DOCUMENT RESUME

ED 119 822 PS 008 373

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TITLE Presentation Modality and Proactive Interference in Children's Short-Term Memory.
PUB DATE Aug 75
NOTE 11p.; Paper presented at the Annual Meeting of the American Psychological Association (83rd, Chicago, Illinois, August 30-September 3, 1975)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage
DESCRIPTORS Aural Stimuli; *Elementary Education; Grade 2; *Learning Modalities; *Memory; *Recall (Psychological); *Shift Studies; Taxonomy; Visual Stimuli
IDENTIFIERS *Short Term Memory

ABSTRACT

This study examined the role of visual and auditory presentation in memory encoding processes of 80 second-grade children, using the release-from-proactive-interference short-term memory (STM) paradigm. Words were presented over three trials within one of the presentation modes and one taxonomic category, followed by a fourth trial in which the six experimental groups received a shift in either taxonomic category, modality, or both category and modality. For the two control groups presentation modality and taxonomic category were the same on all four trials. The stimulus materials were 12 words from the taxonomic category of animal and three words from the category of clothing. Results indicated that auditory and visual presentation of stimuli produced a significant release effect with a shift of taxonomic category. This suggests that young children are able to use taxonomic category efficiency as an encoding dimension in both modalities. In the modality shift conditions, a shift to a visual presentation after three auditory trials produced a small amount of release, while a shift to an auditory presentation after three visual trials produced a large decrement in recall performance rather than a release from proactive interference. Possible causes of this asymmetrical release effect are discussed. (GO)

# Presentation Modality and Proactive Interference in Children's Short-Term Memory

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# Presentation Modality and Proactive Interference in Children's Short-Term Memory

## Abstract

Using the release from proactive interference STM paradigm, the role of presentation modality, visual and auditory, in the encoding process of second-grade children was examined. Words were presented over three trials within one presentation mode and one taxonomic category, followed by a fourth trial in which one or both attributes were shifted or remained constant. Auditory and visual presentation of stimuli produced a significant release effect with a shift of taxonomic category, indicating that young children were able to use taxonomic category efficiently as an encoding dimension in both modalities. In the modality shift conditions, a shift to a visual presentation after three auditory trials produced a small amount of release, while a shift to an auditory presentation after three visual trials produced a significant increase in interference, a "negative release" effect.

It has been hypothesized that a word is encoded into a number of different psychological categories based on the word's distinctive attributes (Bower, 1967; Underwood, 1969; Wickens, 1970). Considerable interest has been shown recently in the investigation of the dimensions along which words are encoded. In order to investigate these dimensions, Wickens (1970, 1972) has used an adaptation of the Peterson and Peterson (1959) short-term memory (STM) paradigm. Triads of words from one category are presented over three learning trials, followed by a fourth trial in which the category is shifted or remains constant. If the words are encoded into the same category, inter-item interference occurs across trials depressing recall. When the category is changed and the words are encoded into a different category, interference is minimized and recall on the shift trial is facilitated. This increment in performance has been termed release from proactive interference (PI). Wickens has suggested that this shift procedure could be used to study the categorical organization of the subject as he encodes in STM.

The studies of Pender (1969); Wagner (1970); and Cermak, Sagotsky, and Moshier (1972) have used the release from PI paradigm to assess category differentiation developmentally. Pender (1969) investigated encoding in second- and sixth-grade children using words differing with respect to rhyming, taxonomic category, and the three dimensions of the Semantic Differential as stimuli. High release from proactive inhibition was obtained for both second- and sixth-graders for taxonomic category, rhyming, and the evaluative dimension. Using third-graders as subjects, Wagner (1970) found that release from PI occurred when taxonomic categories were used as stimuli. Cermak, et al., (1972), on the other hand, found that ~~sixth~~ second-graders showed no development or release.

A consideration in interpreting the conflicting findings of Pender (1969), Wagner (1970), and Cermak, et al., (1972) concerns the method of presentation used to introduce stimuli in these studies. Pender and Wagner presented words auditorily and found release, while Cermak, et al., presented words visually on index cards but found no development or release of PI. One would suspect that the choice of modality is an important variable, particularly when working with children as young as seven years of age. Whether children encode differently in the two modes is not clear. Young children may be able to encode more easily in the auditory mode, thereby demonstrating release from PI if words are presented auditorily. This finding would clarify the results of the two developmental studies and would indicate that visual and auditory information may be stored and processed in characteristically different ways. The first purpose of the present study was to examine the role of presentation modality, auditory and visual, in the encoding process of young children.

A second question was whether a memory can carry a modality attribute (visual, auditory, pictorial, etc.) which may serve to discriminate this memory from a memory carrying an attribute signifying a different modality. The nature of the modality attribute associated with a memory is not clear (Underwood, 1969; Wickens, 1972). A word may carry a modality tag which leads to the appropriate system. Significant release in a shift of modality would indicate modality-specific encoding in children.

## Method

### Subjects

Subjects were 80 children from four second-grades in two elementary schools in Burnt Hills, New York, a middle-class community. The population was restricted to include only those children who were reading at or above

the 2.0 grade level as determined by basal reader level. The testing session took place in March 1974. Ten children, 5 male and 5 female, were randomly assigned to each of eight conditions

Design

Presentation mode (auditory or visual), modality shift (present or absent), and taxonomic category shift (present or absent) were used as between-subject variables, and repeated measures across trials were used as a within-subject variable in a 2x2x2x4 factorial design. Three words were presented on each of four trials in the modification of the Peterson and Peterson paradigm. The conditions remained constant for each subject over the first three trials to assess the development of PI. On the fourth trial, the six experimental groups received either a shift in taxonomic category, modality, or in both modality and category. The two control groups received no shift on the fourth trial, presentation modality and taxonomic category remaining constant across all four trials. The stimulus materials were 12 words from the taxonomic category of animal and three words from the taxonomic category of clothing. A pilot study was conducted in order to ensure that the subjects were able to read the stimuli.

Procedure

Each child received three practice trials in order to ensure familiarity with the procedure. Material presented in the visual mode was projected on a wall approximately 3 feet in front of the subject. Each trial consisted of the sequential presentation of three words for 6 seconds, followed by a retention interval (RI) and a recall period. Following an asterisk, which appeared for 3 seconds, the words for trial one were presented at the rate of one every 2 seconds. During the RI for the visual presentation, the subject was shown slides of a dingle digit selected from a table of random numbers and was asked to read each slide at the rate of one slide per second for 15 seconds. An

asterisk indicated the beginning of the 15 second recall period. The subject was asked to report as many words as he or she could remember, responses recorded by the experimenter. After an intertrial interval of 6 seconds, this procedure was repeated for three additional trials, with different numbers used as distractors for each retention interval task. The entire procedure in the auditory mode was presented on a tape recorder. The experimental groups who received a shift in modality on the fourth trial followed a similar procedure. Auditory trials were presented on the tape recorder, visual trials on the slide projector.

## Results

The response protocols were scored on a four-point basis, with one point assigned for each word correctly recalled and an additional point assigned if all three members of a triad were recalled in the same order as they had been presented. Each of the groups demonstrated a build of PI across the first three trials. On the fourth trial, shift groups, with the exception of the visual to auditory shift groups, showed a release from PI. Control groups showed a continued accretion of inhibition across all four trials. A marked asymmetric effect for the modality shift groups was found, a shift from auditory to visual resulting in a 45% release, a shift from visual to auditory resulting in a large decrement, -37% below the controls. An overall analysis of variance on the effects of modality, taxonomic shift, and modality shift across all four trials showed a significant effect for the taxonomic category shift/no shift factor, $F(1, 72)=6.65$, $p<.025$, and for Trials, $F(1,72)=21.05$, $p<.001$. The Trials x Taxonomic Shift interaction was significant, $F(1,72)=5.74$, $p<.025$, indicating that subjects in the experimental and control groups performed differently across trials when there were taxonomic shift/no shift conditions. Release from PI occurred in both visual and auditory presentation modes.

The recall scores on Trial 4 were analyzed with modality, category shift, and modality shift as factors in a 2x2x2 ANOVAR. The taxonomic shift/no shift

condition was significant, $F(1,72)=26.6$, $p < .001$, and the modality x modality shift interaction was significant, $F(1,72)=5.49$, $p < .025$. A shift from the auditory to visual mode on the fourth trial resulted in a release from PI, whereas a shift from visual to auditory resulted in a strong decrement in performance.

## Discussion

The results of the present study indicate that: (a) Second-grade children are able to use taxonomic class as an encoding tool in both the visual and auditory modality and (b) An asymmetric release effect was demonstrated when the presentation mode was shifted.

Both visual and auditory taxonomic shift groups and controls showed build of PI across the first three trials, while on the fourth trial the shift conditions demonstrated high release, while the control groups continued to build PI. The conflicting results of Pender (1969), Wagner (1970), and Cermak, Sagotsky, and Moshier (1972) suggested that second-grade children may be able to use categories more efficiently as encoding tools if words are presented in the auditory mode. Reading the words may compound the complexity of the encoding process for beginning readers. The results of the present study, however, indicated that young children were able to rapidly abstract the salient features of words presented in either modality.

In addition, the question of whether a word carries a modality attribute was investigated in this study. One of the general points that emerges from memory research is support for the concept of modality-specific memories. Murdock (1974) suggests that the necessity for memory modalities is demonstrated in the way we remember words, sounds, and pictures. If auditory and visual material are encoded differently, there should be a significant release effect with the shift of modality on the fourth trial. This rapid recovery from PI would be interpreted as evidence for differential coding. Results of the

present study indicated that performance for the modality shift groups declined from Trial 1 to Trial 3 indicating build of PI. However, a marked asymmetric effect was demonstrated on the critical shift trial. A shift from auditory to visual presentation resulted in a 45% release, consistent with the hypothesis of modality-specific encoding. However, a shift from visual to auditory not only did not produce a release from PI but produced a large decrement in recall performance, 37% below the controls.

One possible explanation for this asymmetric release effect concerns the role of the interpolated distractor task. Hopkins, Edwards, and Gavelek(1971) carried out a modality study with adults and found a similar asymmetric release effect for visual and auditory shifts using a visual distractor task on all trials. A release from PI followed a visual to auditory shift, but not an auditory to visual shift, which is the reverse of the findings of this study. Since differential encoding could not be expected to produce a release from PI in one direction but not in the other, Hopkins, Edwards, and Cook (1973) carried out further experimentation to determine the variable producing the asymmetrical release. They found that the direction of symmetry could be reversed by changing the mode of presentation of the interpolated task. Further experimentation on the role of the distractor task is necessary. If the mode of the distractor task is varied, the possibility of demonstrating a symmetric release effect with young children seems worthy of investigation.

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