.

Underwood, B. J. and Richardson, J. Some verbal materials for the study of concept formation. Psychol. Bull., 1956b, 53, 84-95.

Underwood, B. J. and Schulz, R. W. Meaningfulness and verbal Learning. Chicago: Lippincott, 1960.

Vernables, P. H., and Tizard, J. Performance of functional psychotics on a repetitive task. J. abnorm. soc. Psychol., 1956, 53, 23-26.

Vernon, P. E., and Allport, G. W. A test for personal values. J. abnorm. soc. Psychol., 1931, 26, 231-248.

Walker, E. L. Action decrement and its relation to learning. Psychol. Rev., 1958, 65, 129-142.

Warren, R. M. Illusory changes in repeated words: differences between young adults and the aged. Amer. J. Psychol., 1961a, 74, 506-516.

Warren, R. M. Illusory changes of distinct speech upon repetition -- the verbal transformation effect. Brit. J. Psychol., 1961b, 52, 249-258.

Weinreich, U. Languages in contact. New York: Linguistic Circle of New York, 1953.

Weitz, J. Criteria for criteria. Amer. Psychol., 1961, 16, 228-231.

Wenger, M. A. A criticism of Pavlov's concept of internal inhibition. Psychol. Rev., 1937, 44, 297-312.

Wertheimer, M. Studies of some Gestalt qualities of words. In Gestalthaftes sehen: Ergebnisse und Aufgaben der Morphologie. F. Weinhandl (Ed.), Darmstadt, Germany: Wissenschaftliche Buchgesellschaft, 1960, 398-405.

Wertheimer, M. The relation between the sound of a word and its meaning. Amer. J. Psychol., 1958, 71, 412-415.

Wertheimer, M. Constant errors in the measurement of figural after-effects. Amer. J. Psychol., 1954, 67, 543-546.

Wertheimer, M., and Leventhal, C. M. "Permanent" satiation phenomena with kinaesthetic figural after-effects. J. exp. Psychol., 1958, 55, 255-257.

Wertheimer, M., and Crow, Eleanor. Relation between individual differences in figural after-effects and in rate of lapse of meaning of words. Percept. mot. Skills, 1959, 9, p. 82.

Wertheimer, M., and Gillis, W. M. Satiation and the rate of lapse of verbal meaning. J. genet. Psychol., 1958, 59, 79-85.

Wertheimer, M., and Wertheimer, N. A metabolic interpretation of individual differences in figural after-effects. Psychol. Rev., 1954, 61, 279-280.

Wertheimer, M., Burns, P., and Gillis, W. M. The effect of emotionality of a word on the rate of lapse of meaning of the word. Paper read at 1957 meeting of Colo. Psychol. Assoc. Meeting, Fort Collins, Colo.

Wimer, C. C., and Lambert, W. E. The differential effects of word and object stimuli on the learning of paired-associates. J. exp. Psychol., 1959, 57, 31-36.