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AFFECT AND MEANINGFULNESS AS VARIABLES  
IN MEDIATE ASSOCIATION

by

James Andrew Aagard

A dissertation submitted in partial fulfillment  
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

Psychology

Approved:

UTAH STATE UNIVERSITY  
Logan, Utah

1969

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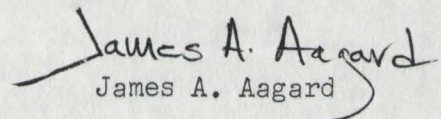
  
James A. Aagard

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ABSTRACT

Affect and Meaningfulness as Variables  
in Mediate Association

by

James A. Aagard, Doctor of Philosophy

Utah State University, 1969

Major Professor: Dr. David R. Stone  
Department: Psychology

The purpose of this study was to determine whether affect influences mediate association. A second purpose of this experiment was to test whether there could be found an interaction between affect and meaningfulness in the verbal mediation scores.

The subjects were all of the students registered for an Educational Psychology class at Utah State University, Spring Quarter, 1969. These students were randomly assigned to one of two groups, designated Phase I or Phase II. Phase I was designed to study the influence of affect upon mediation and the subjects in this group learned two lists of seven paired associates. Phase II was designed to examine the possible interaction of affect and meaningfulness in mediation and the subjects in this group learned two lists of eight paired associates. Phase III was added to the study to determine if there would be a correlation between mediation and association ability of all of the subjects.

Affect level was determined by the magnitude of the Galvanic Skin Response readings on Stoelting Psychogalvanoscope in reaction to the mediating words of the B list. Meaningfulness level of the non-mediators was defined as the association value of Consonant-Vowel-Consonant trigrams used in the A-C lists. Mediation was

defined as the number of correctly paired A-C trigrams in the multiple-choice mediation test.

To test whether affect influences mediation, a comparison was made between mediation scores produced by high affect mediators and mediation scores produced by low affect mediators. The test of the interaction was made by a factorial design with two levels (high, low) of affect and four combinations of levels (high-high, high-low, low-high, and low-low) of meaningfulness.

The procedure first assessed the affect level of the mediators. Then either Phase I, which tested Hypothesis 1, or Phase II, which tested Hypothesis 2, was administered to each subject. Each phase followed the chaining model (A-B, B-C, A-C) of mediation. There was no learning of the A-C list, but mediation was tested by pairing the A-C items in a multiple-choice test. Also, a test of association ability was made after presenting twelve paired associates using a similar multiple-choice test to that used to test mediation.

Statistical analyses were applied to these test scores to determine the empirical support of the following hypotheses:

Hypothesis 1 proposed that there would be a significant difference between the amount of recall scores mediated by high and low affect words when the meaningfulness of the non-mediators is held constant at a medium level. This hypothesis was supported by the data obtained.

Hypothesis 2 predicted that there would be an interaction between levels of affect and combinations of levels of meaningfulness. This hypothesis was strongly supported by the data of this study.

An additional finding was that a low, but significant correlation was obtained between mediation scores and association scores.

The findings of this study showed that affect level of the mediator affects the amount of mediation produced in a chaining paradigm.

There appears to be strong evidence for an affect and meaningfulness interaction in mediation data. Within this interaction, there was an indication that affect is prepotent over meaningfulness. Also, analysis of this interaction shows that the meaningfulness of the stimulus term rather than the response term seems to be critical in producing superior mediation.

Finally, a low correlation seems to exist between simple or paired association and mediate association, because simple (paired) association and mediate association do not seem to be identical processes.

(94 pages)

## INTRODUCTION

### Verbal Learning

Verbal learning is the study of how meaningful, affective, and structural variables relate to the acquisition of verbal units. The student of verbal learning investigates how these verbal units are conditioned to become part of a person's verbal repertoire (Bower, 1967; DeCecco, 1968). The verbal units which are often used for research are nonsense syllables or nonsense syllables and meaningful words used together. Occasionally meaningful words are modified and conditioned in verbal learning studies. The processes of acquisition, retention, and transfer are the primary areas of study in verbal learning (Cofer, 1961; Jung, 1968). In comparison with other human abilities, such as problem-solving or thinking, human verbal learning is a rather simple form of learning. The tasks required in a verbal learning experiment are usually considered to be simple memorization or rote learning (Baker, 1960; Jung, 1968; Underwood, 1966). Much of the formal education of an individual involves learning of this type (Baker, 1960; Underwood, 1966). One reason for studying verbal learning, then, is to attempt to improve the efficiency of a person's formal schooling. A more scientific, less practical reason for studying verbal learning is to try to understand how words are learned, retained, and transferred from one situation to another. But it would seem that the main importance of verbal learning is derived from the knowledge that this study gives us understanding of how words and language control behavior in human beings (Luria, 1959). Therefore, in order to know and understand the process of

verbal learning, the variables that affect the outcome of this process must be explored.

### Affect and Meaningfulness

Two of the most basic and important variables influencing human verbal learning are meaningfulness and affect (Baker, 1960; Stones, 1966). The variable of meaningfulness seems to correspond to Osgood's (1961) "denotative meaning" and Staats' (1968) "image in language," which Staats also calls "denotative meaning," and Mowrer's (1960a, 1960b) "denotative" or "cognitive" meaning. Denotative meaning is usually thought of as the cognitive aspect of a word--where an image from one's memory is associated with the verbal stimulus presented to him. The variable of affect, in turn, seems to correspond with Osgood's (1961) "connotative meaning" which he says is also sometimes called "affective meaning," and corresponds to Staats' (1968) "affective word meaning," also referred to as "emotional word meaning" by Staats, and called "connotative" or "evaluative" meaning by Mowrer (1960a, 1960b). Connotative meaning is usually considered as the emotional aspect of a word--a very personal, idiosyncratic, and emotional feeling that one has associated with a certain verbal stimulus (Hilgard and Atkinson, 1967). The fact that these denotative and connotative meanings are acquired through the process of conditioning can be argued from a common sense basis and also from a basis of authority and empirical evidence.

On a common sense basis, one could argue for the possibility of the meanings being acquired by conditioning. Meaningfulness or denotative meaning seems to be learned by repeatedly pairing a verbal stimulus contiguously with a visual image until the visual image is always associated with the presentation of that particular verbal stimulus. This association between the stimulus and the image can be

considered to be the denotative meaning or the cognitive aspect of a word. Without this association, the stimulus is a meaningless or neutral stimulus. The affective aspect to a word seems to be learned in about the same way--repeated contiguous pairing of the verbal stimulus with, this time, the feelings or emotions present at the time of the occurrence of the visual image. The repeated pairing of these feelings and emotions with the verbal stimulus produces an automatic elicitation of an emotional response when the verbal stimulus is presented. This process can be considered to be the connotative meaning or the affective meaning of a word. Therefore, when a verbal stimulus is presented to an individual, providing it is a meaningful word, it will have both a cognitive and affective meaning to that person (Stones, 1966). This common sense notion is supported both by an authority in the field of verbal learning and by empirical research.

This common sense notion stated above of how word meaning is acquired through conditioning is supported in the writings of Mowrer (1960a, 1960b) and Staats (1967, 1968). Staats differentiates between the denotative meaning and the affective or emotional meaning of a word. He cites the study by Leuba (1940) which showed that a neutral stimulus paired with a sensory stimulus elicits what is described in everyday life as an image. Ellson (1941) is also cited as additional evidence in the literature for the conditioning of sensations. Mowrer (1960b) also reasons that denotative meaning is mediated by images. These investigators give support for the notion of denotative meaning being acquired through classical conditioning. In order to support the claim that affective meaning is acquired through classical conditioning, Staats cites his own studies--(Staats, Staats, & Crawford, 1962) where he conditioned negative affect, and (Staats & Staats, 1957) where he

conditioned both positive and negative emotional meanings. Mowrer (1960a) maintains that evaluative word meaning is contiguously conditioned. Therefore, the position that cognitive and affective meanings of a word are conditioned to provide an automatic association to a verbal stimulus is supported by these prominent psychologists and by empirical studies. Let us consider the notions of affect and meaningfulness in a more general way.

Affect is considered to be an important and relevant variable in the study of verbal learning (Baker, 1960; Noble, 1963). Affect is generally thought of as the general feeling tone or intensity of emotion associated with a word. But this definition or any definition of affect is not unanimously agreed upon (Travers, 1967). However, despite this widespread disagreement, the definition given above will be used throughout this study. As a consequence of this difficulty in defining affect, there has been a problem in agreeing upon how to best measure affect or emotion (see Flanagan, 1967; Grossman, 1967). Traditionally, however, affect has been measured by the galvanic skin response (GSR) and was so measured in this study. Therefore, the definition of this relevant variable in verbal learning called affect will be the emotional loading of a word measured by the GSR.

Meaningfulness is probably the most important variable in the study of verbal learning (Hall, 1967). Meaningfulness, as is affect, is also variously defined and measured (Noble, 1963; Underwood, 1966). But in this thesis, meaningfulness of a verbal unit will be its association value. This value is measured by asking people whether the "word" has any association for them or not; the percentage saying "yes" forms the association value. Hence, meaningfulness is defined and measured

in this study as the association value of a verbal unit.

### Mediation

The learning model in this study was chosen to be the mediate association model in verbal learning. This model was chosen because affect has not been studied as a variable in mediation studies. Also, affect and meaningfulness have not been studied together using the mediation model in human learning studies. Finally, mediate association in verbal learning is a popular area of study in human learning at present. Mediation is "the process of utilizing other learned associations to facilitate the acquisition of new associations" (Jung, 1968). Mediation has been considered to be either one of two things: (a) it is an active strategy or learning technique employed by the learner to improve his performance or (b) it is a process based on past common associations.

There are usually thought to be three types of paradigms of mediation. These are chaining, stimulus equivalence, and response equivalence. The chaining model consists of the process of forming associations in a chain. For example, associations are made between respective words in List A and List B; then associations are learned between Lists B and C. In this model, List B is both a stimulus and a response list. In the stimulus equivalence paradigm, the associations are formed to a common response list with different stimuli for the paired-associate lists. In this situation, List B might be the common response list, while Lists A and C are the stimulus lists. Response equivalence is the situation in which the person learns two different sets of responses on his first two lists, although the stimulus terms



are the same in the two paired-associate lists. This model may be diagrammed as B-A, B-C, with List B serving as the common stimulus list. All possible combinations of these three paradigms resulted in eight different models according to Horton and Kjeldergaard (1961).

The chaining model is the most frequently used model and was chosen to be used in this study. The basic procedure in using this model is to present the A-B list to the individual a few times followed by the presentation of the B-C lists. Then, the person is required to either relearn the A-C list or recognize the A-C pairs that go together. This latter method is known as the forward chaining model (see Horton & Kjeldergaard, 1961) and was chosen for this study.

The more important variables studied within the mediation model have been interlist interference, meaningfulness, mixed vs. unmixed lists, and natural language mediators (Jung, 1968). Mandler and Earhard (1964), in studying interlist interference, found that backward associations formed in learning the first list, B-A, would be extinguished during the learning of the second list, B-C. Horton (1964) found better mediation with high meaningfulness mediators. Horton also found better performance on mediation pairs in an unmixed list in comparison to a mixed list. Montague, Adams, and Kiess (1966) found that original, natural mediators provided better recall than new natural language mediators. These are the more important variables that have been studied in relation to mediate association learning.

#### Basic Elements of the Study

The basic elements in this study were the independent variable, the dependent variable, and the learning model. The independent variables were affect and meaningfulness. The dependent variable was the

recall score after the mediate association learning. Mediate association was the learning model that was used. These comprised the basic elements of the verbal learning task used in this study.

These elements of the study were operationally defined. Affect was defined as the GSR readings in response to orally presented words. The meaningfulness of the words was defined to be the association value for the nonsense syllables. The recall scores were defined as the number of pairs of nonsense syllables from lists A and C that were appropriately matched in a post learning test. The mediate association model used in this study was the three-stage forward chaining model.

#### Hypotheses

The purpose of this study was to test whether affect has an effect on verbal mediation. The study tested also whether there was an interaction between affect and meaningfulness in recall scores after mediation learning. These objectives resulted in the following hypotheses:

1. There will be no (a) significant difference between the amount of recall scores mediated by high and low affect words when the meaningfulness of the non-mediators is held constant at a medium level.
2. There will be no (a) significant interaction in recall scores between levels of affect and meaningfulness.

## REVIEW OF THE LITERATURE

This study examined the influence of two variables, affect and meaningfulness, within the mediate association model of verbal learning. Affect and meaningfulness will be reviewed and then selected aspects of the mediation process will be summarized.

### Affect

#### Early Studies

Probably the earliest objective experimental study of the influence of affect upon the retention of verbal materials was made by Smith (1921). He measured affect by the use of GSR deflections. His stimulus materials were words from Jung's (1919) word list, and he obtained an index of memory from his subjects' free recall. Smith found the words with high affect (as measured by the GSR) were better recalled than words with low affect. Jones (1929) made a similar investigation and essentially supported Smith's findings. Lynch (1932) correlated learning scores obtained from a new group of subjects with the GSR readings of the words used by Smith and Jones and found a correlation of .64 between them. Lynch's results gave strong support to Smith's results and contended that words having a high GSR value will also have a high memory value. However, Stagner (1933) using Smith's data, without attempting to obtain records from his own subjects, found no relation between the GSR measure of affect of words and their retention. Also, Balken (1933) obtained negative results in studying the relationship between the GSR deflections and efficiency of learning, but there appears to be fundamental errors

in Balken's procedure: too rapid a rate of the presentation of the word stimuli to obtain accurate GSR readings. Positive results were found by Bunch and Wientge (1933) who concluded that "the effectiveness with which the material was retained varies with the affective nature of the material." Definite relationships were found between emotional factors (as measured by the GSR) and ease of learning in a study by Carter, Jones, and Shock (1934). The conclusion of this early series of experiments was that words which elicit large GSR deflections are better learned and remembered than those which elicit small deflections (Carter and Jones, 1933).

#### Appropriateness of using the GSR

For the thirty years following these early studies, there were few, if any, studies using the GSR to measure the intensity of affect of verbal materials. During this period, a debate was being held as to whether the GSR was an appropriate measure of affect or emotion. After reviewing the previous studies made on the relation of emotions and memory, Rapaport (1950) pointed out that the difficulty inherent in the association and recall experiments which used physiological measurements to establish the presence and quantity of emotions was the two assumptions that these experimenters made. They assumed, according to Rapaport, that, first, what the physiological methods were measuring was emotion, and second, the influence of emotion on memory bore a proportional relation to these physiological measures. This statement points out the essence of the debate over the appropriateness in using the GSR as a measure of affect. Jones, a strong advocate of using the GSR from his earlier studies said "...resistance change, the simplest index of GSR, is a satisfactory measure of average difference

in response to words of varying affective value." (Haggard and Jones, 1947 p. 349) A group of experiments were then carried out comparing GSR measures and subject ratings of emotion. Hsü (1952) found problems inherent in using either measure. He said that the problem related to using the rating method was a lack of insight and reliability. But the GSR had many extraneous disturbing factors that couldn't be satisfactorily overcome, according to Hsü. He said that the GSR revealed data that appeared to be more emotional than cognitive in nature and that it may therefore be more valuable to evaluating emotional life. Hsü obtained a correlation of .38 between the GSR and rating of emotion. A significant correlation between skin resistance changes and feeling magnitude was obtained by Traxel (1959). He cited the results of an experiment to show that measuring the affective load of experience by the psychogalvanic reaction is a workable method (Traxel, 1960). Arnold (1960) objects to using the GSR as a more reliable sign of emotion than a subject's own report. She reported that the GSR measures attention, mental work, reaction to sensory stimulation, as well as startle and various emotions. Mandler, Mandler, Kremen, and Sholiton (1961) suggested that activation was the process really measured by the GSR. Mandler (1962) said that the GSR was an unreliable measure of emotion for two reasons--first, there is clear evidence that people differ in their patterns of physiological activity, and second, various situations have different physiological effects.

Today, the issue of whether emotion can be measured by the GSR is still unsettled. Even now, there can be proponents on both sides of the issue. Flanagan (1967) strongly believes that the GSR measures attention rather than emotion. However, there are personality researchers

who feel that the GSR measures anxiety as well as emotion in general (Reyher and Smeltzer, 1968). As a measure of deception, the GSR is considered to be the best possible single index (Thackery and Orne, 1968). In spite of all of the evidence gathered on both sides of the issue, there are still those, like Flanagan, who are very definitely against using GSR as an index of emotion, and others (as will be discussed below) who feel that if we say that GSR measures arousal (just changed the name) rather than emotion that we can use the GSR to measure motivation variables.

#### Later studies

The GSR has recently been used to measure arousal in studies which are strikingly similar to the early studies on affect (measured by the GSR) and retention, but these later studies claimed no connection with the earlier ones. However, they studied arousal (as measured by the GSR) and retention. It would seem that these studies are in fact related since their measures of affect or arousal are similarly measured by the GSR and their results are very similar. Kleinsmith and Kaplan (1963) were the first in this later series of studies to investigate the relation between memory and arousal. They recorded GSR readings as a measure of arousal while their subjects were being presented eight paired associates which were to be learned. Recall was tested after two minutes, 20 minutes, 45 minutes, one day and one week. They found that paired associates learned under low arousal exhibited high immediate recall value and rapid forgetting, but high arousal paired associates revealed a marked reminiscence effect (low immediate recall and high permanent memory effects). Thus, low affect words appeared to be best for immediate recall whereas high affect words seemed to be best

for long-term memory.

These investigators (Kleinsmith, Kaplan, and Tarte, 1963) studied the general applicability of the inverted U as a statement of the relationship between arousal and learning. Their subjects attempted to memorize 30 paired associates over a period of five minutes of learning and rest. These subjects were tested for recall after six minutes and one week. GSR was measured continuously during each learning trial. They concluded that when the confounding effects of active consolidation are eliminated by using a long-term rather than a short-term recall interval, a strong positive correlation between learning and arousal is obtained. Walker and Tarte (1963) investigated memory storage and arousal. They had their subjects learn eight stimulus words paired with single digit numbers in one trial. They had three groups of subjects learn a high arousal list, three groups learn a low arousal list, and three groups learn a mixed list. Within each type of list, one group recalled the list at two minutes after learning, one group recalled at 45 minutes, and one group recalled at one week. They found that the low arousal groups had high immediate recall which decreased with time and the high arousal groups had low immediate recall and high ultimate recall.

This same group of investigators at Michigan (Kleinsmith and Kaplan, 1964) studied arousal and recall with nonsense syllables. They presented their subjects with six nonsense syllables paired with single digit numbers while they recorded skin resistance as a measure of arousal. The subjects were required to recall these paired associates at two minutes, 20 minutes, or one week. Their findings were the same as with other verbal materials learned under high and low arousal conditions. Nonsense syllable paired associates learned under low arousal exhibited

high immediate recall and rapid forgetting, while high arousal associates showed a marked reminiscence effect--low immediate recall and high permanent memory. In an indirectly related study, motivational factors in short-term retention were studied by Weiner and Walker (1966). They employed four incentive conditions: win one cent for correctly retaining the stimulus, win five cents, receive a shock for not correctly recalling the stimulus (trigram, 30 percent associative strength) and a control group where neither shock nor money was used as an incentive. Weiner and Walker's results indicated that there was a significant interaction between time of recall and incentive condition. They concluded that motivation affects the capacity to retain verbal material. After a series of experiments of this type, Weiner (1966, p. 1) concluded that "the effects of motivation on retention are in part determined by the magnitude of incentive, quality of incentive, nature of the activity intervening between stimulus onset and recall, place in the memory sequence at which the motivational factor is introduced, type of stimuli, and type of design."

Affect and short-term retention was investigated by Kernoff, Weiner, and Morrison (1966). They used the same incentive conditions as were used in the previous Weiner studies (see Weiner, 1966, Weiner and Walker, 1966). There were three recall intervals: 2.8 seconds, 9.35 seconds, and 17 seconds. The stimuli used were four letter consonants cued for the four different incentives. Their results showed that at a short time interval there were no differences in recall as a function of the incentive condition. But after a longer interval, stimuli associated with a five cent reward or shock were recalled significantly more than stimuli for which neither shock nor money was a potential outcome. These investigators concluded that motivation did not affect the strength



of learning, but did influence the temporally subsequent process of trace storage. These studies ("later studies") carried out at Michigan are the basic studies upon which other related and later studies of arousal were based. The Michigan studies had shown that there was an interaction between the effects of affect and length of recall interval.

#### The importance of intensity of affect

While these studies concerning affect and recall were being performed at Michigan, there were some important related studies that indicated why the Michigan studies were getting positive results. Baron (1962), a ninth grader, performed a study on her classmates to determine the relation of memory and emotion. She used words taken from Young (1937), and had her classmates rate them on a five-point scale. She found that intensity of emotion, rather than kind of emotion, has the primary influence on memory. Her results were supported by studies in India (Dutta and Kanungo, 1967; Kanungo and Dutta, 1966). The learning materials that they used in their first study (Kanungo and Dutta, 1966) were 20 pleasant and 29 unpleasant adjectives matched for their intensity of affect and frequency of usage. Their subjects rated, and later recalled, these adjectives. They said that their results clearly showed that the perceived intensity of affect of material determines its retention. In their second study (Dutta and Kanungo, 1967) they used 50 colored abstract designs. Their subjects were asked to rate the intensity of affect associated with experimentally induced success and failure experiences associated with finding a figure in these abstract designs. They again found that the retention for failure and success was a function of the perceived intensities of unpleasant and pleasant affects. Thus, these studies demonstrate that the retention of verbal and other materials

is a function of the intensity of the affect of the remembered stimulus.

#### Related studies of affect and retention

The following experiments were primarily based on the Michigan studies and are related to their findings. Berlyne, Borsa, Hamacher, and Koenig (1966) studied the relationship of paired associate learning and the timing of arousal. They sounded a 75-db. white noise during the presentation of the stimulus and response terms in training trials. This effect significantly increased recall in a test trial held one day later. White noise presented after the response made no significant difference, and there was no significant interaction between recall interval and arousal. Concerning recall immediately after learning with arousal varied for the learning materials, they say that they are of the opinion that the effects of arousal are variable and complicated. They say that it seems likely to them that there is an optimum degree of arousal for immediate recall, the location of the optimum varying widely with circumstances.

Levonian (1966, 1967) measured skin resistances of tenth grade students during a 10 minute instructional film. He measured their retention of information immediately after and one week after the film. Levonian's results showed that high arousal before information presentation resulted in both short-term and long-term retention, whereas high arousal after information presentation led to reminiscence. Kaplan, Kaplan, and Sampson (1968) repeated Levonian's procedure using single words or pictures rather than a film as stimulus material. They tested free recall immediately after presentation and 30 minutes later. The results of Kaplan et al. indicated that mean GSRs based on

items presented as words predicted both word and picture recall. Also, their results showed that higher GSRs were associated more with reminisced items than with forgotten items, which is consistent with the results of earlier Michigan studies and with Levonian.

Maltzman, Kantor, and Langdon (1966) studied the variables of retention, arousal, and orienting and defensive reflexes as they related to the findings of the Michigan studies. They used Walker and Tarte's (1963) eight high arousal and eight low arousal words for their stimulus items. The words were presented at 10 second intervals through microphones. Contrary to the Michigan studies, they found that high arousal words showed superior immediate as well as delayed retention.

Levonian (1968) studied short-term retention in relation to arousal to test Kleinsmith, Kaplan, and Tarte's (1963) conclusions that the relationship between amount of learning and extent of arousal is not described as an inverted U curve. Levonian (1968, p. 291) tested for information immediately after the presentation of a film during which GSRs were recorded. He concluded from his results that "...the regression of short-term retention on arousal is an inverted U when interindividual analysis and measures of arousal are used, and inverse when intra-individual analysis and measures of arousal increment are used." These results in connection with the Kleinsmith et al. studies suggested to Levonian that differences in results may reflect the type of analysis and measure of arousal that is employed. Berlyne and Carey (1968) made a follow-up study to their previous one (Berlyne et al., 1966) concerning incidental learning and the timing of arousal. Berlyne and Carey (1968) presented four items (Turkish-English paired associates) with white noise. They are not of the opinion that higher arousal during learning invariably makes for better long-term recall but worse short-term

recall as the Michigan group maintained. Rather, Berlyne and Carey believe that there is an optimal, intermediate degree of arousal for learning, and the location of this optimum would vary with the nature of the material and the interval between learning and recall. These related studies, then, make additional suggestions, and even revisions, to the findings of the Michigan group concerning high immediate recall with high arousal and the nature of the inverted U relationship between extent of arousal and length of retention interval.

#### A critical look at previous studies

Recently, Kaplan and Kaplan (1968, 1969) have taken a critical look at their previous studies in comparison to the "related studies" cited above. Kaplan and Kaplan (1968) noted that previous studies by Maltzman et al. (1966, cited above) and Yarmey (1966, cited below) did not obtain the Kleinsmith and Kaplan finding of poor immediate recall of high arousal material. Kaplan and Kaplan felt that these related studies are consistent with the Michigan group results on both methodological and theoretical grounds. They felt that important methodological departures from the Kleinsmith and Kaplan design (free recall and rapid presentation rate) accounts for the discrepancies in results. In a modification of the Kleinsmith and Kaplan studies, Kaplan and Kaplan (1969) presented a six item paired associate list just once to subjects who were tested for recall at varying times: immediately after learning, six minutes, eight minutes, and two days after learning. They found that the high arousal items showed significant reminiscence at six minutes, but the overall effects were not as strong as in previous studies. Thus, they had to modify, to a small extent, the conclusions of their own earlier studies.

### Affect and recall

Recent results (Kammann and Murdock, 1969; Nodine and Korn, 1968) concerning the relationship between affect and recall show that high affect results in superior retention of verbal material. Nodine and Korn (1968) presented their subjects with two picture-trigram paired associate units. The affective content of one stimulus term was pleasant and the other was unpleasant. One of the two paired associates was tested for recall after either a three, none, or 15 second retention interval, during which the subjects engaged in number tracking. They found that the recall of pleasant units was superior to unpleasant units at all of the retention intervals. Very recently, Kammann and Murdock (1969) investigated the learning and recall of emotionally loaded sentences with two types of emotionally bland sentences in learning, immediate recall, and one week recall. They found that only with males was performance better with emotionally loaded items. They also found no evidence for a reminiscence effect in contrast with the Michigan studies. Kammann and Murdock found that final recall was well correlated with degree of original learning. These studies show, in general, that high affect words produce superior recall than low affect words.

### Arousal in Mediation

The final two studies to be considered related to affect are investigations examining the effects of arousal in verbal mediation (Cunningham, 1968; Yarmey, 1966). Yarmey (1966) selected four high and four low arousal words from Walker and Tarte (1963) who had determined the degree of arousal by a GSR measure. These arousal words served as the common (B) elements in a chaining mediation paradigm (A-B, B-C, A-C).

Yarmey used two-digit numbers as the non-common (A & C) elements. The paired associate lists were presented orally using a tape recorder. At each stage there were six study trials alternating with six recall trials. Randomization of the positions was made to prevent serial learning. The paired associates were read approximately two seconds apart during study periods while the stimulus words were spoken at five second intervals during recall trials. Yarmey found that high arousal words significantly facilitated recall during the first two stages, but the effects of the arousal condition were not found to be significant in the third (mediating) stage. These results would seem to indicate that high arousal facilitates paired associate recall but not verbal mediation. Cunningham (1968) found similar results to Yarmey's. Cunningham used a chaining mediation model with high and low arousal words as B words in each list just as Yarmey did. Also, Cunningham's results were similar to Yarmey's--arousal level produced no differences in recall of paired associates. These studies show results which indicate that arousal, as measured by GSR, does not facilitate verbal mediation in the chaining model. Thus, it would seem from the results of these studies that affect is not a significant factor in verbal mediation.

### Meaningfulness

#### Meaningfulness of nonsense syllables

Nonsense syllables were originally developed by Ebbinghaus (1885) to divest verbal units of past learning and meaning. However, since the time of Ebbinghaus, experimenters have realized that even though nonsense syllables do not have the specific meanings that words do, they still possess some associated meanings to varying degrees. To

determine the meaningfulness of nonsense syllables, Glaze (1928) devised an early scale of association value for these verbal units. He had 15 subjects rate a list of over 2000 nonsense syllables according to whether or not they recalled an available association for each syllable within two or three seconds. The association value for each syllable was determined by calculating the percentage of subjects who reported having associations to each syllable. The number of associations elicited by each syllable was not considered by Glaze. Hull (1933) selected 320 of Glaze's 2000 syllables and presented them by use of a memory drum as in a serial learning experiment. He found an estimated correlation between his results and those of Glaze's results for the same syllables of about .63. Hull attributed the lack of a perfect correlation between the two sets of results to differences in technique, subjects, and time. Krueger (1934) attempted to determine the relative difficulty of nonsense syllables. He used a procedure similar to Glaze's and found similar results. Witmer (1935) studied the association value of three-place consonant syllables. His method was similar to that of Hull's (1933). Witmer's comparison of consonant syllables with nonsense syllables as classified by Glaze showed that the two types of material have very different distribution. Nonsense syllables are almost evenly divided into 16 groups of meaningfulness, while consonant syllables more closely approach the normal curve. These, then, make up the early studies of the association value or meaningfulness of nonsense syllables.

More recently, there have been additional attempts to measure meaningfulness of verbal units devised for verbal learning tasks. Noble (1952a) used 18 artificial two-syllable words and 96 actual two-syllable words which he called dissyllables. When each item was given to a subject, he was instructed to write down all associations that came to

mind in 60 seconds. These syllables were ranked on a scale of meaningfulness on the basis of the number of associations given to them.

Noble's results showed, as one might expect, that the actual words received higher positions on his scale than did the artificial words.

Underwood and Schulz (1960) determined the meaningfulness of trigrams (any three-letter combination which does not form a word). They had their subjects respond to each single letter of the alphabet with the first single letter response that came to mind. Then they presented their subjects with all possible two-letter combinations as stimuli and asked them to provide the first single letter they thought of as a response. The frequencies of occurrence for each possible combination of three letters were tallied by Underwood and Schulz. Given any three-letter sequence, one can use their norms to determine the meaningfulness of that unit. The frequency with which the first letter of the sequence elicits the second letter in the norms is combined with the frequency with which the first two letters elicit the third letter in the norms. This value is the generated frequency score, which indicates the trigram's meaningfulness value.

Archer (1960) re-evaluated the meaningfulness of 2480 trigrams. The materials used by Archer were composed only of consonant-vowel-consonant (CVC) trigrams. When each of the possible CVC trigrams was presented, each subject considered whether it was a word, sounded like a word, reminded them of a word, or could be used in a sentence. To minimize the monotony of the task, Archer employed three sessions for each subject. He determined the meaningfulness of each trigram by calculating the percentage of subjects who considered each trigram meaningful. Ratings determined in this way were tested for reliability and found to be stable. Archer obtained high correlations between his



ratings and those of Glaze (1928) and Krueger (1934). But lower correlations were obtained among these studies when sampling was restricted to quartiles instead of using the total range, from 0 to 100 on the meaningfulness scale. Most of the older and more limited scales are not therefore highly correlated with Archer's norms for restricted ranges. Thus, Jung (1968) recommends the use of Archer's scale in preference to the older ones. These studies of nonsense syllables clearly indicate that nonsense materials vary widely in association value reflecting the amount of a person's past associations to such material.

#### Meaningfulness of words

One popular method of measuring the specific pre-experimental verbal habits and their associative strengths is the word association test. This procedure dates back to the days of Galton in 1879 and still has wide application today. The standard word association test was developed by Kent and Rosanoff (1910). The stimulus words are 100 nouns and adjectives for the most part. The test is used by asking the subject to "give the first word that comes into mind" in response to each stimulus word of the list. The subject responds in writing and there is no time limit for responding. Kent and Rosanoff developed norms which show the frequency with which various responses are given to each stimulus word. Word association norms have frequently been published since this study by Kent and Rosanoff, but most of them have been developed after the often cited study of Russell and Jenkins (1954). Since their study, other word association norms have recently been published by Bilodeau and Howell (1965), Entwisle (1966), and Palermo and Jenkins (1964). The word association test apparently measures both

associative and nonassociative factors, such as administrative procedure and task perceptions (Jung, 1968). Therefore, at its best, the word association test only approximately measures associative habits since no associative factors can be eliminated completely.

Words also differ with respect to their relative frequencies of occurrence in the language. Thorndike and Lorge (1944) tabulated the frequency of the usage of different words in a wide range of printed material including newspapers and magazines. If one assumes that differences in frequencies of occurrence of words determine the differences with which individuals experience words, high frequency words should be stronger items, and therefore more easily learned than low frequency words. There is some question as to whether Thorndike and Lorge's norm is out of date today and a new norm based on their procedure should be developed from contemporary printed material (Jung, 1968).

#### Serial learning and meaningfulness

There are a few studies which demonstrate that the meaningfulness on nonsense syllables affect serial learning. Noble (1952b) evaluated the effects of variations of rated meaningfulness of material on serial learning. He asked his subjects to learn lists of 12 dissyllable words of either low, medium, or high meaningfulness. Under the serial anticipation procedure, Noble found learning to improve as the meaningfulness of the dissyllable words increased. McCrary and Hunter (1953) compared serial learning of names with serial learning of nonsense syllables. In this way they varied and meaningfulness of the material to be learned. When they compared the absolute number of errors, they found more bowing in the curve of plotted errors for the nonsense syllable list, but when an analysis was made of percentage errors, they

found that the serial position curves for both types of meaningfulness material was essentially equal. Braun and Heymann (1958) reported similar results to those of McCrary and Hunter. Braun and Heyman examined the effects of meaningfulness as well as distribution on serial position curves. Their subjects serially learned 12 paralogues of either high or low meaningfulness. In one study trial the intertrial interval was either two or four seconds, while in another study it was either six seconds or two minutes and six seconds. Similar to the results of McCrary and Hunter, more bowing in the error curve occurred with low meaningfulness, but only if absolute curves were considered. These studies show that meaningfulness has an effect on serial learning.

#### Paired associate learning and meaningfulness

Meaningfulness has also been shown to have an effect in paired associate learning. Noble and McNeely (1957) studied the effects of meaningfulness on paired associate learning. They devised lists of paired associates which represented 10 equally spaced points on Noble's (1952a) scale of meaningfulness. Their results showed a strong relationship between a comparison of the mean number of errors as a function of the median meaningfulness of the pairs in each list. The more meaningful the pairs in a list, the fewer errors that were obtained. Noble and McNeely saw that further studies were needed in which comparisons would be made for variation in meaningfulness of stimulus and response terms, separately. Cieutat, Stockwell, and Noble (1958) carried out such a study, again using paired associate lists. Four combinations of high and low stimulus and response meaningfulness were employed: high-high, high-low, low-high, and low-low. They found learning to be a direct function of response meaningfulness, but there was no effect of variations

of stimulus meaningfulness on learning. Similarly, Hunt (1959) found greater differences in learning as a function of variations in response meaningfulness than with stimulus meaningfulness. Therefore we see that the studies of Noble and his students showed that meaningfulness is an important variable in paired associate learning.

\* Epstein and his students also studied meaningfulness in paired associate learning. Epstein and Streib (1962) made use of a recognition test so that no response learning was necessary. When their subject was presented with a stimulus, he chose one of three response alternatives. Stimulus-response pairs were formed with paralogues to form low-high or high-low meaningfulness lists. Epstein and Streib predicted that the list with high meaningfulness responses would be better learned under the anticipation method, but that the use of the recognition test method would lead to equal learning of the two lists. Their results supported their predictions except when the similarity of the recognition alternatives was high. In this case, learning was better with the high-low meaningfulness list. Epstein and Platt (1964) studied free recall of paired associates with the same combination of stimulus and response meaningfulness as Cieutat et al. (1958). Study trials were given by Epstein and Platt in which all pairs of the list were shown. Then the test trials were interspersed during which the subject was to recall all the stimuli and responses in any order. In this situation, variations in stimulus rather than response meaningfulness had a greater effect on performance. Therefore these studies show that meaningfulness has an effect in paired associate learning also.

#### Transfer and meaningfulness

Meaningfulness has been shown to be a factor in transfer studies.

Jung (1963) investigated the effects of response meaningfulness in the A-B, C-B, and A-B, A-D paradigms. Also included for an estimate of nonspecific transfer was the A-B, C-D condition. Jung assumed that the factor leading to positive transfer, response learning, would be greater with low meaningfulness in the A-B, C-B situation. He hypothesized that the formation of backward associations would be minimized with low meaningfulness since most of the effort would be concerned with response learning. Jung predicted that low meaningfulness responses would lead to positive transfer, whereas high meaningfulness responses would lead to less positive or even negative transfer. The results of Jung's experiment supported his predictions. Jung reasoned that variations of response meaningfulness in the A-B, A-D paradigm cannot affect transfer between tasks via response learning since different sets of responses are involved on the two lists. But if response meaningfulness affects the strength of associative learning, then it may affect transfer in this paradigm. He thought that stronger competing associations should occur with responses of higher meaningfulness since response learning will be completed quickly and associative learning will occur, thus leading to greater negative transfer. The results of Jung's study showed more negative transfer with responses of high meaningfulness.

Merikle and Battig (1963) also examined transfer as a function of response meaningfulness in different paradigms, the A-B, A-D and the A-B, A-Br. Their results also showed a slight tendency of greater negative transfer with higher meaningfulness responses in the A-B, A-D paradigm. They applied the two stage analysis of Underwood, Runquist, and Schulz (1959) to their findings regarding the effects of response meaningfulness in the A-B, A-Br paradigm. In this situation, they found positive

transfer of response learning, but negative transfer of associative learning. They explained this by reasoning that when high meaningfulness responses are used little learning is required; as a result the associative learning which contributes interference is the major factor. They similarly reasoned that with low meaningfulness responses, the negative transfer from associative learning is offset by greater positive transfer of response learning. These studies, then, show that meaningfulness is a potent factor in transfer studies.

#### Response and associative learning and meaningfulness

Jung (1965) studied the effects of response and associative learning in relation to meaningfulness. He temporally separated test and study parts of each trial where lists of eight pairs of single-digit stimuli and nonsense syllable responses were learned. Each pair of stimuli was shown for two seconds during the study part; then, after each trial, a test of free recall was given to measure the amount of response learning, while an associative matching test was given to assess associative learning. Each test lasted 45 seconds. In free recall, the subject was simply asked to recall as many responses as he could without any aids. Associative matching involved presenting the subject with each of the list stimuli and responses, printed on separate cards, in a shuffled arrangement. The task was to match the stimuli with their appropriate responses. Four conditions were involved, one for each combination of the two levels of formal similarity and meaningfulness of responses. Each subject was tested first for response and then for associative learning. Jung found that high intralist response similarity failed to affect response learning, whereas it hampered associative learning. Response learning was higher than associative

learning, especially on early trials, provided that meaningfulness and similarity were both high. Thus, we see that meaningfulness is a factor in response and associative learning as well.

#### Retention and meaningfulness

Young, Saegert, and Lindsley (1968) investigated retention as a function of meaningfulness. They presented 32 high-meaningful and 32 low-meaningful items for a single trial at a three second exposure rate. Using a recognition measure, they tested half of their subjects for retention immediately after presentation and the other half was tested after a 24 hour interval. They found differential forgetting, with greater forgetting of high-meaningful than low-meaningful items. Young et al. go on to comment that a large number of studies have failed to find that retention is related to meaningfulness (Keppel, 1968). However, they say, their data as well as that obtained from a short-term memory experiment by Turnage (1967), indicate that high-meaningful items are not as well retained as low-meaningfulness items. Thus, under some conditions, at least, retention is related to meaningfulness.

#### Mediation and meaningfulness

There have been some studies investigating meaningfulness as a factor in mediation. Studies using either low association value nonsense syllables or low association value eight-point random shapes all failed to show verbal mediation (Barclay, 1961, 1963; Crawford and Vanderplas, 1959; Hakes and Jenkins, 1962). The results of an experiment by Peterson, Colavita, Sheahan, and Blattner (1964) indicate that the amount of mediation is determined by the extent of the meaningfulness of the learning materials. Peterson et al. employed nonsense syllables of 0-30

percent and 100 percent association value in a set of experiments using all eight possible mediation paradigms. They found that the mediational effect was obtained in six of the paradigms under the high meaningfulness condition, while under the low meaningfulness condition, mediation was found with only three paradigms.

Horton (1964) directly investigated the variable of meaningfulness in verbal mediation. He used nonsense syllables of 70-80 percent association value as the A and C terms and high and low extremes of Noble's (1952a) meaningfulness scale of dissyllables as the common (B) terms. Horton found that the mean number of correct anticipations of the subjects in the A-C list learning with the high meaningfulness mediating terms was significantly less than that of subjects with the low extreme dissyllables as the mediators. Peterson (1965) investigated the effects of meaningfulness and delay intervals of zero, two, or eight seconds between the two acquisition stages of a mediation paradigm or between the second acquisition stage and test stage. When the learning materials were of relatively low meaningfulness, mediated facilitation was found with delays of zero and two seconds, but not with a delay interval of eight seconds. When the learning materials were of high meaningfulness, mediated facilitation was observed with an eight second delay interval as well.

Popp and Voss (1967) examined meaningfulness and mediation recall as factors in mediation. They used the A-B, A-C, B-C paradigm, with the B and C items being presented at 0/6, 2/6, 4/6, or 6/6 criterion efficiency during the third stage of acquisition. Their subjects recalled the items associated with B and C in the first two mediation stages. Popp and Voss found that "high-m materials apparently yield superior backward learning and less backward unlearning in stages one and two,



thus making the mediator more available for high-m material at the onset of stage three." They said that their data suggests that backward associative learning increases as a function of meaningfulness, and therefore the mediator is more available with higher meaningful material. These studies demonstrate that higher meaningfulness facilitates mediation.

#### Interaction of Affect and Meaningfulness

There have been a few studies which have indicated that affect and meaningfulness interact in their effect upon verbal association. Koen (1962) studied the effect of meaningfulness and emotionality in words. His subjects rated words as to their association value by Noble's (1952a) technique and their polarization by the semantic differential. The emotionality of words were derived from the Q-sort technique and frequency of usage was measured by Thorndike and Lorge's (1944) book. He found an indication that meaningfulness is dominate over emotionality in determining verbal association. Greer and Mollenauer (1964) investigated meaning class and affective content in word association. Their subjects learned a list of words which were to be later used as responses in a word association task. Half of these subjects learned 10 hostile words taken from Buss (1961) and half learned a list of words that had been judged neutral. All of their subjects then responded in a word association paradigm with hostile or neutral words given to a list of five neutral and five hostile words. Reaction time reciprocals in the word association test were used as the dependent variable. Their results showed that meaning is dominant over affect in determining verbal associations. Thus, there seems to be an interaction between affect and meaningfulness with meaningfulness being a more potent factor than affect.

## Mediation

### Demonstration of mediation

Peters (1935) was the first experimenter who attempted to investigate mediation using verbal materials. He conducted a series of nine experiments using several mediational paradigms. Words, nonsense syllables, and numbers were his experimental materials. Peters had his subjects learn the first two lists of paired associates and then they were tested for mediate association by the recall method. In general, Peters' experiments failed to demonstrate the intended mediational effects. In only two out of the nine experiments did Peters find any evidence for mediation and only with a few subjects who were able to make use of the common term. One reason for Peter's failure to find significant evidence for mediation might have been that the recall method which he employed for testing mediational effects was too insensitive to use when there was little learning in the first two stages.

Bugelski and Scharlock (1952) were the first to really demonstrate mediation in verbal learning. They used the A-B, B-C, A-C chaining paradigm with nonsense syllables of 40-50 percent association value as the stimuli and responses. Each list of paired associates was made up of 16 pairs of nonsense syllables. Each subject served as his own control and a mixed list design was used where every subject encountered the same lists. This mixed list design was such that half of the A-C pairs (the experimental pairs) were arranged so that an A syllable and a C syllable had in common a B syllable, while the remaining eight pairs (the control pairs) were composed of the A and C syllables paired at random so that none of these had a common B syllable. Their subjects learned the A-B pairs and then the B-C pairs. The A-C pairs were learned

as the test for mediation. The learning criterion was five perfect trials of anticipating the correct response. In order to test for mediation, the median number of trials required for attaining the criterion of the A-C list was compared between experimental subjects and control subjects. The experimental subjects required a median of 5.3 to learn the A-C list as compared to 7.0 for the controls. This difference was significant at the .01 level of confidence thus demonstrating the mediation effect.

The control condition of the Bugelski and Scharlock study was not a non-mediated condition but a negative transfer condition. Norcross and Spiker(1958) attempted to improve on the Bugelski and Scharlock (1952) study by demonstrating both positive and negative transfer in learning the A-C list in the mediated association design. They performed two experiments using the same chaining model (A-B, B-C, A-C) that Bugelski and Scharlock had used. In their first experiment, Norcross and Spiker compared the mediation, negative transfer, and the non-mediated or control conditions. They used three lists consisting of six stimulus-response picture pairs with kindergarten children as subjects. Two pairs were designed to facilitate mediation by providing a common B term. Two other pairs were expected to produce negative transfer by switching the A and C terms already learned in the first two learning stages. The final two pairs were intended to be a control or non-mediation condition by not providing a common B term with no switching of the A and C terms already learned. The subjects received the same form of lists one and three, but different forms of list two which were designed to produce the three conditions outlined above. In the recall test the mean number of correct responses were 7.40 for the facilitation condition, 4.83 for the control condition, and 4.40 for the negative transfer conditions.

The facilitation condition was significantly greater than the control and negative transfer conditions. In their second experiment, Norcross and Spiker used the same procedure as in the first experiment, but omitted the facilitating condition and increased the number of pairs in the control and negative transfer condition to three each. The mean number of correct responses for the control condition was 7.83 and for the negative transfer condition it was 6.21. This difference was significant and they concluded that both positive and negative transfer in mediation could be produced.

Peterson and Blattner (1963) studied the development of a verbal mediator by using the chaining paradigm with only one paired associate at each stage. They conducted four experiments which primarily differed in the meaningfulness of the learning materials. Experiment I used nonsense syllables of 0-17 percent association value for all items. Experiment II used nonsense syllables of 100 percent association value for all items. In experiments III and IV, the A terms were 100 percent association value nonsense syllables, while the B terms were stimulus words from Russell and Jenkins' (1954) norms. The C items of experiments III and IV were either the most frequently occurring response or a low frequency response to each of the B terms from the Russell and Jenkins' norms. Only high frequency responses were used in experiment III, while both high and low frequency responses were used in experiment IV. The frequency of presentation of the pairs varied from one, three, and six times to determine the effect of frequency on mediation. In experiments I and II, the A-B pair was shown one, three, and six times with the B-C pair which had the same frequency as the A-B pair. For experiment III only the A-B pair was shown one, three, and six times, while the B-C association was inferred from the word association norms.

In experiment IV the A-B pair was shown only once while the B-C pair was inferred. The measures of mediate association were done by the multiple choice matching method. Peterson and Blattner's results showed significant mediation in all four experiments. Also, increases in amount of meaningfulness and number of presentations facilitated mediation.

Davis (1966) studied mediation and interference across five grade levels. He employed a mixed-list A-B, B-C, A-C paradigm in which all subjects were under mediation, interference, and control conditions. The lists were composed of nine pairs of high frequency words. Ten students from each of five levels (2, 4, 6, 8, and college) learned each list by the anticipation method. Using the criterion of the mean number of errors in making the correct responses for the A-C list, the results showed that all grade levels performed best on the mediation pairs, intermediate on the control pairs, and poorest on the interference pairs. These results essentially corroborate the findings of Norcross and Spiker. Thus, we can see that mediation has been experimentally demonstrated in the three stage chaining model.

#### Forward vs. backward mediation

Horton and Hartman (1963) compared the effectiveness of forward association against backward association in the facilitation of mediation effects. Two chaining paradigms (A-B, B-C, A-C; A-B, B-C, C-A) were used in the experiment. The task was presented to the subjects as a simple paired associate learning problem involving three lists, each containing six pairs of low-frequency five letter words. Each list consisted of one half A-C pairs and one half C-A pairs, with each subject serving as his own control. Their findings indicated that forward associations were superior to backward associations in the facilitation of mediated learning.

### Later studies

Later studies, in addition to those already cited above, show that mediate association can be experimentally produced. Seidel (1962) examined the importance of the S-R role of the verbal mediator in mediate association. He used four variations of the chaining paradigm (A-B, B-C, A-C) to explore the nature of the verbal mediator. The conditions of the mediator, B, were: S-R, S-S, R-S, R-R. With the control group there were five treatments in this study, which was run as a mixed design. Seidel's results indicated that mediation occurred irrespective of the specific S-R character of the mediator. However, the effect was enhanced when the mediator, B, was first a response and then a stimulus.

Kulp and Robinson (1965) studied the role of temporal factors in reverse mediate association. They used low-frequency five-letter words as learning materials in the A-B, B-C, C-A reverse paradigm with the acquisition method for the test stage. By increasing the interval of anticipation for the C-A test stage from two to four seconds, the facilitative effects of mediation increased, Dean and Martin (1966) examined reported mediation as a function of degree of learning. They used the chaining paradigm where the A-C list consisted of half mediated and half control pairs. The learning materials were nonsense syllables. One group of the subjects learned the A-C list to a criterion of two perfect trials, while the other group was given 10 additional trials beyond the second perfect trial. Mediation was obtained in both groups, but the group that was given 10 additional trials reported significantly more awareness of the mediational process for the mediating pairs in the post-experimental inquiry.

Most of the experiments on mediate association using the chaining model showed that mediation could be experimentally demonstrated and in

the early sixties, it was generally accepted that the process of mediate association did exist (Horton and Kjeldergaard, 1961; Jenkins, 1963). However, a series of studies have questioned this notion.

#### Pseudomediation

Mandler and Earhard (1964) performed a study which reportedly demonstrated that chaining is an artifact, a case of pseudomediation. They compared a pseudomediation paradigm (A-B, B-C, A-E) with a control paradigm (A-B, D-C, A-E). All the lists were constructed from a word pool of 30 low frequency words. Each list of paired associated was learned by the anticipation method to a criterion of two correct trials. When the mean number of trials required to meet the criterion were compared between the A-E lists of the two paradigms, it was found that the learning of the A-E lists of the experimental paradigm was significantly faster than the A-E list of the control paradigm, even though, clearly, there had been no opportunity for mediation. Mandler and Earhard said that pseudomediation was produced because while the subject learned A-B associations, he also learned B-A associations and when in the subsequent stage where B became a stimulus to C, the B-A association was unlearned to some degree. When the B-A association was unlearned to some degree so was the A-B association. Therefore, the A-B association of the experimental paradigm would interfere with A-E learning at a lesser strength than would the A-B association of the control which had no opportunity to become unlearned beyond normal forgetting.

Experiments attempting to answer this question raised by Mandler and Earhard have tried to find out the "fate" of the first (A-B) list learning during and after the learning of the second (B-C) list. Supporting evidence for pseudomediation has been provided by Earhard and

Mandler (1965), and Earhard and Earhard (1968a, 1968b). Contradicting evidence was put forth by Jenkins and Foss (1965), Schulz, Weaver, and Ginsberg (1965), and Horton (1967).

Jenkins and Foss (1965) tried to replicate the pseudomediation experiment of Mandler and Earhard (1964) to test the latter's hypothesis of the unlearning of the first stage during the second and third stage acquisition in the A-B, B-C, A-E pseudomediation and A-B, D-C, A-E control paradigm. The list of six paired associates were constructed from the same pool of words that Mandler and Earhard used. Each list was presented with an eight second intertrial interval while Earhard and Mandler had none. Their results indicated that recall of first-list responses following the second-list learning did not show a significant difference between the experimental and control groups. Similarly, the recall of first-list responses following the third-list learning showed minimal difference. Earhard and Mandler (1965) replied to the Jenkins and Foss argument against pseudomediation. Earhard and Mandler tested for the availability of the first list associations following the second-list learning in three paradigms: A-B, B-A; A-B, C-A; A-B, C-D. The third paradigm served as a control paradigm. They again used their low frequency words for learning materials. For all three paradigms, their subjects learned a common A-B list. The second list was learned separately by three groups of comparable subjects. After the second list was learned, the subjects were presented with the A-B list items unpaired in a random order and were asked to pair them correctly. They found that the lowest mean number of correct associations was with the A-B, B-C paradigm, while the A-B, C-D control paradigm had the highest. Earhard and Mandler concluded that if either member of the pair in the first list was used in the second list, the learning of



the second list weakened the first-list association to some degree.

Schulz, Weaver, and Ginsberg (1965) used a pseudomediation paradigm and its control (A-B, B-C, A-E; A-B, D-C, A-E) and a mediation paradigm and its control (A-B, B-E, A-E; A-B, D-E, A-E) in an attempt to replicate Mandler and Earhard's (1964) effect. Each list contained 10 paired associates with paralogues as the A terms, nonsense syllables as the C and E terms, and common nouns having minimal association overlap as the B and D term. The mean correct responses were used as the criterion in a multiple-choice recognition task. Their results showed a clear mediation effect while no pseudomediation effect was shown. Schulz, et al. (1965) concluded that a mediational interpretation for the observed facilitation under chaining conditions remained highly tenable.

Earhard and Earhard (1968a, p. 226) report eight experiences dealing with interference and strategies in a study of mediation. In stage one of all experiments, their subjects associated two unrelated verbal units with a mediator. In stage two, the performance of mediator linked pairs of associates was compared with performance on new and unrelated control pairs of associates. They found that the mediator linked pairs were learned less rapidly than control pairs even if mediating linkages were overlearned. Earhard and Earhard conclude that "either radical changes in the conditioning model of mediation must be made or else one must have recourse to 'rules' or 'strategies' or to some other organizational mechanism as explanatory principles." Thus, they feel that accounting for the mediating phenomenon by explaining it by the common term is not a satisfactory explanation of this process.

Horton (1967) replied to Earhard and Mandler's (1965) argument that observed differences in mediation experiments cannot be attributed unequivocally to mediation mechanisms, but can be explained by an

interpretation of mediation findings of interlist interference and unlearning effects. Horton's paper attempted to evaluate the pseudomediation position through an examination of relevant literature dealing with interference, unlearning, and mediation. Horton concluded that the experimental findings cannot be adequately explained in the manner proposed by Earhard and Mandler and that mediation theory offers the most reasonable account of the experimental facts. Earhard and Earhard (1968b) replied to Horton's paper. They pointed out three deficiencies in Horton's analysis. First, they said that Horton's review of unlearning data is inadequate, and that the evidence of unlearning that is present in studies Horton cites provides no evidence of unlearning. Second, they argue that Horton's evaluation of the interlist interference interpretation of differences between each of the mediated facilitation, mediated interference, and pseudomediation paradigms, and the standard control paradigm is unsatisfactory. Third, they point out that Horton's contention that the most adequate account of available data is provided by mediation theory is achieved only at the expense of passing over a very substantial body of data incompatible with a mediation interpretation of paired associate paradigms.

#### A-C Recognition Test

Studies which have used mediation tests of matching the A-C lists rather than learning the A-C paired associates have shown mediation and not pseudomediation. By testing the learning that has already occurred on the A-B, B-C lists, there is no interference or negative transfer and mediation effects are clearly demonstrated. However, if the mediation effects are shown by having the subjects learn the A-C pairs, then negative transfer and interference takes place and a case exists for

pseudomediation. Studies will be cited here to illustrate that when tests of mediation are given rather than relearning of the A-C lists, the effects of mediation are always demonstrated.

Peterson and Blattner (1963) studied the development of a verbal mediator. They presented an A-B paired associate followed by a B-C paired associate. On the test trial, A was presented with three alternatives--C, D, and E. The task for the subject was to select C and disregard D and E on the test. Under these conditions, mediation was demonstrated. James and Hakes (1965) studied mediated transfer in a four-stage, stimulus-equivalence paradigm. They presented the first three stages as self-paced paired associate learning tasks. The fourth stage was presented as a matching task which consisted of fourth-list stimulus items (C) on the left of a sheet of paper and the response items (D) were presented on the right of the paper. The subjects had to match the appropriate stimulus and response items for the mediation test. Their results showed a significant amount of mediated transfer on the matching task.

Christiansen (1966) used an A-B, B-C paradigm for the learning trials in a mediation study. He used a matching task for the mediation test with each of the A terms matched with six C terms. The subject was required to circle the C term which had been indirectly associated with the A term on the two training lists. He clearly obtained mediation in his results. Clifton (1966) also used this chaining paradigm that Christiansen employed. Clifton found mediation when the test stimuli (A) were presented for the first time after the learning of the A-B, B-C lists.

Vajanasoontorn (1968) also used the chaining paradigm (A-B, B-C, A-C). He tested his subjects for mediation by using a recognition

multiple-choice method, similar to Christiansen's (1966). He found that mediation was obtained by this method. Weaver, Hopkins, and Schulz (1968) also tested A-C performance in the absence of study trials. They used a series of 10 multiple-choice test trials in the absence of study trials. Weaver, et al. found test performance in the chaining (mediation) condition was reliably superior to that in the non-chaining (control) condition. Therefore, when A-C mediation recall tests are used rather than A-C relearning trials, the pseudo-mediation effects of interference are overcome and true mediation is demonstrated.

The mediation vs. pseudomediation issue has still not been resolved today. The type of test of mediation--whether learning or matching--appears to be the critical variable determining pseudomediation. The mediation process has been demonstrated to exist. But how mediation takes place still has not been experimentally determined at this time.

## METHODS AND PROCEDURE

### Sample

The subjects who participated in this study were all students in an Educational Psychology class, Spring Quarter, 1969. The subjects were required to participate in this study as one of their class assignments during the quarter. They were not rewarded for their participation in any way nor did their performance in the study in any way affect their grade in this psychology class. This sample was selected because it was readily obtainable and control could be exerted over their participation in the study. All students in the class participated in the study. Half of the subjects were assigned randomly to Phase I of the study and half were assigned to Phase II. There were 74 subjects that participated in the study. Each subject appeared to be naive to this type of verbal learning experiment.

### Materials

#### The GSR instrument

The affect level of the mediators (B list) were obtained by measuring the subject's galvanic skin response to each of these words. The name of the GSR instrument used was "Psychogalvanoscope" made by the C. H. Stoelting Company of Chicago, Illinois. The instrument is portable and has two silver electrodes attached to wires leading to the "input" part of the instrument. Also provision is available for an "output" from the instrument for permanent recording purposes and in addition, the amplitude of the "output" may be varied. Provision is also made

for adjusting the sensitivity or amplitude of the "input" signal. Another control, "automatic zero," compensates for constant drift of the subject's skin resistance. The "centering" control balances the subject "in" on the internal bridge network. This GSR instrument has the following performance characteristics: (a) The meter scale is calibrated in "reaction units" since every different setting of the sensitivity control represents another resistance value in "ohms." (b) A "responsive" change of 1000 ohms from basic resistance level by a subject in a test situation will show approximately five reaction units on the meter regardless of whether the subject was initially balanced in at 5000 or 200,000 ohms. (c) The electrode circuit to the subject is a constant current arrangement whereby the current remains within a fixed value irrespective of the resistance level change of the subject. (d) A current limiting feature incorporated into the instrument provides a safety factor for the meter, protecting it against damage from accidental shorts if the electrodes touch or if the subject moves. (e) An automatic zero position selection switch enables the examiner to make the test with the conventional galvanometer arrangement or use the self-centering feature. (f) The natural period for the meter pointer to return to approximately the "0" mark on the meter scale is between five and seven seconds.

#### The verbal learning materials

The learning materials were four lists of nonsense syllables and one list of common meaningful words. First, the source of these lists will be indicated and then their arrangement will be shown.

Source of materials. The meaningful words were taken from a list given by Smith (1921) of the GSR deflections of 100 words which he

obtained from Jung (1919). Four high affect words and four low affect words were taken from Smith's list. These words were not the very highest or lowest of Smith's list, but were selected such that each word represented a different topic (the highest five words seemed to all have sex as the common theme). The high affect words selected were: name, kiss, money, and wound, while the low affect words selected were: pencil, swim, flower, and white. These words were all of about the same common frequency of occurrence (100 occurrences in a million), according to Thorndike and Lorge (1944). These words comprised the mediators (B list) of the mediation paradigm.

The first two lists of nonsense syllables formed the A and C lists of the mediation learning materials. These nonsense syllables were CVC trigrams taken from Archer (1960). The association values of these trigrams were as follows: low meaningfulness-27 percent association value, medium meaningfulness-50 percent association value, and high meaningfulness-73-74 percent association value. The low meaningfulness CVC trigrams were: MIB, BAV, GEH, QOM, JUV, FOV, VAH, QUP. The medium meaningfulness CVC trigrams were: PYR, HYL, MAB, LOH, LAH, FAH, BEM, MOX, FOW, QIK, CYR, VOD, QIN, LUF. The high meaningfulness CVC trigrams were: COV, YOW, NAM, PAG, TEK, SIV, DUS, HEK. These CVC trigrams comprised the nonmediators (A and C lists) of the mediation learning materials used in the experiment.

The last two lists of nonsense syllables were the lists used for the association test. This test was given after the mediation phase of the study. These lists of syllables for this association test were taken from Christiansen (1966), who obtained them from Glaze (1928). The syllables were rated as having high meaningfulness and were selected from the 60-100 percent range of Glaze's list of association value.

The first list of the association test was comprised of the following syllables: BAL, DEK, GIV, PUL, NUF, FAB, CIN, CED, HOM, ROH, KUT, HAF. The second list was made up of the following nonsense units: HET, JUN, LAT, MIL, LIC, KER, DUL, RAC, MUC, NIT, PAV, JOK.

Arrangement of materials. There were three phases of this study, and the learning materials were arranged to meet the objectives of each of these phases. Phase I concerned the differential effect of affect, so affect was varied and meaningfulness held constant. Therefore, the learning materials were high and low level affect words and medium meaningfulness CVC trigrams. Thus, Table 1 shows the lists which were used in Phase I of the study. The serial order of the A-B, B-C lists of paired associates shown in Table 1 is not important since they were shuffled each time between learning trials so that these pairs would not be learned serially.

Table 1. Lists used in Phase I

List A	List B	List C	List A-B	List B-C	List A-C
PYR	Flower	MOX	PYR-Flower	Flower-MOX	PYR-MOX
HYL	Money	FOW	HYL-Money	Money--FOW	HYL-FOW
MAB	Pencil	QIK	MAB-Pencil	Pencil-QIK	MAB-QIK
LOH	Wound	CYR	LOH-Wound	Wound--CYR	LOH-CYR
LAH	Swim	VOD	LAH-Swim	Swim---VOD	LAH-VOD
FAH	Kiss	QIN	FAH-Kiss	Kiss---QIN	FAH-QIN
BEM	Name	LUF	BEM-Name	Name---LUF	BEM-LUF

Phase II was concerned with the interaction of affect and meaningfulness, so both affect and meaningfulness were varied. Hence, the learning materials for this phase were high and low affect words, and



also high and low meaningfulness CVC trigrams. Table 2 shows the lists which were used for Phase II. The A-B, B-C lists of this phase were also shuffled each time between trials to prevent serial learning.

Table 2. Lists used in Phase II

List A	List B	List C	List A-B	List B-C	List A-C
COV	Name	TEK	COV-Name	Name---TEK	COV-TEK
YOW	Pencil	QUP	YOW-Pencil	Pencil--QUP	YOW-QUP
MIB	Kiss	SIV	MIB-Kiss	Kiss---SIV	MIB-SIV
NAM	Swim	VAH	NAM-Swim	Swim---VAH	NAM-VAH
BAV	Money	FOV	BAV-Money	Money--FOV	BAV-FOV
GEH	Flower	DUS	GEH-Flower	Flower-DUS	GEH-DUS
QOM	Wound	JUV	QOM-Wound	Wound--JUV	QOM-JUV
PAG	White	HEK	PAG-White	White--HEK	PAG-HEK

Phase III of the study was the association test, and high meaningfulness nonsense syllables were used to meet the objectives of this phase. The paired associates used in Phase III of the study are shown in Table 3.

Table 3. Paired associate list used in Phase III

Stimulus position	Response position	Stimulus position	Response position
BAL	HET	CIN	DUL
DEK	JUN	CED	RAC
GIV	LAT	HOM	MUC
PUL	MIL	ROH	NIT
NUF	LIC	KUT	PAV
FAB	KER	HAF	JOK

The recognition tests were the last of the materials used in this investigation. The recognition tests also correspond to the three phases of the study to test the learning and mediation effects produced by each phase. Table 4 shows a copy of the recognition test given for Phase I of the study. The underlined syllables are the appropriate answers. It can be seen that this test is a matching, multiple-choice type.

Table 4. Copy of the Phase I mediation test

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Match the syllable on the left with the correct one on the right

1. PYR:	VOD	<u>MOX</u>	QIN	FOW
2. HYL:	QIK	<u>CYR</u>	<u>FOW</u>	MOX
3. MAB:	CYR	<u>QIK</u>	<u>FOW</u>	VOD
4. LOH:	LUF	<u>QIN</u>	VOD	<u>CYR</u>
5. LAH:	MOX	FOW	VOD	<u>LUF</u>
6. FAH:	<u>QIN</u>	LUF	<u>QIK</u>	FOW
7. BEM:	<u>FOW</u>	CYR	<u>LUF</u>	VOD

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Table 5 shows the recognition test for Phase II of the study.

Table 5. Copy of the Phase II mediation test

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Match the syllable on the left with the correct one on the right

1. COV:	QUP	FOV	DUS	<u>TEK</u>
2. YOW:	DUS	SIV	QUP	<u>JUV</u>
3. MIB:	SIV	QUP	<u>HEK</u>	FOV
4. NAM:	<u>DUS</u>	<u>VAH</u>	SIV	TEK
5. BAV:	VAH	<u>SIV</u>	FOV	QUP
6. GEH:	HEK	QUP	<u>FOV</u>	DUS
7. QOM:	<u>JUV</u>	VAH	TEK	<u>DUS</u>
8. PAG:	<u>SIV</u>	<u>HEK</u>	FOV	VAH

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The Phase III association test was taken from Christiansen (1966) and is shown in Table 6.

Table 6. Copy of the association test

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Match the syllable on the left with the correct one on the right

1. BAL:	<u>HET</u>	DUL	RAC	MUC	LAT	JUN
2. CIN:	<u>MUC</u>	LAT	JUN	<u>HET</u>	<u>DUL</u>	RAC
3. DEK:	LAT	MUC	<u>HET</u>	<u>JUN</u>	<u>RAC</u>	DUL
4. CED:	JUN	<u>RAC</u>	LAT	<u>DUL</u>	MUC	HET
5. GIV:	RAC	<u>JUN</u>	DUL	<u>LAT</u>	HET	MUC
6. HOM:	DUL	HET	<u>MUC</u>	<u>RAC</u>	JUN	LAT
7. PUL:	JOK	PAV	<u>LIC</u>	<u>MIL</u>	NIT	KER
8. ROH:	MIL	<u>NIT</u>	KER	<u>JOK</u>	PAV	LIC
9. NUF:	PAV	<u>JOK</u>	MIL	<u>LIC</u>	KER	NIT
10. KUT:	LIC	KER	<u>PAV</u>	<u>NIT</u>	JOK	MIL
11. FAB:	<u>KER</u>	LIC	<u>NIT</u>	PAV	MIL	JOK
12. HAF:	<u>NIT</u>	MIL	<u>JOK</u>	KER	LIC	PAV

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The materials shown in the above tables were used for the three parts of the study which were--affect assessment, mediation learning and recall, and association learning and recall. The GSR instrument was used to assess the affective level of the mediators or List B words; the materials designed for Phase I and Phase II (the A, B, C lists for each phase) were used for the mediation learning and recall; and the nonsense syllable pairs were used to test for the association learning and recall.

#### Operational Definitions

##### Affect

The GSR deflections defined the affect level of the word. The mean of the GSR readings for each subject was calculated on the following

basis. Words having readings greater (to any degree) than the mean were defined as high affect words for that person and words having GSR readings lower (to any degree) than the mean were defined as low affect words for that subject.

### Meaningfulness

The association value of the nonsense syllables determined meaningfulness in this study. The association value was defined by the norm values of Archer (1960) and Glaze (1928) as explained above.

### Mediation

The recognition scores on the multiple-choice tests for Phases I and II defined the extent of mediation for each subject. The possible scores were 0-7 for Phase I and 0-8 for Phase II. The forward chaining model was used in this study.

### Association ability

The association ability of the subjects was defined by the recognition scores on the multiple-choice test for the association test.

### Pilot Study

The pilot study was conducted to determine if level of affect and meaningfulness influences mediation. Another reason for the pilot study was to determine the feasibility of using the materials selected and using GSR scores during the mediation test. The results showed that both affect and meaningfulness effect mediation and that there is an interaction between affect and mediation. High meaningfulness words were mediated most when affect level was low and high affect words were most mediated when meaningfulness was at a medium level. The materials

selected seemed to be appropriate from the results of the pilot study, but the procedure of using the GSR readings during the mediation test was indicated to be not practicable. Therefore, a multiple-choice recognition test was used instead of the GSR readings as the test of mediation.

#### Experimental Environment

The subject sat across a table from the experimenter with the GSR instrument between them. This instrument provided a small barrier in front of the subject, so that he could not observe the materials and instructions used in the study. The table was small (about 4' x 3') and the materials and GSR instrument covered at least one half of its surface. Often there were two subjects learning or taking a test at the same time which made the room and the table surface fully used. There seemed to be no apparent distraction of any subject by the presence of another subject since all of the learning and testing was done silently. There was a one-way mirror on one wall of the room and programmed learning machines lined up against the other, and these also seemed not to distract the subjects. The room was well lighted, but poorly ventilated. Ventilation was only obtained by leaving the door open, which occasionally seemed to be a source of distraction for the subjects. However, extraneous sounds heard in the room usually did not seem to distract the majority of the subjects who were apparently well motivated to perform their best in this experiment.

#### Experimental Procedures

The data of this study was obtained from three procedures: (a) affect level assessment of the mediating words, (b) learning and recall of mediating

words, (b) learning and recall of mediation, and (c) association learning and recall.

#### Affect assessment

The subject was given instructions as soon as he was seated in the experimental room. These were as follows:

We appreciate your participating in this experiment, although it was not entirely voluntary on your part. We hope that you will find your participation in this study interesting. Do you have any idea of what to expect in this experiment? I'm going to attach a pair of electrodes to your hand. They won't shock you or cause you discomfort in any way. There, how does that feel? If they are too tight, just let me know and I will loosen them for you. Put your left arm across the corner of the table and let your left hand hang off the edge. Relax as much as possible. Please do not move and don't look at me; look at the wall or floor. I'm going to say a word out loud. I want you to say it aloud right after I say it. Then think silently how you would use that word in a sentence. Keep thinking about that word until I say the next one. We will try a few words for practice now so that you can get the idea of the procedure.

During these instructions, the experimenter attached the electrodes to the index and ring fingers of the subject's left hand and placed him at the corner of the table so that the subject's left hand could hang comfortably off the side of the table. Also, the subject was seated in such a way that he faced the wall and not the experimenter. In this way, the subject would not anticipate when the experimenter was going to say a word. It was found through experience that the subject could anticipate when the experimenter was going to speak by watching his mouth and this anticipation was reflected as arousal and a GSR deflection on the instrument. Thus, this artifact (produced in the GSR readings) was eliminated by having the subject look away from the experimenter during this affect assessment part of the study. Next, a few practice words were given to the subject to determine his understanding of the instructions and to observe whether he followed the directions given

him. The practice words given were: like, decision, back. This procedure also allowed the subject to use his "overreaction" GSR on practice words before the experimental words were given. (Another artifact of the GSR method--the largest reaction--is always given on the first word that is presented to the subject and this large reaction is not his usual reaction that would be obtained later on in the procedure; hence, this overreaction response to this first word is usually discarded as an artifact). In addition, during the practice assessment, the experimenter could adjust the GSR instrument so that measurable readings could be obtained from the subject during the assessment of the experimental words. After giving the practice words, the experimenter would say, "Okay, do you have the idea now? Do you have any questions about the procedure?" The subject's questions, if any, were answered and then the experimental words were given in the following order: money, flower, pencil, name, swim, kiss, white. (White was given only in Phase II of the study). The words were given in this order for two reasons: (a) the expected high and low affect words were alternated so as to discriminate their reactions more easily on the GSR instrument, and (b) a third artifact of the GSR method was overcome by following this procedure; this artifact is the adaptation effect to the experimental situation, i.e., the obtaining of smaller and smaller readings as the procedure continued. After obtaining GSR readings on the experimental words, the experimenter gave these instructions:

That's fine. Now, take a seat out in the large room and wait until I call you in again in a few minutes. You could study or read for those few minutes if you like.

This ended the affective assessment session.

### Mediation learning and recall

Both subjects, if there were two, came into the experimental room at the same time for the mediation learning and recall. After they were comfortably seated across the table from the experimenter, the following instructions were given:

I am going to show you seven (eight) cards, one at a time. On each card you will see two words. One of these words will be a nonsense word and one of them will be a real word. You are to try to remember the nonsense syllable which goes with the real word that it is paired with on the card. Each card will be shown to you for a period of four seconds. Please look at each card carefully. The first time that each card is shown to you, both words will be shown at the same time. This is so that you can see which words go together. The next time each card is shown to you, the second word will be covered for two seconds. During these two seconds, try to remember which word is covered or the word that goes with the one that you can see. In other words, try to silently anticipate what you think the second word will be each time that you see the first one. The cards will be shuffled after each list, so that they will not appear in the same order each time. Altogether, each card will be shown to you twice. Any questions?

Then, either the cards from Phase I or Phase II were presented to the subjects, depending upon their previous random assignment to one of these two conditions. They were given four seconds exposure to both words on the first trial and then given two seconds to see each word on the card on the second trial. After the learning of the A-B and then B-C lists, the subjects were asked to match the A-C pairs on the recognition test. The following instructions were given for the recognition test.

Here is a little test to see how well you remember the pairs of words. Match the syllable of the left with one of those on the right. Put your name on your paper.

This concluded the mediation learning and recall procedure.

### Association learning and testing

The association learning and testing was carried out immediately



after the mediation learning and testing procedure. The following instructions were then given:

Now, I'm going to show you 12 cards with words on them that are different from the ones you saw before. On each of these cards you will see two nonsense syllables and no meaningful words. You are to learn the nonsense syllables that are paired together on each card. Each card will be shown to you once for just three seconds. Please look at the card for the entire time that it is shown to you. Remember, they will be shown just once, so try to learn them the first time.

The paired associate high meaningfulness nonsense syllables were shown to the subjects. Then, the recognition test, shown in Table 6, was given to them with the same instructions as on the retention test for the mediation learning. This concluded the association learning and testing.

After the completion of the association test, the subjects were thanked for their participation and cooperation in the study. As they were leaving, they were asked not to discuss any of the procedures of the experiment with their classmates, but to recommend that their classmates participate in the study. They were finally told that they would all be told as a class what the experiment was about and that their questions about the study would be answered at that time.

#### Experimental Design

To test the two hypotheses (given in the Introduction) of this study, two phases of the investigation were designed. Separately, each of these phases, which is a separate design by itself, tested one of these hypotheses.

The design testing Hypothesis 1 of the study was a simple comparison between two matched-subjects experimental groups. The independent variable in Phase I was the level of affect of the mediator (List B),

while the dependent variable was the recognition scores on the mediation test. The scores on the mediation test for the same subjects were compared between high and low affect mediators. Therefore, in Phase I of this study, the meaningful words (mediators) of the B list were of two types: high affect and low affect as determined by their GSR readings. A comparison of the results of using these words tested Hypothesis 1 on this experiment.

The design which tested Hypothesis 2 of this study was a 2 x 4 factorial design. The independent variables in Phase II were affect and meaningfulness. The dependent variable in this design was, again, the recognition-matching scores on the mediation test. There were two levels of affect (high and low) and two levels of meaningfulness (high and low). However, there were four combinations of meaningfulness of the nonmediators: high A-high C, high A-low C, low A-high C, and low A-low C. These four combinations of meaningfulness and two levels of affect resulted in a 2 x 4 factorial design. The interaction between affect and meaningfulness was tested by this factorial design to provide data to answer Hypothesis 2 of this study.

Although there was not a hypothesis formally made, Phase III was designed to determine if there was a significant correlation between mediation scores for an individual and his association ability. All experimental variables (affect and meaningfulness) were attempted to be held constant so that the differences among individuals could be detected in their association test scores. These scores were then used to study whether ability of association was correlated, to a significant degree, with mediation scores. Hence, there was an association test used (see Table 6 for a copy and materials for a description of the source and arrangement of the test) to examine if mediation scores are correlated with

association ability.

### Statistical Procedures

Since the experimental designs were separate for each phase of the study, so were the statistical procedures. Hypothesis 1 was tested by a t-test comparing the result of high vs. low level affect mediators in recall for matched subjects. This t-test was calculated on an electronic desk calculator by the experimenter. Hypothesis 2 was tested by a two-way analysis of variance for the 2 x 4 factorial design. This analysis was run on the ANOVAR/360 (Factorial Analysis of Variance or Co variance) Program at the Computer Center at Brigham Young University.

Phase III of the study was a regression analysis which tested for a significant correlation between mediation scores and association ability of the subjects. This analysis was run on the MDCR (Multivariate Data Collection-Revised) Program at the Computer Center at Utah State University.

## RESULTS

### Paired Associate Learning

The subjects learned two lists of paired associates with four seconds exposure time for each pair. Each subject was tested for mediation by pairing one list A trigram with one of several list C trigrams on a multiple-choice recall task. Apparently, this method of learning was too easy for about 24 of the subjects, since they obtained perfect mediation scores. Because a perfect recall score for a subject made it impossible to differentiate differences in mediation scores due to either high or low affect words acting as mediators, the results of these 24 subjects had to be discarded from the analysis of the data. This means that about 60 percent of the data obtained was used for results. There were finally 25 subjects in the Phase I part of the analysis and 25 subjects also in the Phase II part of the analysis. The size of N need for each phase was precalculated to be about 21 subjects.

### Affect in Mediation

Hypothesis 1 proposed that high affect words acting as mediators would produce superior mediation as compared to low affect words when meaningfulness was controlled at a medium level. Table 7 shows the means and standard deviation of mediation scores mediated by high and low affect words.

The data in Table 7 show that the mean mediation score for the high affect mediators was greater than that for the low affect words.

Table 7. Means and standard deviations of medication scores for the A-C list mediated by high and low affect words

Level of affect of the mediator	Means	Standard deviations
High	1.72	1.02
Low	1.44	0.92

The difference between these means is significant ( $t = 7.09$ ;  $p < .01$ ). Thus, high affect words as mediator produced better mediation scores than low affect words, which confirm Hypothesis 1.

#### Affect X Meaningfulness Interaction

Hypothesis 2 predicted that there would be a significant interaction between affect and meaningfulness levels in mediation scores.

Table 8 shows the analysis of variance table for 2 x 4 factorial design of affect and meaningfulness in mediation scores.

Table 8. Summary of the analysis of variance for the number of correct A-C pairs in the mediation test

Source	df	SS	MS	F
Affect (A)	1	0.24	0.24	0.82
Meaningfulness (M)	3	0.77	0.26	0.87
A x M	3	9.57	3.19	10.70*
Error	192	57.28	0.30	
Total	199	67.88		

\*Significant at less than the .005 level

As shown in Table 8, there was no difference in mediation scores due to level of affect. Also there was no significant difference in mediation scores due to level of meaningfulness. However, there was a significant interaction in mediation scores between affect and meaningfulness levels.

Figure 1 shows a graph of the mean mediation scores as a function of the interaction of affect and meaningfulness. With high affect and low meaningfulness, the mediation scores are highest; whereas with low affect and low meaningfulness, the mediation scores are much lower. However, with low affect and high meaningfulness the mediation scores are higher than with high affect and high meaningfulness. The combinations of meaningfulness level indicate that the stimulus term rather than the response term is critical in determining superior mediation. Thus, there appears to be an interaction between level of affect of the mediator (B list) and the level of meaningfulness of the nonmediators (A and C lists), which confirms the prediction made by Hypothesis 2.

#### Association Ability

Phase III of the study sought to determine if there was a significant correlation between number of words mediated and association ability of the subjects. A correlation between association scores and mediation scores was .35 (significant difference from zero at the .02 level). Thus, there seems to be a low correlation between association ability and mediation.

Figure 2 shows the scatter-plot of the relation between the mediation scores and association scores. This figure indicates that the relationship between the mediation and association ability is not an exceptionally strong one.

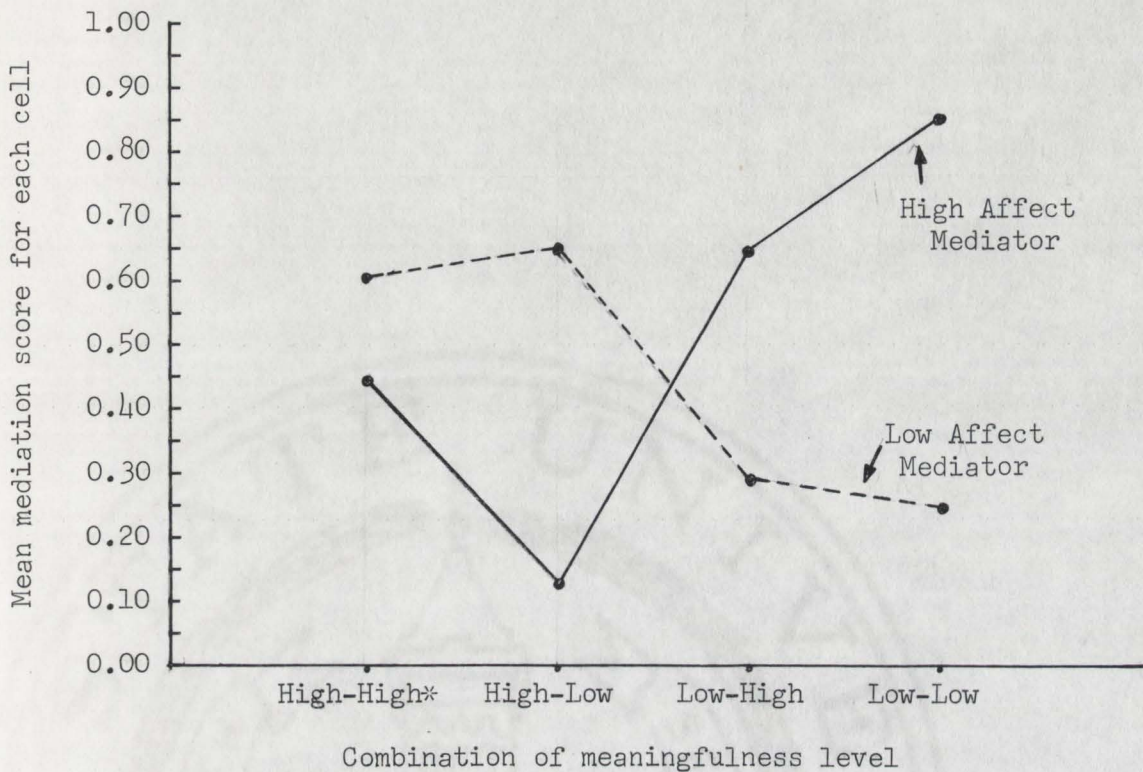


Figure 1. Mean mediation scores as a function of affect level and combination of meaningfulness level.

\*H-H refers to the meaningfulness level of the items in the A & C lists respectively.

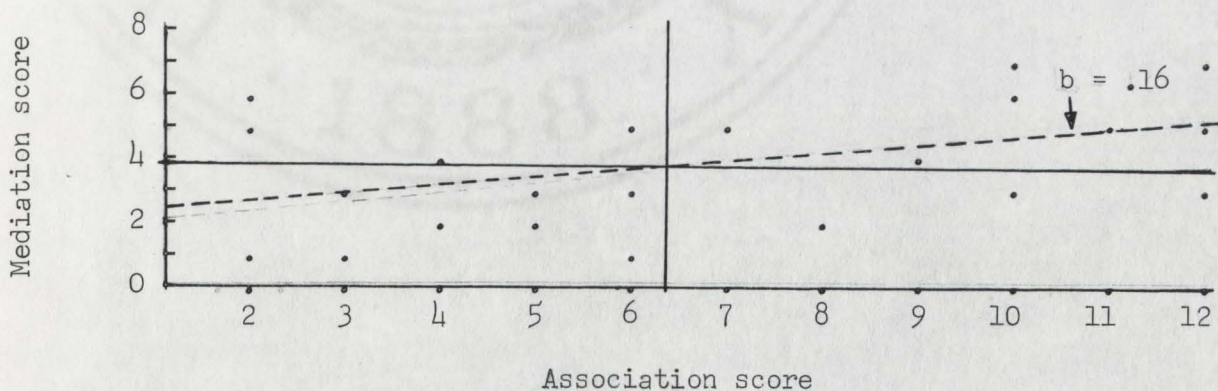


Figure 2. Scatter-plot diagram of the relation between mediation scores and association scores.

## DISCUSSION

This investigation examined some of the influences of affect and meaningfulness as variables in mediate association. Affect was first studied alone to determine if it influenced the amount of mediation. It was found from the results of this study that high affect words do produce superior mediation as compared to low affect words. Affect and meaningfulness were then studied to test whether they interact in their combined influence on mediation. Such an interaction was demonstrated in the results of this study. Finally, a correlation was found between association ability and mediation.

Hypothesis 1--Affect in Mediation

The first hypothesis of this investigation predicted that the affect level of the mediator would differentially affect the extent of verbal mediation with meaningfulness of the learning materials held constant. This prediction was confirmed by the results--high affect mediators produced higher mediation scores than did low affect mediators. This finding, however, is not consistent with results of previous investigators.

These prior investigations used the term "arousal" while in this study "affect" is used to indicate the emotional reaction to words. However, both of these terms are operationally defined in the same way. They are both defined as GSR readings of reactions to verbal stimuli; thus they are essentially the same phenomenon in spite of being called by different terms. Yarmey (1966) first investigated the effect of word arousal in verbal mediation. He attempted to show that the differential



arousal value of the mediators would affect mediate association. He found evidence of such emotional mediators in the first two stages (A-B, B-C) of learning. But he did not find such an effect in his mediation stage (A-C) of learning. This result of Yarmey's is inconsistent with the finding of this present study. Yarmey had his subjects learn high arousal and low arousal words that were taken from Walker and Tarte (1963). Thus, Yarmey accepted the high arousal-low arousal classification of these words by Walker and Tarte's GSR readings of their subjects. Therefore, Yarmey did not measure the emotional reaction of his subjects to these words. In the present study, however, GSR readings were obtained for every subject in response to each word. This was the first important difference between Yarmey's study and the present one. Another important difference was that Yarmey had the same high and low affect words for each subject, but in this present study, high and low affect words varied from subject to subject depending upon their individual reaction to these words. Therefore, Yarmey failed to consider the individual emotional reactions of his own subjects to the words that he selected from Walker and Tarte.

A final important difference between the method used by Yarmey and the one reported here is that Yarmey had his subjects learn the A-C lists in the mediation stage, while in the present study, the A-C terms were matched in a multiple-choice test. As was shown in the Review of the Literature, when the A-C (third stage) lists are learned, interference results (see Earhard and Earhard, 1968a; Earhard and Mandler, 1965; Mandler and Earhard, 1964). This interference resulting from the learning of the previous two stages (A-B, B-C lists) could account for the lack of emotional facilitation of mediation in Yarmey's study. Thus his mediation effects were apparently interfered with in the third stage by

his employing this learning method of mediation (see Yarmey, 1966, p. 452). In this present study, mediation and emotional facilitation was demonstrated in the third stage apparently because only a test was made of prior learning by pairing the A-C lists, thus preventing interference by new learning (see Christiansen, 1966; Clifton, 1966; James and Hakes, 1965; Peterson and Blattner, 1963; Vajanasoontorn, 1968). Therefore, the differences in the results between Yarmey's investigation and these presented here could be accounted for on the basis of the methodological differences discussed above.

Cunningham (1968) also investigated whether high or low arousal mediators would influence mediate association. He found that arousal level produced no overall differences in recall efficiency of the first presented list of three paradigms (chaining, response and stimulus equivalence) as measured by a matching task. Thus, Cunningham's results were also similar to those of Yarmey's and different from those of this study in not finding superior mediation facilitated by high affect. Cunningham, like Yarmey, also borrowed his emotional words from Walker and Tarte (1963) without assessing his subject's reactions to them. This was an important difference between Cunningham's study and the present one. Another difference was that Cunningham tested the paired associate learning of the first list (A-B) after the learning of the second list (B-C). When he found no differential facilitation of the recall of paired associate learning for the first list, Cunningham did not use high and low affect words to act as mediators in the remaining portion of his mediation study. Again, in Cunningham's study there is an indication that new learning interferes with both mediation and its facilitation due to affect. Nevertheless, Cunningham did find in the chaining paradigm that high arousal words were correctly paired with

two-digit numbers eight times while low arousal words were so correctly paired only four times on his matching test, indicating the facilitative function of high affect words.

Cunningham did not complete his mediation study, but stopped this part of his study after examining the results of paired associate learning with high and low affect members. In the present study, no tests were made to test the learning of the first list after the learning of the second list. Therefore, in spite of the same procedure used in testing for association in both studies, the results of this study and those of Cunningham's are not directly comparable, because he tested for first list learning and not for mediation as was done in this study.

Two primary reasons that this study found significantly greater mediation scores with high affective words in comparison to low affective words seem to be that (a) in this present study, the individual emotional reactions of the subjects to the mediator words were assessed, whereas this was not done in these previous studies, and (b) in the present investigation, interference of learning effects were eliminated by a recall test, but this was not done in these related studies.

#### Hypothesis 2--Affect X Meaningfulness Interaction

As a result of the pilot study, the second hypothesis predicted that an interaction between affect and meaningfulness would be found in the mediation scores. An interaction was clearly shown between these variables in mediate association scores, supporting Hypothesis 2. This interaction revealed that high affect facilitated mediation most when the meaningfulness was low. High meaningfulness was shown to facilitate mediation most when the level of affect was low. When affect and meaningfulness were both at a high level, their facilitative effects seemed to

cancel each other out in comparison to the conditions cited above. However, low levels of both affect and meaningfulness produced the poorest mediation scores. The indication that the stimulus term is more important than the response term in facilitating mediation was shown by the levels of meaningfulness.

When the stimulus term was high in meaningfulness, mediation scores were higher than when the stimulus term was low in meaningfulness when affect level was low. However, when the response term was low in meaningfulness mediation scores were higher than when meaningfulness of the response term was high when affect level was low. This relationship was not shown when the affect level was high probably because of the interference effect between affect and meaningfulness when both are at a high level. It may be with using meaningful words as mediators and nonsense syllables as nonmediators that these somehow interfere with each other in mediation effects. Perhaps with having all meaningful words or all nonsense syllables, the effect would be different. Therefore, the meaningfulness of the stimulus term seems to be more critical in facilitating mediation than does the meaningfulness of the response term when the affect level is low.

The interaction also indicated that high affect was more facilitative than high meaningfulness in producing superior mediation. However, studies of interaction between affect and meaningfulness in related studies have shown the opposite result. These studies indicated that meaningfulness is more facilitative than affect in producing associations. Koen (1962) found that a significant correlation was obtained between association value and polarization on the semantic differential for low affect words but not for high affect words, indicating that meaningfulness is a more potent determiner of association than affect. In a more related study to the present one, Greer and Mollenauer (1964) found that

meaning class was a more potent determiner of reaction time reciprocal speed than negative affect. Their results also indicate that meaningfulness is a more important variable in determining associations than affect. From these studies, then, one would be led to expect that meaningfulness would facilitate mediation more than affect. However, the opposite was found in this present study. The results of this study are not directly comparable to these of Greer and Mollenauer's and Koen's since their studies were concerned with word association whereas this present study has examined mediation. Some explanatory support for the present finding of superior facilitation of affect over meaningfulness in mediation scores is provided by Mowrer (1960b). Mowrer feels that emotional meanings are first conditioned to words and then denotative meanings are conditioned. If denotative meanings can be considered the same as meaningfulness, then Mowrer indicates that emotion is more important than meaningfulness in determining verbal associations. However, this result seems to depend upon the dependent variable used.

In the pilot study, it was found that as a result of using GSR as the dependent variable, meaningfulness was prepotent over affect. The pilot study results showed that when meaningfulness level was high and affect was low, the GSR reactions to the correct pairings of the A-C items were higher than when affect level was high and meaningfulness was low. So the prepotency of either affect or meaningfulness in their interaction effects in mediation depends upon the dependent variable that one uses.

#### Association Ability

Phase III of the study tested association ability by an association test taken from Christiansen (1966). A significant correlation was

found between the amount of mediation and association ability score for an individual subject. This correlation was not a high correlation,  $r = .35$ ; nevertheless, it was a significant correlation. The coefficient of determination,  $r^2$ , indicated that not much variance was shared in common by the association score and the amount of mediation ( $r^2 = .12$ ). The reliability of the association test was not high-- $.60$  (see Christian-  
sen, 1966), which would probably account for part of the low correlation between association ability and mediation. Also, it seems that the verbal mediation process and the simple association process are not identical. This is shown by the different effects that affect and particularly meaningfulness have in paired associate retention and word association versus mediation. Paired associates were retained better following learning of low meaningful materials than high meaningful materials (see Young, et al., 1968). Yet mediation is facilitated following high meaningfulness materials (see Horton, 1964, Peterson et al., 1964, and Popp and Voss, 1967). Also, affect seems more potent in mediation than is meaningfulness according to the results of this study while in word association studies meaningfulness seems to be more potent than affect (see Greer and Mollenauer, 1964). Finally, in paired associate learning, meaningfulness of the response term is critical (Cieutat, et al, 1958; Hunt, 1959); however, the data of this study show that the meaningfulness of the stimulus rather than the response term is critical. Thus, it seems that simple association and mediation are different processes, and therefore, one should not expect a high correlation between simple association ability and mediation scores.

## Recommendations

### Recommendations for additional research

Since about 30 percent of the data obtained was not analyzed due to a relatively easy learning method, there is some question as to the generalizability of the results. It may be that with a method that employs a more difficult test on which every subject obtained a less than perfect score that the results may be different from those found in this study. Thus, these results could not be generalized beyond a restricted population represented by the sample whose data were analyzed in this study. In order to ensure that these results would be obtained from an unrestricted sample and population, it is recommended that future studies employ a more difficult learning task. Also, to ensure a wider generalizability of these results, it is suggested that a wider population than an Educational Psychology class be sampled. A wide range of age and ability in future studies similar to this present one would demonstrate the generality of these results to a larger part of our human population.

A further recommendation would be for similar studies to employ a more adequate test of mediate associative ability. Such a test would hold constant such factors as affect, meaningfulness, and motivation to achieve. If such a test could be developed with high reliability and validity, then it could be used as a potential covariate to determine if these same results would be found with ability of the subjects statistically controlled. Another recommendation would be to compare directly mediate association versus paired associate learning with affect and meaningfulness as the variables. This would provide a direct test of whether these variables produce the same results in paired associate

learning as they do in mediate association. There was some indication discussed above that affect and meaningfulness produce different effects in simple paired associate learning than in mediate association.

#### Recommendations for practice

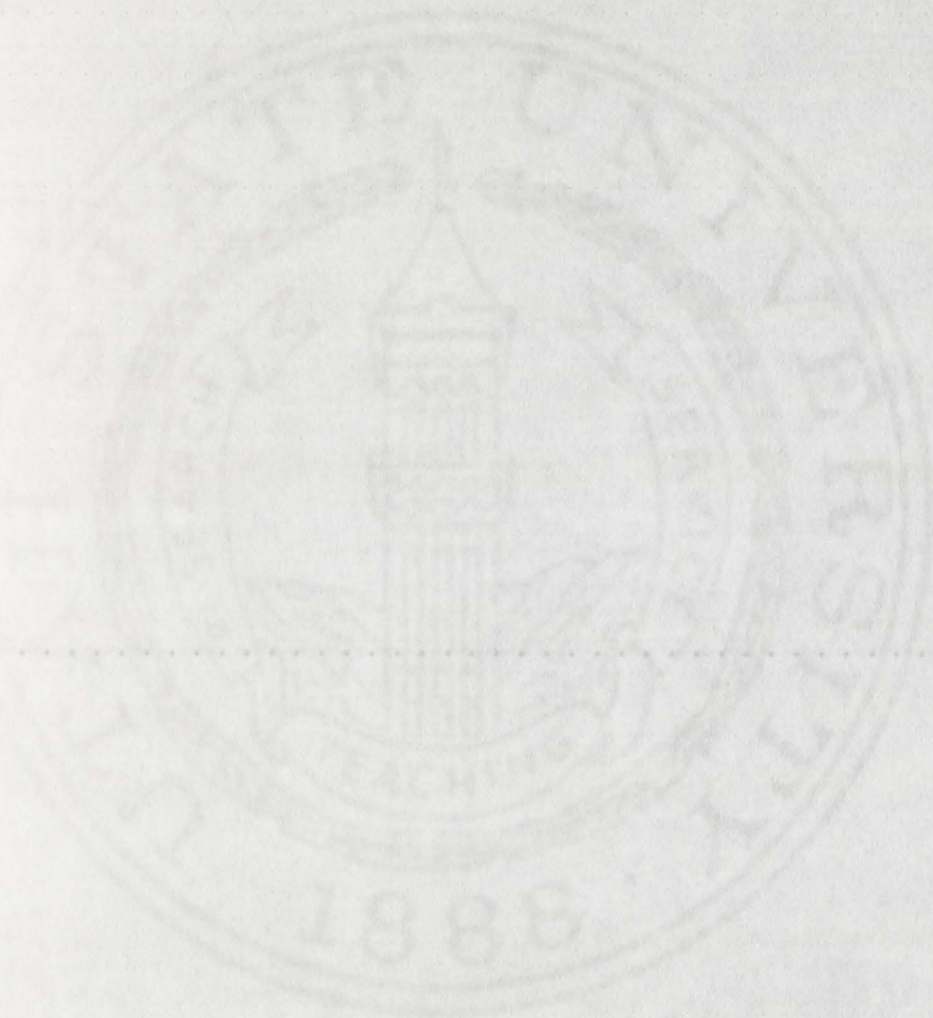
These results indicate the importance of using high affect mediators in connection with low meaningfulness non-mediators. Thus, a classroom teacher attempting to teach the meanings of new vocabulary words should use, at least initially, words that have a high emotional referent to the pupil. This would ensure faster learning and longer retention of the new word. In comparing one new word or idea to another new word or idea, the teacher should utilize a word or idea common to the two that has a high affective value for the pupil. This should produce maximum transfer or understanding by the pupil.

Another practical suggestion from these results is to use high meaningfulness materials when the affect level of these materials is low. This would suggest that a classroom teacher should use well-known words to describe a new process, such as in arithmetic, that the pupil does not find inherently interesting. Or in requiring the student to read technical or unemotional literature, if the words used are highly meaningful to the pupil, he should be able to discuss it better or apply it better to a practical task.

A final recommendation would be for the classroom teacher to attempt to find out what are emotional stimuli to each of his students and use them as aids to assist the student to learn faster and retain the material longer, and transfer and apply the material more effectively. It is suggested that school and the learning provided at that school would be much more valuable and interesting to the student if the teacher



would use emotional stimuli from the past experience of the student as an aid to new learning.



## SUMMARY AND CONCLUSIONS

### Summary

#### Introduction

The purpose of this study was to determine whether affect influences mediate association. A related objective of this experiment was to examine if there was an interaction between affect and meaningfulness in verbal mediation scores. These objectives resulted in the following hypotheses:

1. There will be no (a) significant difference between the amount of recall scores mediated by high and low affect words when the meaningfulness of the non-mediators is held constant at a medium level.
2. There will be no (a) significant interaction in recall scores between levels of affect and meaningfulness.

#### Methods and procedures

The sample used in this study was all students registered for an Educational Psychology class at Utah State University, Spring Quarter, 1969. These subjects were randomly assigned to one of two groups-- either Phase I or Phase II. Phase I was designed to examine Hypothesis 1, while Phase II explored Hypothesis 2. Phase III had all subjects assigned to it and was added to the study in order to determine if there was a significant correlation between mediation and the association ability of the subjects.

The materials used in the study were the galvanic skin response (GSR) instrument and the verbal learning materials. The GSR instrument

was made by the Stoelting Company of Chicago and had provision for automatic "zero" adjustment and a variable sensitivity control. The A and C lists of the verbal materials were taken from Archer (1960) and consisted of CVC trigrams of low association value (27 percent, Phase II), medium association value (50 percent, Phase I), and high association value (73-74 percent, Phase II). The B lists were taken from Smith (1921) and four of high and four of his low affective words which were all of about the same frequency of occurrence (about 100 per million words according to Thorndike and Lorge, 1944) were selected as mediators. The paired associate nonsense syllables which were used in the association test were taken from Christiansen (1966). These syllables were from 60-100 percent association value according to Glaze (1928).

The variables in this study were: independent--affect and meaningfulness, dependent--mediation scores and association scores. Affect was defined as either high or low GSR readings given in response to the B list words. High, medium, or low association value defined meaningfulness in this study. Mediation scores were defined as the correct matching of the A-C items on a multiple-choice test. Association scores were defined as the correct pairing of the paired associates of the nonsense syllable association list.

The procedure consisted of first assessing the affect level of the B words, presenting the mediation lists, then testing the mediation, presenting the association lists, and finally testing the association learning of the subjects. The assessment of the affect level was made by obtaining individual GSR readings of each subject in response to the mediating words used in the study. Various measures were taken to nullify the typical artifacts of the GSR procedure. Then the subjects were presented the learning materials of either Phase I or Phase II depending

upon which group they had been assigned to. In Phase I, two lists (A-B, B-C) of seven paired associates were presented and for Phase II, two lists (A-B, B-C) of eight paired associates were shown to the subjects. The subjects were tested immediately after their learning of the mediation lists. The test required the subjects to match the A-C items which had a B word in common. After the mediation test, the subjects were shown the paired associate nonsense syllable list which comprised the association learning. Subjects were given a multiple-choice test of the paired associates which was the association test. The association learning and test were called Phase III of the study.

### Results

Hypothesis 1 predicted that with medium meaningfulness, high affect mediators would produce superior mediation to low affect mediators. The statistical test used was a matched-subjects  $t$ -test to determine the significance of the difference between the mediation score means produced by the high and low affect levels. The test showed that high affect level mediators produced more mediation recall than low affect mediators. These results confirmed the first hypothesis.

Hypothesis 2 predicted that there would be an interaction between affect and meaningfulness in the mean mediation scores. The statistical test used in this case was a  $2 \times 4$  analysis of variance with two levels of affect (high and low) and four combinations of meaningfulness (high-high, high-low, low-high, and low-low). This test showed no significant main effects, but a significant interaction between affect and meaningfulness. The high affect and low-low meaningfulness combination produced the most mediation, while the high affect and high-low meaningfulness combination produced the lowest amount of mediation.

Indication was also found of affect being prepotent over meaningfulness in mediation and evidence that the stimulus term was the critical term in producing mediation was discussed.

A low, but significant correlation was found between mediation scores and association ability as measured by the association test of Phase III.

### Conclusions

The findings of this study showed that affect level of the mediating word influences the amount of mediation produced in a chaining paradigm. This result is not consistent with the results of previous studies, but indication was made that these prior studies failed to assess their subject's affect level in response to the mediators used and allowed interpolated learning to interfere with the differential mediation produced by affect level. It is concluded that under the proper conditions, affect level can be shown to influence mediation.

In mediation, there appears to be an interaction of the combined effects of affect and meaningfulness. There was evidence that affect is prepotent over meaningfulness in these mediation results. This finding was opposite to studies concerned with such interaction in word association; however, some explanation was found to support the results of this present study. The stimulus term rather than the response term seems to be the critical term in producing superior mediation. This was supported by comparing various points within the graph of the interaction of affect and meaningfulness.

There seems to be a low correlation between mediate association and simple or paired association. This seems likely since evidence was found that simple and mediation association are not identical processes.

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