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Are incidental learning tasks measuring elaboration of coding, or just overloading retrieval cues?

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Craik and Tulving (1975) suggest that an "overloading of retrieval cues" explanation might serve as an alternative to their elaboration of coding theory of incidental learning data. Physical processing instructions require items to share the same encoding question, and thus can create more competition at recall than items of semantic instructions, which have unique questions. In an incidental learning task, 100 subjects named the colors in which words were printed. Recall of congruent words, for example, "money" printed in green, was superior to recall of incongruent words, for example, "money" printed in yellow, which in turn was superior to that of color-neutral control words. Since the items differed qualitatively in richness of information, and not in number of retrieval cues, it was concluded that the "overloading of retrieval cues" explanation cannot serve as a complete account of incidental learning phenomena.

According to Craik and Tulving (1975), memory performance is enhanced to the extent that the encoding question of context forms an integrated unit with the target word, so that, at retrieval, re-presentation of part of the encoded unit will lead easily to regeneration of the total unit. In other words, Craik and Tulving state that an integrated or congruous encoding yields better memory performance, first, because a more elaborate trace is laid down and, second, because richer encoding implies greater compatibility with the structure, rules, and organization of semantic memory; this structure, in turn, is drawn upon to facilitate retrieval processes.

Craik and Tulving's (1975) general procedure, which is taken as support for this "elaboration of encoding" theory, involves having subjects answer yes-no questions about a list of words in an incidental learning situation (e.g., Is word X printed in capitals or lowercase? Does it rhyme with another word? Does it fit into a particular sentence?). What is found is that subjects who are instructed to process the information to a semantic level in the sentence condition recall more items in the list than do subjects who do not engage in semantic analyses.

Craik and Tulving (1975) point out that the differences in recall between case-encoded words and sentence-encoded words could be due to an "overloading of retrieval cues" in the case-encoded condition. This is because each case-encoded word is preceded by the same question ("Is the word in capital letters?"), whereas each rhyme and sentence word has its own unique question. Because of this, it is plausible that the encoding questions that were used for many target words were less effective as retrieval cues since they did not uniquely specify one encoded event in episodic memory. Craik and Tulving go on to suggest that it is also possible to extend the argument to rhyme-encoded words, since phonemic differences may not be so unique or distinctive as semantic questions. Support for the overloading of retrieval cues hypothesis was obtained in an unpublished study Craik and Tulving cited, where several target words shared the same encoding question. They found that the sharing manipulation was most detrimental to recall for deeper levels of encoding.

There are two ways in which the overloading of retrieval cues hypothesis can be tested. One method is to perform an experiment in which a case-encoded word is made more unique by being the only word in an encoding series encoded in this way. Craik and Tulving (1975, Experiment 8) performed a less extreme form of this method by presenting groups of subjects different numbers of trials of each question type. They found that this semi-isolation manipulation produced increments in recall for rhyme-encoded words, but not for case-encoded words. Because Craik and Tulving only compared unique semantic questions to overloaded case questions used four times, it is possible that their

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manipulation was not sufficient in equating for uniqueness of retrieval cues.

A second test of the overloading of retrieval cues hypothesis, as being the only explanation of the findings from incidental learning tasks, involves giving the same incidental instructions at encoding and having the material differ in the richness of information. The present experiment attempted to achieve the latter alternative through a modficiation of the Stroop task (Stroop, 1935), on the assumption that, in many situations, subjects will automatically encode the meaning of words even though they are not specifically told to do so (cf. Wickens, 1970).

The basic procedure involved obtaining a set of color-related words (e.g., blue–policeman, cold, lake; green–money, envy, lettuce; etc.) and a set of color-unrelated words that were equal in recallability. If one were to add the dimension of color to the words and have subjects name the colors, one would expect that the color-related words and the task would have a greater compatibility in terms of shared features in semantic memory, thus providing qualitatively richer encodings than words that were unrelated to colors. If this is true, then the color-related words should have greater recall than color-neutral words. Furthermore, one should expect that congruent words (e.g., "money" printed in green) should be recalled better than incongruent words (e.g., "money" printed in yellow).

METHOD

Words

The color-related words were obtained from 39 subjects who were asked to generate as many words as they could think of as being associated to each of seven different colors. Seven words for each color were selected. The frequency and imagery value for each word was obtained and used as a guideline for matched color-unrelated word selection. A further specification was that each color-neutral word had to have the same number of letters as its matched color-related word. The final criterion was that these words did not generate any specific color associations. Three control word lists were derived.

The next step in word selection involved testing for possible differences between the groups of words, in terms of time taken to read the entire list, and for any differences in ease of recall. The time to read each of the lists is important, since response times of the base word are important in determining color-naming latencies; for example, Dalrymple-Alford and Azkoal (1972) found that pronounceability of the word affected color-naming latencies.

The experiment designed to test for these possible differences involved having different groups of subjects, 25 per group, read the four lists as rapidly as they possibly could, a between-subjects design. Each of the lists was typed in black ink, with each word presented twice. After this, the subjects were asked to recall the words they had just read; something that they did not expect they would have to do.

One of the groups was significantly different in reading latency for unknown reasons, and, therefore, this group of words was not used. The three groups not differing were the color-related words, which took 45.19 sec to read (SD = 7.53), Control 1 color-neutral words, which took 48.39 sec (SD = 8.10), and Control 2 color-neutral words, which took 50.96 sec (SD = 11.45). These three groups did not differ in recall (color-related words, 7.52, SD = 1.87; Control 1, 6.80, SD = 1.57; Control 2, 7.68, SD = 2.81).

The words were printed onto 46 x 31 cm sheets of light gray paper, the letters being about 5 mm high. They were printed in the following colors: green, blue, yellow, black, red, brown, and white. The order of the words was quasirandom, in that no color or word appeared adjacent to itself. Each word was repeated twice. Control 1 color-neutral words had the same order of colors as the congruent card, and Control 2 color-unrelated words had the same order of colors as the incongruent card. The congruent card had the words printed in their associated colors (e.g., "snow" printed in white), while the incongruent card had the words printed in antagonistic colors (e.g., "snow" printed in green).

Subjects

One hundred introductory students, 25 per group, served in the experiment as part of a course option for extra credit.

Procedure

The subjects were informed that they were participating in an experiment in which the effect of color naming on number subtraction was being measured. They were given practice with strings of letter os printed in the different colors of ink to acquaint them with the colors and to check for color blindness. Three subjects were eliminated from the experiment because they were color blind. The subjects were instructed to name the 98 color items as rapidly as they could, and when they came to the number at the end of the list, to count backward from it by three. After 20 sec of counting, subjects were instructed to recall as many words as possible.

RESULTS

The groups did not differ significantly in color-naming latencies [$F(3,96) = .1453$]. The means for the groups were as follows: congruent, 130.80; Control 1, 136.66; incongruent, 139.26; Control 2, 138.10. None of the groups made more than 3% errors.

There were significant differences in the number of words recalled [$F(3,96) = 30.85$, $p < .01$]. The means for the groups were as follows: congruent, 10.52; Control 1, 3.00; incongruent, 6.12; Control 2, 3.40. A Newman-Keuls test found significant differences between congruent and controls, congruent and incongruent, and incongruent and controls.

DISCUSSION

The results from this incidental task are not easily explained by an overloading of retrieval cues hypothesis. Thus, the criticism of Craik and Tulving's (1975) tasks (i.e., that it is plausible that the encoding questions used for many target words were less effective as retrieval cues since they did not uniquely specify one encoded event in episodic memory) would be difficult to apply to the present study. This is because, in this study, all groups received the same instructions and produced the same types of response to the items.

If one accepts the notion that a word's meaning may be represented by a number of attributes, or features, and that the sense impression of color is an integral feature of the experimental words (cf. Wickens, 1970), an encoding interpretation would explain the above data in the following fashion. It may have been that the task demand of color naming contextually primed the features of the experimental words. This would

increase the probability that the experimental words would be processed more deeply (semantically), thereby increasing the words' recallability.

The question remaining centers on the problem of explaining why the congruent condition led to higher levels of recall than the incongruent condition. To do this, it may be necessary to invoke a specific priming mechanism analogous to that proposed by Meyer and Schvaneveldt (1971). They suggested that "retrieving information from a particular memory location produces a passive 'spread of excitation' to other nearby locations" (p. 232). From this, it could be reasoned that, in the congruent condition, the specific color primed the word's specific lexical location, and, therefore, produced a more elaborate encoding of it. These data are also similar to those of Schulman (1974), where he found that a congruent encoding question (e.g., "Is soprano a singer?") yielded better recall than an incongruent encoding question (e.g., "Is mustard concave?"). Schulman reasoned that this advantage arose because a congruent query fostered a relational encoding of the noun and its descriptor, while the incongruent query fostered independent encodings.

In summary, it could be reasoned that the congruent condition benefited from contextual priming and specific lexical priming, the incongruent condition only benefited from contextual priming, and the control conditions did not have the benefits of either type of priming.

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