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Lexical Decisions Under Different Cross-Modal Selective Attention Situations Among Students: A Chronometric Study

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This study investigates the chronometric aspect of information Processing in Lexical Decision making set-up. The procedure employed selective attention situation varying in terms of different levels of facilitating or interfering nature of output responses. The task required the subjects to decide whether the stimulus presented on a particular modality (visual/auditory) was an 'animal' name or not, in a cross-modal situation under different treatment conditions. The findings (analysed with ANOVA of chronometric data) related to the conditions, had as their base the facilitation and interference in the pathways by the stimuli through unattended channel owing to their semantic relationship with those in attended channel. The excellence of visual modality over the auditory one was explained by the principles of visual dominance. The significantly shorter responses were times explained in terms of self-terminating search for 'Yes' response and exhaustive search for 'No' response still extending through the non- animal work dictionary.

INTRODUCTION

Evidence are accumulating to the effect that human beings are not much free to ignore the undesirable information in the sense that the latter is automatically processed and made contacts at the semantic level systems. Posner & Synder (1975) reviewed several experimental investigations to point out that the output is determined on the basis of an interaction of conscious attention with automatic activation processes.

In series of experiments, Sen and Posner (1979) examined the influence of unattended visual and auditory words upon naming latencies. Subjects were required to name a single auditory or visual target word that occurred at the end of a meaningful aurally bimodal. Both unattended visual auditory information improved RT (Reaction Time) to the relevant modality. The redundancy gains were of the same size for both modalities. However, interference effects observed, seemed to result mainly from a violation of the modality-specific expectancies induced by the auditory priming phrase rather than from the unattended visual item. The results indicated that semantic facilitation is modally specific. In the auditory attended condition, presenting a word unrelated to the context significantly increased RT. However, if subjects were required to name a visual word, whether it fitted the context or not, it did not matter.

The present study attempted to investigate the chronometric aspect of information processing in Lexical Decision making set-up. Lexical decision tasks have been used in relation to studies on selective attention (Rubenstein et al, 1971). In essence, the task requires subjects to decide whether string of letters is a word or non-word, an animal name or not an animal name, a fruit name or not fruit name and so on. Schvanaveldt and Meyer 1973) have shown that judgements occurred more rapidly following the presentation of a semantically related item than unrelated one. James (1975) investigated the effect of semantic information lexical decision indicating that lexical decision involves retrieval of semantic information. The present investigation employed selective attention situation, which varied in terms of different levels of facilitatory or interfering nature of output responses. The task required subjects to decide whether the stimulus item presented in a particular modality (visual/auditory) was an 'animal' name or not, in a cross-modal situation under different

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treatment conditions. The dependent
respective conditions and the Errors committed.

METHOD

Design

On the basis of much discussed facilitation and inhibition of ' pathways by the unattended stimuli, four different conditions varying in their facilit[illegible] or interference property were designed as the variable of major importance. These were facilitation I, Facilitation II, Interference and Control Conditions. Facilitation I condition had as its defining feature the presentation of two identical animal or non-animal names through the two modalities, Facilitation II – the presentation of two non-identical, animal or non-animal names through two modalities. In contrast, interference conditon involved on animal name and the other non-animal name through the two modalities and the control condition employed blanks in the 'to-be-rejected' modality. It was expected that maximal facilitation would occur in Facilitation I condition, followed by Facilitation II condition. Interference was expected to occur in interference condition, the control being the basis of comparison for all.

It was expected on the basis of Visual dominance principle that information processing would be faster in case of visual modality as accepted one than the conditions where auditory modality was the accepted one (Howard and Templeton, 1966; Pick, Warren and Hay, 1969; Colavita, 1974; Posner and Summers reported by Posner and Synder, 1975; Posner, Nissen and Klein, 1976). To permit the comparison the nature of attended modality was used as another variable which had two levels, namely, visual and auditory. The third variable employed was that of the response categories i.e. 'Yes' or 'No' it was hypothesized that it would have shorter latency to respond with 'Yes' and with 'No'. In condition to these three variables, sex was also conceived to be a variable and the sample included both males and females, through no significant sex difference was anticipated in the present task situation.

Response time taken to make the decision whether the stimulus; presented in the accepted modality was an animal name or not. Number of errors (if any) committed in taking the decision was also another dependent measure.

Thus a 2X4X2X2 (Modality X Conditions X Types of Response X Sex) Factorial Design with Repeated Measures on the three factors, namely, Modality, Conditions and Types of Responses, were worked out thereby yielding a total of sixteen treatment conditions which are presented below alongwith one example of each.

1. Auditory Modality accepted, Facilitation I, 'Yes' Response type e.g. Tiger (Visual), Tiger (Auditory).
2. Auditory Modality accepted, Facilitation I, 'No' Response type e.g. Chair (Visual), Chair (Auditory).
3. Auditory Modality accepted, Facilitation II, 'Yes' Response type e.g. Gorilla (Visual), Sheep (Auditory).
4. Auditory Modality accepted, Facilitation II, 'No' Response type e.g. Book (Visual), Train (Auditory).
5. Auditory Modality accepted, Interference Condition 'Yes' Response type e.g. Camera (Visual), Kangaroo (Auditory).
6. Auditory Modality accepted, Interference Condition 'No' Response type e.g. Lion (Visual), Wall (Auditory).
7. Auditory Modality accepted, Control Condition 'Yes' Response type e.g. Blank (Visual), Deer (Auditory).
8. Auditory Modality accepted, Control Condition 'No' Response type e.g. Blank (Visual), Comb (Auditory).
9. Visual Modality accepted, Facilitation I, 'Yes' Response type e.g. Rabbit (Auditory).

treatment conditions. The dependent measures were the RTs to take decisions under respective conditions and the Errors committed.

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9. Visual Modality accepted, Facilitation I, 'Yes' Response type e.g. Rabbit (Auditory).

10. Visual Modality accepted, Facilitation I, 'Yes' Response type e.g. Pot (Visual), Pot (Auditory).
11. Visual Modality accepted, Facilitation II, 'Yes' Response type e.g. Ass (Visual), Ox (Auditory).
12. Visual Modality accepted, Facilitation II, 'No' Response type e.g. Table (Visual), Board (Auditory).
13. Visual Modality accepted, Interference Condition 'Yes' Response type e.g. Lizard (Visual), Bottle (Auditory).
14. Visual Modality accepted, Interference Condition 'No' Response type e.g. Ink (Visual), Fox (Auditory).
15. Visual Modality accepted, Control Condition 'Yes' Response type e.g. Leopard (Visual), Boop Signal (Auditory).
16. Visual Modality accepted, Control Condition 'No' Response type e.g. Ring (Visual), Boop Signal (Auditory).

The experiment was conducted in two sessions, in first session the auditory modality was the accepted one and the visual was to be the rejected one and the reverse was the case of the second session for half of the subjects. The rest of the subjects had the two sessions in the opposite order.

Sample

30 University students (15 males and 15 females) within the age range of 19 to 25 years participated as subjects in this study.

Stimulus Material

Five pairs of stimuli were detailed for each treatment condition thereby constituting a total of 80 pairs for the two sessions.

Required number of cards (14.3 x 9.9cms) with words written on them were used as stimulus cards for visual modality, the words for the auditory modality were orally presented to the subjects. Randomization of various stimulus pairs under different conditions was effected by shuffling the cards and thus noting the sequence of cards for each subject.

Apparatus

An Electro-tachistoscope, a Digitimer TW-7010A connected to the tachistoscope, a collar mic, a tape recorder, a cassette with 'Boop'signal recorded on it, and a screen constituted the laboratory set-up where the experiment was conducted.

Procedure

The subjects were instructed to take the decision ad quickly as possible regarding the word presented through the accepted channel whether it was an Animal name or not in the Control condition utilizing visual modality as the attended one, a 'Boop' signal was presented by a tape-recorder in the auditory channel while the control condition with Auditory modality as the attended channel included the visual presentation of three dots on a card. Each subjects was given five practice trials in order to make the nature of the task clear to him followed by the actual experiment. The response time taken and the response given by the subjects were noted down on the prepared data sheet. With the completion of one session, the subject was given a 5-min rest pause followed by the second session of the experiment.

RESULTS

Each treatment condition had five trials and the means for each of the set of five readings were computed and the obtained mean reaction times were treated as raw scores for the statistical analyses.

Table 1 shows the total R Ts, Means and Ranges under each of the sixteen treatment conditions.

Table 1: Summations Means and Ranges of the 16 Treatment Conditions.

	B_1 Facilitation I		B_2 Facilitation II		B_3 Interference		B_4 Control	
	C_1 R 'Yes'	C_2 R 'No'	C_1 R 'Yes'	C_2 R 'No'	C_1 R 'Yes'	C_2 R 'No'	C_1 R 'Yes'	C_2 R 'No
Modality Accepted A1 Auditory								
Summations	22754.4	24016.8	27294.4	25530.6	26824.4	28824.4	24484.6	26949
Means	758.48	800.56	909.81	851.02	894.15	960.81	816.15	898.3
Ranges	523.6	404.2	749.4	461.0	755.2	710.2	406.4	680.8
Modality Accepted A2 Visual								
Summations	20540.0	22750.4	23920.4	25696.2	24177.2	24481.4	19719.0	26899
Means	684.67	758.35	797.35	789.87	805.9	816.48	657.0	896.7
Ranges	388.5	421.8	774.0	525.8	1255.4	958.4	614.8	581.8

An analysis of variance was carried for 2 x 4 x 2 x 2 factorial design with repeated measu on the first three factors. The ANOVA summary is presented in Table 2.

Table 2: Summary of Analysis of Variance.

Source of Variation	Sum of Square	df	Mean Square	F-Ratio	
Between Subjects	43309956.36	29			
G or Sex	107287.18	1	107287.18	071	N
Subjects within Groups Error (g)	4223669.18	28	150845.33		
Within Subjects	91541109.84	450			
A or Modality	1462027.25	1	1462047.25	41.35	01
GA	29181.36	1	29181.36	0.83	NS
A x Subjects within Groups, Error (a)	989970.03	28	35356.07		
B or Conditions	1148531.57	3	3824843.86	26.64	01
GB	138725.12	3	46241.71	3.22	1
B x Subjects within Groups, Error (b)	1207024.04	84	14369.33		
C or Types of Responses	115810.32	1	115810.32	5.13	0
GC	29181.36	1	129181.36	1.29	N
C x Subjects within Groups, Error (c)	632595.20	28	22592.58		
AB	247098.96	3	82366.32	5.85	01
GAB	18168.50	3	5722.83	0.41	N
AB x Subjects within Groups, Error (ab)	1183667.59	84	14019.28		
AC	460.60	1	460.60	0.05	N
GAC	6.68	1	6.68	0.00	N
AC x Subjects within Groups, Error (ac)	262389.43	28	9371.05		
BC	173619.85	3	5783.28	7.52	00
GBC	46443.86	3	15481.29	2.01	N
BC x Subjects within Groups, Error (bc)	646681.45	84	7698.59		
ABC	63925.64	3	21308.55	2.46	N
GABC	32981.03	3	10993.68	1.27	N
ABC x Subjects within Groups, Error (abc)	726623.00	84	8650.27		

The various conclusions drawn from the analysis of variance are as follows:

1. Modality was found to be a significant variable with shorter reaction times f the visual modality as accepted one, thereby proving the relevant hypothesis (F 41.35, df = 1/28, p < .001).
2. Conditions also contributed significantly to the total variance obtained (F 26.64,df = 41.35, df = 3/84, p < .001). Since, F-value for conditions w. significant, a further analysis by Tukey's method of Multiple Comparison (Ryan, 1959) was carried out which showed that Factor I was as facilitating a the Control where blanks were used while Factor II turned out to be comparab in its effects as the interference Condition.
3. Supporting the hypothesis, 'Yes' response category information processing wa significantly faster than that with 'No' response category (F = 5.13, df = 1/28, < .001).
4. No sex difference was found with respect to the fastness in informatio processing of lexical decisions in a selective attention set-up (F = 0.71; df 1/28).
5. Three significant first-order interactions obtained were those between s ...n Conditions, Modality and Conditions, and Conditions and Types of Response with the significance levels given respectively (F =3.22, df=3/28, p < .0 (F=5.35, df=3/84, p< .005, (F=7.52, df= 3/84, p< .005).

For still finer analysis, Tukey's method of multiple comparison of means (Ryan, 1959) was applied to see the significance of the differences between 16 treatment mean Response Times with error Response Times included and the Table 3 cited below shows the results obtained.

The Results of Turkey's Method of Multiple Comparison when Applied to four Condition Means given Below.

	B_1 Facilitation I	B_4 Control	B_2 Facilitation II	B_3 Interference
B_1 Fac. I	-	NS	01	01
B_4 Control	Non-significant	-	01	01
B_2 Fac. II	01	01	-	NS
B_3 Interference	01	01	NS	-
Mean	750.51	767.02	837.01	869.33

DISCUSION

The ANOVA indicated a highly significant impact of the variable (F=41.35, df =1/28.p< 001) where the information processing in the conditions with visual modality as the accepted one was significant faster than the conditions with auditory modality

Being the accepted one. The obvious conclusion seems to the well-established principle of visual dominance over that of auditory modality in so far human information processing as we know it presently, goes. Visual dominance appears to be paradoxically related to the comparatively weaker capacity of visual inputs to alert the organism to their occurrence. In response to this reduced alerting, subjects tend to keep their attention turned to the visual modality. This bias works via prior entry to allow vision to control the mechanisms that sub served conscious reports.

The ANOVA clearly reveals highly significant effect on response latencies (F=26.64. df= 3/84,p<001). The variable of Conditions centered around the premise of semantic interaction of varying degrees between informational contents of two modalities employed irrespective of whichever modality happened to the 'accepted ' or the 'rejected one. The findings however, could be interpreted in terms of the subjects not being able to successfully filter out information occurring on a modality, which they are instructed to ignore when it has a close semantic relationship to the attended information. The conclusion is supported by the findings of Greenwald (1970) Lewis Ugal(2000) Infact, Sen & Posner.(1979) found that the semantic interaction was modality – specific in their auditory- attended condition presenting a word unrelated to the context significantly increased RT, whereas if the subject was to name a visual item, the effect of context provided by the auditory phase was only limited.

In addition, RTs for 'Yes' response were significantly shorter that those taken or respond 'No' (F=13,df= 1/28,p<05). Some what analogous studies using the lexical decisions of "different" (Sternberg, 1966,1969,Krueger, 1973) interpreted the relatively longer RTs "different" in terms of the larger possible set of pairs and thus the could be stimulus uncertainly in the "different" case. One possible speculation that could be made to explain the findings is that owing to the specification of animal category, it could be assumed that the subjects tend to polarize the mental dictionary according to the characteristics typical for animal – the most importance being the 'Living' property. So as soon as the subject comes across an animal name, he scans through the animal dictionary and as soon as he comes across the particular word out of 'n' animal words it terminates his search, thereby being self – terminating in a serial model. This readily explains the less frequently occurring animal names. For a non-animal name, the subject search exhaustively although unknowingly the whole of the animal dictionary. Not finding the name through it, he does not stop there and enters further into the second non-animal name dictionary thereby resulting longer RTs (Reaction Times) for 'No' responses. The subject, however, does not stop here itself and continued his search to confirm the existence of word in the non-animal dictionary as if confirming the correctness of his response. This in turn leads to the different RTs (Reaction Times) obtained for 'no' responses for different words. It must be added that the latter search

is also embraced within the preview of serial model. As expected no significant sex differer were found in the present investigation.

IMPLICATIONS

Accurate and precise information processing by individual is necessary individuals to function adequately in life. From the findings of this study the excellence visual modality over the auditory one. this has implication for employers of labour individuals to be engaged in jobs that require precise acuity and all other situation that requ precise, sound and accurate vision judgement.

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