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Effect of Distinctive Cues on Memory and Recall

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## Abstract

If an auditory cue is paired with semantically related learning material, it may improve recall by reinforcing perceptual thought processes during learning. A two-way within-subjects experiment was conducted on 15 participants. The auditory stimulus variable was whether classical music was played or not played. The learning material was whether a presented photograph showed a familiar scene or a musical instrument. Number of photographs recalled was measured on a ratio scale. Pictures of familiar scenes were recalled significantly higher ( $M = 5.10, SD = .250$ ) than musical instruments ( $M = 3.87, SD = .357$ ),  $F(1, 14) = 11.86, p < .05$ . The effect of distinctive cues on memory can be used with students and those with memory problems.

### Effect of Distinctive Cues on Memory and Recall

Distinctive cues are stimuli that relate to one or a particular few items of information. These cues can facilitate students' learning in school, improve memory in the elderly, and/or alleviate the distressing effects on memory from certain diseases and disorders like Alzheimer's disease (CITATION; CITATION; CITATION). Several areas of research have either directly or indirectly addressed one specific question: Can different forms of distinctive cues be presented simultaneously with learning material to act as stimuli for improving memory of that material?

Dewhurst and Conway (1994) explained that recollection for visual experiences can occur in one of two ways. Through recollective experience, a person recalls something because of its specific details or because of thoughts and feelings he or she underwent at the time they were originally exposed to that stimulus (e.g., an object, word, scene, etc). The other way of recollecting has to do with feelings of familiarity. These processes are referred to as the "remember" response or the "know" response respectively (p. 1088). Dewhurst and Conway (1994) hypothesized that memories of pictures would trigger the "remember" response more often than would memories of words, and that pictures would therefore be better recalled. However, they proposed that if participants were prompted to encode the conceptuality of pictures or words through perceptual processing, then memory for both should improve (p. 1089). This hypothesis was supported by the results of one of their experiments. In this experiment, participants saw a sequence of words or pictures. After each sequence, the participants were asked to rate the difficulty of drawing a presented picture or the difficulty of visualizing the image indicated by a presented word. Compared to a previous experiment conducted by the same researchers, recall for words was higher due

to the change that participants were prompted to visualize the drawings of the words' depiction.

Lorch, Lorch, and Klusewitz (1995) have studied the effects of typographical cues on recall of text. Typographical cues or signals include underlining, italicization, and capitalization and are used for such purposes as emphasizing important information (p. 51). That study attempted to look at the amount of typographical cues and their effect on magnitude of recall, and whether the signals only increased memory for those parts cued. This type of cueing emphasizes and directs the reader to pay closer attention to words or sentences being cued, thus augmenting memory for those signaled parts. In one of their experiments, Lorch et al. (1995) had participants read an expository text that either contained no underlining (control), light underlining (5% of text underlined), or heavy underlining (50% of text underlined). Also, in the light and heavy underlining conditions, half of the target statements (parts of text that would be tested for recall) were underlined (i.e., cued) and half were not. The participants were then given a recall test asking questions pertaining to the target statements. The results showed that target statements were significantly recalled more in the light underlining condition than in the control condition. Participants in the heavy underlining condition had only a 2% higher recall than participants in the control condition, indicating that overly-cued text may actually undermine memory for that text. Lorch et al. (1995) concluded that, when used properly, distinctive cues can facilitate recall for the items they cue.

Macklin (1996) investigated the effect of using pictures and colors as visual cues for recall of brand names by young children. The goal was to discover what type and how many cues can improve learning of brand names. Macklin explained that associative

network theory says that the most effective cues are those that are in some way related and linked to the learning material (p. 252). That is, a relevant and distinguishable association between the item being cued and the cueing item should be present in order for memory to be best enhanced by the process. This idea is not novel; consider that people may recall an image of being at the beach if they hear sounds of crashing waves. Macklin (1996) claimed that pairing brand names and pictures or colors is more concrete when the two are familiar and related to one another by prior experience (p. 253). In the first experiment, five brand names were created on the basis of their associations with young children. For example, children were told a name of something and were asked what color and picture came to mind. The brand name was then constructed from a particular cardboard cutout with a certain color (e.g., “Grass” was a cereal, and “Sky” was a candy bar). In the experiment the children were shown these product shapes with the brand name of each told to them once. After a distraction task the children were asked to recall the brand names. All of the experiments conducted generally gave the following results: visual cues with brand names improve recall, two cues (picture and color) were better than a single cue. As in the study by Lorch et al. (1995), extensive cues overwhelmed recognition ability. Also like Lorch et al. (1995), Macklin (1996) concludes that distinctive cues can be used to facilitate recall.

In the present study we analyzed the effect of auditory cues on recall of photographs. We looked at how an auditory stimulus (classical music) can cue recall of two types of photographs: familiar scenes (unrelated) and musical instruments (related). According to the results of Dewhurst and Conway (1994) and Lorch et al. (1995), the auditory stimulus should serve as a cue for photographs seen during cueing. We predicted a main effect for auditory stimulus; we expected higher recall for photographs accompanied by classical

music than for those accompanied by silence. We predicted that there would be no main effect for type of photograph; we expected that the number of photographs recalled would not differ depending on whether the photograph depicted a familiar scene or a musical instrument.

The conclusions of Macklin (1996) about semantically associated cues indicate that the semantic association between the music heard and the musical instruments shown should improve recall of the photographs of musical instruments. We predicted an interaction between auditory stimulus and type of photograph. We expected higher recall for familiar scenes than for musical instruments when classical music was not played, but we expected higher recall for musical instruments than for familiar scenes when classical music was played.

## Method

### *Participants*

Participants were 15 undergraduate students (14 women and one man) from a research methods course in psychology at the University of California, Los Angeles (UCLA). Participants participated in the experiment to fulfill a course requirement.

### *Design*

The experiment was a two-way within-subjects factorial design. The independent variables manipulated were type of photograph and form of auditory stimulus. Type of photograph had two levels: familiar scenes and musical instruments. Familiar scenes were photographs of structures, buildings, and areas commonly known to UCLA students. Musical instruments were string, woodwind, and brass instruments included in an orchestra.

Form of auditory stimulus had two levels: classical music played and no audio. In the classical music played level participants heard classical music being played while viewing both types of photographs. In the classical music not played level, participants heard no music while viewing the photographs.

The dependent variable was the number of correct photographs participants recalled during a free recall task. A list of photographs recalled was compiled by each participant after experiencing both levels of the auditory stimulus while viewing 32 types of photographs. The number of photographs correctly recalled was then measured on a ratio scale.

#### *Materials and Apparatus*

Sixteen photographs of UCLA scenes were piloted on students to verify equal average familiarity of the photographs. Sixteen pictures of string, woodwind, and brass musical instruments in an orchestra were obtained from the web on the Microsoft Clip Art gallery. To control for an order effect, the photographs of UCLA scenes and of musical instruments were arranged in four random orders (i.e., two different orders for the classical music not played first condition and the played first condition). To control for a sequence effect, neither the absolute nor relative ordinal positions of a photograph were identical across conditions. For example, if a flute was the first photograph shown in one order, then it would not be shown first in the other order; and if a picture of a harp followed a photograph of Drake Stadium in one order, then it would not follow the Drake Stadium again in the other order. The order of the photographs was also arranged so that every picture was paired with both forms of the auditory stimulus--classical music played and not played--depending on to which condition the participant was exposed.

Each of the four different arrangements of photographs was then programmed into Microsoft Power Point XP to be presented as a slide show. Photographs of the UCLA scenes and the pictures of musical instruments with their names appropriately labeled were programmed to appear on the computer screen for three seconds, with a two second interval between each image. Gluck's *Dance of the Blessed Spirits* was also programmed to either play in the first or the second half of the time the photographs were presented. Standard headphones were used to ensure that the participants could not hear what the other participants heard.

Slips of paper were constructed that either had Form 1A, Form 1B, Form 2A, or Form 2B written on them. Form 1A and Form 1B indicated that classical music would be played only during the first half of the slide show of photographs, with the photographs arranged in either the A or B order. Form 2A and Form 2B indicated that classical music would be played only during the second half of the slide show, with photographs arranged in the A or B order. These forms were also used during the free recall task. When classical music was not being played, a series of chimes was heard to indicate the switch from one photograph to the next.

### *Procedure*

Participants were randomly given the forms that assigned them to one of the two auditory conditions and one of the two orders of photographs. Approximately one fourth of the participants were assigned to 1A, one fourth to 1B, one fourth to 2A, and one fourth to 2B. Before entering the computer lab, the participants were given instructions to be seated at the computer designated to them by the form, and to press the space bar when prompted to do so to begin the experiment. The participants then entered the computer lab and were

seated. The experimenters then instructed the participants to put the headphones on and were prompted to press the space bar in sync with one another. When the slide show ended a distraction task took place when the participants were given 30 seconds to write down odd numbers in consecutive order beginning with the number one. Finally, participants were instructed to freely write down as many photographs they recalled seeing during the slide show; they had 3 minutes to complete this task. During both the distraction and free recall tasks, the participants utilized the form given to them at the beginning of the experiment. The experiment was concluded at the end of the recall task.

### Results

Figure 1 presents the average number of photographs correctly recalled when they were either UCLA scenes or musical instruments and under what level of the auditory stimulus they were shown. Looking at the pattern of results displayed in Figure 1, it appears that photographs, in general, were better recalled when they were UCLA scenes than when they were musical instruments and when displayed when classical music was played rather than when not played. The degree to which recall was affected by the type of photograph, however, appears to depend on the way in which the auditory stimulus was presented. More specifically, when photographs were of musical instruments, form of auditory stimulus appears to have an effect on their later recall; whereas, when photographs were of UCLA scenes, form of auditory stimulus appears to have had little or no effect on their later recall.

To test these apparent effects, the data were analyzed using a 2 x 2 within-subjects ANOVA, which did not reveal a significant main effect of auditory stimulus; the average correct recall for photographs shown when classical music was played ( $M = 4.63, SD = .329$ ) was not significantly different from when classical music was not played ( $M = 4.33, SD$

= .351), regardless of the type of photograph shown,  $F(1, 14) < 1$ . A significant main effect of type of photograph, however, was revealed, such that average correct recall was significantly higher when photographs were of UCLA ( $M = 5.10$ ,  $SD = .250$ ), than when they were of musical instruments ( $M = 3.87$ ,  $SD = .357$ ), regardless of the form of auditory stimulus,  $F(1, 14) = 11.86$ ,  $MSE = 1.92$ ,  $p < .05$ . However, the apparent interaction between type of photograph and form of auditory stimulus that appears in Figure 1 was not revealed to be significant,  $F(1, 14) < 1$ .

### Discussion

Our data reveal that form of auditory stimulus--whether classical music is played or not played--did not have a significant effect on memory and recall of learning material presented under both conditions. Only the content of the photograph had an effect on memory and recall--UCLA scenes were better recalled than were musical instruments. Also, form of auditory stimulus and type of photograph did not depend on one another in affecting memory. Our hypothesis that a related auditory cue would augment memory for photographs was not supported. Even though the data suggest that music improved recall for photographs shown, the augmentation was not significant. Unless a concrete relationship is made between the auditory stimulus and the learning material, (i.e., as proposed by Macklin (1996) and her discussion of associative network theory) it is possible that an auditory stimulus may prove to actually be distracting on learning. It was believed that subtle and tranquil music would actually stimulate the mind and therefore induce focus and concentration. However, since this type of stimulus provides more environmental input into bodily senses, specifically hearing, music may actually detract focus from learning material to the auditory stimulus.

*Limitations*

There are several potential limitations to this experiment. Considering our primary focus, we chose to present photographs of musical instruments from an orchestra since we decided that the auditory stimulus would be classical music. In an attempt to hide the purpose of our study from the participants, we needed to include another type of photograph. Since we were not concerned with the effect this type of photograph had on memory, we chose to incorporate pictures that were familiar and that should therefore be better recalled regardless of the presence of an auditory stimulus. The fact that these pictures were highly familiar to the participants presented a specific limitation: During free recall, the participants may have simply listed familiar areas or buildings from the UCLA campus, regardless of whether or not they actually recalled the scenes from the presentation. This may have limited their effort to recall photographs of musical instruments. Another limitation was that the computer lab in which the experiment was conducted had several old photographs of UCLA displayed around the room. Seeing the photographs may have triggered the participants' memory for UCLA photographs shown during the slide show presentation. Both of these may possibly account for the fact that UCLA scenes were significantly recalled more than musical instruments.

The participants were prompted to wear headphones, which created an expectation of an auditory stimulus. In order to prevent demand characteristics, chimes were included to indicate the transitions from one photograph to the next. This was especially important for the participants who did not hear the music playing during the first half of the presentation. Unfortunately, the chimes may have been a distraction. The results indicated that this may

have had an effect on recall for photographs shown with chimes, since average recall tended to be higher in the music condition than in the silent condition.

Another potential limitation was in our general research design. If we had set the presence of a related auditory stimulus as a between-subjects variable, we would have been better able to detect the effect of the classical music cue on recall for musical instruments. Furthermore, making form of auditory stimulus a between-subjects variable would have allotted more time for exposure to each condition, as well as avoiding the potential confounds introduced by the sharp transition from music to silence (or vice versa).

### *Future Research*

There are several ways that future research can improve this study. Future researchers should perhaps look into investigating the effectiveness of auditory cues by using a control group. This way, a baseline can be assessed for recall with no auditory cueing present compared to recall with auditory cueing present. It would also be ideal that researchers create a concrete relationship between the cued photographs, and the cueing auditory stimulus. A strong association between the two would allow for the effects of cueing to reach maximum potential. As an example, photographs may be shown of a rainforest with sounds of rain and wild animals. In addition, the types of photographs shown should be equally familiar to participants so as not to have one type of photograph be more familiar and therefore impede on efforts to recall the less familiar photographs. The implications of distinctive cues research span from education to advertising to clinical treatment. Further, each study that reveals more about how cueing (especially across modalities) augments memory will increase our ability to understand and someday model how humans process information.

## References

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## Figure Caption

*Figure 1.* Mean number of photographs recalled as a function of form of auditory stimulus, and type of photograph. Types of photographs are University of California, Los Angeles (UCLA) scenes, and musical instruments (MI).

