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A variation of Sternberg's paradigm

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A VARIATION OF STERNBERG'S PARADIGM

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Abstract

An investigation was carried out to test Sternberg's stage theory using his additive-factor method. Three factors were proposed that would have additive effects on RT and two factors that would not. Ss were presented stimuli in the form of colors and sound frequencies under varying combinations of mode, stimulus quality, list length, and response type. Ss were also blocked according to sex. Results revealed only stimulus quality and list length to be additive. Response type interacted with list length. Males were faster than females but the sex factor was differentially influencing two of the proposed stages in Sternberg's model. The experiment failed to find any differences between the auditory and visual modes. In light of the present findings a re-evaluation of Sternberg's model was discussed.

THESIS ACCEPTANCE

Accepted for the faculty of The Graduate College of the University of Nebraska at Omaha, in partial fulfillment of the requirements for the degree Master of Arts.

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The problem of individual differences has concerned experimenters from psychology's earliest beginnings. Long before psychology existed as a discipline, for example, the astronomer, Bessel, discovered personal differences while investigating Kinnebrook's dismissal from the Greenwich Observatory in 1796 (Boring, 1957, pp. 134-136).

Much of the early work in individual differences involved human reaction time (RT). According to Woodworth (1938) Helmholtz was the first to report a RT experiment. He attempted to use RT as a measure for the speed of nerve conduction. While his attempt failed, it stimulated other experimenters to try to break down the stimulus-response interval into stages. Donders is celebrated as the first to propose this idea. His research attempted to discover what cerebral processes were involved in sensation, reason, and will.

Donders (1868, trans. by Koster, 1969) acknowledged Hirsch as the first to discover that physiological time was shortest for skin stimulation and longest for stimulation of the eye with stimulation of the ear in between. In 1868, Donders discovered the physiological time for touch, hearing, and vision to be 1/7, 1/6, and 1/5 of a second respectively.

Donders hypothesized the occurance of as many as twelve separate stages that took place between the onset of the stimulus and the onset of the response. To test these ideas he developed the (later contested) subtraction method which was used to measure the length of various processing stages between the stimulus and the

response. It was accomplished by looking at two identical stimulus-response patterns, the second of which supposedly had one more stage added to it. Then it was a simple matter of subtracting the first RT from the second to find how long it took to perform the added stage.

To illustrate this method, imagine an arrangement in which an electrical impulse can be delivered to either foot. The required response would be by the hand on the same side as the stimulated foot. Then the following two experiments can be made: (1) The S knows which foot is to be stimulated. (2) The S doesn't know which foot will be stimulated. By subtracting the first from the second the time for deciding which side had been stimulated was supposedly established.

There are two main criticisms of the subtraction method (Sternberg, 1969b). First, the differences in mean RT varied extensively from laboratory to laboratory and from S to S. Second, there was a question of the assumption of pure insertion. This assumption stated that when changing from the first task to the second, the S merely inserts a new processing stage in the second task without altering the other stages (Sternberg, 1971).

Sternberg (1969a) proposed the additive factor method as a replacement for the antiquated subtraction method. In this method, a search is made for factors that have additive, non-zero effects. When such factors are discovered it is reasonable to assume that there exist corresponding stages between the stimulus and the response. The converse states that if such factors are

not found then it may be taken as evidence against the hypothesis. This method, instead of assuming the notion of pure insertion, assumes selective influence, (Sternberg, 1971). Using selective influence, a factor is assumed to influence one stage of the RT and increase it by u msec. This assumption is satisfied when two or more factors add. Otherwise, an interaction effect would indicate that one factor is influencing more than one stage. To distinguish n stages on the basis of experiments involving n factors - using exclusively the additive relations among factor effects - all two-factor interactions, whether main or simple, must be zero.

The additive factor method is used in conjunction with a stage theory. Smith's (1968) classic analysis of choice reaction time experiments developed four stages that were supposed to take place between the stimulus and the response. The stages were: (1) stimulus preprocessing; (2) stimulus categorization; (3) response selection; and (4) response execution. Stage theory assumes that the next stage doesn't begin until the preceding one ends and that RT is a sum. Sternberg (1971) extended Smith's breakdown into the following: Stage 1 registers and encodes the stimulus. Stage 2 identifies the set of alternative stimuli. Stage 3 selects one of the response alternatives. Stage 4 organizes and executes the response.

Sternberg (1966, 1967, 1969a, b, 1971) developed four factors to test the additive model: (1) stimulus quality; (2) size of positive set; (3) response type; (4) relative frequency of response type. These were found to affect the respective four stages additively.

in an item recognition task. He cautioned that physical time must be used to preserve additivity because transformations may either destroy additivity or change interacting effects into additive ones. The root mean squared deviation of the observed means was used to obtain the best fitting profiles. If the plot of the means exhibits little or no deviation from the two fitted lines, then additivity is assured. He provided a simple example of a 2 x 2 factorial which affects two stages additively.

An analysis of variance (Palef, 1973) can also be used to test for additivity. Suppose two factors, F and G (each with two levels), affect stages a and b respectively, then the time associated with F_0 while influencing a would be Ta (0) and the time associated with F_1 influencing a would be Ta (1). Likewise similar expressions can be made for the levels of G influencing stage b. The various combinations of the experimental conditions are $F_0 G_0$, $F_0 G_1$, $F_1 G_0$, and $F_1 G_1$. To be additive the RTs would be:

$$RT\ (00) = Tw + Ta\ (0) + Tb\ (0)$$

$$RT\ (01) = Tw + Ta\ (0) + Tb\ (1)$$

$$RT\ (10) = Tw + Ta\ (1) + Tb\ (0)$$

$$RT\ (11) = Tw + Ta\ (1) + Tb\ (1)$$

where Tw = duration of all processes other than stages a and b. It then follows that $\mu(00) + \mu(11) = \mu(01) + \mu(10)$. Let F = stimulus quality which may be intact (F_0) or degraded (F_1) and G = size of positive set which may be a list of two digits (G_0) or four (G_1). Then if the levels of each factor add and no interactions take place, the mean RT can be graphically represented as in Figure 1. (Based

on the assumption that it takes longer to react to a degraded stimulus than an intact one and also longer to react to a list length of four digits than one of two.)

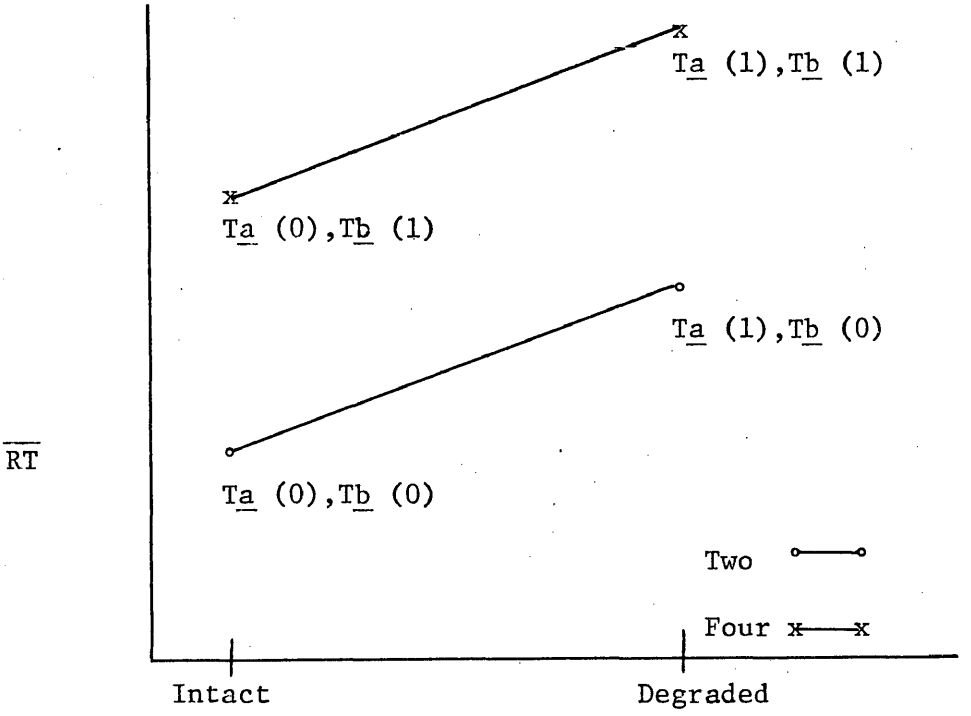

Figure 1. RT as a function of stimulus quality and list length.

Sternberg's additive stages were replicated by Palef (1973); Ells (1973); Briggs and Shinar (1972); and Briggs, Peters, and Fisher (1972). Other experimenters used Sternberg's paradigm to find the locus of various effects, such as recoding and the speed/accuracy tradeoff (Briggs & Blaha, 1969; Swanson & Briggs, 1969; Lyons & Briggs, 1971; Swanson, Johnsen, & Briggs, 1972). Biederman and

Kaplan (1970) supported additivity when stimulus-response compatibility was examined. Lively (1972) sustains Sternberg's results using a card sorting task and Chase and Calfee (1969) found linearity while manipulating modes of presentation and response.

Sternberg (1971) pointed out some limitations of his additive-factor method. The processing stages are distinguished while the actual processes are not. He did not rule out the possibility that two processes could occur in parallel. No information about overall stage duration is provided. Although one stage must end before the next one begins the method does not lend itself to a temporal ordering of stages. Rabbitt (1971) found various empirical difficulties with Sternberg's model. If a high error rate is allowed, then RT may be independent of set size. Under varied practice conditions, Ss may employ strategies differentially.

While in basic agreement with Sternberg, Briggs and Swanson (1969, 1970) have taken issue with the linear relationship of RT and memory load. Their results indicate that linearity is found when RT is plotted against $\log_2$ of the memory load. Briggs suggested that a $\log_2$ transformation be used for information processing rates. In essence, Briggs and Swanson attempt a finer breakdown of central processing. Briggs and Johnsen (1973) and Johnsen and Briggs (1973) hypothesize that the discrepency lies in the choice of the set procedure. Sternberg (1969) used a varied-set; i.e. if a stimulus was not a member of the positive set it belonged to the negative set.

This procedure allows the stimulus to be positive in one trial and negative in another. Briggs used a fixed-set procedure in which the stimulus either belonged to the positive set or negative set and was never used in both. Simson (1972) concurs with Briggs and his associates when a fixed-set is used.

Kirsner (1972) found that set size may influence the encoding stage as well as the memory comparison stage. Ellis and Chase (1971); Murdock (1971); and Conner (1972) all postulate the possibility of parallel processing stages based on their experimental results. Dumas, Gross, and Checkosky (1972) found that the next stage may begin before termination of the preceding one. Townsend and Roos's (1973) results failed to support a linear relationship between RT and memory search.

Sternberg (1969b) compared the results of having Ss required to give negative responses as well as positive responses. Since the fitted lines were parallel, Sternberg hypothesized that a serial exhaustive search is involved no matter what the response, i.e., S compares the test stimulus with all the members of the positive set before making the response. The above search can be contrasted with a self-terminating one in which S compares the test stimulus until a match is made and then executes the response. The serial-exhaustive search appears to be a weak link in Sternberg's theory of information processing. Foss and Dorvell (1971) supported Sternberg's hypothesis when phonemes are stimuli in an auditory memory recognition task. Tolin and Delegans (1973) found evidence for exhaustive search using

simple geometric forms as stimuli. Self-terminating strategies for the positive set are supported by Clifton and Birenbaum (1970); Zechmeister (1971); Klatzky, Juola, and Atkinson (1971); and Clifton (1973). Other strategies have also been suggested. Corballis, Kirby, and Miller (1972) and Corballis and Miller (1973) found a serial position effect and suggest that S has direct access to some internal representation of the test stimulus. Other explanations, such as central processing and parallel processing, were offered by Anders (1971); Williams (1971); Okada (1971); Klatzky and Smith (1972); and Theios, Smith, Haviland, Traupmann, and May (1973).

Most of the research just cited has dealt with visual stimuli alone. Two dealt with auditory stimuli. Little has been done to compare mode of presentation. Kirsner and Craik (1971) and Burrows (1972) used various combinations of auditory and visual positive set presentations and test probes. Both experimenters found the auditory mode of presentation and probe to have the quickest RT. Bernstein, Rose, and Ashe (1970) used combinations of various intensities of auditory and visual stimuli and hypothesized that an interaction may be found between modes.

The present experiment, in order to provide a more thorough test of the additive-factor method, employed a different type of visual stimulus -- colors -- and also used sounds which varied in frequency characteristics.

The proposed model of the present experiment tested for three of the four stages proposed by Sternberg. This was accomplished by hypothesizing three non-interacting factors that would affect each

of the three stages additively. Figure 2 illustrates the simple model.

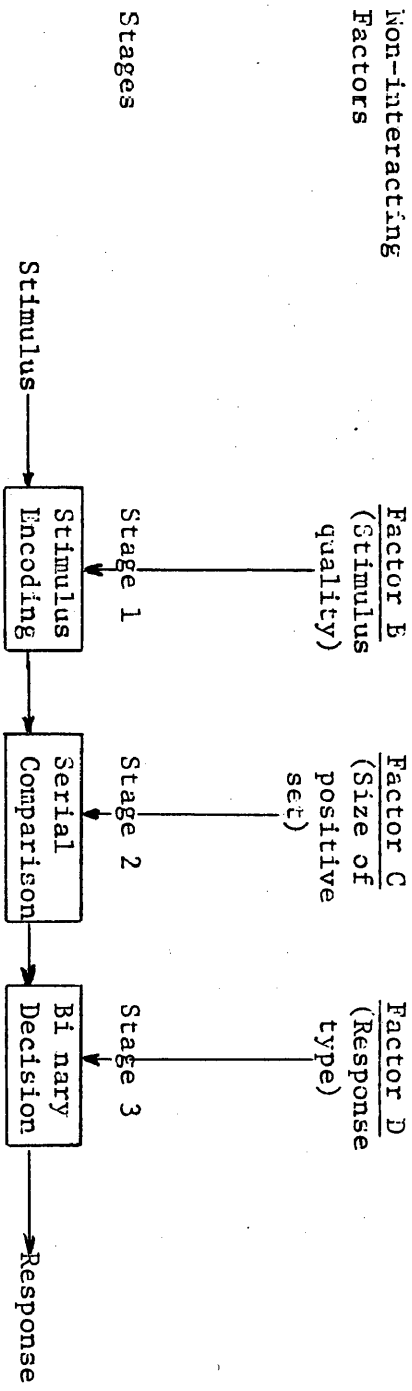

Figure 2. Simple three stage model with proposed three non-interacting factors.

Besides the three non-interacting factors, two more were tested. The literature gives no indication as to how these factors will interact, if indeed they will, with the proposed three stages. Figure 3 shows the completed model. Auditory RT has been found to be faster than visual RT (Woodworth, 1938). Females are slower than males in RT experiments (Murrell, 1965).

To reiterate, if factors B, C, and D are additive and non-interacting, an analysis of variance should yield no significance when testing the interaction of these factors. Factors A and E are assumed to interact differentially with levels of B, C, and D, but may also influence the three proposed stages equally.

Method

A five factor fixed-effects analysis of variance was used with: two modes (audio and visual), two levels of stimulus quality (intact and degraded), two levels of list length (two and four colors or sounds), two levels of response type (yes and no), and two sexes (both male and female subjects). There were repeated measures on the first four of the preceeding factors.

Subjects. Five males and five females from the University of Nebraska at Omaha and the surrounding community volunteered as Ss. Median ages of Ss were: 18.6 (females) and 19 (males).

Apparatus. The visual stimuli were solid-color Kodachrome slides made by photographing Academie No. 53-0528 construction paper. Seven colors were used: Red, orange, yellow, green, blue, violet, and brown. The slides were placed one inch from a GE-46 bulb

which rear-projected each color onto a white translucent screen two inches in front of the slide. The degraded condition was attained by covering the slide with a 50 percent neutral density filter.

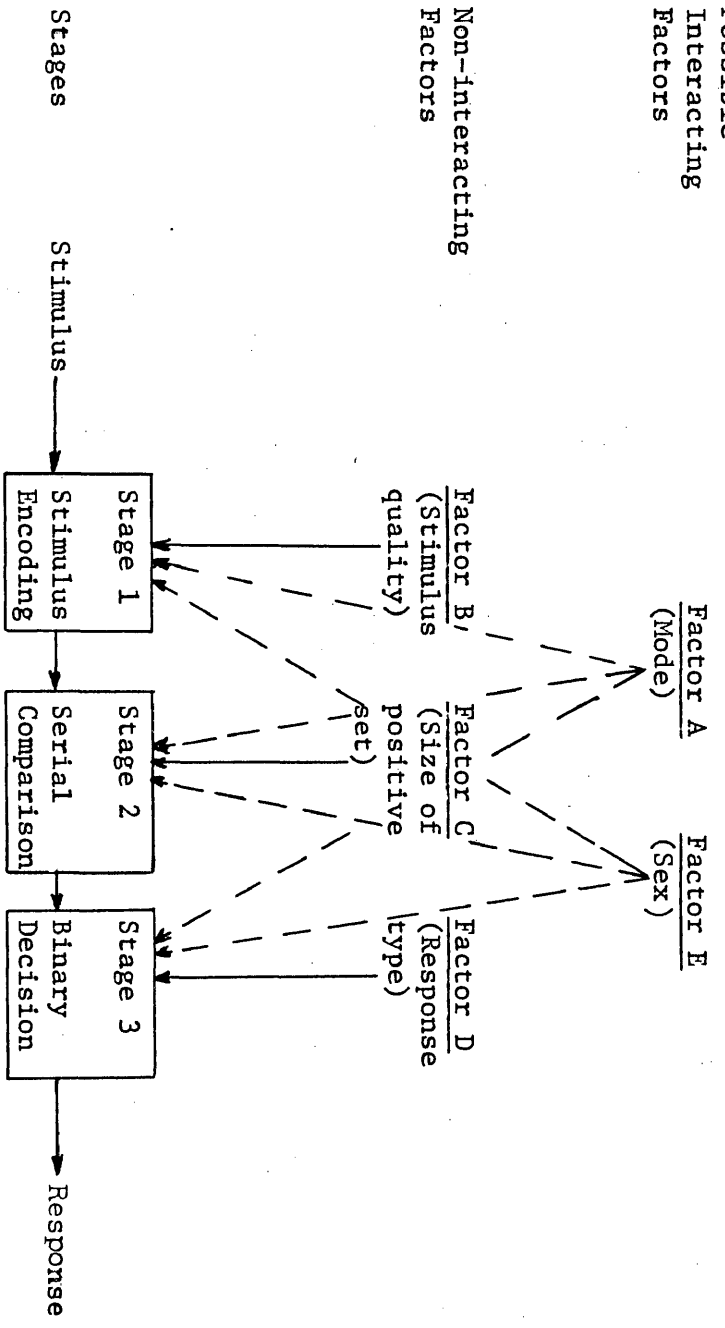

Figure 3. Completed model showing possible interactions involving mode and/or sex.

The auditory stimuli were individually recorded cassette tapes played through a MX-2506/AIC headset via a Wollensak model 2520 AV cassette tape recorder. The seven recordings were: a 250 Hz sine wave, a 4 kHz sine wave, a 25 Hz square wave, a 150 Hz square wave, a 600 Hz square wave, an electric bell, and an electric buzzer. The auditory stimuli were played at an intensity of 61 decibels (.0002 dyne/cm^2). The sounds were degraded by masking the above tones with 64 decibels (.0002 dyne/cm^2) of white noise.

A Lafayette electric stop clock measured S's RT to the nearest 1/100 second.

Procedure. Prior to the start of the experiment each S previewed all the relevant stimuli. Ss were instructed how and when to respond. The Appendix gives the verbatim instructions.

The experiment consisted of the presentation of the initial set (either two or four stimuli) and a test stimulus. The S was required to compare the test stimulus to the initial set and respond as to whether or not the test was a member of the initial set.

A response was made by the S lifting his hand off the appropriate telegraph key. One key was marked "yes" and the other one was marked "no". There were no intratrial mixing of modes or stimuli quality, i.e. a trial was either auditory or visual and the stimuli were either intact or degraded. The S was told prior to each trial what mode was to be presented. A warning light came on immediately after the presentation of the initial set to indicate

that the next stimulus was the test stimulus and a response was required. A correct response terminated the stimulus while an incorrect one did not. For an incorrect response the stimulus terminated when S lifted remaining hand from key (approximately 1 second). Ss sat in front of a two foot square black piece of plywood that hid the E from view. The plywood had holes drilled in it for the translucent screen and the warning light. The interstimulus interval was 4 seconds with a 5 second pause before the test stimulus. Each initial set stimulus lasted 1 second. The intertrial interval was approximately 40 seconds. This was the time necessary for E to record RT and to prepare for the next trial and thus varied from trial to trial. The mode, initial list length, stimulus quality, and required response were randomly presented.

Results

The concern of this experiment was with errorless performance, therefore, only correct responses were used in the analyses. The error rate ranged from 11.4 percent to 21.5 percent, the average being 17.1 percent. This is high for this type of experiment and reasons for it will be discussed later.

A mean RT score was the measure used to assess each S's performance under the various experimental conditions and these were examined through analysis of variance. A summary of the analysis is presented in Table I. There were significant main effects for list length and stimulus quality. Table II gives the means for the main effects. Table I also shows significant interactions. Two

Table I

Analysis of variance summary table.

Source	df	MS	F	
Total	159	12.6826		
E (Sex)	1	2.1627	2.46	NS
S:WG	8	.8778		
A (Mode)	1	.0044	<1	NS
AE	1	.0029	<1	NS
A(W)	8	.036		
B(Stimulus Quality)	1	.1867	10.98	p=.011
BE	1	.0029	<1	NS
B(W)	8	.017		
C(List Length)	1	.3591	17.77	p=.003
CE	1	.0284	1.41	NS
C(W)	8	.0202		
D (Response Type)	1	.0322	2.51	NS
DE	1	.0196	1.53	NS
D(W)	8	.0128		
AB	1	.0272	5.18	NS
ABE	1	.0404	7.69	p=.024
AB(W)	8	.0053		
AC	1	.0044	<1	NS
ACE	1	.0247	1.51	NS
AC(W)	8	.0164		
AD	1	.1878	8.04	p=.022
ADE	1	.0000	0.00	NS
AD(W)	8	.0234		
BC	1	.0099	<1	NS
BCE	1	.0014	<1	NS
BC(W)	8	.0104		
BD	1	.105	3.64	NS
BDE	1	.0055	<1	NS
BD(W)	8	.0288		

CD	1	.0721	17.08	p=.003
CDE	1	.003	<1	NS
CD(W)	8	.0042		
ABC	1	.1032	4.09	NS
ABCE	1	.0162	<1	NS
ABC(W)	8	.0253		
ABD	1	.0447	3.13	NS
ABDE	1	.0809	5.67	p=.044
ABD(W)	8	.0143		
ACD	1	.0000	<1	NS
ACDE	1	.0001	<1	NS
ACD(W)	8	.0168		
BCD	1	.0951	11.04	p=.01
BCDE	1	.0108	1.26	NS
BCD(W)	8	.0086		
ABCD	1	.0327	3.30	NS
ABCDE	1	.0002	<1	NS
ABCD(W)	8	.0099		

Table II

Means for main effects. (msec)

Mode	Audio 934	Visual 944
Stimulus Quality	Intact 905	Degraded 973
List Length	Two 892	Four 987
Response Type	Yes 953	No 925
Sex	Males 823	Females 1,055

two-factor interactions were significant: Mode x Response Type and List Length x Response Type. Two three-factor interactions were also significant: Sex x Mode x List Length x Response Type.

Since part of the hypothesis of this experiment was that interactions involving sex and mode were possible, no further analyses of significant interactions that had either sex or mode as a component were made. An interpretation of the effect of these factors will be discussed later.

Further testing of the Stimulus Quality x List Length x Response Type became necessary as the hypothesis failed to predict this. Since only the stimulus quality and list length factors were significant as main effects, only the simple-simple main effects (Kirk, 1968) tests of these two factors were calculated.

Testing stimulus quality at levels of List Length x Response Type, stimulus quality was significant only at the list length of 4-negative response type level [$F(1,8)=13.255$, $p=.007$], degraded having longer RTs.

When list length was tested at levels of Stimulus Quality x Response Type only the list length at the degraded stimulus quality-negative response type level was significant [$F(1,8)=14.158$, $p=.006$], list length of 4 having longer RTs.

Because the List Length x Response Type interaction was significant, it too was tested at the two levels of stimulus quality. The test at the intact stimulus quality level was not significant while the test at the degraded stimulus quality level was [$F(1,8)=14.66$, $p=.005$].

The List Length x Response Type at the degraded stimulus quality level involves four means and a subsequent mean comparison was performed. A least significant difference test (Kirk, 1968) found that only the list length of 4-negative response type level significantly different from the other level combinations ($p < .05$ the list length of 4-positive response level; $p < .02$ for the list length of 2-negative response level; $p < .01$ for the list length of 2-positive response level).

Graphic interpretations of certain interactions were used to indicate any regularities. An examination of the sex factor found that males always had faster RT means. See Figures 4 and 5. A multiple comparison t-test performed on the Sex x Mode x Stimulus Quality interaction found males significantly faster ($p < .01$). The Mode x Response Type interaction is shown in Figure 6. Figure 7 shows the List Length x Stimulus Quality interaction. This figure shows why no interaction was found and indicates the additivity of the stimulus quality and list length factors.

Discussion

Sex. There was no statistically significant main effect for RT between males and females. Since no prediction was made about the way the sex factor would interact with the hypothesized non-interacting factors, there was no reason to break down the Sex x Stimulus Quality x Response Type and the Sex x Mode x Stimulus Quality x Response Type interactions. Any differences that were present were weighted against significance because of the partitioned error term and the relatively small n. However, males appeared to be faster than

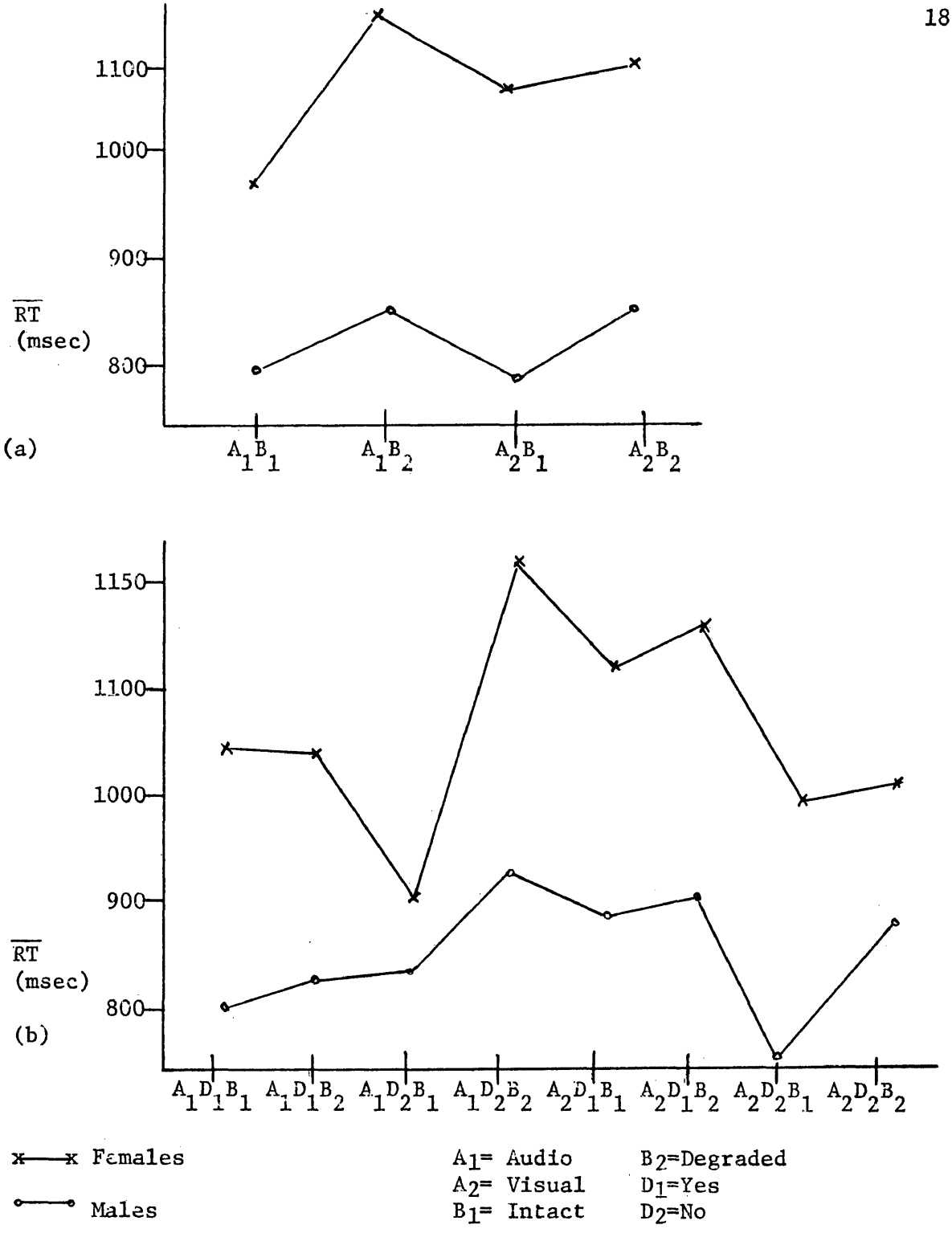

Figure 4. Significant interactions involving sex. (a)RT as a function of mode, and stimulus quality at levels of sex. (b)RT as a function of mode, stimulus quality, and response type at levels of sex.

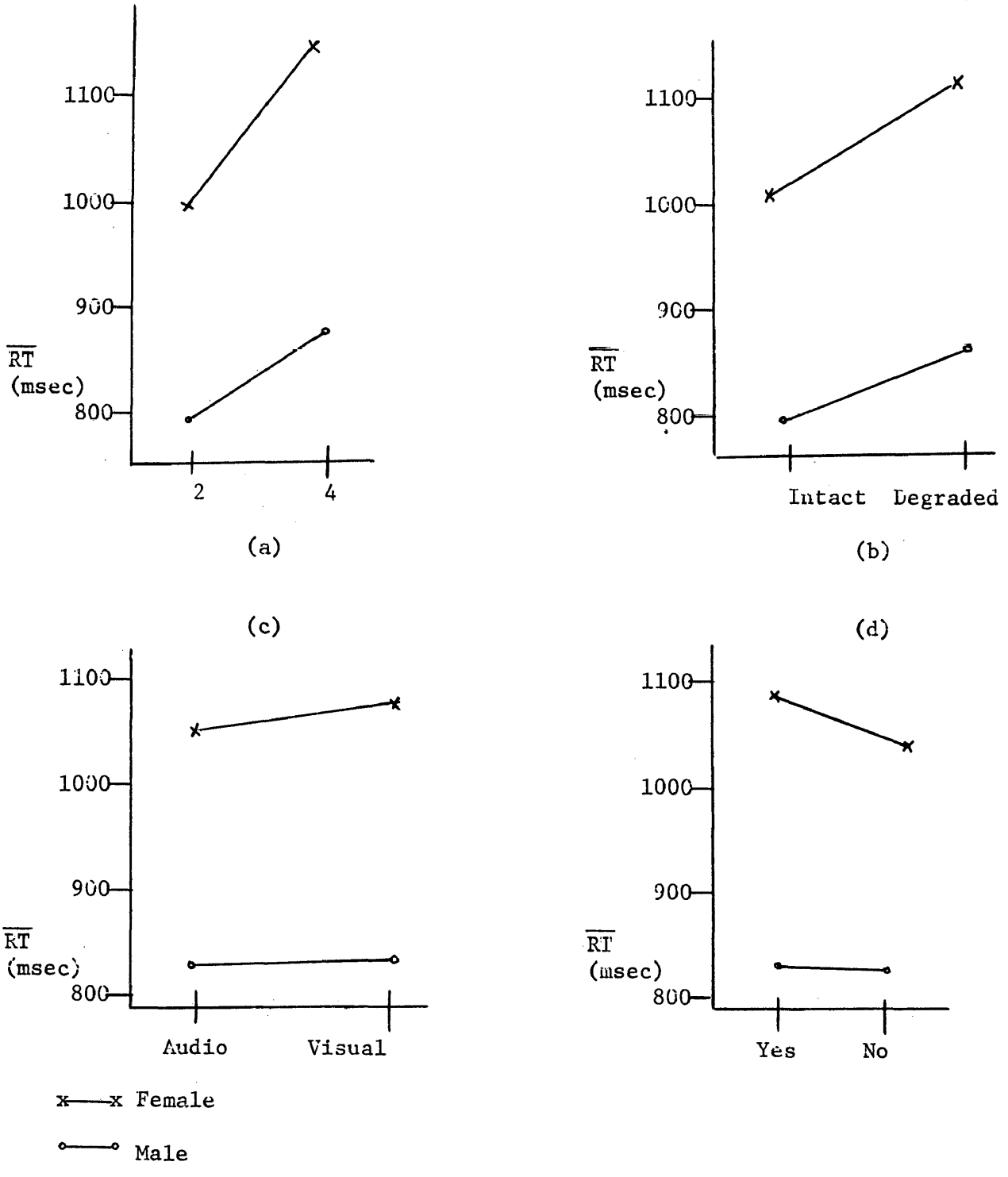

Figure 5. Non-significant interactions involving sex. RT as a function of list length and sex, (a); stimulus quality and sex, (b); mode and sex, (c); response type and sex, (d).

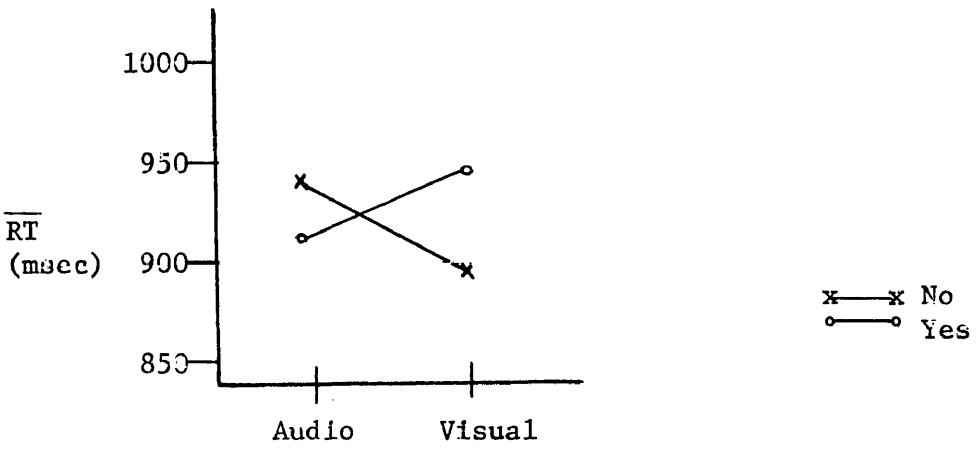

Figure 6. Mode x Response Type interaction.

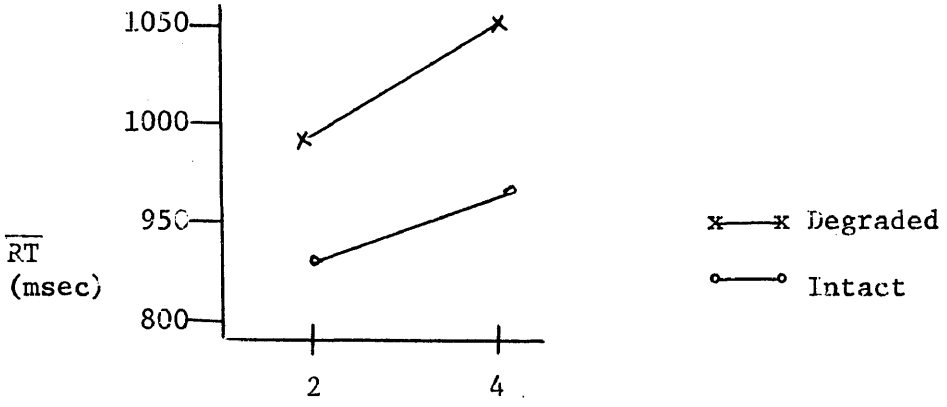

Figure 7. Non-significant Stimulus Quality x List Length interaction that shows additivity of both factors.

females when compared across all combinations of levels of the two-factor interactions and other significant interactions. Males were significantly faster in the Sex x Stimulus Quality x Response Type interaction. This finding agrees with Murrell's (1965) review of RT experiments.

Mode. The mode factor, as predicted, was found to interact with levels of the other factors. In combination with the response type factor, "auditory-yes" responses were faster than "auditory-no" responses while the reverse was true in the visual mode. This result differs from that of Chase and Calfee (1969) who only found interaction when the presentation and test modes were mixed. But, Burrows (1972) supports a logogen theory of memory format which states that presented information is only maintained in modality-specific-stores for a brief period before being fed into a logogen for categorization and extraction of semantic features. This means that an auditory probe would have a shorter RT than a visual probe only if the retention interval is short. Each trial in the present experiment lasted from 14 to 26 seconds, depending on the condition, and could have accounted for the mode interacting under the response type as well as in the Sex x Mode x Stimulus Quality and Sex x Mode x Stimulus Quality x Response Type interactions.

List Length and Stimulus Quality. Although list length was significant as a main effect, this simply mirrored the effect of list length in the Stimulus Quality x List Length x Response Type interaction. List lengths were only significantly different at

the degraded stimulus quality-negative response level.

The significant stimulus quality main effect only reflects the action of stimulus quality under the Stimulus Quality x List Length x Response Type interaction. This effect was only significant at the list length of 4-negative response level.

The additive model proposed by Sternberg (1969a) still holds for the stimulus quality and list length factors even though these are involved in interactions. Sternberg states that any pair of factors are additive and influence no stage in common if overall interactions are zero and all their simple interactions are zero. In this experiment all the interactions, except one, that involved stimulus quality and list length together were non significant. In the overall interaction that was significant, the simple interaction of Stimulus Quality x List Length at levels of response type was zero.

Response Type. Response type was found to be significant only in interactions. It interacted with list length and mode in the two-factor interactions. In the List Length x Response Type x Stimulus Quality interaction, negative responses were found to be faster except at the point where the stimulus was degraded and the list length was 4. In the Sex x Mode x Stimulus Quality x Response Type interaction, negative responses were faster under the visual mode and slower under the auditory mode. These results are opposed to Sternberg's (1969a, b, 1971) findings. He stated that in both cases (positive and negative responses) a serial exhaustive search is conducted in which the S matches the test stimulus with every

member of the positive set even if a match is made. Clifton and Birenbaum (1970) found a serial self-terminating search for positive responses, i.e. the matching process stopped after a match was made. Rabbitt (1971) feels the S may make use of various strategies that may depend on practice effects or a particular set of stimulus combinations and probability values. Thus a response type interaction is possible. Corballis, Kirby, and Miller (1972) and Corballis and Miller (1973) found serial position effects and stated that the S may have a direct access to some internal representation of the test probe and judges whether or not the test item is in the memorized list by examining the strength of this representation in memory much as though the task were one of signal detection, hence response type interactions. Klatzky, Juola, and Atkinson (1971) and Klatzky and Smith (1972) stated that the control process may not be a fixed feature of the information processing system and therefore can be modified depending on such variables as the task context, instructions, and nature of the stimuli. Briggs and Johnsen (1973) postulated a combination of the exhaustive and self-terminating searches. They stated that upon test stimulus onset, information is encoded into a short term sensory store, sampled, and made available to a central processing stage for analysis. Then if a positive response is favored decoding is initiated; if a negative response is favored then rechecking takes place before decoding and finally emitting a response.

Conclusions and Summary. A refinement in Sternberg's stage processing model is illustrated in Figure 8. Because of the

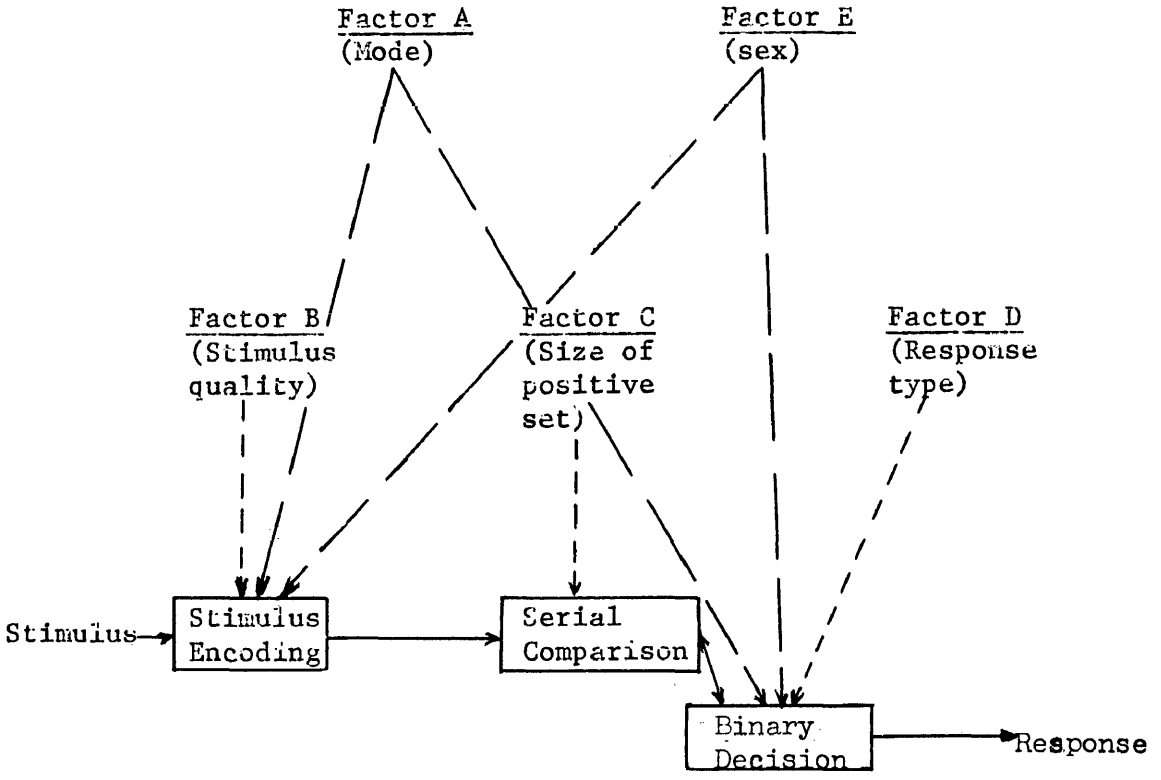

Figure 8. A reevaluation of Sternberg's additivity model.

interaction of response type with list length, the binary decision stage is shown as overlapping with the stimulus comparison stage. The additive factor method indicated that the stimulus quality factor probably influences only the stimulus encoding stage and the list length factor probably influences only the stimulus comparison stage. The response type factor is shown as differentially affecting the stimulus comparison and the binary decision stages. Since the sex and mode factors were involved in significant interactions with the response type and stimulus quality, they are shown as differentially affecting the stimulus encoding stage and binary decision stage. The re-evaluation can only be proved if further replications are made with lower error rates.

Rabbitt (1971) states that difficulties may arise in Sternberg's paradigm if a high error rate is allowed. In Sternberg's studies, error rates were always less than 5 percent. The present study had an average error rate of 17.1 percent and may be another reason for the various complex interactions. Further investigations along this line should limit themselves to more distinct stimuli but not limit themselves to a particular class such as numbers or letters, so that Sternberg's theory may become more generalized.

The significant main effects and interactions accounted for only a small portion of the variance. This result was due in part to the nature of the experiment. Although the stimuli were verified as different in a pilot study, two or three seemed subjectively closer than the others. The introduction of more automation

would eliminate much of the counterbalancing that had to be employed in this experiment and give rise to a lower error rate.

In summary it was found that the hypothesis of the three non-interacting, additive factors only held for two of the factors, stimulus quality and list length. Males were found to be faster than females but the sex factor appeared to differentially influence two of the proposed stages in Sternberg's model.

This experiment failed to find any differences between the auditory and visual modes, which is contrary to classical RT experiments (Woodworth, 1939). This result may have been due, at least in part, to the long retention interval experienced by the S and thus bypass any modality-specific-stores that may have been in operation. Mode also was found to be differentially affecting the binary decision and stimulus comparison stages.

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Appendix

Instructions. This is an experiment to measure reaction time. At the conclusion of the experiment, I will try to explain what I'm trying to find out.

This experiment will use two main sets of stimuli: colors (projected on that white circle in front of you) and sounds (played over the headset).

You will be presented with 2 or 4 stimuli, after which a test stimulus will be presented. Your job will be to decide whether that test stimulus was or was not a member of the just previously presented set. Example: You see a red light, then a blue light as the initial set, after that the test stimulus comes on which is a yellow light, your response should be "no".

A response is made by lifting your hand off the appropriate key. The test stimulus will always be the same mode as the initial set that precedes it, i.e. if you hear 4 different sounds the test stimulus will also be a sound.

A warning light (here) will come on after the presentation of the 2 or 4 stimuli of the initial set to indicate that the next stimulus will be the test stimulus and a response will be required. Only one response is allowed so try to make the correct one.

After each response, whether you make a correct one or not, lift both hands off the keys and leave them off until I say "down" which will indicate the start of a new trial.

You will know if you made a correct response because the stimulus will terminate. The stimulus will stay on if you make an incorrect

one.

These are the colors you'll see.

These are the sounds you'll hear.

The first 4 trials will be practice to help familiarize yourself with the task.

Any questions?