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Attenuating Verbal Overshadowing Through Color Retrieval Cues

Maria A. Brandimonte
University of Trieste

Jonathan W. Schooler
University of Pittsburgh

Patrizia Gabbino
University of Trieste

Five experiments showed that interference resulting from verbalizing visual stimuli (verbal overshadowing) can be reduced by reintroducing visual cues present at encoding. Object color and background color were used as cues. Participants learned either easy- or hard-to-name figures and then performed an image rotation task. Before performing the imagery task, participants were re-presented with the color patch associated with each figure. Color re-presentation attenuated the impairment associated with easy-to-name stimuli (Experiment 1) as well as labeled hard-to-name stimuli (Experiment 2). However, background color cues had no effect on imagery performance (Experiment 3). Experiment 4 showed that naming the object colors at encoding makes color retrieval cues ineffective. Finally, Experiment 5 showed that object color cues can help participants to overcome previously exhibited impairment resulting from covert verbalization.

Sometimes memories that seem lost may have been merely overlooked. In their well-known study on memory for words, Tulving and Pearlstone (1966) explored the hypothesis that "a substantial part of nonrecall of familiar words under typical experimental conditions is attributable to inaccessibility of otherwise intact memory traces" (p. 382). In the Tulving and Pearlstone study, immediate recall was tested with or without category names as retrieval cues. Cued recall was higher than noncued recall, indicating that sufficiently intact memory traces of nonrecalled words were available. Since then a body of research has shown that items are not simply remembered or forgotten. For instance, initially unrecallable items can be later accessed following modifications in the environmental context (e.g., Smith, Glenberg, & Bjork, 1978), in the nature of the task (e.g., Lupker, Harbluk, & Patrick, 1991), and in the participant's perspective (Anderson & Pichert, 1978).

In the domain of visual memories, the accessibility–availability question has remained somewhat controversial. This issue has received the greatest attention within discussions of the misinformation paradigm in which visual memory performance is influenced by exposure to inaccurate verbal suggestions. E. F. Loftus and her coworkers (1981, 1991; see also E. F. Loftus & G. R. Loftus, 1980) interpreted misinformation effects in terms of loss or distortion of original memories. Loftus argued that when participants receive misleading verbal information after visual information, the new information is integrated into the visual scene in such a way as to "update" the previously formed memory. Forgetting observed in these conditions is attributed to the unavailability (loss) of the original information. Other researchers, however (Bekerian & Bowers, 1983; Christiaansen & Ochalek, 1983; Lindsay & Johnson, 1989; Zaragoza & Lane, 1994), have argued that the original visual memory and the subsequent inaccurate verbal information coexist in memory but compete or are confused at the time of retrieval.

A similar conceptual debate has surrounded interpretations of the observation that overtly or covertly verbalizing visual stimuli can interfere with subsequent memory performance. For example, various researchers (Bahrick & Boucher, 1968; Nelson & Brooks, 1973) explained the negative effects of verbally labeling visual stimuli by suggesting that verbal processing reduces the amount of encoded visual information. That is, verbal processing occurs at the expense of visual learning (Bahrick & Boucher, 1968). An alternative view of the disruptive effects of verbalizing visual stimuli has been proposed by Schooler and Engstler-Schooler (1990), who suggested that "verbalization does not reduce the amount of visual information that is encoded, but rather interferes with subjects' use of the visual code" (p. 39). According to this interpretation, verbalization produces a verbally biased code that overshadows but does not eradicate the original visual memory.

The accessibility assumption implies that, under appropriate conditions, verbal interference should be alleviated, hence allowing the use of the original visual information. Initial support for such an hypothesis comes from Schooler and Engstler-Schooler's (1990) Experiment 6. Given the assumption that picture recognition involves serial access of

Maria A. Brandimonte and Patrizia Gabbino, Department of Psychology, University of Trieste, Trieste, Italy; Jonathan W. Schooler, Learning Research and Development Center, University of Pittsburgh.

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Correspondence concerning this article should be addressed to Maria A. Brandimonte, Department of Psychology, University of Trieste, Via dell'Università 7, Trieste, Italy 34123. Electronic mail may be sent via Internet to Brandy@univ.trieste.it.

the two codes—that is, participants first access an accurate visual code followed by a verbally biased code—the authors hypothesized that limiting the time given to the participants for recognition should reduce the impairment. Results were consistent with predictions, hence supporting the hypothesis of coexistence in memory of the original visual information and a new conceptual representation that competes with the original visual memories (see also Bartlett, Till, & Levy, 1980; Schooler, Ryan, & Reder, in press).

In the Schooler and Engstler-Schooler (1990) study, overt verbalization subsequent to visual encoding interfered with the recollection of the original visual memories. More recently, Brandimonte and her colleagues (Brandimonte & Gerbino, 1993; Brandimonte, Hitch, & Bishop, 1992a, 1992b) found that interference can also occur as a consequence of covert verbal processing concurrent with stimulus encoding (i.e., verbal recoding of visual stimuli; see also Brandimonte & Gerbino, 1996). These studies demonstrated that impeding verbal recoding of visual stimuli at the time of learning facilitates imagery performance by preventing the establishment of a competing verbal representation. For example, asking participants to engage in articulatory suppression during initial learning improved subsequent imagery performance when stimuli were easy to name, but not with hard-to-name stimuli (Brandimonte et al., 1992a, 1992b); vice versa, supplying verbal labels to pictures impaired imagery performance only when stimuli were hard to name (Brandimonte et al., 1992b).

In the above studies, manipulations at encoding were intended to prevent verbal recoding, hence removing the cause that could have otherwise produced verbal overshadowing. An issue left unresolved by the covert verbal recoding studies is the question of the accessibility of visual memories when verbal recoding is not prevented. Can the original visual trace be contacted again despite the establishment of a competing verbal representation? Brandimonte and Gerbino (1993, 1996) speculated that verbal overshadowing effects may not only be precluded by preventing verbal recoding (see Brandimonte et al., 1992a, 1992b) but may even be removed once they have occurred so as to make visual memories once again accessible. In support of this claim, Brandimonte and Gerbino (1993) described indirect evidence coming from studies on the reinterpretation of ambiguous figures (such as the duck–rabbit) in mental imagery. In general, these results are in accordance with the view that image reversal is constrained by a verbal bias that limits its occurrence. However, such a bias can be either impeded by using manipulations that are effective during learning (e.g., articulatory suppression at encoding, see also Brandimonte et al., 1992a, 1992b) or removed, once it has occurred, by providing explicit hints (Peterson, Kihlstrom, Rose, & Glisky, 1992) or instructions (Brandimonte & Gerbino, 1993; Chambers & Reisberg, 1992; Hyman & Neisser, 1991) that act on people's understanding of their images. Brandimonte and Gerbino (1993) interpreted the former as reflecting prevention of verbal recoding and the latter as indicating some kind of release from verbal overshadowing.

Although the image reversal literature is generally consistent with the possibility of release from verbal overshadowing and its implications for the availability–accessibility question, such a phenomenon has yet to be conclusively demonstrated. A compelling demonstration of release from verbal overshadowing would be the observation that a manipulation theoretically believed to reduce reliance on a verbal code could reverse the impaired performance of verbalization participants, while having no effect on participants who did not engage in verbalization. In principle, however, the demonstration of a retrieval locus for verbalization effects does not require that verbalization participants first show evidence of impairment and then overcome it. A more modest, though still compelling, demonstration that verbalization influences retrieval processes would be the observation that manipulations introduced before retrieval but after verbal recoding can prevent verbal impairment.

In the present article, we report the results of five experiments in which we attempted to obtain attenuation of verbal overshadowing by using color as a retrieval cue. Recent research by Hitch, Brandimonte, and Walker (1995) observed that memory performance, as assessed by an image combination task, was both improved and more sensitive to the visual surface characteristics of the stimuli when encoding was accompanied by articulatory suppression. Specifically, articulatory suppression sensitized participants to the contrast congruity of the to-be-combined drawings, such that their performance was superior when both line drawings had originally appeared in the same contrast (either both as white line drawings on a black background or vice versa as black line drawings on a white background) rather than in opposite contrast. However, in the absence of suppression, long-term memory was insensitive to contrast congruity, and performance in the imagery task was poorer. These results suggest that verbal recoding of visual memories encourages the retrieval of the abstract characteristics of a stimulus, while decreasing retrieval of its surface characteristics. Given this relationship, it seems plausible that providing surface cues at retrieval might reverse this process; that is, decrease the use of abstract stimulus characteristics and increase access to its visual characteristics. Accordingly, when participants have previously engaged in verbal recoding, exposure to a memory cue corresponding to a surface feature of the stimulus (e.g., its color), may increase access to other surface features of that stimulus, thereby preventing verbal overshadowing.

Overview

The logic of the present experimentation involved a methodology used in previous experiments by Brandimonte et al. (1992a, 1992b) in which the ability to manipulate a mental image is taken as an index of memory for the physical appearance of the original stimulus (see also Hitch et al., 1995). Across the five experiments, we manipulated both encoding (nameability of the stimuli, presence–absence of verbal labels) and retrieval (color cues) variables. With the exception of Experiment 3, the stimuli appeared as line drawings on colored cards. Therefore, color belonged to both the background and the depicted object.

In Experiment 1, the effectiveness of color cues at retrieval in preventing verbal overshadowing was assessed. In Experiment 2, we explored whether the effect occurs even when verbal recoding is experimentally induced by adding verbal labels to otherwise hard-to-name pictures. In Experiment 3, we explored the effectiveness of background color in influencing imagery performance when it is used as a retrieval cue. In Experiment 4, we tested the hypothesis that overtly naming the color of the cards at the time of initial learning can prevent subvocalization of the pictures names, hence impeding verbal recoding. Finally, in Experiment 5, we examined whether it is possible to attenuate verbal overshadowing effects once they have already been produced (release from verbal overshadowing).

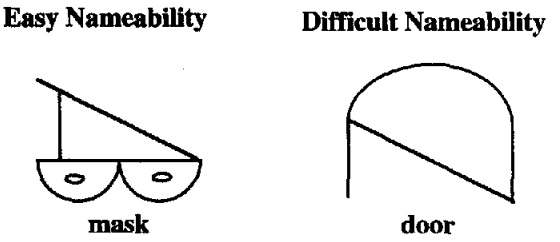

Figure 1. An example of easy-to-name and hard-to-name stimuli (from Brandimonte et al., 1992b) used in the present experiments. From "Verbal Recoding of Visual Stimuli Impairs Mental Image Transformations," by M. A. Brandimonte, G. J. Hitch, & D. V. M. Bishop, 1992, *Memory & Cognition, 20,* p. 450. Copyright 1992 by the Psychonomic Society. Adapted with permission.

Experiment 1

Before we describe Experiment 1, some clarifications about the assumptions underlying the present work are in order. A first assumption was that easy-to-name stimuli elicit more labeling than hard-to-name stimuli. Such an assumption is not new in the memory literature (see, e.g., Paivio, 1986), and it has been recently substantiated by evidence coming from Brandimonte et al.'s (1992b) observation that labeling the stimuli during encoding impaired subsequent imagery performance with hard-to-name stimuli but not with easy-to-name stimuli, implying that naming spontaneously occurred with the easy-to-name stimuli.

A second assumption underlying the present research was that verbal labeling during encoding encourages verbal recoding (the formation of a memory corresponding to the verbal label) that can influence performance at the time of retrieval. This assumption is supported by considerable research demonstrating that the use of verbal labels during encoding systematically influences subsequent memory performance such that participants tend to emphasize details consistent with the label and de-emphasize evidence inconsistent with the label (e.g., Carmichael, Hogan, & Walter, 1932; Daniel, 1972). An implication of this assumption is that verbal recoding and verbal overshadowing can be conceived of as at least potentially distinct processes; that is, verbal recoding corresponds to the formation of a verbal trace during encoding, whereas verbal overshadowing corresponds to the dominance of this verbal trace over a visual trace at the time of retrieval.[1] Accordingly, manipulations introduced during encoding will be assumed to influence verbal recoding, whereas manipulations introduced during retrieval will be assumed to influence verbal overshadowing.

A final assumption of the present paradigm was that our imagery task serves as a reasonable measure of participants' memory for the stimuli. This task required participants to revisualize each previously seen picture and then to mentally rotate it to discover two joined capital letters (see Brandimonte et al., 1992b). Inspection of the stimuli used in this task (see Figure 1) indicates that successful completion of this kind of "mental discovery" (see Finke, 1989, 1990) requires that participants possess a relatively detailed and nondistorted recollection of the image. It might be suggested that recognition or reproduction (drawing) would have provided a more straightforward test of visual memory. However, unlike in the case of verbal memory, both reproduction and recognition measures can be problematic for testing memory for visual forms, especially when they are used as primary measures. Reproduction measures rely heavily on individuals' drawing skills as well as on people's conventions about drawing per se (Kosslyn, 1980). Therefore, there might be a marked discrepancy between what may be internally available to participants and what they are capable of—or decide to—physically externalize. Recognition measures can also be problematic because they critically depend on the experimenter's ability to anticipate the possible distortions that participants might generate (cf. Daniel, 1972). Moreover, recognition measures are known to be affected by verbal information encoded at study (see G. R. Loftus, 1972; G. R. Loftus & Bell, 1975; G. R. Loftus & Kallman, 1979). The inherent limitations of reproduction and recognition measures, along with the prior demonstrations of the effectiveness of the mental imagery tasks used in this study (cf. Hitch et al., 1995), led us to consider this task a more appropriate measure of memory for visual forms.

In our first experiment, we investigated whether verbal overshadowing could be prevented at retrieval by showing, before image formation, a visual cue (color) that was present at encoding. Participants learned either easy- or hard-to-name line drawings that were drawn on colored cards. They were then asked to complete the letter rotation task. In each condition, just before performing the mental rotation task, half of the participants were re-presented with the color of

[1] There has been considerable debate about whether to characterize memory interference in terms of competing traces or processes (e.g., Kolers & Roediger, 1984) It is beyond the scope of this article to resolve this issue. However, although here we characterize our approach in terms of competing codes–traces, it could equally well be described in terms of competing processes. Accordingly, verbal recoding could be characterized as the introduction of verbal processing at the time of encoding. Verbal overshadowing could be understood as a situation in which verbal encoding or postencoding processes are inappropriately transferred to retrieval situations that would be better served by visual processing (for further discussions of the viability of considering verbal overshadowing in terms of competing processes, see Fallshore & Schooler, 1995; Schooler, Ryan, & Reder, in press).

the card on which each picture was drawn, while half were directly required to perform the imagery task. As in prior studies (Brandimonte et al., 1992a, 1992b), it was expected that in the no-color cue conditions, easy-to-name stimuli would be verbally recoded (cf. Paivio, 1986, 1991), and consequently imagery performance should be superior for participants receiving hard-to-name as compared with easy-to-name items. However, if verbal recoding exhibited its effects at retrieval by overshadowing an intact visual memory, and if visual cues increased the likelihood of contacting this intact visual memory, then the color cue might minimize the difference between imagery performance for participants receiving hard- versus easy-to-name pictures.

Method

Participants. Sixty University of Trieste undergraduates took part in this experiment as volunteers. Participants were randomly assigned to the experimental conditions in a 2 (hard vs. easy nameability) × 2 (presence–absence of the retrieval cue) between-subjects factorial design. The participants were all Italian and were tested individually in a laboratory at the Department of Psychology. There were 15 participants per condition.

Materials. Materials were two sets of pictures described and used in the experiments reported by Brandimonte et al. (1992b), with the modification that the stimuli were black line drawings (i.e., wirelike figures) on colored cards measuring 20 × 20 cm. The colors were chosen to be highly distinguishable and with no preexisting association with the depicted object (e.g., yellow–lemon). In terms of the Munsell system, the six colors used in our experiments corresponded to the following notation: red (5R 5/12), yellow (5Y 8/12), green (5G 5/8), blue (5B 6/6), purple (5P 6/6), and neutral gray (5G N6/0).

The two learning sets consisted of six pictures that were either easy- or hard-to-name and a training figure (Figure 1). When rotated 90% counterclockwise, each shape revealed two capital letters that were always joined together and could occasionally share one side. An additional set of colored cards measuring 10 × 10 cm for use as retrieval cues was prepared. Colors were the same as those used for the learning sets.

Procedure. The procedure was modeled after Brandimonte et al.'s (1992b) study. Participants were asked to memorize a series of six colored pictures that were presented by hand at a rate of 5 s per picture, for a total of three presentations. Pilot work with an independent group had shown that 90 s was a sufficient time for participants to remember the series with 100% accuracy. Of importance, at this stage participants were not forewarned about the task they would be requested to perform thereafter, so as to make unlikely that participants would rotate the stimuli while learning them. Immediately after learning, participants were asked to check, in their mind, whether they could remember the members of the series exactly in the order in which they had learned them. All participants reported that they could do so. A practice trial in the mental rotation task followed the memorization phase. After practice, participants were requested to form a mental image of the first picture, to mentally rotate it 90% counterclockwise, and to identify and name the two capital letters compounding the original stimulus. After naming the two letters, they were asked to form an image of the second stimulus, and so on. Participants were given as much time as they needed.

In each nameability condition, immediately before performing the imagery task, half of the participants were shown for each stimulus the patch re-presenting the color of the correspondent picture in the learning set, and half were directly required to perform the mental rotation and discovery of letter task. Care was taken in presenting the color patch before each image formation so as to minimize the possibility that the overshadowed representation was formed prior to the color cue presentation (this issue is further considered in Experiments 4 and 5). Although we cannot empirically demonstrate that all participants complied with instructions—and therefore that we measured prevention of rather than release from verbal overshadowing—on a logical ground, the former mechanism seems most likely. Specifically, participants were told that to help them remember each stimulus in the correct sequence, they would be presented with the color patch associated with each stimulus and that for the cue to be effective, they should wait until the cue was shown before forming the image and rotating it. Thus, after memorization and practice in the imagery task, the exact sequence for each stimulus was color cue, instructions to generate the image and to rotate it, and naming of the resulting letters. The order of the six stimuli was counterbalanced across subjects.

Results and Discussion

Scoring reflected the number of letters correctly identified in mental imagery (0, 1, 2, maximum of 12). Figure 2 shows the results for performance on the rotation task, expressed as the number of letters correctly identified in mental imagery. A two-variable between-subjects analysis of variance (ANOVA) revealed an effect of the presence of color cue, $F(1, 56) = 4.31$, $p < .05$, $MSE = 6.18$, and an effect of nameability that approached significance, $F(1, 56) = 3.11$, $p < .09$, $MSE = 6.18$.[2] There was also an interaction between nameability and presence of the retrieval cue, $F(1, 56) = 4.75$, $p < .05$, $MSE = 6.18$. Planned comparisons showed that this interaction reflected a significant effect of nameability in the no-cue condition, $F(1, 56) = 7.78$, $p < .01$, but not in the cue condition ($F < 1$).

The outcome of Experiment 1 supports the contention that verbally recoding visual stimuli at the time of learning does not alter the original visual memory, but rather verbal recoding appears to overshadow the visual memory at the time of retrieval. As in prior studies (e.g., Brandimonte et al., 1992a, 1992b), under standard retrieval conditions, participants who encoded easy-to-name figures had greater difficulty subsequently deciphering the letters in their images, compared with participants who encoded hard-to-name figures. On the assumption that easy-to-name figures are more likely than hard-to-name figures to be spontaneously named, this finding suggests that verbal recoding during encoding impaired subsequent imagery performance in the no-cue condition. However, when a color cue was presented prior to image rotation, the otherwise observed difference between imagery performance and easy- versus hard-to-name pictures was eliminated. The capacity of a retrieval manipulation to attenuate the effects of spontaneous verbalization during encoding suggests that despite the establishment of a competing verbal representation, overshadowing of the original visual information can be prevented. It is particularly noteworthy that visual processing had no additional

[2] For Experiments 1 and 2, we are not able to report the analyses by item because the protocols with the raw data were lost during transfer to another building.

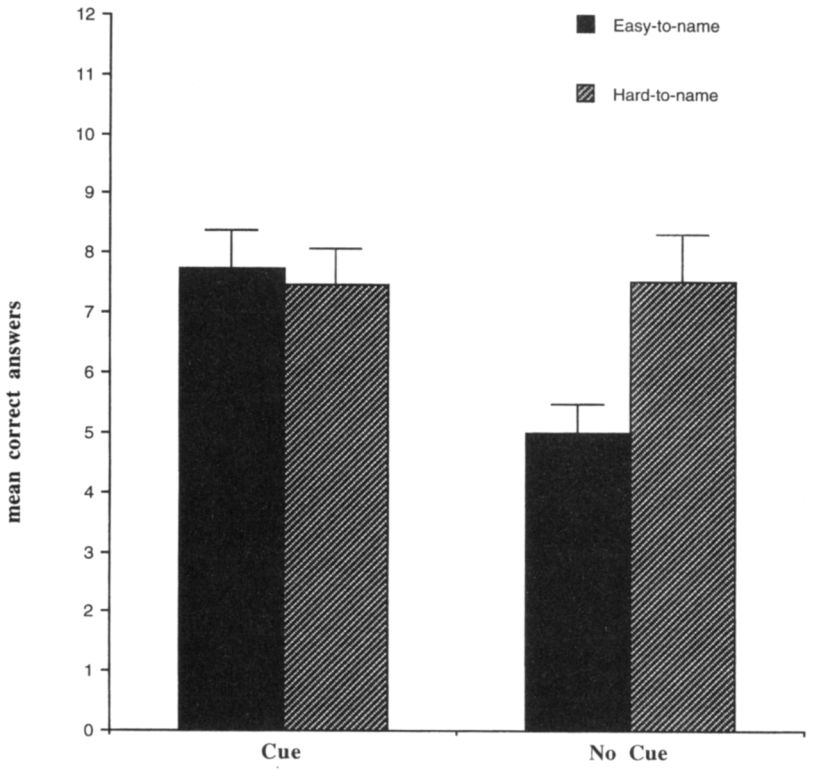

Figure 2. Mean number of letters correctly identified in mental imagery in the cue and no-cue conditions as a function of nameability (Experiment 1).

effect on performance when pictures were hard to name. This latter finding might be interpreted as indicating that in the case of hard-to-name stimuli, the similarity between the characteristics of the stimuli and the nature of the task may have prompted the most appropriate processing operations (i.e., visual), with no need for further help by the cue.

Although the present findings can be readily interpreted in terms of prevention of verbal overshadowing, one might argue that differences in imagery performance were produced by differential initial learning. That is, participants in the easy-to-name condition might have encoded less information than did the participants in the hard-to-name condition, perhaps because they did not attend as much to the seemingly easy stimuli (M. J. Intons-Peterson, personal communication, January 17, 1995). However, if participants in the easy-to-name condition learned the original stimuli less well than did participants in the hard-to-name condition, there is no way to explain how the color cue could have enabled them to retrieve the visual information necessary to perform the imagery task. If little is learned, little can be retrieved, regardless of what type of retrieval cue is present.

In our view, the poor imagery performance associated with easy-to-name stimuli retrieved in the absence of a visual cue is a result of the existence of a competing verbal representation formed at the time of encoding. This interpretation is based on the seemingly reasonable assumption that the degree of nameability of the stimuli determines whether or not a competing verbal representation of the same stimuli will be spontaneously formed (see Brandimonte et al., 1992a, 1992b). Although this assumption is both supported by prior research and consistent with the results observed in the no-cue condition of this experiment, it must be conceded that there was no explicit manipulation of verbal labels in this study, raising the possibility that some difference, other than covert labeling, was responsible for the differential imagery performance elicited by the easy- versus hard-to-name stimuli. In Experiment 2, we addressed this issue by examining whether a comparable interaction between color cues and (what we believe to be) verbal recoding occurred when verbal coding was overtly induced by supplying verbal labels to hard-to-name pictures (Brandimonte et al., 1992b). If our interpretation of the results from Experiment 1 was correct, then the effect of color cues should generalize to conditions in which verbal recoding is not determined by the easy nameability of the stimuli, but it is fostered by the presence of labels associated with hard-to-name pictures. Therefore, in Experiment 2, an interaction is predicted between presence–absence of labels at encoding and presence–absence of retrieval cues such that color cues have a beneficial effect only in the labels condition, while having no effects in the condition with no labels.

Experiment 2

In Experiment 2, participants performed the same imagery task as in Experiment 1, with the modification that only

hard-to-name stimuli were used and labels representing names of the pictures were applied below each shape (see Brandimonte et al., 1992b, Experiment 2). Names were chosen from the list obtained by Brandimonte et al. (1992b) through a nameability agreement test. Those names that obtained the highest percentage of agreement on a single name were used as labels (see Figure 1). As in Experiment 1, half of the participants were re-presented with the color patch immediately before performing the rotation task, and half were required to directly perform the task. The central prediction of Experiment 2 was that color re-presentation would prevent the negative effects of verbal overshadowing that result from encoding hard-to-name stimuli with verbal labels. This prevention of verbal overshadowing would be indicated by an interaction such that the presence of labels has a greater impact in the no-cue condition as compared with the cue condition.

Method

Participants. Sixty University of Trieste undergraduates took part in this experiment as volunteers. They were randomly assigned to four experimental conditions in a 2 × 2 factorial design (presence–absence of labels, presence–absence of color retrieval cue).

Materials and procedure. Only hard-to-name stimuli were used in this experiment. They were presented either with or without labels. Labels were applied 1 cm below the picture. The same procedure as in Experiment 1 was used for the image rotation task. In each condition, half of the participants were re-presented with a patch of the color associated with each picture, and half were directly required to perform the task.

Results and Discussion

Results are illustrated in Figure 3. A two-way between-subjects ANOVA showed an interaction between labeling and presence of the retrieval cues, $F(1, 56) = 4.54, p < .05$, $MSE = 3.76$; an effect of presence of the color cue, $F(1, 56) = 10.21, p < .01, MSE = 3{,}76$; and an effect of presence of the labels, $F(1, 56) = 5.74, p < .05, MSE = 3.76$. Planned comparisons showed that in the no-cue condition, adding labels significantly impaired performance in the imagery task, $F(1, 56) = 10.25$, $p < .01$. However, in the cue condition, there was no effect of labeling ($F < 1$).

The results from Experiment 2 replicated and extended those obtained in Experiment 1 by showing that color re-presentation not only attenuates the imagery performance decrement associated with easy-to-name pictures, but it also eliminates the negative effect of labeling when the stimuli are hard to name. The significant effect of labeling in the no-cue condition can be taken as indicating that verbal overshadowing occurred. In this context, the absence of any effect of labeling in the cue condition suggests that verbal overshadowing can be prevented even after a verbal representation of the corresponding visual stimulus has been formed.

The effectiveness of color retrieval cues in attenuating verbal overshadowing can be taken as a further demonstra-

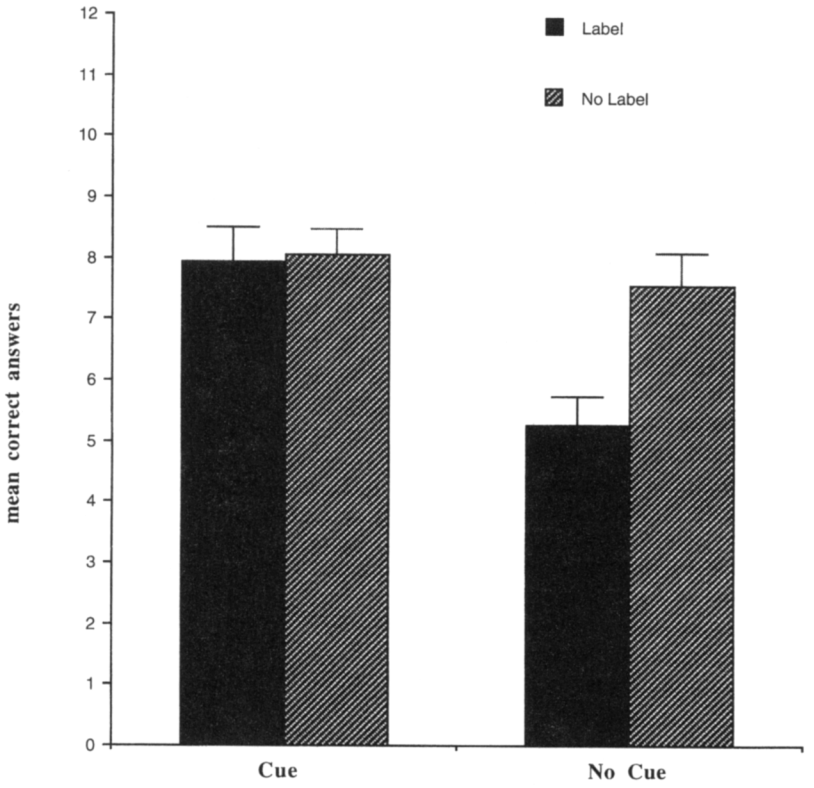

Figure 3. Mean number of letters correctly identified in mental imagery in the cue and no-cue conditions as a function of the presence of labels (Experiment 2).

tion (see, e.g., Hitch et al., 1995; Kosslyn, 1980; Walker, Hitch, Dewhurst, Whiteley, & Brandimonte, in press) that the long-term visual representation used in mental imagery can preserve surface characteristics. However, in Experiments 1 and 2, the pictures were based on the line drawings used by Brandimonte et al. (1992b). That is, color belonged to both the background and the object, hence leaving open the question of whether only one or both features (i.e., background color and object color) are included in the representation and, as a consequence, may be effective as retrieval cues. In fact, there are reasons to believe that impact of color cues may critically depend on whether the color is a characteristic of the figure or its background. Specifically, Walker et al. (in press) observed that the color congruency of a figure between encoding and test influences image operations, whereas the congruency of the background does not. This finding suggests that individuals may maintain a visual representation for the color of a figure but not for the color of its background. Therefore, one possibility is that color is effective as a retrieval cue only when it belongs to the object but not when it belongs to the background. In Experiment 3, we tested this hypothesis.

Experiment 3

The purpose of Experiment 3 was to examine whether color cues associated with the background operate in a different manner from cues associated with the figure. In this experiment, the stimuli consisted of the same set of easily nameable line drawings used in Experiment 1 and of a new set of solid two-dimensional forms drawn as white figures on a colored background (see also Walker et al., in press). Participants performed the same image rotation task as in previous experiments, with or without color retrieval cues. In addition, in this experiment, two recognition measures (for the figures and for the colors) and a postexperimental questionnaire were administered at the end of the imagery task.

On the basis of previous results (Walker et al., in press), an interaction was predicted between type of stimuli (line drawings vs. solid forms) and presence of the color retrieval cue such that the cue should improve imagery performance when color was an integral component of the to-be-learned figure (i.e., the original line drawings) but not when color was exclusively associated with a figure's backround (i.e., white forms on colored backrounds). With respect to the overall imagery performance associated with the two types of stimuli, there are two different possible outcomes that follow from prior research. On the one hand, being easy-to-name stimuli, imagery performance with the white forms might be comparable to that associated with the uncued line drawings in Experiment 1. On the other hand, there is a possibility that participants may spontaneously name background colors rather than figures. If so, this concurrent verbalization at the time of encoding might reduce verbal recoding of the figure's appearance, thereby preventing subsequent verbal overshadowing of the figures. In this case, performance in the solid forms conditions might be as high as that in the cued line-drawings condition.

Method

Participants. Forty undergraduates from the University of Trieste took part in this experiment as volunteers. They were randomly assigned to four experimental conditions in a 2 (line drawings vs. solid forms) × 2 (presence–absence of color retrieval cue) between-subjects factorial design.

Materials and procedure. Only easy-to-name figures were used in this experiment. A new set of pictures was prepared to be used in the solid forms condition. It consisted of the same easily nameable figures used in Experiment 1, with the exception that they were drawn as white objects on colored cards rather than as line drawings.

The same procedure as in Experiment 1 was used for the image rotation task. In each condition, half of the participants were re-presented with a patch of the color associated with each picture, and half were directly required to perform the task.

At the end of the image rotation task, each participant took part in two 5AFC (alternative-forced-choice) recognition tasks (for the figures and for the colors). The color recognition task was always administered before the figure recognition task to prevent cue participants from using the color cue itself as a memory source for recognizing the color.

Figure recognition. For each figure of the learning set, participants viewed a series of five pictures (the target plus four distractors). The distractors (Figure 4) were constructed so as to differ from the original for only one visual characteristic. The position of the target among the distractors was random, as well as the position of the distractors in the row.

Color recognition. In this task, participants were shown a ring of five colors, all with the same name (the target plus four distractors), extrapolated from the Munsell color system charts. The following criteria were chosen for construction and administration of the recognition test. The stimuli were viewed on a horizontal surface, directly from above. Namely, the participants were shown the charts directly from the Munsell book. On each chart, only the five samples of interest were left in view. Direct sunlight was avoided; illumination fell on the chart at an angle of about 45° from the side of the reader.

After completing the imagery and recognition tasks, participants were asked to respond to a brief questionnaire about the strategies they used to encode the stimuli.

Results and Discussion

Results are illustrated in Figure 5. A two-way between-subjects ANOVA showed an interaction between type of stimulus and presence of the retrieval cues, $F(1, 36) = 4.31$, $p < .05$, $MSE = 4.21$. This interaction reflects the fact that the color retrieval cue had the effect of improving imagery performance only in the line drawings conditions, $F(1, 36) = 5.73$, $p < .03$, $MSE = 4.21$, whereas it had no effect when the figures were drawn as solid forms. However, in the solid forms conditions, participants' performance was as high as that in the cued line-drawings condition. Similar

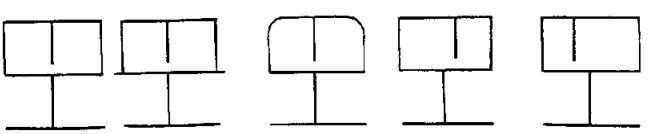

Figure 4. Examples of distractors used in the recognition tasks.

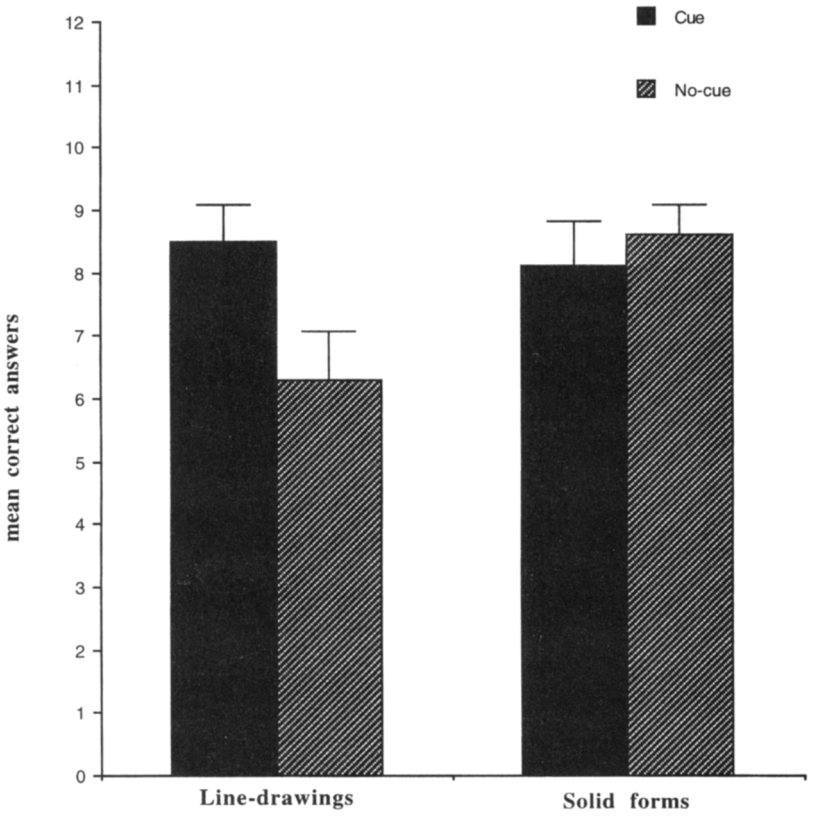

Figure 5. Effects of the cue in the line drawings and solid forms conditions.

effects were obtained when an ANOVA was calculated by using items as a random variable. In particular, an interaction between type of stimulus and presence of the retrieval cues was found, $F(1, 10) = 21.53, p < .0001, MSE = 1.40$, with a beneficial effect of the cue in only the line drawings conditions.

No effects of either variables were observed in the figure recognition task. In both the line drawings and solid forms conditions, participants performed as well with as without the retrieval cue. These results were confirmed by an ANOVA by items (all Fs < 1). Table 1 shows the means for each condition in the figure recognition test.

In the color recognition task, a main effect of type of stimulus was observed, $F(1, 36) = 5.61, p < .03, MSE = 2.15$. That is, participants in the line drawings conditions recognized colors better than did participants assigned to the solid forms conditions. No other effect reached significance (Fs < 1). An ANOVA by items showed a main effect of type of stimulus, $F(1, 10) = 8.52, p < .02, MSE = 0.16$. Table 2 shows the means for each condition in the color recognition test.

In the postexperimental questionnaire, most participants reported naming the original figures (recall that they were all easy-to-name figures). However, a higher percentage of participants reported naming the original figures in the line drawings conditions (90%) than in the solid forms conditions (60%). To the contrary, a higher percentage of participants reported naming the colors in the solid forms conditions (50%) than in the line drawings conditions (5%).

The main result of Experiment 3 is that a beneficial effect of providing color retrieval cues was found in the line drawings conditions but not in the solid forms conditions. Apparently, people's performance in the image rotation task

Table 1
Mean Performance in the Figure Recognition Test

	Cue		No cue	
Stimulus	*M*	*SD*	*M*	*SD*
Solid form	4.30	1.43	4.50	1.43
Line drawing	4.70	1.25	4.40	1.26

Table 2
Mean Performance in the Color Recognition Test

	Cue		No cue	
Stimulus	*M*	*SD*	*M*	*SD*
Solid form	2.50	1.50	2.50	1.35
Line drawing	3.50	1.71	3.70	1.25

does not benefit from having a color cue available at retrieval when color is a background feature. However, this effect cannot be taken as indicating that the visual representation used to perform the imagery task in the solid forms conditions does not preserve color information (cf. Walker et al., in press). Rather, the finding that performance in the solid forms condition is as high as that in the cued line-drawings condition suggests that the absence of any effect of verbal overshadowing may be a result of the fact that naming of the figures was replaced by naming of the background colors, thus preventing verbal overshadowing to occur and the cue to be effective. Such an interpretation is supported by the results of the postexperimental questionnaire. In fact, although the percentage of naming the figures decreases from 90% in the line drawings conditions to 60% in the solid forms conditions, the percentage of naming the colors shows an inverse pattern of results in that it increases from 5% in the line drawings conditions to 50% in the solid forms conditions.

An alternative explanation of these results is that the enhanced contrast derived from using white figures on a colored background as compared with black line drawings on a colored background made visual coding more likely in the solid forms conditions, and this produced the observed effects rather than automatic verbal coding of the background color (J. Davidoff, personal communication, April 19, 1996). However, if so, asking people to overtly verbalize the color names during initial learning of the line drawings (a condition in which the contrast is relatively lower) should not produce a beneficial effect on imagery performance as compared with a nonverbalization condition with the same type of stimuli. This issue is addressed in Experiment 4.

Although they were not used as primary measures, the two recognition tests also provided useful information. As regards figures recognition, the finding that performance was equally good irrespective of conditions suggests that the original figures were learned equally well by participants assigned to the various conditions. The lack of differences in the figure recognition task cannot be attributed to the difficulty of the task in that neither floor nor ceiling effects were observed (see Table 2). However, the lack of any effects of the retrieval cues is reminiscent of some results in the domain of context-reinstatement studies (see, e.g., Smith, 1988; Smith et al., 1978). Presumably, recognition tasks are not well suited to context-reinstatement techniques because the tests themselves can serve as a form of visual context reinstatement, thus perhaps explaining why context effects can be difficult to observe with recognition tasks (see also Estes, 1988).

As regards color recognition, the finding that participants in the line drawings conditions performed better than those in the solid forms conditions is fully consistent with results showing that the surface color of an object is remembered better than the color of its background (see, e.g., Ceraso, 1985; Wilton, 1989). However, the difference between conditions in the percentage of naming colors can be plausibly taken as indicating that some kind of verbal overshadowing of the secondary information (background color) took place. It seems plausible to hypothesize that the color recognition task required visual coding to be successfully performed because a ring of colors (all with the same name) was exposed around the target for the recognition test.

As already noticed, one possible explanation for the absence of verbal overshadowing effects in the solid forms conditions is that naming of the figures was replaced by naming of the background colors, thus preventing verbal overshadowing to occur and the cue to be effective. If this interpretation is correct, then asking people to overtly name the colors in the line drawings conditions should alleviate the verbal overshadowing effects commonly observed in standard conditions. In Experiment 4, we verified this hypothesis.

Experiment 4

To test whether verbal overshadowing effects can be attenuated by overtly verbalizing the secondary visual information, in this experiment, we manipulated overt verbalization of color names during initial learning of the pictures. Participants performed the image rotation task used in previous experiments, with the modification that during presentation of the stimuli they were asked to overtly name the color of each card. The stimuli were the easy-to-name line drawings used in previous experiments.

Another issue tested in Experiment 4 was the effect of the timing of the color cues relative to image formation. In the previous studies, we argued that retrieval cues presented prior to image formation alleviate the negative effects of verbal recoding by preventing verbal overshadowing. In other words, we assumed that retrieval cues deter participants from accessing their recoded verbal representation, thereby preventing the verbal representation from interfering with the visual memory. An alternative interpretation, however, is that the retrieval cues caused a release from verbal overshadowing. Accordingly, it is possible that participants generated a verbally biased image that then became ineffectual following the introduction of the visual cues. To distinguish between these two alternative accounts, in Experiment 4, we included a condition in which the color cues were introduced after participants generated the image. If the previously observed benefits of retrieval cues are a result of the prevention of verbal overshadowing, then retrieval cues presented prior to image formation should be more effective than cues presented after image formation. If, however, retrieval cues enable participants to overcome verbal overshadowing that has already occurred, then the effects of retrieval cues should be comparable irrespective of whether they are introduced before or after participants are instructed to form a visual image.

Finally, in Experiment 4, a no-color condition was added as a further control condition to obtain baseline performance and to verify whether a beneficial effect of varying the color at encoding was present in addition to the beneficial effect of color cues at retrieval observed in Experiments 1–3.

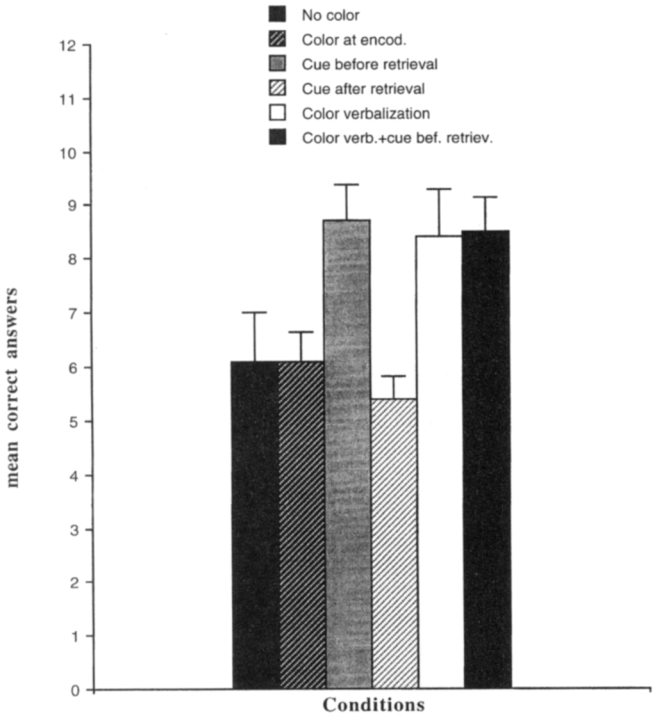

Figure 6. Effect of color verbalization on imagery performance (Experiment 4). Encod. = encoding; verb. = verbalization; bef. retriev. = before retrieval.

Method

Participants. Sixty undergraduates participated in this experiment as volunteers. They were randomly assigned to six experimental conditions (no color, color at encoding, color cue before retrieval, color cue after retrieval, color verbalization at encoding, color verbalization at encoding plus color cue before retrieval).

Materials and procedure. Only easy-to-name stimuli were used in Experiment 4. The procedure for the image rotation task was the same as in previous experiments. The no-color condition served as a control (see Brandimonte et al., 1992b) condition. In the condition with color at encoding, which corresponded to the no-cue condition of previous experiments, participants studied the figures that were drawn on six cards having different colors, but they were not re-presented at retrieval with the associated color. In the condition with color cue after retrieval, participants were re-presented with each color after being instructed to generate the image for the imagery task. In the condition with color cue before retrieval, participants were re-presented with each color before being instructed to generate the image for the imagery task. In the color verbalization condition, participants were asked to overtly verbalize the name of each color while looking at the pictures. The condition with color verbalization at encoding plus color cue before retrieval was a conjunction of the last two conditions, and it was aimed at investigating whether the two treatments have additive effects.

Results and Discussion

Results are shown in Figure 6. A one-way ANOVA showed a significant difference among conditions, $F(5, 54) = 4.46$, $p < .005$, $MSE = 4.94$. Verbalizing colors at encoding improved performance in an imagery task that requires accurate retrieval of the visual characteristics of the stimuli to be successfully performed. Planned comparisons showed that performance in this condition was as high as that obtained when color cues were presented before retrieval. Of interest, the conditions with no color, color at encoding, and color cue after retrieval did not differ from one another. However, they significantly differed from the conditions with color cue before retrieval, $F(1, 54) = 12.22$, $p < .01$, $MSE = 4.94$; color verbalization, $F(1, 54) = 9.77$, $p < .01$, $MSE = 4.94$; and color verbalization plus cue before retrieval, $F(1, 54) = 10.56$, $p < .01$, $MSE = 4.94$. These results were confirmed by an ANOVA by items that showed a significant difference among conditions, $F(5, 25) = 13.66$, $p < .0002$, $MSE = 2.69$.

The outcome of Experiment 4 provides a number of insights for understanding the various ways in which verbally induced interference of visual memory can be attenuated. First, the finding that varying the color of the cards at encoding facilitates performance only when participants are explicitly instructed to verbalize the color names implies that in the absence of such instructions, color knowledge may not be preferentially accessed verbally (cf. Davidoff, 1991; Davidoff & Ostergaard, 1988; Ostergaard & Davidoff, 1985) and thereby does not interfere with the formation of a competing verbal representation of the figures (see Experiments 1 and 2).[3] This finding is consistent with the hypothesis, advanced in the discussion of Experiment 3, that under conditions in which color is a background feature, naming of the figures is presumably replaced by naming of the colors. It also rules out the alternative explanation that the effects observed in previous experiments could be a result of the different contrasts of the stimuli. Second, the results of Experiment 4 further support the distinction between prevention of verbal recoding (through verbalization at encoding) and prevention of verbal overshadowing (through color cues at retrieval). Either treatment alone is sufficient to improve imagery performance, whereas combining the two treatments does not have any additive effects. Finally, the observation that color retrieval cues facilitate performance when presented prior to image retrieval but not

[3] It is important to point out that the positive effect of verbalization on imagery performance observed in this research is not at odds with previous observations of the detrimental effect of verbalization on recognition (Schooler & Engstler-Schooler, 1990). To the contrary, the two results nicely complement each other. The beneficial effect of verbalization observed here involved the covert (Experiment 3) or overt (Experiment 4) concurrent articulation of nontarget visual information, whereas in Schooler and Engstler-Schooler's task, verbalization involved the overt description of target visual information after encoding. Thus, in the former case, verbalization of nontarget information presumably impeded verbalization of the target information hence benefiting visual operations. However, in the latter case, translating the crucial visual information into words encouraged verbal overshadowing. A straightforward conclusion is that although verbalizing irrelevant information during picture encoding prevents verbal recoding and hence overshadowing, verbalizing relevant information after encoding disrupts performance because it induces verbal overshadowing.

afterwards suggests that the cues are helpful in preventing verbal overshadowing but not in reversing it.

Experiment 5

In Experiment 4, we observed that color cues presented after image formation failed to enable participants to overcome the interference resulting from verbal recoding of easy-to-name figures. This finding suggests that the effect of color cues in the previous experiments has been to prevent verbal overshadowing as opposed to reversing it. The question thus remains whether it is possible to directly demonstrate release from verbal overshadowing. In other words, does the original visual memory trace remain available after verbal overshadowing has taken place, and, if so, can it be made accessible?

As mentioned earlier, there is some evidence from the image reversal literature suggesting that verbal overshadowing of visual forms, once it has occurred, can be overcome when the appropriate instructions or hints are provided (Brandimonte & Gerbino, 1993, 1996; Hyman & Neisser, 1991; Peterson et al., 1992). For example, when participants were provided with explicit hints, such as information about the orientation and the category of the alternative interpretation of the duck–rabbit figure, image reversal was facilitated. However, as already noted, although this literature is consistent with the notion of release from verbal overshadowing, a direct test of this construct has yet to be conducted. A critical finding necessary to interpret a result as evidence for release from verbal overshadowing is that a manipulation improves the performance of participants who were previously impaired by verbalization, while having minimal effects on participants who were not impaired by verbalization.

In Experiment 5, we explored whether a direct demonstration of release from verbal overshadowing could be obtained in a within-subjects condition, by giving participants who initially participated in the cue-after-retrieval condition (a condition shown in Experiment 4 to fail to prevent verbal overshadowing), a second test in which they were given the cues before retrieval (a condition shown in Experiments 1 and 4 to prevent verbal overshadowing). The complete design included test (Test 1 vs. Test 2) as a within-subjects variable and presentation of the cue on Test 1 and on Test 2 as two between-subjects variables. Within the present design, a release from verbal overshadowing interpretation would be implicated if participants who were given the cue-after-image formation on Test 1 benefited from receiving the cue-before-image formation on Test 2, whereas participants in the other conditions were unaffected by repeated testing. However, if verbal overshadowing effects cannot be reversed once they have occurred, then only manipulations of the cue on Test 1 should affect performance in the image rotation task on both Test 1 and Test 2.

Method

Participants. Forty University of Trieste undergraduates took part in this experiment as volunteers. Participants were randomly assigned to one of four conditions: cue after on Test 1/cue before on Test 2, cue after on Test 1/cue after on Test 2, cue before on Test 1/cue after on Test 2, and cue before on Test 1/cue before on Test 2.

Design. The experiment consisted of a 2 (Test 1, Test 2) × 2 (cue after/cue before on Test 1) × 2 (cue after/cue before on Test 2) mixed design, with test as a within-subjects variable and cue positions as two between-subjects variables.

Materials and procedure. Only easy-to-name stimuli were used. Participants were asked to perform the same imagery task used in previous experiments with the modification that participants were tested twice, with the relative presentation of the color cue and the imaging instructions varied at both tests. In the critical condition with cue after on Test 1/cue before on Test 2, participants were given an initial test (Test 1) in which they were shown the color cue after each image was formed but, possibly, before attempting the rotation task. After completing Test 1, participants were told that some of the letters they had named were wrong and that they would have another opportunity to do the rotation task. They were informed that they would be allowed to change their answers, but that whenever they felt confident about the correctness of their previous response they should maintain it. Participants in this condition were also informed that in this second test, they should wait for the color cue presentation before forming their image. They were told that given that this second test was an attempt to make them improve their performance, it was crucial that they comply with instructions and wait for the cue presentation before forming the image. The same general procedure was used in the other conditions except that the cue orders in the two tests were varied so as to produce the remaining combinations.

Results and Discussion

Results are shown in Figure 7. A 2 (cue after/cue before on Test 1) × 2 (cue after/cue before on Test 2) × 2 (Test 1/Test 2) ANOVA for mixed designs was calculated. It showed a significant three-way interaction, $F(1, 36) = 9.17, p < .005$, $MSE = 0.72$. This interaction reflected the fact that an improvement from Test 1 to Test 2 was observed, as a result of varying the presentation of the cue on Test 2, only when on Test 1 the cue was presented after image formation. A significant effect of cue position on Test 1 was also found, $F(1, 36) = 18.11, p < .0001$, $MSE = 5.46$. This effect is due to the fact that when the cue was given before on Test 1, participants performed better than when the cue was given after. None of the remaining conditions altered performance in the imagery task. An ANOVA by items showed a significant three-way interaction, $F(1, 20) = 23.00, p < .0001$, $MSE = 0.47$; an interaction between test and cue position on Test 1, $F(1, 20) = 9.78, p < .006$, $MSE = 0.47$; an interaction between test and cue position on Test 2, $F(1, 20) = 7.34, p < .02$, $MSE = 0.47$; and an effect of cue position on Test 1, $F(1, 20) = 16.00, p < .0005$, $MSE = 10.31$.

The results of Experiment 5 provide compelling evidence for a release from verbal overshadowing interpretation. As in Experiment 4, participants who received the color cues after retrieval of their image on Test 1 were initially unable to avoid the verbal overshadowing associated with easy-to-name figures. However, when these same participants were given a second test for which the cues were presented before retrieval, their performance markedly improved. The fact that no other condition benefited from retesting suggests that

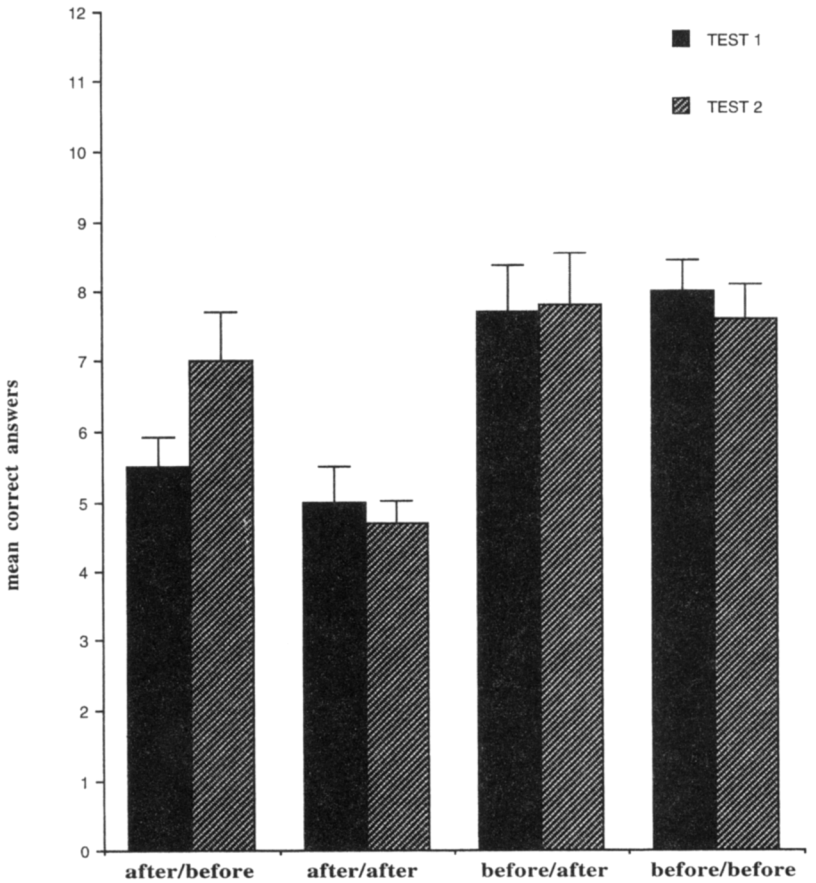

Figure 7. Mean number of letters correctly identified in mental imagery on Test 1 and Test 2 as a function of cue presentation (Experiment 5).

the second test did not induce some type of general benefit (e.g., hypermnesia, see Erdelyi & Becker, 1974). Instead, the results indicate that the cue before retrieval manipulation on Test 2 produced improvement exclusively by promoting release from verbal overshadowing: Only participants who exhibited evidence of verbal overshadowing on Test 1 showed a benefit from a manipulation specifically designed to prevent verbal overshadowing on Test 2. The three-way interaction can be interpreted as suggesting that the most important manipulation is that on Test 1, the cue is presented after image formation. This induces verbal overshadowing and makes the retrieval cue given before on Test 2 most effective.

Although we cannot ensure that participants complied with instructions, the results argue against such an interpretation in that a difference between Test 1 and Test 2 was observed only when the cue was given after on Test 1 and before on Test 2. Indeed, had participants formed the image before the cue presentation, performance should have been comparable with that in the control conditions.

Although Experiment 5 provides strong evidence for the construct of release from verbal overshadowing, two possible interpretations of the nature of this construct can be advanced. An on-line interpretation (see Brandimonte & Gerbino, 1996; Peterson et al., 1992) would suggest that release from verbal overshadowing can occur with on-line images without having to retrieve additional information. According to this view, on-line images can contain all the information needed for reinterpretation; however, the verbal component must be de-emphasized through the appropriate retrieval conditions to prevent it from overshadowing the visual component. Alternatively, a reretrieval interpretation would suggest that release from verbal overshadowing requires the discarding of the inadequate verbally biased image and the reretrieval of a new image. According to this view, once the on-line verbally biased image is discarded, altered retrieval conditions may enable the formation of a new image containing nonverbally biased information useful for imagery processing (cf. Chambers & Reisberg, 1992). Although the present data cannot definitively discriminate between an on-line and reretrieval interpretation, if anything, they favor the latter. Specifically, the reretrieval view is supported by the observation that participants who were unable to benefit from the color cues when they had a retrieved image in mind were nevertheless able to benefit from cues when they reattempted retrieval.

General Discussion

Overview of Present Findings

Results from the present research allowed us to identify various conditions under which verbal overshadowing of visual memories is and is not observed.

In Experiment 1, we replicated the previous observation (e.g., Brandimonte et al., 1992a, 1992b) that imagery performance associated with easy-to-name figures is poorer than that associated with hard-to-name figures (a result that presumably occurs because easy-to-name stimuli are more likely than hard-to-name pictures to be verbally recoded). However, this difference was alleviated if, prior to retrieval, participants were exposed to visual context reinstatement in which the color cues present during encoding were represented. In Experiment 2, we demonstrated that color cues similarly reverse the imagery performance decrement that results from giving participants verbal labels for otherwise hard-to-name stimuli (a manipulation that also presumably encourages verbal recoding). However, in Experiment 3, we showed that when background color rather than object color is used as a retrieval cue, imagery performance is unaffected by the presence of the cue, presumably because participants tend to name the colors at encoding, hence preventing verbal recoding of the figures. In Experiment 4, we confirmed that if participants are explicitly instructed to verbalize the color names at encoding, the beneficial effect of the cue disappears, and performance is equally good irrespective of conditions. We further demonstrated in Experiment 4 that the retrieval cues must be presented prior to image formation to prevent verbal overshadowing. Finally, in Experiment 5, we provided direct evidence that release from verbal overshadowing can occur if participants who previously retrieved images under circumstances that fail to prevent verbal overshadowing (i.e., when cues are presented after retrieval) are given a second test in which the visualization occurs under conditions that can prevent verbal overshadowing (i.e., when cues are presented before retrieval).

Taken together, the present results are consistent with the view (a) that verbal overshadowing can be the by-product of verbally recoding pictures at the time of learning; (b) that the original visual representations are neither lost nor distorted but rather are overshadowed by a verbal representation during retrieval; (c) that color cues at retrieval prevent verbal overshadowing despite implicit (Experiment 1) or explicit (Experiments 2 and 4) verbal recoding; (d) that background color is ineffective as a retrieval cue because it is spontaneously named (Experiment 3); and (e) that verbal overshadowing can be removed once it has occurred (Experiment 5).

Prevention of Verbal Recoding, Prevention of Verbal Overshadowing, and Release From Verbal Overshadowing

As mentioned earlier, one fundamental assumption underlying the present research is that verbal recoding and verbal overshadowing reflect sequential processes that take place at encoding and at retrieval, respectively. That is, verbal overshadowing at retrieval can be the by-product of verbally recoding the stimuli during initial learning (see Brandimonte & Gerbino, 1993, 1996). On the basis of this assumption, the results from the present series of experiments can be interpreted as suggesting that the attenuation of interference resulting from verbalization can occur at three different stages.

Prevention of verbal recoding involves the prevention of the formation of a verbal code at encoding that may subsequently interfere with the visual code. Prevention of verbal recoding was implicated in the present study by the effectiveness of encoding manipulations (e.g., difficult-to-name stimuli; Experiments 1 and 2), covert (Experiment 3) and overt (Experiment 4) nontarget verbalization that discouraged the verbalization of the target information at encoding. These results provide additional support for the view that preventing verbal recoding during initial learning impedes the formation of a competing verbal representation, hence facilitating the recollection of the original visual memories at the time of test (see Brandimonte & Gerbino, 1993; Brandimonte et al., 1992a, 1992b). Indeed, although verbal recoding of a visual stimulus at the time of learning is the basis for the overshadowing of the visual code by the verbal code, manipulations such as articulatory suppression or, as in the present research, verbalization of nontarget visual information that act on verbal recoding of target stimuli, only indirectly prevent overshadowing. In other words, encoding manipulations do not prevent verbal overshadowing itself, but rather they prevent the precursor to verbal overshadowing: the formation of a verbally biased code.

Prevention of verbal overshadowing involves the avoidance during retrieval of access to a previously generated verbal code that would otherwise interfere with memory performance. Prevention of verbal overshadowing in the present study was indicated by the effects of retrieval manipulations that solely enhanced the performance of participants in conditions (e.g., easily nameable stimuli, verbal labeling) that would have otherwise produced verbal overshadowing. The prevention of verbal overshadowing at the time of retrieval observed in this study further supports the view expressed by Schooler and Engstler-Schooler (1990) that verbalization does not eradicate the original visual memory but rather overshadows it at the time of retrieval.

The present study also helped to illuminate some of the limits to the conditions under which verbal overshadowing can be prevented. In both Experiments 4 and 5, prevention of verbal overshadowing was observed only when participants were given the color cues prior to generating their images. This finding suggests that verbal overshadowing cannot be prevented if one has currently accessed a verbally biased image. Thus, there is a very subtle time frame within which it is possible to prevent verbal overshadowing (i.e., after participants know retrieval is imminent but before retrieval actually occurs). This potentially small window in which it

is possible to prevent verbal overshadowing at retrieval may help to account for why some studies have failed to observe it (e.g., Dodson, Johnson, & Schooler, 1997; Read & Schooler, 1994).

Release from verbal overshadowing involves the access to visual memories following a prior retrieval that was disrupted by verbal overshadowing. In Experiment 5, we demonstrated release from verbal overshadowing by using a manipulation introduced after that retrieval had already been attempted. Specifically, participants whose initial retrieval attempts were impaired as a result of verbal overshadowing were able to reverse their performance when told to abandon their prior images and given the opportunity to reretrieve the images in the context of color retrieval cue. This finding suggests that release from verbal overshadowing can be accomplished after unsuccessful retrieval by manipulations (a) that encourage participants to discard their verbally biased image (i.e., retesting) and (b) that provide them with cues that encourage visual processing (color retrieval cues on the second test).

Although the present results provide a consistent picture, there are a number of questions that still remain unanswered, some of which are currently under study. A first issue, which arises from the present results and only recently has been addressed in detail (Brandimonte, Pelizzon, Luccio, Schooler, & Gabbino, 1996), concerns the question of whether and, if so, in which conditions background information can be effective as a retrieval cue. From the present results, it appears that background information is not effective as a retrieval cue because participants tend to spontaneously shift naming from the figure to the background, hence preventing verbal overshadowing of the figures and, consequently, eliminating the otherwise crucial role of the visual cue. Yet, this interpretation needs further investigation. For example, one might ask whether the same effect is obtained with different visual cues (e.g., shape of the background) and whether background information can work as a retrieval cue when participants are forced to overtly name the figures (hence preventing them from naming the background). These questions are currently under study in our laboratories.

Another open question refers to the possibility that other visual features, such as curves or angles, that are more intrinsic to the actual shapes of the depicted objects, afford release from verbal overshadowing. However, it should be noticed that although the same curves and angles may belong to more than one figure, in our experiments, one color belonged to just one figure, hence being more distinctive.

Finally, a related issue that requires investigation is whether there is symmetry in how visual and verbal codes compete in the interference of retrieval of verbal and visual information. Theoretical support for such a hypothesis comes from the fuzzy-trace theory developed by Brainerd and Reyna (1993; Brainerd, Reyna, & Kneer, 1995) in the context of cognitive development studies. In their theory, the authors distinguish between memory for the surface details of an input (verbatim traces) and memory for the meanings that are accessed on the basis of that input (gist traces). Verbatim traces are richly specified with respect to context, preserving detailed episodic information, whereas gist traces are schematic and vague. Both traces coexist in memory. However, their accessibility changes with modifications in the retrieval environment (Brainerd & Reyna, 1993). Though in a different domain, the theory predicts interference not only from the gist over the verbatim traces but also from the verbatim over the gist traces. To our knowledge, in the domain of the imagery studies the question of whether a symmetrical visual overshadowing effect could be found has yet to be answered in detail (but see Paivio, 1991, p. 56).

The Source of Interference

In many respects, the present research represents a revisiting of an old question, formulated in various ways over the years, which concerns whether the source of memory interference occurs at retrieval, as response competition, or at storage, as a result of memory loss or alteration. Both retrieval and storage accounts have been used to explain a variety of interference effects. Explanations proposing response competion at retrieval have been offered for AB:AC list learning interference paradigms (e.g., McGeoch, 1942), misinformation effects (e.g., Bekerian & Bowers, 1983), form labeling effects (Hanawalt & Demarest, 1939), postencoding verbalization effects (Schooler & Engstler-Schooler, 1990), and have served as the basis of general theoretical accounts of memory interference (e.g., Murnane & Shiffrin, 1991). However, accounts that emphasize alterations in the storage of memories have also been offered in many of these domains including AB:AC list learning (Melton & Irwin, 1940), misinformation effects (e.g., E. F. Loftus & G. R. Loftus, 1980), form labeling effects (e.g., Daniel, 1972), and as the underlying assumption of formal models of memory interference (e.g., Eich, 1982, 1985). The present observation that the interference associated with overt or covert verbal labeling of visual stimuli can be fully eliminated by providing a retrieval context that favors the visual memory suggests a response competition interpretation. Thus, in a general sense, the present findings buttress a response competition view of interference (although, naturally, we must be cautious in generalizing the implications of the present findings to other interference paradigms).

In addition to providing another example of the viability of a response competition approach, the present findings also add some refinements to this old debate. Of most importance, the present studies address a form of interference that has received relatively little attention, self-generated verbal representations interfering with visual memories and, as discussed, document three different loci at which evidence of the competing codes can be observed.

It is particularly striking that we were able to document the existence of competing codes even after participants had retrieved the interfering source (release from verbal overshadowing). A number of studies have failed to find evidence for the target memory after participants have actively recollected the interfering source (e.g., Birch & Brewer, 1995;

Schooler, Foster, & Loftus, 1988). Consistent with this literature, Experiments 4 and 5 demonstrated that retrieval cues were ineffective when presented after participants had already retrieved their image. However, participants' subsequent ability to benefit from the cue when they reretrieved pictures suggests that although the act of recollecting an intefering representation may make the target memory temporarily less accessible, it still remains available.

The finding that the visual trace is not damaged by verbal overshadowing provides support for the idea—included in many theories of memory (e.g., Baddeley, 1986; Paivio, 1971, 1986, 1991)—that there are independent visual and verbal memory systems and that stimulus processing may be modality specific. However, these independent systems are interconnected in such a way that input information can be easily transferred from one system to the other. This process implies "translation" of information from one code to the other. The process of translation produces dual coding of the figure that can be either beneficial (see e.g., Paivio, 1971) or detrimental (see Brandimonte et al., 1992a, 1992b; Nelson & Brooks, 1968; Schooler & Engstler-Schooler, 1990), according to the nature of the task. When the task requires recollection of the surface details of the stimulus, translation from the visual to the verbal code generates verbal overshadowing. However, as shown in the present research, interference coming from verbal overshadowing of visual stimuli can be not only prevented but even reversed, under the appropriate conditions.

The present findings also demonstrate the effectiveness of visual cues in enabling participants to disentangle competing sources that were encoded at the same time. In the present study, visual cues enabled participants to overcome interference produced by a verbal memory that was associated with the same temporal and physical encoding context as the visual memory. Apparently, presenting a visual cue does not equally refresh all aspects of a memory but rather seems to disproportionately activate visual as compared with verbal components of a memorial event.

Our claim that two competing codes of the same stimulus can be maintained in memory, with the retrieval context encouraging the use of one code or the other, is once again in good accord with the fuzzy-trace theory (Brainerd & Reyna, 1993). For example, in one recent study, Brainerd et al. (1995) used a verbatim-priming methodology to increase the accessibility of the verbatim trace and, consequently, decrease the interference coming from recollection of the gist traces. These studies are consistent with the general view that interference of one memory trace over another can be prevented if the context enhances retrieval of the appropriate traces.

Finally, it is notable that context reinstatement prevented memory interference from impeding participants' ability to discover a novel visual form. Often novel discoveries are hampered by situational context, which prevents the consideration of alternative interpretations (e.g., Dunker's functional fixedness; for a recent review, see Schooler & Melcher, 1995). However, here we find a new twist to an old story, with perceptual context enabling individuals to escape the constraints of their self-imposed verbal context and to recognize emergent characteristics that would have otherwise gone unnoticed.

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