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 Effect of Level of Processing on Memory
 Memory and Cognition
 Single Group Repeated Measures
 Data collected by Dina Schwam for an Undergraduate Class Assignment

Project:

Learning involves many factors, but one consistent factor is that what is learned must be able to be remembered and then be able to be retrieved from memory. There have been several theories on how the memory works, one of which is the levels of processing theory by Craik and Lockhart (1972). This theory proposes that perception involves processing at levels from shallow (surface characteristics) to deep (meaning) and that the deeper information is processed the better the memory for the experience. In an attempt to test this theory, an experiment similar to the study employed by Craik and Lockhart was performed on 18 adults ages ## years of age. Each individual was shown 60 index cards, one at a time that displayed a four letter word and was asked to questions about the words to effect 3 different level of processing. After all the cards were identified, the participant was given a recognition test that included all 60 words plus 60 additional words used as a distraction (total 120 words) and were asked to circled all words they were presented on the cards. The numbers of words recognized under each level of processing for each of the participants are listed below. It is expected that the deeper the level of processing, the better the participant will remember the words.

Graphemic (appearance)		Phonemic (sound patterns)		Semantic (meaning)	
4	17	10	15	13	17
3	5	5	9	10	17
4	9	5	12	14	18
8	2	14	8	19	16
11	6	11	3	15	5
13	3	13	9	19	13
11	2	17	6	18	14
15	6	9	5	19	10
3	11	8	6	15	16
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Effect of the Levels of Processing on Memory

Introduction

Learning involves many factors, but one consistent factor is that what is learned must be able to be remembered and then be able to be retrieved from memory. There have been several theories on how the memory works, one of which is the levels of processing theory by Craik and Lockhart (1972). This theory proposes that perception involves processing at levels from shallow (surface characteristics) to deep (meaning) and that the deeper information is processed the better the memory for the experience. The first level is the surface level and it focuses on appearances. For instance is one were to identify how many letters in a word, if it is uppercase of lower case, if there any vowels, one would be processing at the graphemic level. The second level is based on a pattern of sounds, also called phonological, would include rhyming two words that do not look alike (such as yacht and hot). This would be the phonemic level of processing. The third level is based on determining the meaning, to know the meaning of a word, and this would be the semantic level of processing. It is hypothesized that the deeper the level of processing the more words would be remembered.

Method

An experiment similar to the original study by Craik and Lockhart was conducted to test the hypothesis. Participants included 18 adults were recruited from a reservation sales office during the evening shift. Each individual was shown 60 index cards, one at a time that displayed a four letter word and was asked to questions about the words to effect 3 different level of processing. After all the cards were identified, the participant was given a recognition test that included all 60 words plus 60 additional words used as a distraction (total 120 words) and were asked to circled all words they were presented on the cards. The numbers of words recognized under each level of processing were then tallied and analyzed using a single group (with-in factor) repeated measures.

Results

The results were as expected in that the number of words recognized on the recognition test increased with the level of processing. As depicted in Table 1, the mean scores for each level were 7.39 (SD = 4.68) for graphemic, 9.17 (SD = 3.89) for phonemic, and 14.89 (SD = 3.72).

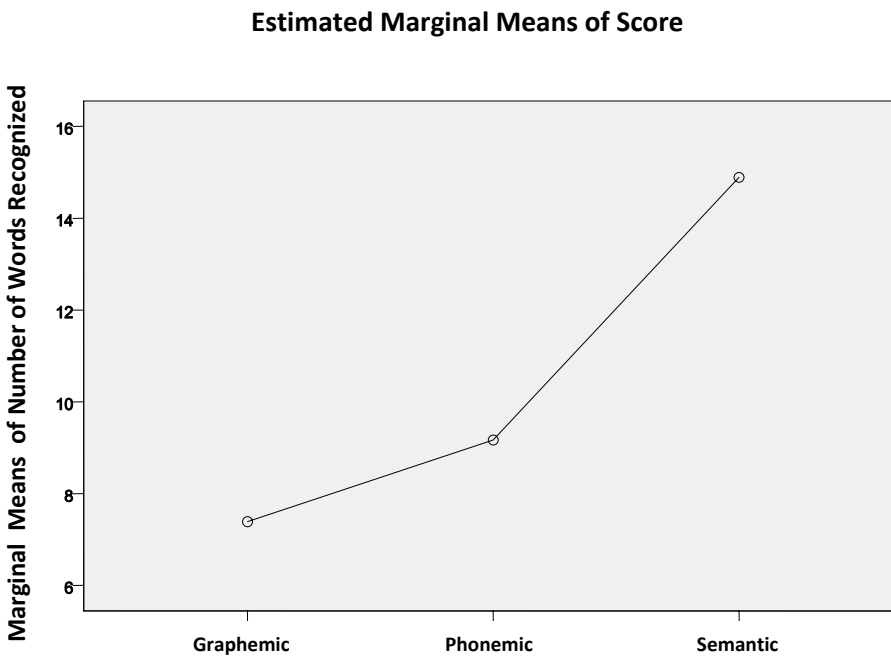
Table 1

Mean Scores of Each Level on Recognition Test

	Mean	Std. Deviation	N
Graphemic	7.39	4.68	18
Phonemic	9.17	3.89	18
Semantic	14.89	3.724	18

The scores were analyzed using a single group repeated measures ANOVA with the level of processing (graphemic, phonemic, and semantic) as a within-subject factor. The sphericity assumption was met using Mauchly's Test of Sphericity. A main effect was found to be significant for the level of processing, $F(2, 34) = 46.90$, $p < .001$, $\eta_p^2 = .73$ as indicated in table two. A post hoc pairwise comparison using the Bonferroni adjustment for multiple comparisons indicated a significant difference between the graphemic level and the semantic level and then again between the phonemic level and the semantic level. No significance was found between the graphemic level and the phonemic level. This significance is illustrated in Figure 1.

Figure 1



Discussion

The results indicated as expected that the deeper the level of processing the greater the number of words were to be remembered. Mean scores for processing information at the semantic level just about doubled the mean scores for processing information at the graphemic level. Although the mean scores increased at the phonemic level from the graphemic level there was no significant difference between these two levels. This experiment was done with the participants' full knowledge that this was a memory experiment and therefore they were participating in intentional learning. Further comparison of a group who is unaware of the nature of the experiment would be of interest to see if there is a difference in semantic processing when the learning is inferential versus intentional.