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REVIEW OF THE MEASUREMENT OF SEMANTIC SATIATION

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Studies which have used various measures of meaningfulness to measure semantic satiation, and in other ways have attempted to test the effects of semantic satiation, are critically evaluated. It is concluded that the effects of the phenomenon labeled as semantic satiation have not been reliably measured and are in doubt. An attempt is made to link semantic satiation to what has been called the verbal transformation effect, and an alternative approach to the study of semantic satiation is suggested.

Since Amster's (1964) favorable review of the results of semantic satiation studies, new studies have appeared which cast doubt on the validity of the measurement of semantic satiation. The methods which have been used to measure the phenomenon have become open to question, necessitating a reevaluation of the entire field. Such a review is attempted in this study.

Semantic satiation has been defined as the loss or decrement of the meaning of a stimulus word following either (*a*) (overt) verbal repetition, (*b*) prolonged visual inspection, or (*c*) repeated writing of the stimulus word. Attempts at measurement of the phenomenon have included the use of subjective report, the commonality of associates to the test word, Osgood's semantic differential, number of associations elicited by the test word, decision latency, and word-search time. The effects of semantic satiation on verbal learning and problem solving have also been investigated.

Subjective Report

In 1907, Severance and Washburn wrote that six subjects, who had been instructed to look fixedly at several words for 3 minutes per word and to report all changes in the words during this period, reported perceptual changes and a loss of meaning of the words. Focusing on the reported "loss of meaning" in the Severance and Washburn study, Bassett and Warne (1919) were the first to use verbal repetition as the satiation treatment. Their two subjects were instructed to "repeat the word aloud until it had lost its meaning." They and other investigators (Don & Weld, 1924; Fillenbaum, 1963a; Wertheimer, 1958; Wertheimer & Gillis, 1958) also used subjective report as the dependent variable.

Miller (1963) found that when people pushed a drawer while repeating PUSH, they took significantly longer to report loss of meaning than subjects in a no-action control group. Lifting a window while repeating LIFT yielded results which were in the same direction, but not significant. In addition, Miller reported that if a subject pulled the drawer while repeating PUSH, satiation times were also significantly longer than for the control group, even though they were still significantly shorter than for the group who pushed the drawer while repeating PUSH. In a second experiment, visual stimulation, that is, looking versus not looking while pushing the drawer, was found to have a significant effect, but only for PUSH. Since only two words were used in the experiment, and since the results were different for the two words, one cannot rule out a confounding between word-specific effects and conditions. Therefore, these results are very tenuous at best.

Though the subjective report studies have been consistent with each other in that they have generally been interpreted as providing positive evidence for the semantic satiation phenomenon, one must also note severe criticisms of these studies. In each of the earlier studies (Bassett & Warne, 1919; Don & Weld, 1924; Severance & Washburn, 1907) the results may have been influenced by the small number of subjects (six or fewer in each study). In all the cited studies, except that by Severance and Washburn, subjects were told in the

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instructions to expect a loss of meaning of the test words as a result of the visual fixation and/or verbal repetition. These instructions may have influenced the subjects to label any experienced change as a "loss of meaning." Only in the Severance and Washburn study did some subjects "spontaneously" label any experienced changes as a loss of meaning.

Commonality of Associates

Smith and Raygor (1956) first used the commonality of associates as a dependent variable. After the satiation treatment, subjects gave one association, the first that came to mind, to the test word. Subjects in the control condition were shown the test word for 40 milliseconds and asked to respond as above. The assumptions were that less common associates, defined according to the Kent-Rosanoff (1910) frequency table, imply greater satiation effects and that meaning and associative power are somehow related. Subjects gave significantly fewer common associates to test words involved in the satiation treatment compared to test words which were not. The experimenters concluded that satiation had occurred and was measurable by this method.

One of the dependent variables used by Paul (1962) was similar to that of Smith and Raygor. Hypothesizing that inhibition due to repetition of a word would generalize to associates, Paul had subjects associate to a word for 1 minute, repeat for 30 seconds a word whose relationship to the first word was one of either identity, high association, low association, or unrelatedness, and then associate to the first word again. Corresponding control groups underwent the same treatment except that the 30 seconds of repetition were replaced by a 30-second pause between the first and second association test. Each subject's first emitted association was assigned a number equal to the frequency with which the association occurred to the appropriate stimulus word in the Minnesota norms (Russell & Jenkins, 1954). Paul concluded that there was a weak inhibition effect due to repetition such that the first "associations in the control condition were more popular (of higher frequency) than in the experimental condition [p. 165]" even though the probability of his F ratio was between .05 and .10.

One must not rule out possible explanations involving some general effect due to repetition which does not involve meaning. For both sets of words used in the Paul study, the log frequencies of the associates observed in the unrelated experimental condition showed decreases equal to or greater than the decreases for the log frequencies in the identity experimental condition when compared to their respective control conditions—a result which the satiation hypothesis would not predict.

Additional studies by Wolfensberger (1963) using Tresselt's (1958) frequency tables, by Baras (1968) using Palermo and Jenkin's (1964) frequency tables, and by Cramer (1968) using the Palermo and Jenkins (1964) female norms, found no evidence for satiation effects using the commonality of associates measure.

Investigating the effects of repetition of response members as a function of the relationship between the stimulus and response of paired associates, Goldman, Costanzo, and Lehrke (1968) had subjects learn paired associates which were either common associates, semantic space associates, or nonassociates. The subjects then repeated the response member and were immediately afterward asked to recall its corresponding stimulus member. The common-associate and semantic-space-associate conditions yielded fewer errors which the authors interpreted as evidence for their hypothesis that the stronger the preexperimental association between a word and its associate, the more difficult for inhibition (through repetition) to occur. But, in the absence of no-repetition control groups, one cannot be sure that this result is not simply due to the relationships between the paired associates (see Esposito & Pelton, 1969) since the two factors (repetition and relationship) are confounded in this experiment and since, on the basis of results from backward association studies (see Ekstrand, 1966, for a review), one might expect exactly the same results because of the different stimulus-response relationships with no intervening satiation treatment. Thus, working from the commonness of the associate back to the stimulus, there is no unequivocal evidence for a difference due to verbal repetition.

If for the above studies one were willing to assume (*a*) that there is no fundamental difference between satiation treatments, and (*b*)

that the different frequency tables were appropriate for the respective groups, then the results of Smith and Raygor (1956), Paul (1962), and Goldman et al. (1968) are contradictory to the results of Wolfensberger (1963), Cramer (1968), and Baras (1968). Furthermore, the results of Paul (1962) and Goldman et al. (1968) have very plausible alternative explanations.

Fillenbaum (1963b) conducted five experiments differing from each other only in the duration of the satiation treatment (written repetition of the stimulus), in which subjects repeated either a test word, a synonym of the test word, or a word considered to be semantically unrelated to the test word. After the satiation treatment, each subject was instructed to give his first association to the test word. The dependent variable was the commonality of the given associate as inferred from the rank order of the Minnesota norms (Russell & Jenkins, 1954) for the Kent-Rosanoff words. It was found that the synonym-satiated items generally yielded the least common associates. This study has been reviewed and criticized by Esposito and Pelton (1969).

Esposito and Pelton (1969) claimed that it is possible that Fillenbaum's dependent variable did not measure semantic satiation and that the synonym-satiated condition may have yielded less common associates due to a *priming* effect (see, e.g., Cramer, 1964; Howes & Osgood, 1954). That is, the probability of occurrence of less common associates to the test word may have been *increased* because of the verbal context of the test word. To test this possibility, Esposito and Pelton (1969, Experiment I) replicated Fillenbaum's (1963b) conditions as closely as possible, but excluded any satiation treatment. Their results were the same as Fillenbaum's, namely, the synonym condition yielded the least common responses, and they concluded that Fillenbaum did not measure any effects due to repetition.

Gumenik and Spencer's (1965) results are also consistent with this priming interpretation of Fillenbaum's (1963b) results. They argued from their results that repetition of a synonym of the test word sets the subject to respond to the test word in terms of the meaning which the synonym shares with the test word, thereby changing the meaning of the test word. Words unrelated in meaning to the test words, however, cannot set the subject toward any particular meaning of the test words. Gumenik and Spencer did not employ a no-satiation control group.

The priming interpretation and the set hypothesis are similar in that both depend only upon the semantic relations between the words. A priming interpretation could also explain Paul's (1962) results from his associative measure if his reported F ratio was to be considered significant. In the associate conditions subjects in the experimental groups repeated a word until immediately prior to the second association measure. The repeated word (an associate of the test word) might have provided a context for the test word, thus priming less frequently occurring associates to the test word. Any context or priming effect might have been sufficiently eliminated in the control conditions because subjects only momentarily saw the associate of the test word, and that momentary viewing was followed by a 30-second interval. As shown by Esposito and Pelton (1969), the priming effect is greater when the priming or context word is a synonym of the test word, and associates used by Paul might be considered as (associative) synonyms of the test words. Paul's data did show the greatest differences between the experimental and control conditions to be for the words satiated on associates. Results from another of Paul's measures, latency of the subject's most popular response, could also be explained in this way.

It must be noted that Cramer's (1968) results from her normative response rank measure showed no evidence that prior presentation of a synonym yields less common associates than prior presentation of the test word itself, in contrast to the results of Fillenbaum (1963b), Gumenik and Spencer (1965), and Esposito and Pelton (1969). Esposito and Pelton (1969) hypothesized that this might be accounted for if Cramer used synonyms which were highly related to the test words, unlike the other studies. Meanings of highly related synonyms and test words might be too close to produce a meaning change in the test word.

With this method of measurement, only one study (Smith & Raygor, 1956) yielded signifi-

cant results which could be interpreted as positive evidence for semantic satiation; Paul's (1962) study yielded results which he considered significant, but which failed to reach the .05 level of significance. Fillenbaum's (1963b) results, which were orginally attributed to satiation, were replicated by Esposito and Pelton (1969) without the use of any satiation treatment at all. Esposito and Pelton accounted for their results in terms of the semantic relationships among the words used. The results of Paul (1962), Gumenik and Spencer (1965), and Goldman et al. (1968) could also be explained in this way. Wolfensberger (1963), Cramer (1968), and Baras (1968) found no evidence for the satiation hypothesis using the commonality of associates measure.

Semantic Differential

Operationally defining semantic satiation as a decrease in the polarity of ratings of words on Osgood's semantic differential (see Osgood, Suci, & Tannenbaum, 1957), Lambert and Jakobovits (1960) were the first to employ this measure in a semantic satiation study. They had subjects rate five words on nine scales before the satiation treatment and then individually rate each of the words on each of the scales following 15 seconds of overt, verbal repetition at a rate of 2–3 repetitions per second. That is, one word was repeated aloud and then rated on one scale, another word was repeated and then rated on another scale, etc., until all five words were rated on all nine scales. This group was compared with a number of control groups. The difference from the pre- to the postsatiation ratings for the satiation group was significant, the average change being toward the middle point of the semantic differential scales. None of the other groups showed a significant change in ratings.

Floyd (1962) attempted to replicate Lambert and Jakobovits' (1960) results with a slightly modified experimental design. Though he found a significant decrease in semantic differential ratings from the pre- to the postrepetition ratings for the six repeated words, he also found no difference between the postrepetition ratings for the repeated words and the ratings of six nonrepeated control words. However, it must also be noted that the repeated and nonrepeated words were different so that the possibility of word-specific effects exists.

Using essentially the same method as that used by Lambert and Jakobovits (1960), Yelen and Schulz (1963) failed to find any effects of the satiation treatment. In one experiment Yelen and Schulz found that some semantic differential scales seemed to yield consistent satiation effects while other scales seemed to yield consistent generation effects.

Yelen and Schulz explained their findings in the following way. The "satiation scales," as shown by their results, are those which initially have ratings at the extremes of the scale; the "generation scales" are those which have initial ratings closer to the middle point. Therefore,

> the present results are most simply explained as a regression-like phenomenon whereby repetition in some way interferes with *S*'s [subject's] recall of his initial ratings or disposes *S* to believe that he is to *change* his initial ratings following repetition. Hence, if *S*'s initial rating was relatively intense, then there is a greater possibility that his second rating will be less so. Analogously, if his initial rating is relatively neutral, the likelihood is increased that his second rating will be more intense [p. 377].

Further, they wrote,

> it is of interest that 16 of 30 *S*s in the repetition conditions in Exp. IV, when asked what they thought the purpose of the experiment was, indicated in one way or another that change in ratings as a result of repetition was the purpose. Under control conditions, only 4 *S*s thought change in ratings as a function of time was the purpose [p. 377].

Amster (1964) reported that her analysis of results obtained by Messer, Jakobovits, Kanungo, and Lambert (1964; also see later discussion) showed a + .42 rank-order correlation between the magnitude of satiation effect and initial word rating. This correlation was only found in experimental satiation groups, and not for various control groups. Such a correlation might be interpreted as evidence for Yelen and Schulz's regression hypothesis. Amster stated, however, that though the regression hypothesis may account for some variance of ratings, it does not cast doubt upon the existence of the phenomenon. She tried to reconcile the differences between the results of Lambert and Jakobovits (1960) and Yelen and Schulz (1963) by noting that Lambert and Jakobovits used a polarity difference measure while Yelen and Schulz used a mean difference score and

that it is possible to account for discrepancies in this way. As empirical evidence, an unpublished 1963 study by Hodge and Battig was cited by Amster showing that the different methods of scoring the same data could lead to different results. But, regardless of the method used, the Hodge and Battig results were *not* statistically significant; that is, there was no statistical evidence for semantic satiation whether the polarity difference or mean difference scores were used. Yet Amster was willing to conclude: "Despite the lack of statistical significance, these results seem inconsistent with those of Yelen and Schulz (1963) and consistent with those of Lambert and Jakobovits (1960) [p. 227]."

Schulz, Weaver, and Radtke (1965) conducted a study using the same words, scales, and procedures that Yelen and Schulz (1963, Experiment IV) found to produce satiation and generation effects, but employed a "posttest only" design so that the subjects did not make presatiation ratings. This eliminated the possibility of any regression effects. Analyzing both mean ratings and mean polarity scores, the authors found no differences between the repetition and no-repetition conditions either on satiation or on generation scales. These results are consistent with Yelen and Schulz's regression hypothesis implying that semantic differential ratings are influenced by other-than-semantic factors which may account for results which have been attributed to semantic satiation.

In a subsequent article, Jakobovits and Lambert (1967) reiterated and expanded the criticisms that Amster (1964) made regarding Yelen and Schulz's scoring procedures. In addition, Jakobovits and Lambert questioned Schulz et al.'s (1965) use of untransformed scores, as well as their use of transformed (polarity) scores, namely, whether the transformation into polarity scores was made for each subject's individual ratings (as was done by Lambert and Jakobovits, 1960), and the use of a posttest-only design. The first two issues were raised since, again, it was shown that differences in scoring could lead to different conclusions from the same data. The third issue was raised because Jakobovits and Lambert (1967) contended that there are "enormous individual differences in ratings involved when the scores of one group of persons are used for initial ratings and those of *another* group are used for final ratings [p. 956]."

Schulz (1967) answered these criticisms by stating that whether one observes differences in results due to differences in scoring procedures depends partly upon the particular distribution of pre- and postrepetition ratings. Further, Schulz noted that in Yelen and Schulz's (1963) Experiments I through IV, verbal repetition yielded no consistent results even though the polarity difference scores were used. Regarding untransformed scores, Schulz stated that they never advocated untransformed *instead* of transformed scores; rather, untransformed scores were used in addition to transformed scores. Schulz further explained the reason for their use, and presented some data from Yelen and Schulz (1963, Experiment IV) which supported the regression hypothesis. In reply to Jakobovits and Lambert's questioning of the transformation of scores, Schulz flatly stated, "it is insinuated that the ratings might have been improperly transformed to polarity scores. This was not the case [p. 959]." Finally, concerning the issue of individual differences, Schulz noted from the evidence presented in Table 2 of the Schulz et al. (1965) study that the distributions of initial ratings obtained from two independent samples of subjects representing the same population were very comparable, and that the standard deviations of the repetition and control groups were .45 and .46, respectively, thus providing little evidence for "enormous individual differences." "Hence, unless Jakobovits and Lambert are proposing that the theory of random sampling be repudiated, it is difficult to comprehend their objections to the posttest-only design [p. 959]." In a second posttest-only study, Shima (1966) also found no indication of satiation.

Approaching the problem of the regression hypothesis in a slightly different way, Jakobovits and Rice[2] tested, among other variables, the effect of initial polarity on the direction and amount of change in semantic differential

[2] Jakobovits, L. A., and Rice, U. M. Semantic satiation as a function of initial polarity and scale relevance. A later version of a paper presented at the meeting of the Eastern Psychological Association, Boston, April 1967.

ratings. They reported that subjects displayed no differences in the direction and amount of change in ratings, regardless of the initial polarity of the stimulus. But in their experimental design, Jakobovits and Rice had to use different semantic differential scales for each subject, thereby introducing an uncontrolled factor; and they also confounded the variable of *relevance* (i.e., they attempted to measure the relevance of a semantic differential scale to the word being rated on that scale) with the factor of initial level of polarity since all levels of polarity were not tested in combination with all levels of relevance. Consequently, one cannot determine what effects, if any, resulted from varying initial polarity only or from varying relevance only. Therefore, the experimenters' conclusions that initial semantic ratings had no effect but that there was a significant regression effect due to relevance are vitiated. A study to experimentally separate polarity and relevance might be useful to determine (*a*) the relationship, if any, between polarity and relevance; and (*b*) the relationship, if any, between Yelen and Schulz's satiation and generation scales and relevance. The latter relationship is important if, as some people have written (e.g., Osgood & Suci, 1955; Osgood et al., 1957; Weinrich, 1958), in some cases a middle rating on a semantic differential scale is due to the irrelevance of the scale to the concept being rated. Hence, polarity and relevance may *not* be orthogonal factors implying that regression effects due to relevance may have the same significance as regression effects due to initial polarity.

Because of (*a*) the confounding of polarity and relevance, (*b*) the possible relationship between polarity and relevance, and (*c*) the regression effect for relevance, the results of Jakobovits and Rice (see Footnote 2) do not contradict the previous findings with regard to regression effects. In particular, Yelen and Schulz's regression hypothesis still remains a plausible explanation for results obtained with the use of the semantic differential. (One might also note that Jakobovits and Rice's study is not a good demonstration of the semantic satiation phenomenon since no control groups were used.)

In a subsequent study, Kasschau (1969) tested three levels of initial meaning intensity (2.5, 1.5, and 0.5 units away from the midpoint of semantic differential scales), three semantic differential factors (Evaluative, Potency, and Activity), and seven levels of repetition duration (0, 5, 10, 15, 30, 60, and 120 seconds) in a pre- and postrepetition rating design. Both mean difference scores and polarity difference scores were computed. For both scoring procedures, significant effects were found for the three main factors and the interaction between the semantic differential factors and initial meaning intensity, as well as a three-factor interaction for mean difference scores. It seems as if, in general, the regression hypothesis could explain the results for the mean difference scores. Two questions which arise, particularly for the mean difference score data, are why the 0-second repetition conditions yielded satiation effects, and which repetition duration conditions differed significantly from the 0-second repetition conditions which might be construed as control conditions. For the polarity difference scores, the 1.5 initial-meaning intensity condition showed less satiation than the 2.5 condition at every level of repetition duration which is in accordance with the regression hypothesis. However, the 0.5 initial-meaning intensity condition did not seem to differ from the 2.5 condition which is inconsistent with the regression hypothesis. If one disregards the regression hypothesis, there still remains a result which is difficult to explain, namely, why is the 1.5 initial-meaning intensity condition consistently below the 2.5 and 0.5 conditions? One must then further ask what, if any, subtle differences exist between the pre- and postrepetition ratings design and the postrepetition-rating-only design such that the studies employing the latter design consistently report no significant satiation effects (a fact which was further confirmed in our own laboratory in an unpublished study). Perhaps only further research will clarify these points.

Other semantic differential studies have produced contradictory or negative results with regard to the satiation hypothesis. Studying the effects of verbal repetition and type of bilingualism, Jakobovits and Lambert (1961) found a satiation effect for one of their satiation groups; but they also found a generation effect for a second satiation group and a "satia-

tion" effect for a control group—contrary to expectations. Reynierse and Barch (1963) found no satiation effects, and Schwartz and Novick (1964) concluded from their study that the satiation treatment may have nonspecific, nonsemantic effects. Using both numbers and words for stimuli, Messer et al. (1964) found no satiation effects for numbers on the standard semantic differential scales, but did find an effect on a special *meaningful-meaningless* scale. For words, the satiation group showed a satiation effect on the standard semantic differential scales, but, unexpectedly, so did one of their control groups. No satiation effect was found for words on their special scale. Madigan and Paivio (1967) obtained satiation and generation effects following verbal repetition depending upon the type of instructions they gave their subjects with respect to the semantic differential. No evidence of satiation was found by Hupka and Goss (1969). All of the above studies used pre- and postrepetition ratings designs, and their results are not necessarily inconsistent with the regression hypothesis in view of the fact that for some studies the semantic differential scales used were not published, thus precluding a conclusion with regard to the regression hypothesis.

Of all the experiments reviewed in this section, no single one takes into account all possible factors (e.g., relevance of scales, type of scales, regression effects, and meaningfulness of stimuli) and includes all appropriate control conditions. Though Lambert and Jakobovits (1960) reported positive evidence for semantic satiation using the semantic differential, Reynierse and Barch (1963), Yelen and Schulz (1963), Schulz et al. (1965), Shima (1966), and Hupka and Goss (1969) did not. In other studies, Jakobovits and Lambert (1961) and Messer et al. (1964) found satiation effects for some experimental groups but not for others, and also found unpredicted "satiation" effects for some of their control groups. Floyd's (1962) results were equivocal. Schwartz and Novick (1964) presented some evidence for a nonspecific effect of repetition, and Madigan and Paivio (1967) provided some evidence that semantic differential instructions may affect ratings. Yelen and Schulz (1963) provided an alternative interpretation of Lambert and Jakobovits' (1960) positive results stating that they might ultimately be due to the subjects' perception of the experimental situation and a concomitant regression effect, and provided some evidence for that interpretation. The regression hypothesis might also be able to account for the significant differences found for some different-word control groups (i.e., groups in which subjects rate Word A, repeat unrelated Word B, and then rate Word A again; e.g., see Jakobovits & Lambert, 1961; Messer et al., 1964) if, in some way, subjects in these groups also perceived the "purpose" of the experiment as being the investigation of changes in pre- and postrepetition ratings due to intervening repetition of any word. The results of Jakobovits and Rice (see Footnote 2) were contrary to the Yelen and Schulz's hypothesis, but at least two of Jakobovits and Rice's variables were confounded, and this confounding could also account for their results. The results of Kasschau (1969) further confused the issue since part of his results were consistent with the regression hypothesis, and part were not. Until such time as positive results can be consistently and unequivocally obtained, controlling all appropriate factors, the semantic differential method of measuring semantic satiation is extremely suspect.

Number of Elicited Associations

Defining meaning as an acquired response or set of responses to a stimulus (after Noble, 1952, and others), Kanungo[3] and his associates (Kanungo & Lambert, 1963a, 1963b, 1964; Kanungo, Lambert, & Mauer, 1962) viewed semantic satiation as a temporary extinction phenomenon in which the response to or meaning of a verbal stimulus is temporarily extinguished due to satiation treatment. Kanungo and Lambert (1963b) first used Noble's *m* as a measure of meaningfulness in a semantic satiation study in order to operationalize their view of semantic satiation (*m* is the average number of relevant associations given to a stimulus within 60 seconds; see Noble, 1952). In their first experimental condition the same group of subjects associated to the test words before the satiation treatment (2–3

[3] Kanungo, R. N. Semantic satiation and verbal learning. Paper presented at the 74th Annual Convention of the American Psychological Association, New York, September 1966.

repetitions per second for 20 seconds with visual fixation), and after the satiation treatment. Subjects in a control condition similarly associated to the test words twice, but with no intervening treatment. A second experimental condition was run in which one group of subjects associated to the test words without the satiation treatment, and a second group of subjects associated to the test words following satiation treatment on them. For the first experimental condition and the control condition, contrary to expectations, there was a significant increase in the number of relevant responses, and therefore in the meaning of the words as measured by this method, from the first to the second test. For the second experimental condition a significant decrease in the number of relevant associations and a significant increase in the number of irrelevant (i.e., clang, perseverative, free, and illegible) associations was observed from the pre- to the postrepetition test. The two significant differences for the second experimental condition were interpreted by Kanungo and Lambert as evidence of satiation, while the differences in the control and first experimental conditions were attributed to a memory effect which in the case of the first experimental condition was assumed to be greater than the presumed satiation effect. No different-word satiation group was employed to control for possible, diffuse, nonsemantic effects of repetition.

There were no indications or examples of the types of responses considered to meet Noble's vague criteria of irrelevance. Paul (1962, p. 163), concerning the use of total number of associations, had stated: "Although some associations were highly personal and others seemed determined partly by inappropriate response chaining, they were still included in the subject's score because no satisfactory objective criterion for eliminating such responses could be found." The present authors have had similar experiences using Noble's *m* in their own research. They had two raters independently judge associations for irrelevance, but the interrater agreement was generally extremely low, indicating that the criteria of irrelevance are idiosyncratic to each judge. Another consideration is whether, for instance, an increase in the number of illegible responses is necessarily an indication of satiation or a result of some other factor, such as fatigue. Similar considerations have to be taken into account for the other criteria of irrelevance. One should, therefore, be aware of the fact that there was no difference in the total number of elicited associations between the pre- and the postrepetition associative test for Kanungo and Lambert's (1963b) second experimental condition, and if one were to consider only the total number of responses, the two significant differences for the second experimental condition would disappear.

In other studies, Paul (1962) and Shima (1966) failed to find any satiation effects using total number of associations elicited within 60 seconds. Similarly, Cramer (1968) and Baras (1968) using the total number of associations elicited in 30 seconds and 15 seconds, respectively, also failed to find satiation effects. However, neither Paul, Shima, Cramer, nor Baras distinguished between relevant and irrelevant responses (i.e., they did not use Noble's *m*).

Until more stringent criteria are devised for the classification of associations as either relevant or irrelevant, this method does not seem to be reliable for measuring semantic satiation.

Decision Latency

Jakobovits and Lambert (1962b) introduced the use of decision latency as a measure of semantic satiation with the rationale that tasks involving less meaningful symbols would take longer when the meaning of the symbol is required for solution. They gave each of their subjects pairs of numbers to add. Half of the pairs were preceded by 15 seconds of verbal repetition of one of the addends; the other half of the pairs were preceded by the repetition of a number different from either addend. Then the first addend was exposed for half a second followed by a half-second exposure of the second addend. Each subject responded as soon as possible after the second addend appeared by pressing the keys (indicating the integers 0 to 9), one at a time, which corresponded to this answer. Jakobovits and Lambert then subtracted the control latencies (e.g., the latency from repeating 1 and adding 7 + 7) from their corresponding experimental latencies (e.g., repeating 7 and adding 7 + 7) to find an average significant positive difference of .063

seconds, indicating to them that satiation had occurred.

It may be noted that a no-satiation control group was not included in this study and that the numbers preceding the addends for the control condition were always either 1, 2, or 3 while the satiator numbers preceding the addends in the experimental condition were always either 7, 8, or 9. Perhaps there could be an effect attributable to the magnitude of the satiator number. For instance, if subjects have a first impulse to add all three numbers, regardless of the instructions, then it is not untenable that decision latency would be affected by the magnitude of the satiator number since, in general, larger numbers take longer to add. Though more formal experimentation is necessary on this point, informal observation by one of the present writers does find a tendency of subjects to add all three numbers.

Messer et al. (1964) found no differences between the initial and the final latencies of semantic ratings for numbers, indicating that their satiation group did not differ from their control groups with regard to response latencies. Neither did they find evidence for number satiation from the semantic ratings.

Using decision latency as a dependent variable to extend Jakobovits and Lambert's (1962b) rationale to words, Fillenbaum (1964) had subjects repeat a word for 1 minute (or, in one experiment, until the reported loss of meaning) and then decide whether a pair of words were synonymous. The relationship between the satiator word and one of the words of the pair was one of either identity, unrelatedness, or synonymity. The relationship between the members of the pairs of words (the decision pair) was one of either close synonymity, far synonymity, or unrelatedness (according to Haagen, 1949). In general, the close synonym pairs yielded the shortest decision latencies, followed in order by the unrelated pairs and the far synonym pairs. For the satiator–decision-pair relationship, the shortest latencies were for the identical condition, followed by the synonym condition and the unrelated condition. This study, and Fillenbaum's explanation of his findings, have been reviewed and criticized elsewhere (Esposito & Pelton, 1969).

Gough and Rohrman (1965) designed a study in which amount of repetition (1 or 15 seconds) of the satiator word, decision-pair relationship (synonym or unrelated), and amount of practice were varied. They found that giving subjects one of the words of the decision pair as a "satiator" word before they decided if the words of the decision pair were synonymous (the "forewarning" condition) yielded significantly shorter latencies than did using a "satiator" word unrelated to the decision pair. Practice effects were also significant, but repetition had no effect. Gough and Rohrman concluded that in Fillenbaum's (1964) study, as in their own, the satiation treatment was not effective; forewarning was the important variable. The forewarning hypothesis was again supported by Rohrman and Gough (1967).

In a similar experiment, Gumenik and Perlmutter (1966), found, in agreement with the results of Gough and Rohrman (1965), that repetition had no effect on decision latency.

Since none of these studies (Gough & Rohrman, 1965; Gumenik & Perlmutter, 1966; Rohrman & Gough, 1967) employed all of Fillenbaum's (1964) conditions, Esposito and Pelton (1969), using Fillenbaum's material from Haagen (1949), attempted to reproduce Fillenbaum's conditions as closely as possible, but without using any satiation treatment. The hypothesis was that his results were due to the semantic relationships among the words and not to semantic satiation. Their results, in general, duplicated those of Fillenbaum (1964).

Gorfein (1967) did find some evidence for differences in association speed (or latency) following repetition in a study in which the commonness of the associations was experimentally manipulated. Gorfein simultaneously varied the popularity of the responses to a stimulus (according to Palermo & Jenkins, 1964) and repetition (15 seconds) of either the stimulus itself or the most common associate of the stimulus. Only in the low-popularity, stimulus-repetition condition was there an increase in the time in which the subjects give their associations to the stimulus word as compared with their performance on nonrepeated items; the differences in the other three conditions were not significant. However, Das (1964a; also Das & Cook, 1964) and Baras (1968) found no significant effects using as-

sociative latency as a dependent variable, but they did not distinguish between high-popularity and low-popularity items.

Only three studies using latency measures (Fillenbaum, 1964; Gorfein, 1967; Jakobovits & Lambert, 1962b) found any results which might have been interpreted as evidence for semantic satiation. However, Jakobovits and Lambert's (1962b) results might have been due to a factor other than repetition, Fillenbaum's (1964) results were duplicated without satiation treatment, and Gorfein's results indicate an interaction effect which would challenge the generality of the phenomenon at least with the use of their measure. Therefore, it would seem as if more research is needed to clarify their results.

Verbal Learning and Problem Solving

Many investigators have attempted to assess the effects of verbal repetition on words used in verbal learning situations (primarily the learning of paired associates) and on words needed to solve a subsequent problem. The writers would first like to point out various general problems which could alter the current interpretations of the verbal learning studies, and then do the same for the problem-solving studies.

Although the investigators of the verbal learning studies attempted to assess any change in meaning of the relevant words prior to the learning situation, most did so by means of the semantic differential (Das, 1966; Jakobovits & Lambert, 1962a; Kanungo & Lambert, 1964; Kanungo & Ross, 1966; Kanungo et al., 1962). One must note, however, that in no cases were control groups used (neither different word nor no-satiation) with regard to the semantic differential ratings, and that in each case the same subjects did both the pre- and the postrepetition ratings so that the regression hypothesis cannot be eliminated as a possible explanation for the significant differences between the pre- and postrepetition ratings which were generally, but not always, found. A further reason for the consideration of the regression hypothesis with respect to these ratings is the fact that at least four of the cited studies used three semantic differential scales, two of which Yelen and Schulz (1963) found to be satiation scales. Therefore, these semantic differential ratings are open to all the criticisms discussed in the semantic differential section; they in no way add to the previous arguments.

A second serious consideration of verbal learning studies, especially the paired-associate studies, is the possible effects which nonsemantic factors not necessarily due to repetition had on the subsequent learning tasks. Inhibitory effects may, as is known, occur as a result of similarities of *operations* as well as materials of interpolated tasks, and similarities in material may include such nonsemantic factors as similarity of pattern, sound, etc. (see Woodworth & Schlosberg, 1954). Therefore, inhibition due to semantic satiation is not the only possibility. Yet few of these other possible nonsemantic factors have been investigated; experimenters for the most part have assumed that any change in the subjects' performances was because of a meaning decrement of the stimulus material due to repetition.

In at least one case, similar methods used by different experimenters have yielded contradictory results. Kanungo et al. (1962) had subjects in an experimental group learn List 1 of paired associates. The subjects then rated the response members of List 2, repeated them for 15 seconds, rerated them, and then learned List 2. Subjects in the control group learned List 1 (for matching purposes), rated, repeated, and rerated irrelevant words, and then learned List 2. The experimental group was significantly inferior to the control group on the number of errors and number of trials to criterion. However, Pyke, Agnew, and Adams (1966), reportedly using exactly the same method, found exactly the opposite results. It must be noted that Pyke et al. attempted to explain this discrepancy for at least one of their groups by noting that "there is some suggestion that had the PA [paired-associates] items been matched for intralist competition, repetition might have led to poorer performance, at least for the dexedrine drug group [p. 104]."

Other findings which are difficult to explain are those of Kanungo and Lambert (1964). Following a prerepetition rating of eight words, each subject in each of three satiation groups repeated Word 1 of the eight words for

either 5, 15, or 25 seconds and then rated that word on one semantic differential scale. The same procedure was followed for Words 2–8 after which Word 1 was again repeated and rated on another semantic differential scale, etc., until all words were rated on three semantic differential scales. Subjects then learned the eight words as response members in a paired-associates situation. Though there was a significant difference between the experimental satiation groups and the control groups, there were no differences among the 5-, 15-, and 25-second repetition groups on the postrepetition semantic differential ratings or with regard to the number of trials to criterion. Since Kanungo and Lambert found a significant decrease in semantic ratings following repetition, the implication for the satiation hypothesis is that 5 seconds of repetition is sufficient to decrease the meaning of a word as measured on one scale, unless one is willing to assume that the effects of 5 seconds of repetition summate with the effects of another period of 5 seconds of repetition even though the repetition periods are separated by a minimum of 35 seconds needed for the repetition and rating of seven other words. Perhaps, as suggested by the regression hypothesis, another interpretation is that subjects' perception of the purpose of the experiment is important, and 5 seconds of repetition might be equally effective as 25 seconds of repetition in altering the subjects' views and performances accordingly.

Das (1966) correlated subjects' combined scores from two verbal conditioning tasks with what Das called semantic satiation as indexed by the semantic differential and found a $-.484$ coefficient. However, when Das separated his subjects into fast learners and slow learners on the basis of whether their performances in the verbal tasks were above or below the median, he found that the fast learners group showed a mean polarity difference score of $+1.31$ from the pre- to the postrepetition ratings which, as Das indicated, was evidence of semantic generation. Since the fast learners group represented half of the subjects providing scores for the correlation coefficient, it is obvious that Das had correlated *not* semantic satiation (defined as a *decrease* in polarity scores) with verbal conditioning scores, but polarity changes (both positive and negative) with verbal conditioning scores. On the basis of these results it is difficult to see how Das could conclude as he does only about the relationship between satiation (i.e., negative polarity changes) and verbal conditioning. Parenthetically, it might be noted that this same criticism can be made of other studies by Das (1964a, 1968), and that in these same studies (as well as Das, 1964b) he was willing to conclude that there were satiation effects even though he obtained no significant statistical differences.

In a free recall situation, Roberts, King, and Reid (1967) found inhibition when subjects first repeated a word related to an eight-word list and were then asked to recall the eight-word list in a retroactive inhibition paradigm, but they found no such inhibition in a proactive paradigm.

Cook (1968) claimed that the effectiveness of a verbal reinforcer was reduced when third-graders repeated the reinforcers prior to a conditioning session. However, Cook also concluded that "the satiation effect . . . is not dependent on the *semantic* [italics added] characteristics of the satiated word. Thus, the effectiveness of a positive reinforcer was altered when the satiated word was either positive or negative . . . [p. 1085]." Further, it was reported that for a satiation treatment consisting of 0, 10, or 80 repetitions, there was no observed decrement in the effectiveness of the repeated word, whereas for 20, 30, and 40 repetitions there was. This is difficult for the semantic satiation hypothesis to explain, especially for the 80-repetitions condition.

Though verbal conditioning studies, especially paired-associates studies, may provide evidence for semantic satiation, they cannot do so convincingly until appropriate control groups have been investigated in order to eliminate other plausible interpretations of these studies. In particular, inhibition by means of semantic satiation is only one possible alternative; inhibition may also occur as a result of similarity of interpolated tasks or operations along nonsemantic dimensions. For instance, the rating of response items on semantic differential scales may be psychologically similar to the paired-associate task since the same words are being used in a slightly different task, especially if one takes the view that in using the semantic differential one is "associating" a word (i.e., the word to be rated) to one

of the two bipolar adjectives (e.g., see Bousefield, 1961). That is, one could argue that rating FATHER on the GOOD–BAD scale is simply noting which bipolar adjective the subject would be more likely to give as an associate to FATHER. Hence, the response of the paired-associate list would be a stimulus in the rating condition—a stimulus which might be emphasized by means of repetition. Such similar operations using the same words in different ways, rather than repetition, might be responsible for any negative effects on paired-associates learning.

Purohit (1965) came to a similar conclusion when he had subjects undergo satiation treatment on eight numbers which were the products of eight multiplication problems. Subjects then learned, by the anticipation method, four correct and four incorrect products to the eight multiplication problems. Using Kanungo's stimulus-response interpretation, Purohit hypothesized that compared to a no-satiation control group, the satiation of the correct responses should have facilitated the learning of the incorrect products, but should have hindered the learning of the correct products. This latter prediction was upheld, but there were no differences between the satiation and no-satiation groups regarding the learning of the incorrect products. Purohit concluded that repetition might induce reactive inhibition but "not effect the semantic structure of the satiated material."

The above considerations, coupled with the negative evidence (Cook, 1968; Pyke et al., 1966; the proactive condition of Roberts et al., 1967) and results difficult to explain by means of the semantic satiation hypothesis (Kanungo & Lambert, 1964), lead one to be very cautious in interpreting these studies as evidence for *semantic* satiation.

It can also be argued that there are many nonsemantic factors which have not been ruled out of studies which use performance in a problem situation as a measure of semantic satiation. Cook and Vachon (1968) concluded that following repetition of a key word (e.g., STRING), a problem which was to be solved by use of an actual piece of string took significantly longer to solve as compared to a control group who repeated an irrelevant cue before the presentation of the problem. However, Cook and Vachon's analyses show no significant differences among groups differing on number of repetitions (1, 15, 30, or 60) of the word in the satiation treatment. The implication is that 1 repetition leads to as much satiation as 60 repetitions, which is contrary to the satiation hypothesis. One might ask how the subjects (fourth-graders) viewed the experimenter's purpose in running the study. Usually when teachers present problems to their pupils, they do not give the "answer" beforehand. Therefore, children may discount a possible solution simply because it was mentioned before the presentation of the problem, and this may go against the children's expectations.

In a related study, Jakobovits (1965) prepared sets of 12 words (e.g., REFLECTION, DISPERSION, REFRACTION, BEAM, GLEAM, STREAM, STEAM, SCHEME, SEEM, PERMISSION, DISCUSSION, and ATTENTION) such that each set could be classified into two equal subsets either on the basis of semantic similarity or physical similarity such as rhyme or word length. Subjects repeated either one of the words in the set or an unrelated word before classifying the set. Jakobovits found more physical similarity solutions in the experimental group and interpreted this as evidence that the semantic mediator needed for the semantic solution was satiated and therefore less available. However, the same result could be predicted even if the repetition were eliminated, or if a word similar in sound to some of the set words were repeated. For instance, it might be predicted from a set interpretation that subjects would use more physical similarity solutions for the above word set even if subjects did not repeat REFLECTION but simply saw it beforehand or if subjects saw, for instance, COLLECTION, a nonsemantically related rhyme of half of the words. Until this possibility is eliminated, the results remain tenuous.

Though both verbal learning studies and problem-solving studies may index an effect of repetition, it is seriously doubted that these effects are semantic in nature.

Search Time and Visual Thresholds

Gampel (1966) had subjects search for a target word in an array of words following 0, 5, 15, 30, 60, or 120 seconds of repetition of either the target word or a high associate of the

target word with the rationale that as meaning decreased, search time should increase. For repetition on both types of words, the general results were that the shortest search times were obtained for a repetition duration of 15 seconds, the longest for a repetition duration of 60 seconds. The latencies for the 0-second repetition condition fell between those for the above conditions. In a second experiment Gampel held repetition duration constant at 60 seconds and varied the time (delay duration) between the end of the repetition and the beginning of the search. For repetition of both types of words, the 5-second delay duration yielded the longest latencies, but for the 15-second delay duration condition, the latencies were shorter than for the 0-second delay duration condition.

Gampel's explanation of her results follows:

> The *S*s reported both auditory and visual fluctuations between the whole word and its component parts (e.g., BUTTER changed to BUT and HER; CARPET to CAR and PET). These changes would thus account for the increased search times, since the effective stimulus for the identification tasks was at least momentarily absent. If the effect achieved here and termed satiation is in fact due to this stimulus disorganization, search times for the word components and their associates should decrease with repetition as the search times for the entire word and its associates increase [pp. 205–206].

Though it might be that Gampel's (1966) results were due in some way to verbal repetition, it is not clear that they were due to semantic satiation. First, it is not clear why the visual fluctuations should account for increased search times for self-satiated items since it is conceivable that the self-satiated items could also be perceived in the reorganized way in the array, suggesting that the effective stimulus for identification may have still been present following satiation treatment. That is, in the array, CARPET could still have been identified as the reorganized CAR-PET without necessarily increasing search time. Second, it is possible that the longer search times following the 60-second repetition were due to a diffusion of attention effect resulting from the satiation treatment. The effect might not have been specific to the particular words the subject was searching for. To test for this, a control condition with satiation treatment on a word different from the test word should have been included in Gampel's study. The satiation hypothesis would predict longer search times for the satiation condition than for the different-word control condition. In a series of pilot studies (Hubbard, 1964, Appendix I), Gampel did use a silence control group and a control group which counted from 1 to 10 as comparisons for the repetition group. Though she found the repetition group inferior to these control groups, neither control group allowed for the evaluation of nonspecific, nonsemantic effects due to repetition.

The results of a study by Baras, Braun, Teft, and Pettigrew (1969, Experiment I)[4] which attempted to assess the effect of repetition on recognition thresholds were explained by Baras et al. (1969, Experiment II; see Footnote 4) by the fact that in the repetition condition subjects saw the target words before their tachistoscopic presentation, unlike the no-repetition condition. Thus, both studies have explanations which do not depend on the semantic satiation hypothesis.

Conclusion

The several methods of measurement which have been used to assess the effects of repetition on the meaning of words have yielded questionable results. Although the results of subjective report studies have been generally consistent, many used very few subjects, and all of them except Severance and Washburn (1907) may have set their subjects to expect a loss of meaning upon repetition by the instruction they gave to the subjects. Studies using other methods have produced contradictory, unreliable results, and sometimes their conclusions seemed to be based upon faulty reasoning.

One source of confusion in many studies has been the lack of control: for instance, the lack of some proper control groups, the lack of control of semantic differential scales and initial ratings, etc. Therefore, one might conclude that what is needed now are studies using the various measures of meaning that will incorporate more precise controls. However, because of the considerable number of studies that re-

[4] Baras, H. L., Braun, J. R., Teft, L. W., & Pettigrew, L. E. The effects of verbal repetition on visual recognition thresholds. An unpublished paper based upon a paper presented at the meeting of the Eastern Psychological Association, Philadelphia, April 1969.

sulted in negative findings, we are encouraged to look for a fresh approach to the phenomenon.

Most later studies dealing with semantic satiation have concentrated on the semantic aspects of subjects' reports from the Severance and Washburn (1907) study, and have completely ignored subjects' reports from that study which dealt with changes in the perceptual qualities of the words, for instance, the reports of regrouping of the letters (see also Gampel, 1966). These later studies made no mention of the possibility—and were not designed to detect it—that a subject's percept of the distal stimulus (the physical word) is constantly changing throughout his continued viewing and/or repetition of the word. If these perceptual changes are taking place, then the experienced "loss of meaning" of the original word (and here we are granting, despite the small number of subjects used in the Severance and Washburn study, that there was some subjective experience which was labeled as loss of meaning) might very well be a secondary phenomenon dependent upon changes or reorganizations in the subjects' perception of the distal stimulus. Successive reorganizations of the original meaningful-word percept might very well be meaningless to the subject. However, in this case we should not speak of a word "losing" its meaning (as have most other experimenters who have unsuccessfully tried to measure such a loss). Rather, we should say that the original percept of the word is no longer being experienced, and the percept which replaces the original one is meaningless. For instance, "blood" might be perceived after a period of visual fixation as "b-loo-d," and this percept might be reported as being foreign or meaningless, as was reported by Severance and Washburn. This report would not indicate that the percept "blood" has *become* meaningless, but that "b-loo-d," the new percept, has no meaning. Presumably, if the subject were to perceive "blood" again, it would still have meaning.

Measures of meaningfulness have been used after the period of satiation treatment, and it is quite possible that at the time of measurement the original percept of a word has been reinstated. Perceptual reorganizations are abrupt, and relatively brief pauses or absences of the distal stimulus are enough to reinstate the original, most stable percept. This is true, for example, of the Necker cube (see, e.g., Orbach, Zucker, & Olson, 1966); if this is also true of satiation treatment, then one would expect that a loss of meaning would not be indicated by a measure of meaningfulness, a possibility which is not contradicted by the reviewed studies.

Some scant evidence which supports the above conceptualization is the fact that for Severance and Washburn's (1907) subjects, the reports of meaninglessness came only *after* reports of perceptual changes. For stronger support of the above interpretation, we turn to the phenomenon which has been labeled the verbal transformation effect.

Warren (1968) has reported that when one listens to a recording of identical repetitions of a single word or phrase, "abrupt illusory changes are experienced, frequently involving considerable phonetic distortion [p. 261]," and has referred to this phenomenon as the verbal transformation effect.

It is interesting that those experimenters studying the verbal transformation effect ask their subjects to report perceptual changes, while those studying semantic satiation generally elicit responses from their subjects on measures of meaningfulness, and do not ask them for perceptual reports, even though both phenomena involve repetition.

Warren (1968) claimed that the "loss of semantic organization" associated with semantic satiation is avoided in the verbal transformation effect. Yet, if changes in the perceived word are taking place (e.g., "say" becoming "ace") then it is obvious that the *original* semantic organization of the word is momentarily lost. What Warren might mean here is that the new perceived sound is also a meaningful one, that is, another word. That Warren should find this result to be so prevalent is not surprising since Warren (e.g., 1961) instructed his subjects to report words. When in contrast, subjects are instructed that "what you hear may be meaningful or meaningless, and the words may be English or nonsense," they often report perceiving nonsense forms as well as words (Taylor & Henning, 1963; this also supports the conjectured importance of instructions in semantic satiation). Moreover, Warren and Gregory (1958) recognized that

reorganizations of a word also occurred when a subject repeated the word aloud for himself. These facts lead us to suspect that we have all been studying the same phenomenon in different ways.

Warren (1968) explicitly stated: "It seems that the neuromuscular activity of producing speech sounds prevents verbal transformations by inhibiting illusory phonetic changes [p. 268]." But there is no reported evidence to support his statement since investigators of the effects of having subjects repeat words have attempted to index loss of meaning using measures of meaningfulness. These investigators have *not* asked for perceptual reports.

Warren (1968) further stated, "When one continues to stare at a printed word, changes analogous to verbal transformations do not occur [p. 268]." Yet Severance and Washburn (1907), whose study Warren cited in support of the above statement, *did* report changes which they classified as regroupings of the letters of the word and changes in the perception of various letters.

Finally, Warren claimed that semantic satiation involves a "progressive disorganization until we are left with a meaningless jumble of speech sounds [p. 268]," which he referred to as perceptual decay, and implied that this is not the same as illusory phonetic changes. That "meaningless jumble of sounds" is, however, a new percept, or what Warren called a perceptual reorganization. Though Warren claimed that perceptual reorganization and perceptual decay are two different processes, we are claiming that Warren's "perceptual decay" can be better conceptualized as another case of perceptual reorganization. That is, "perceptual decay" is the reorganization of a meaningful word into a new percept which is meaningless to the subject. The original percept does *not* "decay," that is, become increasingly less meaningful. Again it might be noted that Warren might have inhibited reports of semantically meaningless percepts by the type of instructions used.

We do not disclaim that there are certain types of changes, which occur when verbally repeating a word, that do not occur with prolonged visual inspection or with continued hearing of repetition of a word. We are merely suggesting that verbal transformations probably do occur in all instances, and so any experienced loss of meaning might be dependent upon them.

We suggest that the subjective reports of "loss of meaning" are secondary, dependent upon perceptual changes and that future studies of semantic satiation should be set up so as to be able to detect perceptual changes, as were the early studies from Titchener's laboratory as well as Warren's (1968) studies.

A further implication of the above conceptualization is that reported changes of meaning are *qualitative* changes, as are the perceptual changes on which they depend. Measures of meaningfulness, which presumably indicate *quantitative* changes, are not suitable in this case since we do not have one constant word percept which gradually loses more and more of its meaning, but a succession of percepts, some having meaning for the subject, and others not. This view contrasts with the studies reviewed in this paper.

Of course, an alternative conceptualization of the effects of satiation treatment is that because the original percept of the distal stimulus becomes meaningless, perceptual reorganization is precipitated. While this is a possibility, it must again be pointed out that for the subjects in the Severance and Washburn (1907) study, reports of loss of meaning came only *after* the reports of changes in the perceptual qualities of the words. But even if this alternative conceptualization were valid, the use of measures of meaningfulness following repetition would still not be plausible since one would not know whether a subject's percept had changed.

The recommendation is that subjective reports should, if possible, be elicited *during* the satiation treatment by instructing subjects to describe their experiences. Instructions should be as neutral as possible so that subjects will not be set to respond in any particular way. This should be done regardless of other measures used.

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