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Nixon, Sara Jo

ENVIRONMENTAL CUES AND ASSOCIATIVE LEARNING

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SARA JO NIXON

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ENVIRONMENTAL CUES AND ASSOCIATIVE LEARNING

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Rather than thank all the people who have made this step possible, including, of course, the lady downstairs who finally got rid of that yipping dog, I would like to share a quotation from a Newsweek (1981) interview with Goldie Hawn which has held a place of prominence on my refrigerator door for a considerable length of time. Ms. Hawn states,

> Women can do 400 things at once because we're equipped to do it. I don't know why. We're able to juggle. We can be strong, we can be smart and have an effect on society, but we can also be mothers and be warm and loving. Sometimes you think you're never going to make it, but you do make it. Sometimes you hug onto your pillow and cry at night, but this doesn't mean that life is bad. It just means that's the way it is. Life is rich. It's rich!

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Abstract

Recent literature has indicated that subjects who acquire information and are then tested for recall in the environmental context of original learning typically produce higher recall scores than those subjects who test in a new or different context. The current study includes a test of a model which is designed to predict and explain why the facilitation in same-context testing should occur and also when and why it should not occur. The proposed model is based on the principles of classical conditioning and as such focuses on the importance of spatial or temporal contiguity of contextual cues and list or task items and the reliability of these cues as predictors of list items as the foundation for the establishment of context-item associations and the resultant "context-effect." Two studies were conducted utilizing the paired-associate paradigm and testing the effects of environmental context manipulations on response integration (Experiment 1) and response selection (Experiment 2). The findings of Experiment 1 provided considerable support for the model with moderate DOL (8/16) subjects being more affected by contextual manipulations than either low (4/16) or high DOL (16/16) subjects. The predicted elicitation of response "parts" in same-context conditions was demonstrated most clearly in an increased number of inversions in the cued-recall of CCC trigrams for the moderate DOL group. Data from Experiment 2, in which a 2-choice recognition test was used on the criterion task, did not yield the predicted interaction of acquisition and test room context on either the proportion of hits, correct rejections, false positives and misses or the reaction time data on these measures. Rather, the data indicated that subjects who engaged in the recognition test in an "enriched" environment performed substantially better than those who tested in a "deprived" environment. Potential reasons for these findings as well as a discussion of the implications and extensions of the model are also provided.

ENVIRONMENTAL CUES AND ASSOCIATIVE LEARNING

INTRODUCTION

Performance on memory tasks has been found to be related to the environmental context in which acquisition and later testing occur (e.g., Abernethy, 1940; Godden & Baddeley, 1975; Smith, 1979; Smith, Glenberg, & Bjork, 1978). This "context effect" has typically been associated with superior performance if acquisition and testing occur in matched or same, rather than different, environmental contexts (cf. Smith, 1979). However, the significant superiority of "same" context has not been consistently found across all experimental paradigms or instructional sets (e.g., Nixon & Kanak, 1981; Smith et al., 1978).

Probably partially due to this inconsistency and to the relatively few boundaries of the effect that have been investigated, attempts to explain the context effect in a theoretical manner have actually been more descriptive than explanatory in nature. Smith et al. (1978) proposed that the facilitation of free recall found in "same" context study and test could be attributed to the encoding specificity hypothesis (e.g., Thomson & Tulving, 1970; Tulving & Thomson, 1973).

However, utilizing the encoding specificity hypothesis as an explanatory tool is actually an overextension of its capabilities since it is primarily a descriptive tool.

Later, Smith (1979) proposed that the context effect could be explained by the differential strategies available to and/or utilized by "same" and "different" context subjects. He suggested that individuals who obtain information in one room and are then tested in a second or different room (different-context subjects) are either less able to utilize previously associated contextual cues, the cueing hypothesis, or are simply less likely to utilize these cues since they are not immediately available, the strategy hypothesis. Given that the actual separation of these two hypotheses is nebulous, at best, since subjects are typically less likely to utilize cues or associations if they are unable to reconstruct the appropriate cue, stimulus, or association, the issue remains that such hypotheses are still primarily descriptive, not explanatory or predictive.

Further, it is also important that these proposals do not appear capable of accounting for much of the available, pertinent information provided in many of the environmental context studies available in the literature. Particularly important is the fact that subjects in these studies are not typically intentionally utilizing contextual cues during acquisition or at test, and yet individuals in same-context conditions typically produce superior test scores if recall scores are the measure of interest (e.g., Godden & Baddeley, 1975; Smith et al., 1978). Furthermore, if subjects are informed as to the general potential usefulness of contextual cues prior to acquisition, the context effect does not occur although instructed subjects recall significantly more items, particularly in the middle of the list (Nixon & Kanak, 1981). The typical lack of intentionality and the lack of a context effect when instructions regarding the environment are given before acquisition therefore negates a strong "strategy" interpretation. The present author proposes that the context effect occurs as a result of (1) incidental associations being formed between general contextual cues or stimuli and list items, or the list as a whole, during acquisition, and (2) the contextual cues or stimuli eliciting the list responses when they are presented or reconstructed during the test.

Within this conception, environmental context cues function as do classically conditioned stimuli in that they elicit response items qua responses and/or correct responses to the extent that they are actually predictive of differential reinforcement (cf. Mackintosh, 1975; Rescorla & Wagner, 1972). Thus, the cues may make list items "more available" or make more list items "available." In free recall tasks, either of the possible functions is analogous to classically conditioned stimuli since it is usually the "quantity" of responses which is measured. On the other hand, in paired-associate learning, where correctness is typically the issue, the stimuli must also be connected to the context to mediate the elicitation of both elements of the association. The following review of the literature is presented to support this conception of the processes involved in the context effect.

Additionally, throughout the remainder of this paper, it will become evident that by utilizing a model grounded in a classical conditioning framework, one has the capacity to not only predict when the context effect should occur, but also, when it should not occur; that is, when the contextual cues are not valid components or stimuli in an associative network. Specifically, it is predicted that contextual cues will affect performance or behavior in a manner analogous to other conditioned stimuli and as such should have differential effects on the phenomena involved in acquisition, extinction, spontaneous recovery, and latent inhibition.

Bilodeau and Schlosberg (1951) and Greenspoon and Ranyard (1957), utilizing paired-associate lists, found reduced retroactive inhibition effects when the two lists were acquired in different rooms/contexts. Both of these studies, however, were subject to the criticism that both experimental (different context) and control (same context) groups did not undergo "psychological disruption" (Strand, 1970). That is, the control group was not interrupted between lists as was the experimental group and thus the learning was more "massed" for this group. Later cited studies have corrected for this error and have still obtained the context effect.

Dallett and Wilcox (1968) utilized a "special box" to test the effects of contextual changes on proactive inhibition. Subjects in their experiments were asked to learn and recall four, six or eight serial lists of common nouns in either of two contexts. One context was a fairly typical laboratory room. The other context was a box into which subjects inserted their heads and watched flashing lights as they received the list auditorily. Aside from those subjects who became nauseated and were dismissed from the study, no differential acquisition effects attributable to the two contexts were found. As predicted, however, the data did indicate a release from proactive inhibition in free recall tests when later lists were acquired in a different context than the context previously employed.

Eckert (1973) manipulated environmental context in an early attempt to identify its effect on frequency judgements in recognition memory. In the Eckert studies, subjects were presented two neutral lists with items systematically repeated differing numbers of times in each list in either the same or different room contexts. They were then asked to engage in either an absolute frequency judgement task, a task testing recall of frequency of item occcurrence, or a comparative frequency judgement task for one of the two lists (which list was "critical" was determined by whether the subject was a member of the retroactive or proactive group). These tasks were performed in either the same or interfering context as the one in which the critical list had been previously presented or different context.

Eckert's findings supported the work of Bilodeau and Schlosberg (1951), Greenspoon and Ranyard (1957), and Dallett and Wilcox (1968) by demonstrating that a greater amount of retroactive or proactive inhibition was found in the absolute frequency tasks if both lists were presented in the same experimental context versus when the lists were presented in different contexts. The different context therefore produced a "release" of retroactive and proactive inhibition in frequency judgements.

However, Eckert did not find comparable results for the comparative judgement of frequency task. Although he found proactive and retroactive effects on comparative frequency judgements, he could not conclude these effects were influenced by environmental context changes in the expected way since there were no significant interactions between experimental groups. It is noteworthy, however, that the comparative frequency judgement task involves a strong recognition memory component and that later investigations of context effects upon recognition memory tasks have generally been unsuccessful in producing a context effect.

Godden and Baddeley (1975) requested divers to learn a list of words either on land or underwater. They found that subjects recalled more items when the recall test occurred in the same context as original learning regardless of the acquisition context. However, in a later study (1980) using a recognition test, they failed to find analogous results.

Smith et al. (1978) conducted a series of experiments designed to clarify the role of the environmental context in recall processes. In experiment 1, subjects engaged in two learning sessions. The findings indicated that those subjects who participated in the learning sessions in two different rooms produced superior recall scores as compared with those subjects who had only one input context. Experiment 2, wherein subjects engaged in a cued recall of a PA list, indicated that matching input and output contexts improves recall. In experiment 3, data showed that matched context in input and retrieval improves recall of categories and recall of words within a category in "incidental" learning tasks. However, in experiments

4 and 5, these researchers found that a) environmental context has only a weak effect on the ability to access a semantic sense of a word, and b) environmental context does not apparently affect recognition of a semantically disambiguated word.

It is evident in the review of this literature that the environmental context effect is quite well established in recall tasks and is in agreement with semantic context manipulations (e.g., Gartman & Johnson, 1972; Light & Carter - Sobell, 1970; Thomson & Tulving, 1970). However, it usually evades the investigator employing recognition tasks. One possible explanation for these findings is that most recognition tasks are relatively simple involving a single choice and therefore do not demand that the subject engage in associative learning. Thus, contextual cues would not be effective in eliciting list items or responses since associative networks would not be utilized when the recognition task is quite simple.

It should be noted, again, that in none of the previously cited studies in which the facilitative effect of same context was found were subjects instructed to utilize contextual cues during acquisition. Yet, at least in the recall tasks, subjects who recalled in the context of original learning produced superior recall. As was discussed previously, such findings are supportive of the assumption that contextual stimuli are an integral part of associative learning, as are other exemplars of conditioned stimuli, and that these associations occur as a result of the spatial/temporal contiguity of contextual cues and response lists or list items.

The Testing Paradigm and Model

The Paradigm

Proposing a new model to account for and predict environmental effects requires that an appropriate testing paradigm be selected and implemented. The appropriate paradigm must have (a) a sufficient empirical/theoretical background so that specific predictions can be made, and (b) components which are relevant to the general thesis of the model. The classical paired-associate (PA) paradigm of the human learning research tradition presents a good fit to these requirements. The PA paradigm has not only a firm theoretical foundation via Stage-Analytic theory (Underwood, Runquist, & Schulz, 1959; Underwood & Schulz, 1960) but also employs readily differentiated stimulus-response components, a factor which is of prime importance for the test of a model grounded in the processes of Pavlovian conditioning.

According to Stage-Analytic theory, PA acquisition consists of two stages, response learning and associative learning. Response learning refers to the establishment of the availability of the responses per se as demonstrated by overt response evocation, regardless of the correctness of responding. Response learning is assumed to have two possible components or processes; response integration and response selection. Response integration is important in situations wherein individuals must learn to respond to an unfamiliar item as an integrated whole such as in the use of CCC trigrams. Response selection is the process wherein individuals select from their repertoires of available responses which responses are actually on the list. This component is particularly relevant within lists employing high meaningful items such as concrete nouns which require no integration and within lists where responses have a high degree of semantic similarity. Response selection is usually said to be accomplished via the operation of a "selector" mechanism (cf. Underwood et al., 1959) which controls the recall of response units and the rejection of extra-list items. Although the selector mechanism is poorly understood and actually more descriptive than explanatory in its present state, it could still be a useful explanatory tool, if it could be associated with other theoretical concepts. Within the present framework, it is proposed that the "selector" mechanism, particularly in situations where higher levels of processing (e.g., Craik & Lockhart, 1972) are unavailable or difficult, is the result of cueing by contextual stimuli in the environment.

Associative learning refers to the acquisition of specific stimulus-response associative bonds. Obviously, both those responses which require integration and those which require only response selection must be associated with their appropriate stimulus component if correct associations are necessary for task completion.

The Model

The proposed model is a pseudo-mathematical model similar to the Rescorla and Wagner (1972) model for the Pavlovian conditioning of compound stimuli. The Rescorla-Wagner model formula took the form of:

$$\Delta V_A = \alpha_A \beta(\lambda - V_{AX}) \tag{1}$$

where:

V_A = amount of associative strength present on any one trial for stimulus A,

α_A = salience of stimulus A,

β = learning rate parameter of the unconditioned stimulus (e.g., intensity),

λ = asymptotic amount of associative strength for a given unconditioned stimulus,

V_{AX} = amount of associative strength for the A and X compound stimulus on any given trial.

The primary variable of interest to the Rescorla-Wagner model of conditioning is V_A which denotes the amount of associative strength which a given stimulus might command at any given point in time. α_A and β are assumed by Rescorla-Wagner to remain fairly constant and were not unique numbers for a particular experimental situation and are therefore often collapsed into a factor called θ (theta).

However, as Mackintosh (1975) has stated, this model cannot account for the data regarding latent inhibition because within this model the associative strength of nonreinforcement is not assumed to be any value less than zero and the sum of the saliencies of the stimuli present is assumed to equal a constant. That is, it is assumed that if a subject is attending to one stimulus he may not attend to others due to capacity limitations, the inverse hypothesis, and that the lowest amount of associative strength available for nonreinforcement is zero. Because of these assumptions, particularly the inverse hypothesis, the appropriate alterations in the formula, for instance a change in $^{\alpha}A$, which would allow the formula to account for latent inhibition, are not available. Due to this discrepancy between theory and empirical data, Mackintosh (1975) has suggested that the saliency of a given stimulus also varies from trial to trial as a function of that stimulus' reliability as an indicator of differential reinforcement. That is, it is a function of subjects attending to it independent of other stimuli. The saliency of a given stimulus should be higher if the stimulus is valid and should take on a negative value if the stimulus has actually been associated with nonreinforcement and therefore should be more difficult to employ as a conditioned stimulus in later learning situations. That is, when presented in later situations, the stimulus should retard learning via latent inhibition.

The present model is actually more "Mackintoshian" than "Rescorla/Wagnerian" in orientation. Specifically, the theory states that in certain situations, the contextual cues acquire sufficient saliency or potency over trials that they become capable of eliciting response items. This situation arises only under conditions wherein the environmental context is indicative of differential reinforcement; that is, the response list or task items.

Response integration. The following formula is proposed to account for the role of environmental context on response integration.

$$\frac{1}{\lambda + I_x} + \beta = {}^{\alpha}c \qquad (2)$$

${}^{\alpha}$context = saliency of the environmental context,

λ = asymptotic level of response item or response list meaningfulness. Range is from an arbitrarily small decimal to 1.00. Within experimental constraints it is not reasonable to assume that "DOG" and "QPR" will acquire equivalent amounts of meaningfulness,

I_x = total amount of integration present on trial n, Range = 0.00 - 1.00,

and

β = factors external to the materials employed which affect the acquisition rate such as age, fatigue, various personality variables, presentation rate, and method or mode of presentation.

This formulation predicts that as response meaningfulness increases and therefore pre-experimental integration also increases, the role of context as a potent contributor to response integration will be mitigated. Similarly, the role of context within response integration will increase if responses are initially of low meaningfulness and pre-experimentally poorly integrated.

For example, consider the cases where β is a constant and

(a) response meaningfulness is high and thus I_x is initially high (.80),

$$^{\alpha}c = \frac{1}{.80 + .80} + \beta = .625 + \beta \tag{3}$$

(b) response meaningfulness is low and thus I_x is initially low (.20),

$$^{\alpha}c = \frac{1}{(.20 + .0)} + \beta = 5 + \beta. \tag{4}$$

Obviously, the saliency of the experimental context is greater in the second case than in the first, and thus, the role of contextual cues in response integration is predicted to be greater in the second than in the first example.

There are several other important points that must be considered at this time. Except in the case where $I_x = 1.00$, I_x will change from trial to trial. Such a deduction provides divergent predictions for the effects of degree of learning (DOL) on $^{\alpha}c$. That is, with low DOL, the effects of context should be greater than at higher DOL where subjects are not only perceiving the response item as an integrated whole, but are also establishing the S-R bond and perhaps also utilizing "higher or deeper levels" of processing (Craik & Lockhart, 1972) in the formation of the specific association.

The saliency of the context ($^{\alpha}c$) is assumed to be an inverse function of λ and I_x. This inverse relationship is predicted because a) as response integration (I_x) nears completion over trials and thus becomes a less potent factor in the PA task, the saliency of the cues for integration should also diminish; and b) the greater the λ, the less important is the response integration stage to the completion of the PA task. Thus, if λ is relatively high, both the role of response integration and the saliency of the contextual cues for integration should be relatively low.

β has an additive rather than a multiplicative function in the model. This function was intentionally utilized to provide a by-pass for the situation where both λ and I_x are close to zero and thereby allow $^{\alpha}c$ to contribute to the learning process even when the remainder of the equation might be functionally zero. This specification results in the prediction that if response meaningfulness is functionally zero and I_x is zero and β is high (via the instructions, etc.), contextual cues will, for example, because of the importance of the task still continue to function as sources of association. Likewise, individuals with certain personality characteristics such as high field dependency may have a "natural" and greater propensity to attend to (at some level of consciousness), or be affected by, context-item associations regardless of stimulus/response characteristics.

Response selection. At the theoretical level, the role of meaningfulness produces antithetical effects on context - item associations in this stage as compared to the previous stage. The proposed deduction for this stage is:

$$^{\alpha}c = |\lambda - R_I + (-R_S)| + \beta \qquad (5)$$

where $^{\alpha}c$, λ and β retain their previous definitions, and

R_I = the amount of within experiment response integration required for a particular response or response list to be fully integrated; Range = 0.0 - 1.00,

R_S = degree of formal or semantic similarity between response items within a list. When items within a list have no semantic associations and only <u>minimal</u> formal similarity, then $R_S = 0.0$. On the other hand, $R_S = 1.0$ when all responses within a list are identical. For most situations, excluding mixed list designs, the impact of R_S will be only minimal. (Because this theoretical orientation is not at this time prepared to address the results of mixed list manipulations, the R_S variable will generally be assumed to be 0.0.)

Thus, if $\lambda = 1.00$, $R_I = 0.0$, $R_S = 0.0$, β is an arbitrary constant,

$$|1.00 - 0.0 + (-0.0)| + \beta = \qquad (6)$$
$$1 + \beta$$

and if $\lambda = .20$, $R_I = 1.00$, and $R_S = 0.0$ (7)

$$|.20 - 1.00 + (-0.0)| + \beta =$$
$$|-.80| + \beta$$

and if $\lambda = .40$, $R_I = 0.0$, $R_S = 1.0$ (8)

$$|.40 - 0.0 + (-1.00)| =$$
$$.60 + \beta$$

The ordering of the influence of $^{\alpha}c$ would therefore be:

6 > 7 > 8

It is important to realize that in equation 5, it is the absolute value $|\lambda - R_I + (-R_S)|$ that is employed rather than the "real" value. The absolute value is utilized to avoid subtracting from β, which is affected by variables such as instructions and personality variables rather than specific characteristics of the items. Also, note that R_I is subtracted from λ since the amount of response integration required should reduce the importance of λ in determining the overall importance of response selection in the PA task. R_S is subtracted from $\lambda - R_I$ because as semantic or formal similarity of responses within a list increases, subjects will be more likely to utilize available mnemonic cues which will produce an override of the influence of elicited contextual associations.

Associative learning. Finally, consider the application of such a model to associative learning or the development of the S-R bond. Whereas a direct relationship was assumed between ${}^{\alpha}c$ and response meaningfulness in the response selection stage, an inverse or indirect relationship between ${}^{\alpha}c$ and S-R meaningfulness is assumed in the present stage. Specifically:

$$ {}^{\alpha}c = (\lambda - |V_{SR}|) + \beta \qquad (9) $$

where β and ${}^{\alpha}c$ retain their previous definitions and

λ is a function of pre-experimental learning and equals the total amount of associative strength that a given association can accrue; and the range = an arbitrarily small decimal - 1.00. Thus, a DOG - CAT pair is assumed to have a higher λ than, for example, TRV - CFQ due to pre-experimental experience,

V_{SR} = the amount of associative strength between the stimulus and response present on any one trial, with the range = 0.00

$\pm$ 1.00. V_{SR} is similar to I_x in that this variable changes from trial to trial and thus is a function of the number of learning trials. V_{SR} acquires a negative value in situations where the primary associates of the stimulus items are in the response list but, rather than being paired with their respective associatively related stimuli, are paired with another stimulus.

Consider the following examples wherein β is a constant and

$$\lambda = .80 \qquad (.80 - .75) + \beta = {}^{\alpha}c$$
$$V_{SR} = .75 \qquad .05 + \beta = {}^{\alpha}c \tag{10}$$

$$\lambda = .50 \qquad (.50 - 0.0) + \beta = {}^{\alpha}c$$
$$V_{SR} = 0.0 \qquad .50 + \beta = {}^{\alpha}c \tag{11}$$

$$\lambda = .50 \qquad \beta = (.50 - |-.25|) = {}^{\alpha}c$$
$$V_{SR} = -.25 \qquad .25 + \beta = {}^{\alpha}c\ . \tag{12}$$

Notice that ${}^{\alpha}c$ is predicted to be of most importance in equation 11 and it should be of least importance in equation 10. That is, ${}^{\alpha}c$ will be greater when V_{SR} = 0.0 than when it is either positive or negative.

The form of the equation is rather straightforward for this stage. Again, β has an additive function due to its independence from list materials. V_{SR} is subtracted from λ since it is assumed that as intrapair associative strength increases, it will approach λ and thus reduce or override the saliency of contextual cues as other forms of associative learning (e.g., semantic networks) become available. This last point is important to the essence of the present model. Specifically, it is assumed that if other forms of associative learning, particularly those involving obvious semantic or phonemic associations, are available to the subjects, the influence of environmental context will be mitigated.

EMPIRICAL TESTS

Two studies are reported in the current investigation. These studies are a test of the predictions for response integration and response selection, respectively. Although a third experiment testing the role of context on associative learning would have ideally been included, such a possibility was prohibited by the paucity of available subjects.

Experiment 1

As was discussed previously, the saliency of the context during response integration is proposed to be an indirect function of the amount of integration required and acquired across trials for a given list of responses. Therefore, one possible way of evaluating the saliency of the context is to manipulate the DOL of pre-experimentally poorly integrated items (e.g., CCC's) during acquisition and to then test for recall in either the context of original learning or a different context in which no previous learning has occurred.

The proposed model predicts an interaction between DOL and the saliency of the context. Specifically, it is predicted that the saliency of the context should increase initially through the low to moderate DOL's, and thus subjects in these conditions who are tested for recall in the context of original learning (same context subjects) should produce superior recall scores relative to the different context subjects, assuming, of course, that the subjects have not engaged in sufficient rehearsal to create idiosyncratic mnemonic or rote memory systems. In the case where subjects have engaged in sufficient rehearsal to commit the response elements to some type of semantic of rote memory system, the context effect should be evidenced in countering errors in that same-context subjects in the moderate DOL condition should produce fewer omissions but higher inversion errors of the CCC letters due to the elicitation by the contextual stimuli of incompletely integrated response "parts." The saliency of the context should decrease as response integration is accomplished with higher DOL's and therefore correct recall and errors should be relatively unaffected by contextual changes between acquisition and test for the high DOL subjects.

Method

Design. The experiment employed a 2 X 3 X 2 factorial design with two types of acquisition context (a counterbalancing control factor), three levels of DOL (4/16, 8/16, or 16/16 response list emissions on any one trial without regard for appropriate S-R pairing), and two types of test room (same or different from acquisition). The experiment also employed a repeated measure; second recall test,as will be discussed later. The primary dependent variables were the number of correct CCC completions on a "cued" recall task, the number of complete omissions of responding, and the number of second and third position inversions.

Subjects. The subjects were 72 students enrolled in general psychology courses who participated as a course elective. These subjects were naive with regard to context-related experiments.

List and apparatus. Sixteen stimulus items were selected from the Haagen (1949) adjective norms. These items were chosen such that no category was represented more than once in order to avoid semantic relatedness among the stimuli.

The 16 consonant trigram response items were selected from the Witmer (1935 ; in Underwood & Schulz, 1960) CCC norms. All response items had a 17% meaningfulness rating. No letter appeared in position 1 more than once. No letters appeared in positions 2 or 3 more than twice except "F" which occurred 3 times in position 3.

The response items were randomly assigned to the stimuli within the restriction of avoiding any idosyncratic pairings. (See Table 1.) The pairs were then randomly ordered into four presentation orders, again avoiding idiosyncratic sequences.

Insert Table 1 About Here

The list was typed in upper case letters (black on white background) and was presented via a Kodak 860 slide projector at a 2 sec interval per pair with a 4 sec intertrial interval. The slides were presented via the study-test method to avoid the rapid alternation between storage and retrieval processes inherent in the anticipation method (Kanak & Neuner, 1970).

Rooms. One half of the subjects were presented the list and/or were tested for recall in an 18' by 26' room, brightly illumina-

Table 1

Word List Experiment 1

Stimuli*	Responses**
ANCIENT	KFX
INSANE	ZPB
HIGHEST	TJF
VACANT	SGJ
STEADY	CQZ
CRUEL	LJF
EXPERT	MHF
SILENT	JTQ
UNFIT	HFM
FROZEN	DQH
DISTANT	QLB
MODEST	GZK
ENTIRE	PZW
DARING	FCQ
FILTHY	WBN
DESERT	RBM

* Taken from Haagen (1949) adjective norms

**Taken from Witmer (1935) 17% rating in Underwood and Schulz (1960) ted and decorated with various posters and additional laboratory apparatus beyond normal circumstances (Room A). The other half of the subjects learned and/or were tested for recall in a smaller 12' X 18' room (Room B) with equivalent illumination, but with an absence of posters and extraneous apparati. Both windowless rooms were located on the same floor among a series of laboratory rooms used for psychological research. In both rooms, the subjects sat 6.5 feet from a slide screen and the experimenter was seated behind the subject. The neutral context used during the intertask interval was a small 8' X 12' room resembling a fairly typical laboratory room with a normal amount of apparati and with other materials unrelated to the other two room contexts and the tasks of interest.

Procedure. Each subject was taken to the previously assigned acquisition room context upon arrival at the laboratory. The subject then received conventional paired-associate acquisition instructions for the study-test method. The subject was not, however, informed as to the learning criterion. Rather he was simply told to continue through the trials until the experimenter stopped the presentation. The subject was not informed that a recall test would follow this task. The instructions and the list of practice words used to acquaint the subjects with the study-test method are available in Appendix A.

When the subject reached the acquisition criterion (4/16, 8/16, or 16/16 response evocations without regard to correctness) appropriate for her assigned condition, there was a 20 minute intertask period. This period was designed to control for equivalent amounts of "psychological disruption" (Strand, 1970) between the same or different test context groups. During the period, each subject was taken to a third, neutral room context where she engaged in several digit elimination tasks, thus being led to believe that the PA task was indeed completed. It should be noted that the learning criterion refers not, for example, to four out of 16 correct stimulus-response associations but rather to the emission of four response list items regardless of associative correctness.

When the 20 minute period had elapsed, the subject was returned to the context of original learning (same context condition) or taken to a different, previously unencountered context (different context condition) depending on his assigned condition. Here each subject was given cued recall instructions. Based on the presentation of the first consonant of the unit, he was asked to write the two missing consonants of the response trigram in the proper order. First consonants and spaces for the remaining consonants were presented in typewritten form with each first consonant cue appearing on a separate sheet to prevent the subject from reevaluating his responses. Subjects were instructed to turn the page every 10 sec as cued by the experimenter. A copy of the instructions and order of cued recall is provided in Appendix A.

After the subject completed this task, he was asked to step into the hall while the experimenter ostensibly completed the forms necessary for him to obtain class credit. After this second 2-minute disruption period, however, each subject was taken to the context of original learning and given a second unexpected recall test with the same instructions and procedure as the first test. Obviously, this second test was not independent of the first and an incomplete factorial combination of first and second rooms was produced. However, this "reinstatement" test manipulation was designed to provide additional information concerning the action of contextual associations as will be discussed in the following results and discussion sections.

When this "reinstatement" test was completed, each subject was debriefed and dismissed.

Results

Trials to criterion. Analysis of the number of trials to reach criterion for the various levels of learning indicated significant effects for the DOL variable, F (2, 66) = 120.07, MS_e = 10.06, $p < .001$, the acquisition context, F (1, 66) = 14.94, MS_e = 10.06, p = .0003, and the interaction of these two variables, F (2, 66) = 3.47, MS_e = 10.06, p = .04. The main effect means for the three DOL conditions were 18.25 (16/16), 7.92 (8/16), and 4.67 (4/16). Subjects acquiring the list in Room B required significantly more trials to reach criterion than subjects learning the list in Room A ($\bar{X}$ = 11.72 vs. $\bar{X}$ = 8.83, respectively). Cell means indicated that high DOL subjects required an average of 15.42 and 21.08 trials in Room A and Room B, respectively. Moderate DOL subjects took 7.25 and 8.58 trials on the average in Room A and B, respectively. Subjects in the low DOL condition required 3.83 mean trials to reach criterion in Room A versus 5.50 in Room B. Neither the acquisition context factor nor the interaction of DOL and acquisition context, however, were found to significantly affect later recall scores.

Multivariate analyses Test 1. A multivariate analysis utilizing Wilks' criterion (Timm, 1975) indicated that on the dependent variables of the first recall test only the levels of learning, $\underline{F}$ (10, 112) = 9.05, $\underline{p}$ = .0001, and level of learning by test context (same (S) or different (D)) effects, $\underline{F}$ (10, 112) = 2.36, $\underline{p}$ = .01, could be evaluated at the univariate level. All other $\underline{F}$'s $\leq$ 2.15, p $\geq$ .07.

Univariate analyses for Test 1. As expected, the degree of learning significantly affected the number of correct completions of the trigram units, $\underline{F}$ (2,60) =57.84, MS_e =5.79, $\underline{p}$ <.0001. Subjects in the high DOL (16/16) group successfully completed an average of 10.71 trigrams, compared to 6.00 and 3.33 for the moderate and low DOL groups, respectively. The DOL X test context interaction was not significant, $\underline{F}$ < 1.0.

Analysis of the correct recall of the second position only letters indicated a main effect of DOL, $\underline{F}$ (2, 60) = 3.04, MS_e = 1.15, $\underline{p}$ = .056. The means were .79, 1.04, and 1.54 for the high, moderate, and low groups, respectively. The interaction was not significant, $\underline{F}$ = 1.20, $\underline{p}$ = .31

Analysis of the correct recall of the third position only produced similar results. The main effect of DOL was significant, $\underline{F}$ (2, 60) = 4.36, MS_e = 1.01, $\underline{p}$ = .02, but the interaction was not, $\underline{F}$ < 1.0. The means for the main effect were .25, .83, and 1.08 for the high, moderate, and low DOL subjects, respectively.

The number of second and/or third position inversions produced a significant effect for the interaction as well as the DOL main effect, $\underline{F}$ (2, 60) = 6.00, MS_e = 1.11, $\underline{p}$ = .004.

This dependent variable was calculated by counting the number of times that a second and/or third position letter was given, but in the wrong position. This measure was taken as a reflection of incomplete response integration, a measure which the theory predicts should be particularly sensitive to context influences for moderate DOL subjects. The level of learning X test room interaction yielded an $\underline{F}$ (2, 60) = 6.77, MS_e = 1.11, $\underline{p}$ = .002. Planned-t comparisons on the test room variable at the various levels of learning indicated that same-context subjects in the Moderate DOL group ($\bar{X}$ = 2.5) produced significantly more inversions than did different context subjects ($\bar{X}$ = .67), $\underline{t}$ (60) = 4.25, $\underline{p}$ < .001. No other comparisons were significant, t's < 1.0. The cell means for the high DOL group were .42 and .75 for same and different context subjects, respectively. For the low DOL group these means were 1.5 and 1.25 for the same and different conditions, respectively. (See Table 2.)

Insert Table 2 About Here

This same interaction was significant on the total number of complete response omission errors, $\underline{F}$ (2, 60) = 6.57, MS_e = 6.27, $\underline{p}$ = .003. Planned-t comparisons on the test room context variable at the various levels of learning showed that the moderate DOL group yielded fewer omissions when tested in the same ($\bar{X}$ = 1.00) versus the different ($\bar{X}$ = 3.33) context, $\underline{t}$ (60) = -2.28, $\underline{p}$ < .05. On the other hand, however, subjects in the low DOL group produced significantly more omissions in the same ($\bar{X}$ = 4.83) rather than the different context ($\bar{X}$ = 2.33, $\underline{t}$ (60) = 2.45, $\underline{p}$ < .05. High DOL subjects were not significantly affected by contextual changes,

Table 2

Cell Means for Number of Inversions

and Number of Omissions

	Test 1				Test 2			
	Inversions		Omissions		Inversions		Omissions	
	S	D	S	D	S-S	D-S	S-S	D-S
High DOL	.42	.75	3.17	1.33	.25	.67	3.75	1.17*
Moderate DOL	2.5	.67*	1.00	3.33*	2.08	1.0*	.67	3.33*
Low DOL	1.5	1.25	4.83	2.33*	1.5	1.67	5.00	2.42*
	MS_e = 1.11		MS_e = 6.27		MS_e = 1.24		MS_e = 5.18	

* denotes significant planned-t comparison, $\underline{p} \leq .05$

t (60) = 1.8, $p > .05$. The main effect of DOL was nonsignificant, F (2, 60) = 2.42, $MS_e = 6.27$, $p = .10$. (See Table 2.)

The number of response units recalled incorrectly yielded both a significant DOL X test room interaction and a significant DOL main effect. This dependent variable included responses which had previously been counted as inversions plus those to which subjects had responded with intra- or extra-list intrusions. The interaction produced a F (2,60) = 4.17, $MS_e = 6.04$, $p = .02$. Planned-t's on the test room variable at the various DOL's showed that moderate DOL subjects had significantly more incorrect responses if tested in the same ($\bar{X} = 7.25$) vs. different ($\bar{X} = 4.67$) context, t (60) = 2.57, $p < .05$. No other comparisons were significant, t's ≤ 1.1. The main effect of DOL yielded a F (2, 60) = 23.69, $p < .0001$. The high DOL subjects produced an average of 2.00 incorrect responses, the moderate DOL group, 5.95, and the low DOL group, 6.48.

Multivariate analyses Test 2. As for Test 1, multivariate analyses utilizing Wilks' criterion were employed to determine which variables should be considered within the univariate analyses. The Wilks' criterion indicated that the level of learning (DOL) variable, F (10, 112) = 12.21, $p = .0001$, and the DOL X Test 1-Test 2 room combination interaction (T 1-T 2), F (10, 112) = 2.73, $p = .005$, should be further considered. The Test 1-Test 2 room combination resulted in the following conditions, Test 1 context = original context = Test 2 context (S-S condition) or Test 1 context = different context and Test 2 context = original context (D-S condition). All other F's ≤ 1.68, $p \geq .09$.

Univariate analyses for Test 2. Overall, the data indicated a very similar pattern of results for the second recall test analyses as compared to the first. Again, the number of correct completions was directly related to the level of learning, F (2, 60) = 86.82, MS_e = 4.5, p = .0001. The means were 11.04 (high), 6.42 (moderate), and 3.00 (low). The interaction of level of learning X T 1-T 2 was not significant, F < 1.0.

As with Test 1, the analysis of second position only correctly recalled produced a significant DOL effect, F (2, 60) = 8.04, MS_e = .83, p = .0008. The means were .67, 1.30, and 1.71 for the high, moderate, and low conditions, respectively. The interaction of interest was not significant, F = 1.05, p = .36.

Analysis of the correct recall of the third position only indicated both a significant main effect of DOL, F (2, 60) = 4.03, MS_e = .43, p = .02, and a significant interaction of DOL X T 1-T 2, F (2, 60) = 3.51, p = .04. The cell means for the S-S condition were .17, .83, and .42 for the high, moderate, and low DOL conditions, respectively. For the D-S condition, the means were .17, .33, and .91 for the high, moderate, and low DOL conditions, respectively. Planned-t comparisons on the T 1-T 2 variable at the various DOL's failed to indicate where the significant differences were, t (60) $\leq$ 1.88, p > .05.

As in the first test analysis, the data regarding the number of second/third position inversions indicated both a significant interaction of DOL X T 1-T 2, F (2, 60) = 3.13, MS_e = 1.24, p = .05, and significant DOL main effect, F (2, 60) = 7.80, p = .0009. The cell means for the S-S condition for the high, moderate, and low DOL groups were

.25, 2.08, and 1.5, respectively. For the D-S conditions, these means, in the same group order, were .67, 1.0, and 1.67. Planned-t's conducted on the T 1-T 2 variables at the various DOL's indicated that subjects in the moderate DOL condition ($\bar{X}$ = 2.08) produced significantly more inversions in the S-S condition than in the D-S condition ($\bar{X}$ = 1.00), t (60) = 2.38, $p < .05$. This effect is in the same direction as reported for the first recall test. The other t's were not significant, all t's < 1.0. (See Table 2.)

As with the number of inversions, the analysis of the number of complete response omissions also indicated a significant interaction, F (2, 60) = 10.67, MS_e = 5.18, p = .0001. According to the planned-t comparisons of T 1-T 2 at the various DOL's, the moderate DOL subjects left significantly fewer blank in the S-S ($\bar{X}$ = .67) vs. the D-S condition ($\bar{X}$ = 3.33), t (60) = -2.86, $p < .01$. Again, however, the low and also the high DOL subjects exhibited an opposite pattern. Both of these groups produced significantly more omissions in the S-S vs. the D-S conditions. For the low DOL condition, the means for the S-S and D-S groups were 5.00 and 2.42, respectively. For the high DOL group, the means for the S-S and D-S groups were 3.75 and 1.17, respectively. In both cases the t (60) = 2.78, $p < .05$. The main effect of DOL was also significant, F (2, 60) = 3.62, p = .03. (See Table 2.)

The analysis of response units recalled incorrectly revealed a pattern nearly identical to the Test 1 analysis. Again, both the interaction, F (2, 60) = 4.78, MS_e = 5.89, p = .01, and the DOL main effect, F (2, 60) = 30.65, $p < .0001$, were significant. The cell means for the S-S conditions were 1.0, 6.91, and 6.33 for the high, moderate, and low DOL groups, respectively. For the D-S groups, these means, in the same order, were 2.33, 4.41, and 7.5. Planned-t comparisons on the context variables revealed that moderate DOL subjects again gave more incorrect responses if recall occurred in the S-S condition than in the D-S condition, $\underline{t}$ (60) = 2.52, $\underline{p} < .05$. No other $\underline{t}$'s were significant, $\underline{t}$'s ≤ 1.34.

Multivariate analyses on difference scores between Test 1 and Test 2 scores. As in previous analyses, preliminary multivariate analyses were employed to determine which variables should be considered in univariate analyses. Utilizing Wilks' criterion, it was found that none of the independent variables contributed significantly to the various difference scores (e.g., Number of inversions Test 1 - Number of inversions Test 2), all $\underline{F}$'s ≤ 1.75, $\underline{p} \geq .08$.

Discussion

The basic thesis of the experiment was that context-list associations accrue strength as they are presented in spatial/temporal contiguity across trials and that as the associative strength increases, contextual cues became capable of eliciting the list items. However, the context functions as a conditioned stimulus only to the extent that it is predictive of reinforcement, that is, the correct response (Mackintosh, 1975). Within this framework, therefore, it should be the moderate DOL group that demonstrates the greatest context effect. The low DOL group should not have experienced an adequate number of context-list presentation pairings to establish sufficient associative strength between context and list items and thus should be relatively unaffected by contextual manipulations. The high DOL group, because of the numerous pairings of context and list over extended trials, should have theoretically undergone extinction over trials as the context ceased to be the valid indicator of the correct response and as the nominal stimulus in the PA paradigm became a more valid and reliable indicator of the appropriate response. Thus, this group, also, should not be facilitated by same-context testing conditions and indeed may experience retardation of responding via latent inhibition. These general predictions were largely supported by the data. However, rather than finding a facilitative effect of same context testing as did previous investigators (e.g., Smith et al., 1978), the data indicated no context effect for correct responding, except for the significant interaction of DOL X T 1-T 2 in Test 2 for third position only which failed to be very enlightening since the absolute values of these means were small and not "psychologically significant." Instead, the context X level of learning interaction appeared to be most prominent in the number of inversions, the number of omissions, and the number of incorrect responses on both tests. Although these findings would not have been predicted within the conceptual frameworks of most of the previous studies on environmental context, they are expected within the present model.

Specifically, the model predicts a facilitation of correct recall in same context testing only when the contextual cues are the most valid and reliable predictors of the correct response. Obviously, if the response items have been incorporated into either a mnemonic or rote memory system, the saliency of the contextual cues should decrease as the integration of the units increases. Thus, manipulations of the environmental context between acquisition and test should have no effect on correct recall in situations where subjects are utilizing operant or controlled responding independent of the environment.

Therefore, it should be noted that a careful consideration of the designs of both the Smith (1979) and Smith et al. (1978) studies as well as the Godden and Baddeley (1975) study, all of which showed superior recall in same-context conditions, reveals that in each of these studies subjects were in situations which should produce the facilitating context-effect. Specifically, they were typically asked to learn (although some of the tasks in the Smith studies involved incidental learning paradigms) and recall a rather long list following a single presentation. Thus, although the environmental cues were presented only once per "item," they were "presented" many times or present continuously for a lengthy period per list. Additionally, a single presentation minimizes the potential influence of semantic cues, even if "readily available" (cf. Smith et al., 1978), and thus the contextual cues would be predicted to be the most reliable predictors of differential reinforcement. Incompletely integrated response elements, on the other hand, have not been successfully incorporated into a viable response system and are therefore more susceptible to contextual manipulations. Thus, for those subjects who have encountered sufficient, though not extensive context-list pairings, that is, the moderate DOL group, the number of inversion and intrusion errors should be increased and the number of omissions decreased in same-context testing conditions. These effects should occur because, for this group, the contextual cues are capable of eliciting response letter elements though not necessarily integrated response units. As the contextual cues elicit the various elements of the trigram, the subject has no other discriminable or differentiated cue on which to rely and thus responds with the elicited letter. This elicitation without benefit of differentiation results in more response letters being given by these subjects and thus a reduction in the number of omissions and an increase in the overall number of incorrect responses. Likewise, the number of inversions for this group should be higher than for different-context testing conditions since the context is eliciting only partially integrated response units and thus letters that were part of the same trigram are elicited, but in the incorrect order.

The effect of Test 1 occurring in a <u>different</u> context appeared to reduce the saliency of contextual stimuli for the moderate DOL subjects since the D-S group performed differently than the S-S group on Test 2 as well as on Test 1. Perhaps, the reliability of the contextual cues was diminished by different context testing and therefore when Test 2 occurred in the context of original learning, the associative strength was reduced and thus, likewise, the number of elicitations.

As was predicted, the high DOL group did not exhibit any reliable context effects on Test 1. On Test 2, the only context effect revealed was that this group produced significantly more omissions if the test had occurred in the same context twice than if there had been a change of context. This finding is also predicted by the model. As was discussed previously, the data on the latent inhibition effect (e.g., Mackintosh, 1975) indicate that the associative strength associated with nonreinforcement is not limited to a value of "zero." Rather, it can also accrue negative strength which would not only not facilitate later responding, but rather retard it. This retardation occurs when a stimulus has been previously indicated to not predict differential reinforcement. Therefore, high DOL subjects become conditioned to respond to contextual cues in a way that indicates that the cues are not predictive of later reinforcement. Thus, no context effect occurs on Test 1. However, subjects who took the initial test in the context of original learning were actually undergoing an additional extinction trial, i.e., extinction of response tendencies elicited by contextual stimuli, which subjects in the D-S condition did not experience. Therefore, for the S-S group the potential associative strength of the contextual cues is not "zero," but rather is less than zero. Thus, Test 2 performance should not only not be facilitated, but actually retarded in the S-S condition. This prediction was supported by the results that demonstrated an increase of omission errors in the S-S condition for the high DOL subjects.

It might be noted that, if indeed the first test served as an extinction trial, one might expect spontaneous recovery of the context-list associative strength. Such a prediction could be easily evaluated with an appropriate increase in the interval between retention tests which allowed the process of spontaneous recovery to occur.

The low DOL group is a bit more troublesome to explain. Although no context effects were predicted for this group, they were found in the measure of the number of omissions on both tests. Specifically, these subjects produced more omissions when the recall tests were always in the context of original learning. One explanation for this finding is that subjects in the S and S-S conditions were not only experiencing normal forgetting and confusion due to the large number of still unintegrated and thus undifferentiated trigrams, as were the D and D-S subjects, but were also prohibited from responding by the mass of undifferentiated contextual stimuli equally conditioned to list items but at a low level of strength. The contextual cues would be relatively equally associated with an array of equally unfamiliar trigrams and the overall effect would be one of elicitation of competing associations. Given the absence of a stimulus differentiation gradient (Gibson, 1940), the contextual cues should then have a retardative rather than facilitative effect, as indeed the increased number of omissions indicated.

Experiment 2

The predicted facilitative power of the context in regard to response selection of familiar words is based on the assumption that the context serves to aid the subject in his discrimination or selection between the number of "common" items within his cognitive networks which were on the experimental list and those which were not. Contextual cues, therefore, are posited as the fundamental factors controlling the operation of the "selector mechanism" (Underwood & Schulz, 1960). Thus, it is hypothesized that the context serves to aid in "recognition" and selection of list members from equally familiar "distractors" which may also be "recalled" or "retrieved" as the subject is attempting to associate the proper response with a particular stimulus. Therefore, superior "selection" or recognition of list items is predicted to be produced by subjects engaging in a recognition task in the context of original learning. Single choice recognition tasks, however, provide a 50% opportunity for correct responding on the basis of chance alone and therefore accuracy scores are typically inflated and insensitive. Thus, a difference in overall accuracy between same and different context groups would not be necessarily predicted.

A more sensitive and appropriate measure would be to consider the reaction times for both correct and false recognitions. Using this more precise dependent variable, the model predicts that same-context subjects will have faster "hit" times than different-context subjects and slower false recognition times.

Method

Subjects. The subjects were 48 undergraduate students enrolled in general psychology courses and participating for class credit. These students were naive to context-related manipulations.

Design. The study employed a 2 X 2 X 2 design with two levels of response item meaningfulness (high or low), two levels of test context (same or different) and two levels of acquisition context (counterbalancing control measure). The primary dependent variables were the reaction times for the hits and false recognitions.

Lists and apparatus. The two lists varying in response item meaningfulness consisted of 20 word pairs. These pairs were comprised of 20 CVC stimuli selected from the Glaze (1928; in Underwood & Schulz, 1960) norms to have equivalent meaningfulness ($\overline{X}$ meaningfulness rating = 47%). The responses for List H were high meaningful, high frequency norms selected from Cluster 7 of the Toglia and Battig (1978) norms. The responses for List L were selected from Cluster 3 of the same norms. The mean meaningfulness rating for the List H responses was 4.48. The mean meaningfulness rating for List L responses was 2.73. The two lists are presented in Table 3. The stimuli and responses were randomly paired avoiding idiosyncratic pairings. A random ordering of the pairs was composed, again avoiding idiosyncratic sequences. The presentation order of the stimuli for both lists was the same.

Insert Table 3 About Here

The list pairs were typed in uppercase letters and presented via the same apparatus as employed in the response integration experiment. The pairs were presented once for two seconds per pair. The one trial recognition test for each list was comprised of the appropriate 20 response list items plus 30 distractors of equivalent meaningfulness. The test words were typed in uppercase letters and shown at a 4 second interval. A complete listing of the "test" items is available in Appendix B.

A two-choice button panel was placed on a table in front of the subject for the recognition test. For half the subjects, the button on the left indicated an "old" or actual response list item while the

Table 3

Experiment 2 PA Lists in Order of Presentation

List L		List H	
Stimuli*	Responses**	Stimuli*	Responses**
QET	BUFFOON	QET	PLATE
LEH	SEQUEL	LEH	CENT
NEF	ENVOYS	NEF	GARDENIA
PEQ	SANDER	PEQ	EGG
TAJ	CURDS	TAJ	STRING
HYB	FROCK	HYB	METAL
DYT	AXIOM	DYT	TON
GIZ	MAGNATE	GIZ	FOG
RUK	REVERY	RUK	DAGGER
ZAD	TENURE	ZAD	LUMBER
KIX	SILOS	KIX	GRAVE
MIH	SEER	MIH	NEEDLE
WAZ	BRISKET	WAZ	ROD
BUW	TRAWL	BUW	SLIPPER
FAH	OHMS	FAH	KNOB
JEP	BALE	JEP	CUP
VIW	APEX	VIW	BEGGAR
SOQ	LETTERHEAD	SOQ	MORGUE
YIT	SANCTITY	YIT	TABLE
CES	LOON	CES	TRASH

*Stimuli selected from Glaze (1928; in Underwood & Schulz, 1960) $\overline{X}$ meaningfulness rating = 47%

**Responses selected from Cluster 3 (list L; $\overline{X}$ meaningfulness rating = 2.73) and Cluster 7 (List H, $\overline{X}$ meaningfulness rating = 4.48) of the Toglia and Battig (1978) norms.

button on the right indicated a "new" or distractor item. For the other half of the subjects, the position was reversed. All subjects utilized the index finger of their preferred hand and maintained position of their fingers directly over the panel box.

The buttons were attached to a clock which recorded RT's. Because the timing apparatus required significant manual operation by the experimenter the test slides were advanced at a constant 4 sec rate. Subjects, however, were told that they had only 2 sec to respond in order to reduce the probability of subjects engaging in intricate sorts of mnemonics during an extended presentation rate. The reaction time measures indicated subjects conformed to the 2 second-expectation.

Rooms. The experimental rooms utilized were the same as those employed in the test of response integration. As in the first experiment, both rooms were employed as acquisition and/or test rooms.

Procedure. Upon arrival at the laboratory, each subject was taken to the acquisition context appropriate for the previously randomly assigned condition and given acquisition instructions. These instructions indicated that the subject was going to participate in a series of tasks and that the first one consisted of viewing a list of CVC-word pairs. No mention was made of what later tasks would be required. (See Appendix B.)

After hearing the instructions, each subject saw the list pairs for a single presentation and was then taken to the "neutral" context for a twenty minute disruption control period during which he engaged in various digit elimination tasks, also utilized in the previous experiment. Following this intertask interval, the subject was taken to the appropriate test room and given the appropriate recognition test.

Each subject was instructed as to the use of the button panel and was informed that within a 2 second limitation accuracy was more important than speed, although speed or RT was also important and was being recorded. The instructions are presented in Appendix B.

Upon completion of the test, the subject was asked to step into the hall for a short time (two minutes) while the experimenter ostensibly completed data recording and prepared the class credit form. After this brief disruption period, the subject was returned to the context of original learning and was re-administered the recognition test. Note should be taken here, again, that although this second test was not independent of the previous test, it was designed to provide potentially illuminating information regarding the context manipulation.

After completing this final task, the subject was debriefed and dismissed.

Results

The data were analyzed both in terms of a) the proportion of hits, correct rejections, false positives, and misses, and b) the mean reaction times for these dependent variables.

Multivariate analyses on Test 1 dependent variables. As in experiment 1, a preliminary multivariate analysis utilizing Wilks' criterion (Timm, 1975) was used to determine which variables could be considered at the univariate level. This test indicated that only the acquisition room context X test room context interaction effects could be evaluated on the dependent variables utilizing the proportion of the various measures, F (4, 29) = 2.79, p = .04. All other F's $\leq$ 2.52, p > .06.

The multivariate analysis on the reaction time measures revealed that only the level of response meaningfulness (high or low) should be further analyzed, F (6, 27) = 3.52, p = .01. All other F's $\leq$ 2.01, $p \geq$ .10.

Univariate analyses Test 1. The acquisition room context X test room context interaction was found to have a significant effect on the proportion of correct rejections, F (1, 32) = 8.43, MS_e = .04, p = .007, and for false positives, F (1, 32) = 8.57, MS_e = .04, p = .006. The interaction was not significant for hits (grand $\bar{X}$ = .65) or misses (grand $\bar{X}$ = .34), both F's < 1.0.

The mean proportions for the correct rejections and false positives are presented in Table 4.

Insert Table 4 About Here

For simplicity in presentation, only the differences in proportions in terms of relative percentage changes will be presented. The mean proportions for correct rejections revealed that subjects who acquired and tested in Room A (A-S condition) produced 17.9% more correct rejections than did subjects who acquired in Room A, but tested in Room B (A-D condition). Subjects who acquired in Room B, but were tested in Room A (B-D condition) produced 23.8% more correct rejections than those subjects who acquired and tested in

Table 4

Cell Means: Correct Rejections and False Positives for the Interaction of Acquisition Room X Test Room Contexts

	Correct Rejections		False Positives	
	Acquisition Context		Acquisition Context	
Test Context	A	B	A	B
Same (S)	.84	.61	.15	.39
Different (D)	.69	.80	.31	.20
	$\underline{F}(1,32) = 8.43$, $\underline{p} = .007$		$\underline{F}(1,32) = 9.57$, $\underline{p} = .006$	

Room B (B-S condition). There was only a 4.8% increase in correct rejection by subjects in the A-S condition relative to those in the B-D condition. For subjects in the A-D condition, the percent increase as compared to the B-S condition was only 11.6%. Essentially, these results reveal that testing in Room A, the "enriched" room, produced superior correct rejections of distractors regardless of acquisition context.

Percentage differences in the cell means for false positives indicated that subjects in the A-S condition made 51.6% fewer false positives than subjects in the A-D condition. However, those subjects in the B-S condition made 48.7% more false positives than those in the B-D condition. Again, the "enriched" room was associated with superior performance when utilized as the recognition test room.

The reaction time data revealed a significant main effect for response meaningfulness in three dependent variables. These variables were the mean reaction time for hits, correct rejections, and false positives. For hits, the $\underline{F}$ (1, 32) = 6.00, MS_e = .02, $\underline{p}$ = .02. The mean reaction time on correctly identified high meaningful ($\underline{m}$) "old" items was 1.52 sec versus 1.43 sec for low $\underline{m}$ "old" items.

Analysis of the reaction times on false positives produced a similar picture. The mean reaction time on high $\underline{m}$ distractors was 1.66 sec compared to 1.51 for low $\underline{m}$, $\underline{F}$ (1, 32) = 4.91, MS_e = .05, $\underline{p}$ = .03. Further, correct rejections were completed significantly faster for high ($\bar{X}$ = 1.54) vs. low ($\bar{X}$ = 1.63) $\underline{m}$ distractors, $\underline{F}$ (1, 32) = 3.96, MS_e = .03, $\underline{p}$ = .055.

The analysis for reaction time on misses revealed no effect due to response m, $F < 1.0$.

Multivariate analyses on Test 2 dependent variables. Wilks' criterion indicated that none of the independent variables or their potential interactions could be evaluated at the univariate level for the "proportion" dependent variables, all F's ≤ 2.52, $p > .06$ or for the reaction time measures, all F's ≤ 2.20, $p \geq .07$.

Multivariate analyses on the difference scores between Test 1 and Test 2. The preliminary multivariate analysis on the differences between proportions between Test 1 and Test 2 revealed no main or interactive effects which could be analyzed further, Wilks' criterion, all F's $(4, 29) \leq 1.31$, $p \geq .29$. The multivariate analysis of reaction time data indicated that only the main effect of response meaningfulness could be evaluated at the univariate level, $F\ (6, 27) = 3.05$, $p = .02$, all other F's ≤ 2.16, $p \geq .08$.

The main effect of response meaningfulness was found to produce a significant effect on the differences in reaction times on correct rejections between Test 1 and Test 2, $F\ (1, 32) = 4.69$, $MS_e = .04$, $p = .04$. The mean difference in reaction times for high m responses was .05. For low m responses, this difference was almost 4 times that for high m, with an average difference of .173.

The analysis of difference scores for hits, false positives, and misses revealed no significant effect attributable to response meaningfulness, all F's ≤ 2.46, $p \geq .13$.

Discussion Experiment 2

Unfortunately the data do not offer support for the original predictions. The predicted facilitation of reaction times by same context conditions was not obtained. In fact, the reaction time data were impervious to context manipulations, being affected only by the level of response/distractor list meaningfulness. Although this finding is interesting, it is not particularly relevant to the present investigation.

Failure to support the predictions regarding reaction times and the failure to find the desired facilitation in the proportion data is not, however, particularly detrimental to the current model. As was discussed in the introduction, the recognition test employed in this experiment was a simple two choice recognition test. Thus, a subject had to simply divide his available attention and response consideration between only two choices. The subject, therefore, had a 50% opportunity of being correct on the basis of chance alone. Furthermore, consideration of the level of correct responding showed that subjects were correct in their identification of old items only 65% of the time on the first test. The experimental manipulations therefore may not have been sensitive to a performance level only 15% above chance. On the second test, the level of correct responding decreased to only 59%. Therefore, it is possible that the absence of supportive results is largely the result of a "floor" effect. It may have been that the relatively low _m_ CVC stimuli employed in the present study drew considerable attention time for processing during the list presentation from attention to response items. Future research should be directed toward increasing the overall level of performance to permit greater sensitivity.

There was an acquisition room context X test room context interaction in the proportion of correct rejections and false positives, but it also failed to reveal a facilitative effect of same-context testing. Rather, it indicated that subjects increased their proportion of correct rejections by an average of 20.9% when testing occurred in Room A vs. Room B and false positives were reduced by an average of almost 50.2% when testing occurred in Room A vs. Room B, regardless of acquisition room context.

In order to understand why this effect might have occurred, it is necessary to consider the room contexts themselves. Room A was decorated with various posters and, although not cluttered, did have several pieces of apparatus strewn about. Room B, on the other hand, was without wall decoration and other objects and presented an image of "starkness." Thus, the two rooms could have created very different moods and therefore recognition scores for the subjects, with Room A creating a mood and atmosphere similar to those which they typically encounter when attempting to retrieve or recognize old information. For instance, in classroom testing there are usually numbers of individuals dressed in an assortment of colors and styles and although the exam or test may be difficult, the "mood" is often one of anticipated success, etc. Room B, on the other hand, may have elicited feelings of vague anxiety, depression, and perhaps gloom. Such feelings could reduce the level of correct responding as was indicated in the reduction of correct rejections and increase in false positives for subjects testing in Room B. Unfortunately, because these results were not anticipated, no mood scales were given to the subjects. These data suggest that in further studies utilizing this kind of context manipulation: such scales should be employed.

There are several other issues raised by the current study which also merit further investigation. For instance, why should "enrichment" have a greater effect on recognition than on acquisition? Results indicated that subjects in the B-D condition had 23.8% more correct rejections than those in the B-S condition vs. a 17.9% decrease in correct rejections for A-D subjects as compared to the A-S group. Why this result would occur is unclear.

Additionally, although the rooms in the two experiments were identical, they produced differential results in the two experiments with facilitation only at retrieval occurring only in Experiment 2. Even though the subjects in this second experiment were performing at near-chance level, the data still suggest a potential different role or action of environmental cues on recognition vs. recall tasks. It may be that due to the relatively low amount of associative learning necessary to complete a simple recognition task, contextual cues do not play a part or function in associative networks. Presenting a more stimulating or "enriched" environment at test, however, may provide the conditions which facilitate overall performance by increasing arousal,

General Discussion

The proposed model, grounded in the theoretical principles of classical conditioning, was only partially supported by the obtained data. Experiment 1 on response integration provided considerable support for the model. Specifically, it was predicted that the moderate DOL group should be the condition in which the greatest influence of the manipulation of environmental context was exemplified. In agreement with these predictions, it was found that subjects in this group produced more letter inversions and fewer omissions in cued recall if testing occurred in the S-condition. These results are in obvious agreement with the elicitation hypothesis inherent in the classical conditioning framework. Likewise, as predicted, the low DOL and high DOL groups were largely unaffected by contextual changes with the notable exception of the number of omission errors produced. The latter finding, however, is not particularly detrimental to the current theory. In fact, the increased number of omission errors for the high DOL group in the S-S Test 2 condition actually provides the groundwork for the later extension of the model directly to studies of spontaneous recovery and latent inhibition, as will be discussed later.

The higher rates of omission errors for the S-S low DOL group on both tests may be a simple result of the low level of learning and the undifferentiated association of response elements to the contextual stimuli resulting in competing associations and, hence, omissions. Further, although the measures of letter inversions and response units incorrectly recalled are not completely separable due to letter duplication between responses, this letter duplication is a constant across conditions and an examination of the difference between these measures gives an estimate of the amount of incorrect responses which can be considered intralist response letter intrusions. Such intralist response letter intrusions can be viewed as competing associations resulting from undifferentiated association with contextual stimuli, particularly for the low DOL group. On Test 1 for the low DOL group, the estimated average number of such intrusions was 4.42 for same-context versus 5.75 for different. Thus intralist intrusions were lower in the same context, as would be predicted, due to the facilitative effect of whatever low degree of differentiation of the letter elements had already been associated with the contextual cues present during acquisition. This difference continues into Test 2 with 4.83 for same versus 5.83 for different. Interestingly, however, the effect is in the opposite direction for the moderate DOL condition in which more contextual associations should have developed with the response letter elements, though not completely integrated as was demonstrated in the higher number of inversions in this condition versus low DOL. The estimated average number of intralist response letter intrusions for the moderate DOL condition on Test 1 was 4.75 for same versus 4.00 for different. This difference increased on Test 2 to 4.83 for same versus 3.41 for different. Such intrusion errors for high DOL subjects were minimal, of course, with means of 1.16 (same) and 1.67 (different) on Test 1 and .75 versus 1.66, respectively, on Test 2. Thus the intrusion error data for low and moderate DOL conditions vary in opposite directions with the contextual manipulation and supports the notion that competing context-response letter associations may account for the higher rate of omissions for low DOL subjects when tested in the same context as acquisition.

Experiment 2, on the other hand, produced primarily null results regarding the effect of contextual manipulations on recognition tests. The obtained interaction of acquisition by test room context actually shed little light on the issue of the contextual stimuli functioning as conditioned stimuli for list items. The only consistent effects of this interaction were that individuals produced more correct rejections and fewer false positives if testing occurred in the "enriched" context regardless of acquisition context. Such findings lead one to consider the possibility that, at least for recognition tests where the demand for associative learning is at a minimum, the role of contextual cues is different than it is for recall tasks. Specifically, it is suggested that in tasks requiring little associative learning, contextual cues may function as "emotional" rather than "semantic" cues and alter anxiety and arousal levels, thus affecting performance. It is important to note that earlier studies conducted by Thomson (1972) indicated that changing the semantic context between acquisition and test did affect performance on a recognition test. Thomson suggested that these data indicated the presence of retrieval processes in recognition memory and provided indirect support for the encoding specificity hypothesis. However, the present results reveal that recognition tasks, at least 2-choice tasks, are rather unaffected by environmental context changes. It may be that the various "types" of context manipulation, i.e., semantic vs. environmental cues, produce differential effects depending on the task demands, particularly on recognition tasks where associative learning of any type is really at a minimum and thus, although consistency in semantic cues between acquisition and test affect performance, consistency of less specific or less directly associated environmental cues is less instrumental in affecting performance. All of these possibilities are, of course, highly speculative at this time, particularly given the overall low level of performance in Experiment 2.

Although the data from Experiment 2 were rather disappointing, the implications of Experiment 1 data are not only quite interesting, but also testable. For instance, the issue of the spontaneous recovery of context-item associations between tests was raised earlier following Experiment 1. Spontaneous recovery in verbal tasks has previously been demonstrated (e.g., Saltz, 1965; Underwood, 1948), although the effect is sometimes elusive (e.g., Koppenaal, 1963). The primary problem for a test of the spontaneous recovery issue is in identifying the appropriate spacing of tests in order to allow for the recovery of the associations following extended pairings of the context and list which have via nonreinforcement produced extinction during acquisition. If high DOL subjects could be found to perform as do moderate DOL subjects on Test 2 following an appropriate time interval, then the model would quite obviously gain substantial credibility.

The phenomenon of latent inhibition also provides a good testing ground for the theory. The phenomenon refers to the fact that when subjects are pre-exposed to a stimulus which is not associated with any differential outcome, later acquisition of the stimulus as a conditioned stimulus is retarded relative to subjects who have not encountered the stimulus previously (e.g., Ackil & Mellgren, 1968; Lubow & Moore, 1959). The reason for this retardation has been the issue of some debate (cf. Ackil & Mellgren, 1968). However, it has been generally assumed that it is the result of subjects diverting their attention, that is, ignoring stimuli which have not been previously associated with differential reinforcement. The analogs to the present model are readily apparent. Subjects learn via incidental learning over trials that contextual cues are not valid predictors of the list items. Thus, they learn to ignore these cues when they are presented later. The ideal paradigms for testing this hypothesis would be the PA transfer paradigms, particularly the A-B, A-C and A-B, C-B paradigms where the stimuli and responses, respectively, are identical between List 1 and List 2. Using these paradigms and various degrees of S-R meaningfulness and DOL's would allow one to ferret out the various effects attributable to response or stimulus learning, associative learning, and contextual cueing. For example, if contextual cues are unavailable for use in associative networks as a result of latent inhibition or other inhibitory processes, second list acquisition in A-B, C-B should be retarded in the S-conditions relative to D-conditions. Any deficit or facilitation of the various transfer paradigms should be the result of several interacting factors such as degree of first list learning, response or stimulus meaningfulness, and the degree of inter-list relatedness.

There are extensions of the model applicable to other areas of learning/memory research. For instance, Tulving (1962); see Crowder, 1976 for a summary of current literature) found that if the to-be-remembered list had not inherent structure or organization, subjects created their own in order to facilitate task completion. One possible source of these organizational strategies is, of course, the environment. One way to perhaps test this hypothesis would be to have certain words in the list presented in particular contexts via visual and/or auditory changes during list presentation and then test for recall and determine whether subjects clustered responses according to consistent contextual cues or relied upon other recall strategies such as serial order.

Another related area of interest is the effect of environmental changes on serial learning and thus the primacy and recency effects. Although initial data (i.e., Nixon & Kanak, 1981) indicated no context effect for primacy or recency items, further research is obviously in order. The conclusions from this study that it is neither the well-rehearsed primacy (analog high DOL) nor the just-encountered recency (analog low DOL) items which are affected, but rather the middle-list items for which the environmental cues serve as the primary source of differentiated stimuli, would be supported if later studies also reveal that it is the middle list items which are most affected by contextual manipulations.

The practical implications of such a model are innumerable. There are obvious implications for academic settings, but there are also less obvious, yet still important, extensions to the areas of business and industry. For instance, seldom do individuals attend to wallpaper, or the color of walls, or the signs or pictures on the wall, particularly when they have passed that wall or walls like it many times and have never noticed anything on it which indicated "differential reinforcement," e.g., a pay-hike or new hours, etc. However, very often safety signs, rules and regulations and other kinds of pertinent information are displayed on walls, the very place or stimulus most people have learned to ignore. Obviously, people must be either re-educated or pertinent information should be displayed in a different manner.

From the previous paragraphs, it is evident that even though the model has been tested within the framework of PA learning, the implications are not limited to that paradigm. On the contrary, the basic thesis, that is, that contextual cues acquire some degree of capacity to facilitate or retard acquisition and retrieval of information as a consequence of their capacity to function as conditioned stimuli, is potentially generalizable to all situations wherein individuals acquire and retrieve information.

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APPENDIX A

MATERIALS FOR EXPERIMENT 1

ACQUISITION INSTRUCTIONS: EXPERIMENT 1

This experiment is a study in learning processes. On the screen in front of you, I am going to show you 16 pairs of items, one pair at a time at a 2 second pace per pair. Each pair is arranged so that the stimulus or cue item is on the left and the response item, which is the item you must remember, is on the right. Your task is to study the item pairs as they are presented individually during the study phase. You should recall out-loud which response was paired with it previously. The responses are actually three consonant letters put together in a particular order. That is, there are no vowels in the responses so you will not see "a", "e", "i", "o", or "u" in any of the response items. When you study the responses on each study trial be aware of the order of the letters for each response. Then on each test trial be sure to try to recall the letters of each response in a left-to-right fashion, as though you were reading. You will have 2 seconds per stimulus or cue item to respond out loud with the response item. If you cannot recall all three letters, recall as many as you can on each trial. It is a fairly difficult task, however, so do not get discouraged.

Before each study trial, you will see two slides with asterisks on them. The first will indicate a test trial has ended and the second that a study trial will begin on the next slide. Between the study and test phases, there will be one asterisk slide to indicate a test trial. We will continue cycling through study and test trials until I turn off the slide projector. The order of the pairs will change on each trial, but the particular items will not change.

Remember to respond out loud and to be alert for the beginning of test or study trials after the asterisk slides. After the first study trial, you should begin responding on the test trial. Do you have any questions?

Show and explain practice list.

PRACTICE LIST - EXPERIMENT 1

DOG	-	TREE
HOUSE	-	CUP
PENCIL	-	SPOON
BOOK	-	ARM

* *

HOUSE

BOOK

DOG

PENCIL

RECALL INSTRUCTIONS: EXPERIMENT 1

DO NOT OPEN PAMPHLET UNTIL TOLD TO DO SO

This test pamphlet contains 16 sheets of paper with a single letter and 2 blanks on each page. The letter represents the first letter of one of the response units which you learned previously. Your job is to provide the two missing consonants so that the 3 letter response items you learned earlier will be reproduced. Again, the order of the consonants is important so be aware of what order you write the letters. You will have approximately 3 minutes to complete the test, but actually it is a paced task. Every 10 seconds I will advise you to turn the page. If you complete that response before the 10 seconds has elapsed, DO NOT TURN THE PAGE, WAIT UNTIL I TELL YOU TO DO SO. Likewise, if you have not completed the response and the 10 seconds has elapsed, you must turn the page. Once you have turned the page, you may not return to it.

Do you have any questions?

BEGIN

CUED RECALL: EXPERIMENT 1

Order of Cue Letters

Cue	Correct	Response
M	H	F
L	J	F
J	T	Q
F	C	Q
D	Q	H
G	Z	K
S	G	J
Z	P	B
W	B	N
K	F	X
P	Z	W
R	B	M
T	J	F
C	Q	Z
H	F	M
Q	L	B

APPENDIX B

MATERIALS FOR EXPERIMENT 2

TEST LIST: EXPERIMENT 2

LIST L

EONS	SPANGLED
TENURE	AXIL
SURTAX	BUFFOON
BALE	SPOUT
PESTLE	MOTE
APEX	SEQUEL
OHMS	REVERY
ETHER	CHAMOIS
ARBOR	LETTERHEAD
CURDS	LOON
MOUSSE	SQUIB
LYRE	TRAWL
PERRY	BEECH
LATHER	MAIZE
SEER	SILOS
BERTH	FROCK
PLACARD	LYNX
SALVE	MAGNATE
GILT	PIDGIN
GAUNTLET	BRAMBLE
BRISKET	LICHEN
ENVOYS	SANCTITY
SINE	FRAYS
EWE	RAMROD
AXIOM	SANDER

TEST LIST: EXPERIMENT 2

List H

DAGGER	STRING
WIG	BASEMENT
CENT	DENTIST
BLADE	TABLE
MISSILE	KNOB
BEE	HUT
LUNG	ROD
TRASH	COFFIN
BEETLE	SHEEP
CRUCIFY	HOG
LUMBER	TON
HURRICANE	WALL
METAL	GARDENIA
GRAVE	INK
SKUNK	SLUSH
CANNON	EGG
NEEDLE	HOSTAGE
SEAT	SLIPPER
FOG	MORGUE
DITCH	CAVE
CEILING	HAZE
CUP	SHARK
SOLDIER	DOLL
DESK	QUART
BEGGAR	PLATE

ACQUISITION INSTRUCTIONS: EXPERIMENT 2

This is a study in learning processes. For the first of your tasks, I am going to show you a list of 20 pairs of items, one pair at a time, at a 2 second pace for each pair on the screen in front of you. The pairs are arranged so that the item on the left is called the "stimulus" and is a C-V-C trigram. That is, the item on the left consists of a consonant-a vowel-and another consonant, in that order. For example, T-A-X is a C-V-C trigram. The item on the right of each pair is an actual word and is called a "response".

You will see each pair only once. After you've seen all of the pairs, we will go to another room while I prepare for the next task in your series of tasks. Do you have any questions?

RECOGNITION INSTRUCTIONS: EXPERIMENT 2

You are now going to participate in a recognition test. On the screen in front of you, I am going to show you a list of words, some of which were <u>response</u> items on the list which you saw earlier and some of which you have not seen in this experiment before. As each word is presented individually, your job is to determine whether or not that word was on the previous list. If it was an old item, push the button on your right (or left). If it is a new item, that is, if you have not seen the item before, push the button on your left (or right) using the index finger of your preferred hand. You will have 2 seconds per word to respond before the slide automatically advances. Within this 2 second period, accuracy is more important than speed. However, speed or reaction time is also being measured so respond as accurately, but quickly, as you can. The list will be preceeded by an asterisk slide. When you see the asterisk slide, push the button to the right. You must respond to every slide even if you are unsure. Do you have any questions?

APPENDIX C

ANALYSES OF VARIANCE

EXPERIMENT 1

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: TRIALS TO CRITERION

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	5	2634.7777	526.9555
ERROR	66	663.6666	10.0555
CORRECTED TOTAL	71	3298.4444	
MODEL F =	52.40		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.7987	30.8535	3.1710	10.2777

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A LEVEL OF LEARNING	2	2414.7777	120.07	0.0001
B ACQUISITION CONTEXT	1	150.2222	14.94	0.0003
A*B	2	69.7777	3.47	0.0369

MAIN EFFECT MEANS

DOL		ACQUISITION CONTEXT
HIGH (16/16)	18.25	ROOM A = 8.83
MODERATE (8/16)	7.92	ROOM B = 11.72
LOW (4/16)	4.67	

INTERACTION MEANS

DOL	ROOM A	ROOM B
HIGH	15.42	21.08
MODERATE	7.25	8.58
LOW	3.83	5.50

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF CORRECT COMPLETIONS, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	708.4861	64.4078
ERROR	60	347.1666	5.7861
CORRECTED TOTAL	71	1055.6527	
MODEL F =	11.13		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.6711	36.0065	2.4054	6.6805

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A LEVEL OF LEARNING	2	669.3611	57.84	0.0001
B ACQUISITION CONTEXT	1	1.1250	0.19	0.6608
C TEST CONTEXT	1	3.1250	0.54	0.4653
A*B	2	14.2500	1.23	0.2992
A*C	2	1.0833	0.09	0.9108
B*C	1	13.3472	2.31	0.1341
A*B*C	2	6.1944	0.54	0.5883

MAIN EFFECTS FOR DOL

HIGH = 10.71 MODERATE = 6.00

LOW = 3.33

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF SECOND POSITION ONLY CORRECT, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	18.7083	1.7007
ERROR	60	69.1666	1.1527
CORRECTED TOTAL	71	87.8750	
MODEL F =	1.48		PR > F = 0.1644

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2128	95.4378	1.0736	1.1250

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	7.0000	3.04	0.0555
B	1	0.6805	0.59	0.4453
C	1	5.0138	4.35	0.0413
A*B	2	1.4444	0.63	0.5379
A*C	2	2.7777	1.20	0.3069
B*C	1	0.0138	0.01	0.9130
A*B*C	2	1.7777	0.77	0.4670

MAIN EFFECT MEANS FOR DOL

HIGH = .79 MODERATE = 1.04

LOW = 1.54

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF THIRD POSITION ONLY CORRECT, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	12.1111	1.1010
ERROR	60	60.3333	1.0055
CORRECTED TOTAL	71	72.4444	
MODEL F =	1.09		PR > F = 0.3809

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1671	138.8456	1.0027	0.7222

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	8.7777	4.36	0.0170
B	1	0.0555	0.06	0.8150
C	1	0.0555	0.06	0.8150
A*B	2	2.7777	1.38	0.2591
A*C	2	0.1111	0.06	0.9463
B*C	1	0.2222	0.22	0.6400
A*B*C	2	0.1111	0.06	0.9463

MAIN EFFECT MEANS FOR DOL

HIGH = .25 MODERATE = .83

LOW = 1.08

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF INVERSIONS, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	35.8194	3.2563
ERROR	60	66.8333	1.1138
CORRECTED TOTAL	71	102.6527	
MODEL F =	2.92		PR > F = 0.0038

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3489	89.3994	1.0554	1.1805

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	13.3611	6.00	0.0042
B	1	0.0138	0.01	0.9115
C	1	6.1250	5.50	0.0224
A*B	2	0.0277	0.01	0.9876
A*C	2	15.0833	6.77	0.0022
B*C	1	0.6805	0.61	0.4375
A*B*C	2	0.5277	0.24	0.7898

MAIN EFFECT MEANS FOR DOL

HIGH = .58 MODERATE = 1.58

LOW = 1.38

INTERACTION MEANS

TEST ROOM

DOL	SAME	DIFFERENT
HIGH	.42	.75
MODERATE	2.50	.67
LOW	1.50	1.25

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF OMISSIONS, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	174.0000	15.8181
ERROR	60	376.0000	6.2666
CORRECTED TOTAL	71	550.0000	
MODEL F =	2.52		PR > F = 0.0110

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3163	93.8749	2.5033	2.6666

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	30.3333	2.42	0.0975
B	1	2.0000	0.32	0.5742
C	1	8.0000	1.28	0.2630
A*B	2	4.3333	0.35	0.7091
A*C	2	82.3333	6.57	0.0026
B*C	1	8.0000	1.28	0.2630
A*B*C	2	39.0000	3.11	0.0518

INTERACTION MEANS

TEST CONTEXT

DOL	SAME	DIFFERENT
HIGH	3.17	1.33
MODERATE	1.00	3.33
LOW	4.83	2.33

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF

INCORRECTLY RECALLED RESPONSES, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	468.6111	42.6010
ERROR	60	362.6666	6.0444
CORRECTED TOTAL	71	831.2777	
MODEL F	7.05		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.5637	51.1605	2.4585	4.8055

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	286.3611	23.69	0.0001
B	1	3.5555	0.59	0.4461
C	1	0.8888	0.15	0.7027
A*B	2	35.0277	2.90	0.0629
A*C	2	50.3611	4.17	0.0202
B*C	1	34.7222	5.74	0.0197
A*B*C	2	57.6944	4.77	0.0119

MAIN EFFECT MEANS FOR DOL

HIGH = 2.00 MODERATE = 5.95

LOW = 6.48

INTERACTION MEANS

	TEST ROOM	
DOL	SAME	DIFFERENT
HIGH	1.58	2.42
MODERATE	7.25	4.67
LOW	5.92	7.00

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER CORRECT COMPLETIONS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	812.4861	73.8623
ERROR	60	270.1666	4.5027
CORRECTED TOTAL	71	1082.6527	
MODEL F	16.40		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.7504	31.1165	2.1219	6.8194

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	781.8611	86.82	0.0001
B	1	3.1250	0.69	0.4081
D	1	6.1250	1.36	0.2481
A*B	2	11.0833	1.23	0.2993
A*D	2	6.5833	0.73	0.4857
B*D	1	0.0138	0.00	0.9559
A*B*D	2	3.6944	0.41	0.6653

MAIN EFFECT MEANS FOR DOL

HIGH = 11.04 MODERATE = 6.42

LOW = 3.00

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF SECOND POSITION ONLY CORRECT, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	23.1527	2.1047
ERROR	60	49.8333	0.8305
CORRECTED TOTAL	71	72.9861	
MODEL F =	2.53		PR > F = 0.0107

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3172	73.7270	0.9113	1.2361

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	13.3611	8.04	0.0008
B	1	1.6805	2.02	0.1601
D	1	1.1250	1.35	0.2491
A*B	2	0.3611	0.22	0.8052
A*D	2	1.7500	1.05	0.3551
B*D	1	3.1250	3.76	0.0571
A*B*D	2	1.7500	1.05	0.3551

MAIN EFFECT MEANS FOR DOL

HIGH = .67　　MODERATE = 1.30

LOW = 1.71

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF THIRD POSITION ONLY CORRECT, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	8.2777	0.7525
ERROR	60	25.6666	0.4277
CORRECTED TOTAL	71	33.9444	
MODEL F =	1.76		PR > F = 0.0818

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2438	138.5041	0.6540	0.4722

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	3.4444	4.03	0.0229
B	1	0.2222	0.52	0.4739
D	1	0.0000	0.00	1.0000
A*B	2	0.7777	0.91	0.4084
A*D	2	3.0000	3.51	0.0363
B*D	1	0.0555	0.13	0.7198
A*B*D	2	0.7777	0.91	0.4084

MAIN EFFECT MEANS FOR DOL

HIGH = .17 MODERATE = .58

LOW = .67

INTERACTION MEANS
TEST 1-2 CONDITION

DOL	S-S	D-S
HIGH	.17	.17
MODERATE	.83	.33
LOW	.42	.91

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF INVERSIONS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	38.9444	3.5404
ERROR	60	74.3333	1.2388
CORRECTED TOTAL	71	113.2777	
MODEL F =	2.86		PR > F = 0.0045

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3437	93.1859	1.1130	1.1944

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	19.5277	7.88	0.0009
B	1	0.2222	0.18	0.6734
D	1	0.5000	0.40	0.5277
A*B	2	2.6944	1.09	0.3436
A*D	2	7.7500	3.13	0.0510
B*D	1	2.0000	1.61	0.2088
A*B*D	2	6.2500	2.52	0.0887

MAIN EFFECT MEANS FOR DOL

HIGH = .46 MODERATE = 1.54

LOW = 1.58

INTERACTION MEANS

TEST 1-2 CONDITION

DOL	S-S	D-S
HIGH	.25	.67
MODERATE	2.08	1.00
LOW	1.50	1.67

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF OMISSIONS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	251.4444	22.8585
ERROR	60	311.0000	5.1833
CORRECTED TOTAL	71	562.4444	
MODEL F =	4.41		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.4470	83.6336	2.2766	2.7222

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	37.5277	3.62	0.0328
B	1	0.0000	0.00	1.0000
D	1	12.5000	2.41	0.1257
A*B	2	0.5833	0.06	0.9453
A*D	2	110.2500	10.64	0.0001
B*D	1	24.5000	4.73	0.0337
A*B*D	2	66.0833	6.37	0.0031

MAIN EFFECT MEANS FOR DOL

HIGH = 2.46 MODERATE = 2.00

LOW = 3.71

INTERACTION MEANS

TEST 1-2 CONDITION

DOL	S-S	D-S
HIGH	3.75	1.17
MODERATE	.67	3.33
LOW	5.00	2.42

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: NUMBER OF

INCORRECTLY RECALLED RESPONSES, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	500.1666	45.4696
ERROR	60	353.3333	5.8888
CORRECTED TOTAL	71	853.5000	
MODEL F =	7.72		PR > F = 0.0001

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.5860	51.0885	2.4267	4.7500

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	361.0000	30.65	0.0001
B	1	0.8888	0.15	0.6990
D	1	0.0000	0.00	1.0000
A*B	2	4.1111	0.35	0.7068
A*D	2	56.3333	4.78	0.0118
B*D	1	12.5000	2.12	0.1503
A*B*D	2	65.3333	5.55	0.0062

MAIN EFFECT MEANS FOR DOL

HIGH = 1.67 MODERATE = 5.67

LOW = 6.92

INTERACTION MEANS

TEST 1-2 CONDITION

DOL	S-S	D-S
HIGH	1.00	2.33
MODERATE	6.91	4.41
LOW	6.33	7.50

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF CORRECT RESPONSES, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	32.6111	2.9646
ERROR	60	198.0000	3.3000
CORRECTED TOTAL	71	230.6111	
MODEL F =	0.90		PR > F = 0.5478

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1414	1307.9450	1.8165	-0.1388

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	8.1111	1.23	0.29999
B	1	0.5000	0.15	0.6985
D	1	0.5000	0.15	0.6985
A*B	2	6.3333	0.96	0.3888
A*D	2	2.3333	0.35	0.7037
B*D	1	12.5000	3.79	0.0563
A*B*D	2	2.3333	0.35	0.7037

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF SECOND POSITION ONLY CORRECT, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	16.4444	1.4949
ERROR	60	84.6666	1.4111
CORRECTED TOTAL	71	101.1111	
MODEL F =	1.06		PR > F = 0.4086

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1626	1069.1118	1.1879	-0.1111

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	2.1944	0.78	0.4641
B	1	0.2222	0.16	0.6929
D	1	1.3888	0.98	0.3251
A*B	2	2.5277	0.90	0.4137
A*D	2	1.1944	0.42	0.6569
B*D	1	2.7222	1.93	0.1700
A*B*D	2	6.1944	2.19	0.1202

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF THIRD POSITION ONLY CORRECT, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	9.5000	0.8636
ERROR	60	38.0000	0.6333
CORRECTED TOTAL	71	47.5000	
MODEL F =	1.36		PR > F = 0.2134

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2000	318.3290	0.7958	0.2500

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	1.3333	1.05	0.3554
B	1	0.0555	0.09	0.7681
D	1	0.0555	0.09	0.7681
A*B	2	4.1111	3.25	0.0459
A*D	2	2.1111	1.67	0.1975
B*D	1	0.5000	0.79	0.3778
A*B*D	2	1.3333	1.05	0.3554

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF INVERSIONS, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	13.1527	1.1957
ERROR	60	99.8333	1.6638
CORRECTED TOTAL	71	112.9861	
MODEL F =	0.72		PR > F = 0.7171

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1164	9287.4108	1.2899	-0.0138

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	1.4444	0.43	0.6499
B	1	0.3472	0.21	0.6495
D	1	3.1250	1.88	0.1757
A*B	2	3.1111	0.93	0.3983
A*D	2	1.3333	0.40	0.6717
B*D	1	0.3472	0.21	0.6495
A*B*D	2	3.4444	1.04	0.3615

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF OMISSIONS, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	23.7777	2.1616
ERROR	60	178.0000	2.9666
CORRECTED TOTAL	71	201.7777	
MODEL F =	0.73		PR > F = 0.7077

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1178	3100.3226	1.7224	-0.0555

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	1.8611	0.31	0.7320
B	1	2.0000	0.67	0.4149
D	1	0.5000	0.17	0.6829
A*B	2	7.7500	1.31	0.2784
A*D	2	3.5833	0.60	0.5499
B*D	1	4.5000	1.52	0.2229
A*B*D	2	3.5833	0.60	0.5499

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCE IN

NUMBER OF INCORRECTLY RECALLED RESPONSES, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	11	37.4444	3.4040
ERROR	60	210.3333	3.5055
CORRECTED TOTAL	71	247.7777	
MODEL F =	0.97		PR > F = 0.4825

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1511	3370.1632	1.8723	0.0555

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	2	9.5277	1.36	0.2647
B	1	0.8888	0.25	0.6164
D	1	0.8888	0.25	0.6164
A*B	2	17.1944	2.45	0.0947
A*D	2	0.6944	0.10	0.9058
B*D	1	5.5555	1.58	0.2129
A*B*D	2	2.6944	0.38	0.6826

EXPERIMENT 2

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF HITS-TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.3141	0.0209
ERROR	32	1.0700	0.0334
CORRECTED TOTAL	47	1.3841	
MODEL F =	0.63		PR > F = 0.8313

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2269	27.9530	0.1828	0.6541

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A R-item meaningfulness	1	0.0002	0.01	0.9376
B-Acquisition context	1	0.0033	0.10	0.7543
C-Test context	1	0.0033	0.10	0.7543
E-Response hand	1	0.0352	1.05	0.3125
A*B	1	0.0018	0.06	0.8143
A*C	1	0.0102	0.31	0.5844
A*E	1	0.0033	0.10	0.7543
B*C	1	0.0008	0.02	0.8756
B*E	1	0.0168	0.50	0.4826
C*E	1	0.0002	0.01	0.9376
A*B*C	1	0.0468	1.40	0.2451
A*B*E	1	0.0408	1.22	0.2774
A*C*E	1	0.0408	1.22	0.2774
B*C*E	1	0.1102	3.30	0.0788
A*B*C*E	1	0.0000	0.00	1.0000

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF CORRECT REJECTIONS-TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.9105	0.0607
ERROR	32	1.3725	0.0428
CORRECTED TOTAL	47	2.2831	
MODEL F =	1.42		PR > F = 0.1993

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3988	28.1619	0.2071	0.7354

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0389	0.91	0.3480
B	1	0.0511	1.19	0.2831
C	1	0.0052	0.12	0.7298
E	1	0.2361	5.51	0.0253
A*B	1	0.0000	0.00	0.9816
A*C	1	0.1102	2.57	0.1188
A*E	1	0.0005	0.01	0.9083
B*C	1	0.3616	8.43	0.0066
B*E	1	0.0052	0.12	0.7298
C*E	1	0.0194	0.45	0.5053
A*B*C	1	0.0002	0.00	0.9449
A*B*E	1	0.0602	1.40	0.2448
A*C*E	1	0.0168	0.39	0.5350
B*C*E	1	0.0018	0.04	0.8357
A*B*C*E	1	0.0028	0.07	0.7999

CELL MEANS: SIGNIFICANT INTERACTION
ACQUISITION CONTEXT

TEST CONTEXT	ROOM A	ROOM B
SAME	.84	.61
DIFFERENT	.69	.80

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF FALSE POSITIVES-TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.8918	0.0594
ERROR	32	1.3503	0.0421
CORRECTED TOTAL	47	2.2421	
MODEL F =	1.41		PR > F = 0.2021

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3977	78.4644	0.2054	0.2618

SOURCE	DF	ANOVA SS	F VALUE	PF > F
A	1	0.0352	0.83	0.3679
B	1	0.0511	1.21	0.2792
C	1	0.0052	0.12	0.7277
E	1	0.2268	5.38	0.0270
A*B	1	0.0000	0.00	0.9815
A*C	1	0.1039	2.46	0.1264
A*E	1	0.0005	0.01	0.9075
B*C	1	0.3616	8.57	0.0062
B*E	1	0.0039	0.09	0.7627
C*E	1	0.0222	0.53	0.4731
B*B*C	1	0.0000	0.00	0.9815
A*B*E	1	0.0602	1.43	0.2411
A*C*E	1	0.0168	0.40	0.5316
B*C*E	1	0.0028	0.07	0.7983
A*B*C*E	1	0.0011	0.03	0.8708

CELL MEANS: SIGNIFICANT INTERACTION
ACQUISITION CONTEXT

TEST CONTEXT	ROOM A	ROOM B
SAME	.15	.39
DIFFERENT	.31	.20

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF MISSES-TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.3131	0.0208
ERROR	32	1.0950	0.0342
CORRECTED TOTAL	47	1.4081	
MODEL F =	0.61		PR > F = 0.8448

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2223	53.8133	0.1849	0.3437

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0002	0.01	0.9383
B	1	0.0052	0.15	0.6990
C	1	0.0033	0.10	0.7570
E	1	0.0352	1.03	0.3180
A*B	1	0.0018	0.05	0.8164
A*C	1	0.0133	0.39	0.5369
A*E	1	0.0052	0.15	0.6990
B*C	1	0.0008	0.02	0.8770
B*E	1	0.0168	0.49	0.4876
C*E	1	0.0008	0.02	0.8770
A*B*C	1	0.0533	1.56	0.2209
A*B*E	1	0.0352	1.03	0.3180
A*C*E	1	0.0408	1.19	0.2828
B*C*E	1	0.1008	2.95	0.0957
A*B*C*E	1	0.0000	0.00	1.0000

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIME, HITS, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.4419	0.0294
ERROR	32	0.5678	0.0177
CORRECTED TOTAL	47	1.0097	
MODEL F =	1.66		PR > F = 0.1119

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.4377	9.0437	0.1332	1.4729

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.1064	6.00	0.0200
B	1	0.0014	0.08	0.7800
C	1	0.0752	4.24	0.0477
E	1	0.0468	2.64	0.1139
A*B	1	0.0330	1.86	0.1817
A*C	1	0.0006	0.04	0.8466
A*E	1	0.0126	0.71	0.4043
B*C	1	0.0720	4.06	0.0523
B*E	1	0.0102	0.58	0.4537
C*E	1	0.0002	0.01	0.9144
A*B*C	1	0.0290	1.63	0.2102
A*B*E	1	0.0310	1.75	0.1956
A*C*E	1	0.0014	0.08	0.7800
B*C*E	1	0.0090	0.51	0.4797
A*B*C*E	1	0.0126	0.71	0.4043

MAIN EFFECT MEANS FOR RESPONSE MEANINGFULNESS

HIGH = 1.52 LOW = 1.43

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIME, CORRECT REJECTIONS, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.6267	0.0417
ERROR	32	0.8368	0.0261
CORRECTED TOTAL	47	1.4636	
MODEL F =	1.60		PR > F = 0.1300

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.4282	10.1855	0.1617	1.5877

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.1036	3.96	0.0552
B	1	0.0000	0.00	0.9929
C	1	0.0682	2.61	0.1160
E	1	0.0063	0.24	0.6269
A*B	1	0.0105	0.40	0.5308
A*C	1	0.0981	3.75	0.0616
A*E	1	0.0526	2.01	0.1655
B*C	1	0.0305	1.17	0.2882
B*E	1	0.0526	2.01	0.1655
C*E	1	0.0143	0.55	0.4642
A*B*C	1	0.1131	4.32	0.0457
A*B*E	1	0.0017	0.07	0.7974
A*C*E	1	0.0003	0.01	0.9084
B*C*E	1	0.0093	0.36	0.5540
A*B*C*E	1	0.0652	2.50	0.1240

MAIN EFFECT MEANS FOR RESPONSE MEANINGFULNESS

HIGH = 1.54 LOW = 1.63

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIMES, FALSE POSITIVES, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.8885	0.0592
ERROR	32	1.7583	0.0549
CORRECTED TOTAL	47	2.6468	
MODEL F =	1.08		PR > F = 0.4120
R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3356	14.7737	0.2344	1.5866

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.2700	4.91	0.0339
B	1	0.0261	0.48	0.4954
C	1	0.0168	0.31	0.5833
E	1	0.0494	0.90	0.3501
A*B	1	0.0133	0.24	0.6257
A*C	1	0.0154	0.28	0.6001
A*E	1	0.0114	0.21	0.6517
B*C	1	0.0102	0.19	0.6693
B*E	1	0.0200	0.36	0.5505
C*E	1	0.1365	2.48	0.1248
A*B*C	1	0.0602	1.10	0.3030
A*B*E	1	0.1386	2.52	0.1220
A*C*E	1	0.0432	0.79	0.3819
B*C*E	1	0.0408	0.74	0.3951
A*B*C*E	1	0.0363	0.66	0.4223

MAIN EFFECT MEANS FOR RESPONSE MEANINGFULNESS

HIGH = 1.66 LOW = 1.51

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\overline{X}$ REACTION TIMES, MISSES, TEST 1

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.6741	0.0449
ERROR	32	1.5032	0.0469
CORRECTED TOTAL	47	2.1773	
MODEL F =	0.96		PR > F = 0.5179

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3096	13.5217	0.2167	1.6029

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0114	0.24	0.6255
B	1	0.0154	0.33	0.5708
C	1	0.0602	1.28	0.2660
E	1	0.0300	0.64	0.4301
A*B	1	0.0520	1.11	0.3006
A*C	1	0.0000	0.00	0.9895
A*E	1	0.0280	0.60	0.4455
B*C	1	0.1026	2.19	0.1491
B*E	1	0.1408	3.00	0.0930
C*E	1	0.0005	0.01	0.9158
A*B*C	1	0.0884	1.88	0.1797
A*B*E	1	0.0120	0.26	0.6162
A*C*E	1	0.0800	1.70	0.2011
B*C*E	1	0.0300	0.64	0.4301
A*B*C*E	1	0.0225	0.48	0.4936

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF HITS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.2616	0.0174
ERROR	32	0.0133	0.0316
CORRECTED TOTAL	47	1.2749	
MODEL F =	0.55		PR > F = 0.8898

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2051	30.0234	0.1779	0.5927

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0013	0.04	0.8406
B	1	0.0275	0.87	0.3579
D	1	0.0004	0.01	0.9039
E	1	0.0000	0.00	0.9679
A*B	1	0.0004	0.01	0.9039
A*D	1	0.0188	0.59	0.4466
A*E	1	0.0150	0.48	0.4955
B*D	1	0.0379	1.20	0.2817
B*E	1	0.0025	0.08	0.7783
D*E	1	0.0275	0.87	0.3579
A*B*D	1	0.0013	0.04	0.8406
A*B*E	1	0.0567	1.79	0.1902
A*D*E	1	0.0379	1.20	0.2817
B*D*E	1	0.0275	0.87	0.3579
A*B*D*E	1	0.0063	0.20	0.6585

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF CORRECT REJECTIONS-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	1.1810	0.0787
ERROR	32	2.0200	0.0631
CORRECTED TOTAL	47	3.2010	
MODEL F =	1.25		PR > F = 0.2899

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3689	37.7263	0.2512	0.6659

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A R-item meaningfulness	1	0.1233	1.95	0.1718
B Acquisition context	1	0.4344	6.88	0.0132
D Test context	1	0.0083	0.13	0.7184
E Response hand	1	0.0316	0.50	0.4837
A*B	1	0.0002	0.00	0.9545
A*D	1	0.2455	3.89	0.0573
A*E	1	0.1372	2.17	0.1501
B*D	1	0.1102	1.75	0.1958
B*E	1	0.0168	0.27	0.6087
D*E	1	0.0066	0.11	0.7469
A*B*D	1	0.0028	0.04	0.8345
A*B*E	1	0.0389	0.62	0.4382
A*D*E	1	0.0083	0.13	0.7184
B*D*E	1	0.0018	0.03	0.8643
A*B*D*E	1	0.0144	0.23	0.6354

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF FALSE POSITIVES, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	1.1957	0.0797
ERROR	32	2.0562	0.0642
CORRECTED TOTAL	47	3.2520	
MODEL F =	1.24		PR > F = 0.2942

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3676	76.5265	0.2534	0.3312

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.1233	1.92	0.1755
B	1	0.4472	6.96	0.0128
D	1	0.0083	0.13	0.7208
E	1	0.0316	0.49	0.4876
A*B	1	0.0005	0.01	0.9250
A*D	1	0.2455	3.82	0.0594
A*E	1	0.1233	1.92	0.1755
B*D	1	0.1166	1.82	0.1873
B*E	1	0.0194	0.30	0.5859
D*E	1	0.0066	0.10	0.7491
A*B*D	1	0.0018	0.03	0.8654
A*B*E	1	0.0428	0.67	0.4205
A*D*E	1	0.0083	0.13	0.7208
B*D*E	1	0.0028	0.04	0.8359
A*B*D*E	1	0.0168	0.26	0.6119

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: PROPORTION OF MISSES, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.2581	0.0172
ERROR	32	1.0200	0.0318
CORRECTED TOTAL	47	1.2781	
MODEL F =	0.54		PR > F = 0.8973

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2019	43.9473	0.1785	0.4062

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0008	0.03	0.8726
B	1	0.0300	0.94	0.3393
D	1	0.0008	0.03	0.8726
E	1	0.0000	0.00	1.0000
A*B	1	0.0002	0.01	0.9361
A*D	1	0.0168	0.53	0.4721
A*E	1	0.0168	0.53	0.4721
B*D	1	0.0352	1.10	0.3011
B*E	1	0.0018	0.06	0.8099
D*E	1	0.0252	0.79	0.3805
A*B*D	1	0.0008	0.03	0.8726
A*B*E	1	0.0533	1.67	0.2051
A*D*E	1	0.0408	1.28	0.2661
B*D*E	1	0.0300	0.94	0.3393
A*B*D*E	1	0.0052	0.16	0.6887

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIMES, HITS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.2041	0.0136
ERROR	32	0.8154	0.0254
CORRECTED TOTAL	47	1.0196	
MODEL F =	0.53		PR > F = 0.9012

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2002	10.7937	0.1596	1.4789

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0031	0.12	0.7267
B	1	0.0001	0.01	0.9357
D	1	0.0077	0.30	0.5851
E	1	0.0123	0.48	0.4913
A*B	1	0.0058	0.23	0.6350
A*D	1	0.0046	0.18	0.6737
A*E	1	0.0006	0.02	0.8788
B*D	1	0.0117	0.46	0.5026
B*E	1	0.0035	0.14	0.7133
D*E	1	0.1017	3.99	0.0542
A*B*D	1	0.0067	0.27	0.6098
A*B*E	1	0.0009	0.04	0.8506
A*D*E	1	0.0130	0.51	0.4802
B*D*E	1	0.0054	0.21	0.6478
A*B*D*E	1	0.0266	1.04	0.3146

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIMES, CORRECT REJECTIONS, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.3643	0.0242
ERROR	32	0.8134	0.0254
CORRECTED TOTAL	47	1.1777	
MODEL F =	0.96		PR > F = 0.5190

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3093	10.7861	0.1594	1.4781

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0143	0.56	0.4579
B	1	0.0028	0.11	0.7398
D	1	0.0015	0.06	0.8085
E	1	0.0275	1.08	0.3056
A*B	1	0.2041	8.03	0.0079
A*D	1	0.0002	0.01	0.9213
A*E	1	0.0038	0.15	0.6996
B*D	1	0.0058	0.23	0.6346
B*E	1	0.0105	0.41	0.5249
D*E	1	0.0093	0.37	0.5484
A*B*D	1	0.0450	1.77	0.1927
A*B*E	1	0.0063	0.25	0.6219
A*D*E	1	0.0111	0.44	0.5134
B*D*E	1	0.0204	0.80	0.3768
A*B*D*E	1	0.0013	0.05	0.8224

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\overline{X}$ REACTION TIMES, FALSE POSITIVES, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.5592	0.0372
ERROR	32	1.7719	0.0553
CORRECTED TOTAL	47	2.3311	
MODEL F =	0.67		PR > F = 0.7903

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2399	15.3842	0.2353	1.5295

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0120	0.22	0.6443
B	1	0.0420	0.76	0.3902
D	1	0.0126	0.23	0.6356
E	1	0.0574	1.04	0.3162
A*B	1	0.1496	2.70	0.1100
A*D	1	0.0016	0.03	0.8647
A*E	1	0.0120	0.22	0.6443
B*D	1	0.1180	2.13	0.1541
B*E	1	0.0396	0.72	0.4036
D*E	1	0.0168	0.30	0.5848
A*B*D	1	0.0456	0.82	0.3708
A*B*E	1	0.0012	0.02	0.8839
A*D*E	1	0.0000	0.00	1.000
B*D*E	1	0.0184	0.33	0.5683
A*B*D*E	1	0.0320	0.58	0.4525

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: $\bar{X}$ REACTION TIMES, MISSES, TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.4934	0.0328
ERROR	32	1.6024	0.0500
CORRECTED TOTAL	47	2.0958	
MODEL F =	0.66		PR > F = 0.8050

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2354	14.5252	0.2237	1.5406

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0117	0.23	0.6319
B	1	0.0204	0.41	0.5277
D	1	0.0157	0.31	0.5786
E	1	0.0072	0.14	0.7061
A*B	1	0.0963	1.92	0.1751
A*D	1	0.1150	2.30	0.1394
A*E	1	0.0000	0.00	0.9949
B*D	1	0.0020	0.04	0.8428
B*E	1	0.0111	0.22	0.6409
D*E	1	0.0157	0.31	0.5786
A*B*D	1	0.0760	1.52	0.2269
A*B*E	1	0.0295	0.59	0.4484
A*D*E	1	0.0825	1.65	0.2085
B*D*E	1	0.0099	0.20	0.6593
A*B*D*E	1	0.0001	0.00	0.9643

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN PROPORTIONS, HITS, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.2011	0.0134
ERROR	32	1.3100	0.0409
CORRECTED TOTAL	47	1.5111	
MODEL F =	0.33		PR > F = 0.9875

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1331	329.2152	0.2023	0.0614

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0025	0.06	0.8044
B	1	0.0117	0.29	0.5963
D	1	0.0013	0.03	0.8596
E	1	0.0325	0.80	0.3792
A*B	1	0.0004	0.01	0.9155
A*D	1	0.0013	0.03	0.8596
A*E	1	0.0042	0.10	0.7503
B*D	1	0.0500	1.22	0.2771
B*E	1	0.0063	0.15	0.6974
D*E	1	0.0229	0.56	0.4593
A*B*D	1	0.0325	0.80	0.3792
A*B*E	1	0.0013	0.03	0.8596
A*D*E	1	0.0000	0.00	0.9718
B*D*E	1	0.0275	0.67	0.4181
A*B*D*E	1	0.0063	0.15	0.6974

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN PROPORTIONS,

CORRECT REJECTIONS, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.7248	0.0483
ERROR	32	1.9170	0.0599
CORRECTED TOTAL	47	2.6418	
MODEL F =	0.81		PR > F = 0.6628

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2743	352.4543	0.2447	0.0694

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0237	0.40	0.5338
B	1	0.1875	3.13	0.0864
D	1	0.0267	0.45	0.5087
E	1	0.0948	1.58	0.2175
A*B	1	0.0000	0.00	0.9689
A*D	1	0.0267	0.45	0.5087
A*E	1	0.1200	2.00	0.1666
B*D	1	0.0725	1.21	0.2792
B*E	1	0.0408	0.68	0.4151
D*E	1	0.0489	0.82	0.3726
A*B*D	1	0.0014	0.02	0.8760
A*B*E	1	0.0023	0.04	0.8454
A*D*E	1	0.0489	0.82	0.3726
B*D*E	1	0.0000	0.00	1.0000
A*B*D*E	1	0.0300	0.50	0.4843

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN PROPORTIONS,

FALSE POSITIVES, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.7166	0.0477
ERROR	32	1.9562	0.0611
CORRECTED TOTAL	47	2.6729	
MODEL F =	0.78		PR > F = 0.6874

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2681	356.0449	0.2472	-0.0694

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0267	0.44	0.5130
B	1	0.1959	3.20	0.0829
D	1	0.0267	0.44	0.5130
E	1	0.0889	1.46	0.2365
A*B	1	0.0008	0.01	0.9078
A*D	1	0.0300	0.49	0.4887
A*E	1	0.1070	1.75	0.1951
B*D	1	0.0675	1.10	0.3012
B*E	1	0.0408	0.67	0.4198
D*E	1	0.0533	0.87	0.3573
A*B*D	1	0.0014	0.02	0.8773
A*B*E	1	0.0014	0.02	0.8773
A*D*E	1	0.0489	0.80	0.3774
B*D*E	1	0.0000	0.00	1.000
A*B*D*E	1	0.0267	0.44	0.5130

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN PROPORTIONS,

MISSES, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.1925	0.0128
ERROR	32	1.3550	0.0423
CORRECTED TOTAL	47	1.5475	
MODEL F =	0.30		PR > F = 0.9915

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.1243	329.2416	0.2057	-0.0625

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0018	0.04	0.8347
B	1	0.0102	0.24	0.6268
D	1	0.0008	0.02	0.8893
E	1	0.0352	0.83	0.3687
A*B	1	0.0008	0.02	0.8893
A*D	1	0.0002	0.00	0.9445
A*E	1	0.0033	0.08	0.7808
B*D	1	0.0468	1.11	0.3006
B*E	1	0.0075	0.18	0.6767
D*E	1	0.0168	0.40	0.5323
A*B*D	1	0.0408	0.96	0.3335
A*B*E	1	0.0018	0.04	0.8347
A*D*E	1	0.0000	0.00	1.0000
B*D*E	1	0.0208	0.49	0.4881
A*B*D*E	1	0.0052	0.12	0.7281

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN

REACTION TIMES ON HITS FROM TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.6186	0.0412
ERROR	32	1.3854	0.0432
CORRECTED TOTAL	47	2.0041	
MODEL F =	0.95		PR > F = 0.5217

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3087	3444.0250	0.2080	-0.0060

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0728	1.68	0.2038
B	1	0.0006	0.01	0.9069
D	1	0.1312	3.03	0.0913
E	1	0.0111	0.26	0.6161
A*B	1	0.0667	1.54	0.2234
A*D	1	0.0088	0.20	0.6551
A*E	1	0.0077	0.18	0.6750
B*D	1	0.1419	3.28	0.0796
B*E	1	0.0256	0.59	0.4470
D*E	1	0.0927	2.14	0.1530
A*B*D	1	0.0077	0.18	0.6750
A*B*E	1	0.0426	0.98	0.3287
A*D*E	1	0.0058	0.14	0.7156
B*D*E	1	0.0004	0.01	0.9178
A*B*D*E	1	0.0025	0.06	0.8097

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN

REACTION TIMES ON CORRECT REJECTIONS, TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	1.1083	0.0738
ERROR	32	1.3324	0.0416
CORRECTED TOTAL	47	2.4407	
MODEL F =	1.77		PR > F = 0.0849

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.4541	186.2078	0.2040	0.1095

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.1950	4.69	0.0380
B	1	0.0027	0.06	0.8006
D	1	0.0901	2.16	0.1510
E	1	0.0602	1.45	0.2380
A*B	1	0.3072	7.38	0.0106
A*D	1	0.1083	2.60	0.1166
A*E	1	0.0850	2.04	0.1627
B*D	1	0.0630	1.51	0.2274
B*E	1	0.0161	0.39	0.5380
D*E	1	0.0005	0.01	0.9106
A*B*D	1	0.0154	0.37	0.5473
A*B*E	1	0.0147	0.35	0.5566
A*D*E	1	0.0075	0.18	0.6741
B*D*E	1	0.0574	1.38	0.2490
A*B*D*E	1	0.0850	2.04	0.1627

MAIN EFFECT MEANS FOR RESPONSE MEANINGFULNESS

HIGH = .046 LOW = .173

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN

REACTION TIMES ON FALSE POSITIVES FROM TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	0.8820	0.0588
ERROR	32	2.1851	0.0682
CORRECTED TOTAL	47	3.0671	
MODEL F =	0.86		PR > F = 0.6092

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.2875	457.7777	0.2613	0.0570

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.1680	2.46	0.1266
B	1	0.0018	0.03	0.8694
D	1	0.0003	0.00	0.9476
E	1	0.0003	0.00	0.9476
A*B	1	0.0736	1.08	0.3069
A*D	1	0.0070	0.10	0.7508
A*E	1	0.0468	0.69	0.4135
B*D	1	0.0588	0.86	0.3604
B*E	1	0.0033	0.05	0.8265
D*E	1	0.2494	3.65	0.0650
A*B*D	1	0.0010	0.01	0.9040
A*B*E	1	0.1140	1.67	0.2054
A*D*E	1	0.0432	0.63	0.4322
B*D*E	1	0.1140	1.67	0.2054
A*B*D*E	1	0.0001	0.00	0.9650

ANALYSIS OF VARIANCE PROCEDURE

DEPENDENT VARIABLE: DIFFERENCES IN

REACTION TIMES ON MISSES FROM TEST 1-TEST 2

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE
MODEL	15	1.8009	0.1200
ERROR	32	2.7545	0.0860
CORRECTED TOTAL	47	4.5554	
MODEL F =	1.39		PR > F = 0.2088

R-SQUARE	C.V.	STD DEV	GRAND MEAN
0.3953	470.9980	0.2933	0.0622

SOURCE	DF	ANOVA SS	F VALUE	PR > F
A	1	0.0000	0.00	0.9961
B	1	0.0713	0.83	0.3696
D	1	0.0143	0.17	0.6858
E	1	0.0667	0.78	0.3851
A*B	1	0.2898	3.37	0.0758
A*D	1	0.1170	1.36	0.2523
A*E	1	0.0285	0.33	0.5689
B*D	1	0.1333	1.55	0.2223
B*E	1	0.2310	2.68	0.1112
D*E	1	0.0221	0.26	0.6158
A*B*D	1	0.3283	3.81	0.0596
A*B*E	1	0.0792	0.92	0.3446
A*D*E	1	0.3250	3.78	0.0608
B*D*E	1	0.0744	0.86	0.3594
A*B*D*E	1	0.0196	0.23	0.6365