Research Report

Skimming the Surface

Verbal Overshadowing of Analogical Retrieval

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ABSTRACT—*It has become almost a maxim that "talking through" a problem is advantageous. Contrary to this wisdom, studies from numerous domains have demonstrated that describing one's thought processes or analyzing a judgment may, in some circumstances, actually impair performance. The two experiments reported here built upon prior work by examining the effect of verbalization on the retrieval of analogies. Participants read a series of 16 short stories. Later, they were presented with 8 test stories and indicated whether these stories were analogies of the stories they had read previously. Each test story shared the same deep structure with one prior story and only surface characteristics with another prior story. Half of the participants completed the test while thinking aloud, and half did not think aloud. In both experiments, participants who thought aloud were more likely to retrieve surface matches and less likely to retrieve true analogies than participants who did not verbalize their thoughts during the test.*

It is often helpful to "talk through" one's thoughts, and, indeed, verbal reflection can aid both learning (e.g., Chi, 1996) and problem solving (Ahlum-Heath & DiVesta, 1986). Nevertheless, describing difficult-to-verbalize cognitions, such as the appearance of a face or a color, can impair performance (e.g., Schooler & Engstler-Schooler, 1990). Evidence suggests that such *verbal-overshadowing effects* occur because verbalization focuses subjects on verbally relevant information (e.g., facial features) at the expense of critical information that is less easily verbalizable (e.g., relations between facial features). Although most verbal-overshadowing research has focused on nonverbal stimuli (e.g., faces, tastes, colors, visual forms, sounds; for reviews, see Schooler, 2002; Schooler, Fiore, & Brandimonte, 1997), even verbal information can be vulnerable when the

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processes associated with it are difficult to describe. For example, Schooler, Ohlsson, and Brooks (1993) found that thinking aloud disrupted verbal insight problem solving. More recently, Sieck, Quinn, and Schooler (1999) examined whether verbalization affects people's evaluation of the soundness of analogies (e.g., match evaluation; Gentner, 1989). Participants in this study saw pairs of stories that varied in their superficial or analogical similarity and judged the match (soundness) of each pair. Participants who wrote down reasons for their soundness judgments had higher ratings for all pair types relative to control participants, and their ratings showed less discrimination between superficially and analogically similar pairs. Sieck et al. suggested that participants' explanations led them to activate surface features rather than structural features because the former are easier to articulate.

Although the finding that verbalization disrupts people's ability to evaluate analogies is of interest, an even greater cost would be implicated if verbalization also interfered with people's ability to access analogies. The ability to recognize and use analogies plays a central role in learning, reasoning, and other important aspects of cognition (e.g., Gentner, 1989; Holyoak & Thagard, 1995). Nevertheless, people often fail to recall cases that are analogically related to situations they currently face (e.g., Gick & Holyoak, 1980). Given individuals' inability to verbally appreciate deep-structure analogies, and their general difficulties retrieving information that relates at the deep-structure level, it seems quite plausible that verbalization might also interfere with people's ability to retrieve analogies.

The present study examined the effect of verbalization on the retrieval of analogies using a paradigm in which participants read 16 short stories and later took a test that contained 8 additional stories. Each test story was related to 2 prior stories from the study phase. In one case (*mere-appearance match*), the stories were similar in terms of shared objects (i.e., characters, places, and other nouns) and first-order relations (e.g., actions). In the other case (*true analogy*), the stories shared first-order and higher-order relations (relations between relations), but the objects differed (Table 1 provides examples of the stories). Participants were asked whether each test story was an analogy

TABLE 1
Examples of Stories

A.   Base story

   Karla, an old hawk, lived at the top of a tall oak tree. One afternoon, she saw a hunter on the ground with a bow and some crude arrows that had no feathers. The hunter took aim and shot at the hawk but missed. Karla knew the hunter wanted her feathers so she glided down to the hunter and offered to give him a few. The hunter was so grateful that he pledged never to shoot at a hawk again. He went off and shot deer instead.

B.   Mere-appearance match (surface-structure similarity)

   Once there was an eagle named Zerdia who donated a few of her tailfeathers to a sportsman and he promised never to attack eagles. One day Zerdia was nesting high on a rocky cliff when she saw the sportsman coming with a crossbow. Zerdia flew down to meet the man, but he attacked and felled her with a single bolt. As she fluttered to the ground Zerdia realized that the bolt had her own tailfeathers on it.

C.   True analogy (deep-structure similarity)

   Once there was a small country called Bildo that learned to make the world's smartest computer. One day Bildo was attacked by its warlike neighbor, Gagrach. But the missiles were badly aimed and the attack failed. The Bildon government realized that Gagrach wanted Bildon computers so it offered to sell some of its computers to the country. The government of Gagrach was very pleased. It promised never to attack Bildo again.

Note. These stories were developed by Gentner and her colleagues (see Ratterman & Gentner, 1987; also Gentner, Ratterman, & Forbus, 1993).

for a story from the prior study phase. In addition, half of the participants thought aloud during the process of deciding whether they were reminded of a prior analogy (verbalization participants), and half did not. Because it is much more difficult to verbalize the higher-order relations between stories than it is to talk about lower-order relations or object matches (Sieck et al., 1999), we predicted that verbalization would decrease retrievals of true analogies and increase retrievals of mere-appearance matches.

EXPERIMENT 1

Method

Participants
Thirty-two undergraduate students participated for class credit.

Materials and Procedure
Participants were run one at a time and completed a vocabulary test upon arrival. Sixteen stories (from Ratterman & Gentner, 1987; cf. Gentner, Ratterman & Forbus, 1993) were used in the initial study phase. The order of the stories was counterbalanced. The stories varied in their relationship to eight stories that were given in the test phase. For each of the eight test stories, one of the studied stories was a mere-appearance match (shared surface similarity), and a second studied story was a true analogy (shared deep structure). Participants were asked to read the stories and pay close attention to each story's title and content because this information would be needed later.

   Participants were then given two unrelated filler tasks for 5 min (word search and a logic problem). *No-verbalization* participants were instructed to complete the problems. *Verbalization* participants were given the same instructions, but were additionally asked to think aloud (i.e., talk about information they were thinking about, anything they read, and questions they asked themselves). This phase functioned as a think-aloud practice session for verbalization participants.

   Before beginning the final test, participants were given a definition of an analogy (two stories that share the same moral, message, or pattern of events) and an example. They were instructed to read each of the test stories carefully and indicate whether it was an analogy for any of the stories from the first set.[1] If so, they were instructed to write down the title of the prior story or describe what it was about. If they thought the current story was an analogy of more than one prior story, they were asked to pick the best analogy. Participants in the verbalization condition were further instructed to think aloud during the test phase.

Results
There was a significant Verbalization × Type of Match interaction with respect to the mean number of analogies that participants retrieved, $F(1, 30) = 14.4$, $p < .05$, $\eta_p^2 = .32$ (see Table 2). Simple effects tests revealed that, as predicted, verbalization participants retrieved significantly more mere-appearance matches than no-verbalization participants did, $F(1, 30) = 23.8$, $p < .05$, $\eta_p^2 = .44$. Although verbalization participants also retrieved fewer true analogies than no-verbalization participants, this difference did not reach statistical significance, $F(1, 30) = 2.0$, $p > .05$, $\eta_p^2 = .06$. However, verbalization participants were more likely overall to retrieve any type of base story as an analogy than were no-verbalization participants ($Ms = 5.3$ and 2.9), $F(1, 30) = 12.8$, $p < .05$, $\eta_p^2 = .30$. Because of this finding, we computed retrievals of

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[1]In the context of Gentner's (1989) stages, our test instructions could be said to affect both reminding and evaluation because we asked participants to retrieve analogies of target stories. We argue against this interpretation because Blanchette and Dunbar (2000, Experiment 3) have found that varying whether participants receive typical reminding instructions or instructions to retrieve the best analogy does not affect reminding performance. In addition, we believe our retrieval situation more closely resembles the access processes typically found during problem solving, and that "pure" reminding instructions may actually lack the organizing elements that normally characterize retrieval factors in real-life circumstances (cf. Hammond, Seifert, & Gray, 1991).

Mean Number of Responses as a Function of Type of Match and Condition in Experiment 1

Match type	Condition	
	Verbalization	No verbalization
Mere appearance	4.38 (0.60)	1.06 (0.31)
True analogy	0.94 (0.37)	1.8 (0.49)

Note. Standard errors are in parentheses.

mere-appearance matches and true analogies as a percentage of overall retrievals for each participant. Only 20% of verbalization participants' retrievals were true analogies, compared with 53% for no-verbalization participants, $F(1, 27) = 5.6$, $p < .05$, $\eta_p^2 = .17$. Thus, although verbalization led participants to retrieve more stories, the vast majority of these stories were mere-appearance matches rather than true analogies.

Finally, verbalization and no-verbalization participants differed in their scores on the vocabulary test (Ms = .67 and .77), $F(1, 30) = 5.4$, $p < .05$, $\eta_p^2 = .15$. Because verbal ability has been found to interact with the verbal-overshadowing effect (with verbal overshadowing greater among low- than high-ability participants; Ryan & Schooler, 1998), we reexamined the data using an analysis of covariance (ANCOVA) with vocabulary score as a covariate. There was a significant Verbalization × Type of Match interaction, $F(1, 29) = 7.7$, $p < .01$, $\eta_p^2 = .21$. Verbalization participants were more likely to retrieve mere-appearance stories than no-verbalization participants (adjusted Ms = 4.0 and 1.4), $F(1, 29) = 15.1$, $p < .05$, $\eta_p^2 = .34$, but not significantly more likely to retrieve true analogies (Ms = 1.1 and 1.6), $F < 1$, $\eta_p^2 = .02$.

Discussion

Participants who thought aloud while attempting to retrieve prior analogies were more likely to retrieve mere-appearance matches than were participants who did not think aloud. This finding is consistent with other verbal-overshadowing findings in suggesting that verbalization focuses participants on easily verbalized information (in this case, objects and first-order relations) while deemphasizing less readily verbalizable information (higher-order relations). However, one possible difficulty in interpreting these results is that verbalization participants also retrieved more total stories during the test than nonverbalization participants did. Thus, it is unclear whether the greater proportion of mere-appearance matches generated by verbalization subjects was due to the differential accessibility of the two types of analogies or was an artifact of the greater frequency with which verbalization participants retrieved a match of any kind relative to control participants. Experiment 2 explored this issue.

EXPERIMENT 2

In Experiment 1, participants who thought aloud while trying to retrieve prior analogies of test stories were more likely to retrieve mere-appearance stories (surface matches) than participants who did not think aloud. However, we also found that verbalization increased the overall number of prior stories that participants called analogies. The goal of Experiment 2 was to determine if verbalization increases the ratio of surface- to deep-structure retrievals, or simply leads participants to adopt a more liberal criterion for calling a prior story an analogy. Toward this end, we encouraged all participants to feel accountable (Tetlock & Kim, 1987) for their judgments by indicating whether they had a specific "reason" for their judgments. We expected that such accountability instructions would lead participants to adopt a more conservative criterion for labeling an earlier story as an analogy, potentially attenuating differences between conditions in the number of matches that were retrieved, and thereby enabling a more direct comparison of participants' relative ability to retrieve sound analogies.

Method

Participants

Thirty-two undergraduate students participated for class credit.

Materials and Procedure

The materials and procedure were the same as used in Experiment 1, except that participants were asked to indicate whether or not they had a specific reason for their judgment ("no reason" responses were labeled "just know"). In order to avoid verbalization, we did not require participants to actually provide their reason.

Results

Verbalization participants were more likely to retrieve false analogies and less likely to retrieve true analogies than were no-verbalization participants. Because the vocabulary test scores of the two groups differed significantly (Ms = 80% and 69% correct for verbalization and no-verbalization groups, respectively), $F(1, 30) = 8.9$, $p < .05$, $\eta_p^2 = .23$, the data were analyzed using a 2 (verbalization) × 2 (analogy type) mixed-model ANCOVA with vocabulary test score as a covariate. As predicted, there was a Verbalization × Type of Match interaction, $F(1, 29) = 6.5$, $p < .05$, $\eta_p^2 = .18$ (see Fig. 1). Simple effects tests revealed that verbalization participants retrieved significantly more false analogies, $F(1, 29) = 5.3$, $p < .05$, $\eta_p^2 = .15$, and significantly fewer true analogies, $F(1, 29) = 4.5$, $p < .05$, $\eta_p^2 = .13$, than did no-verbalization participants. In contrast to Experiment 1, the overall retrieval of analogies did not differ significantly between the two conditions, $F(1, 29) = 2.2$, n.s., $\eta_p^2 = .07$.
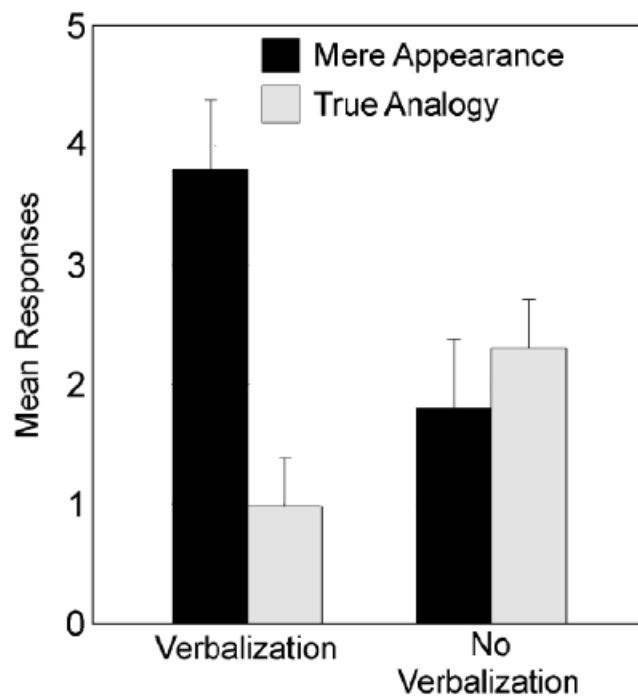
Fig. 1. Mean number of responses as a function of type of match and condition in Experiment 2. Error bars indicate standard errors.

With respect to participants' responses as to whether they had a reason for their judgments, there was no interaction between condition and type of analogy, as participants almost always said they had a reason for retrieving a particular story rather than that they "just knew" ($M = .88$ vs. $.12$ for true analogies and $M = .97$ vs. $.03$ for mere-appearance stories, collapsed across condition). Further, participants in the verbalization condition were not significantly more likely than no-verbalization participants to have a reason for their true analogy-retrievals ($Ms = .96$ and $.85$), $F(1, 19) = 1$, $\eta_p^2 = .05$, or their mere-appearance retrievals ($Ms = .94$ and $.93$), $F(1, 26) < 1$, $\eta_p^2 = .001$.

Discussion

Experiment 2 replicated Experiment 1 in demonstrating that participants who thought aloud while attempting to retrieve prior analogies were more likely to retrieve false analogies (mere-appearance stories) and less likely to retrieve true analogies than were participants who did not think aloud. Further, encouraging participants to consider the reasons for their judgments appeared to reduce verbalization participants' tendency to adopt a liberal criterion for calling a prior story an analogy at test. Thus, the results suggest that even in the absence of a liberal criterion, verbalization increases focus on surface matches at the expense of deep-structure matches.

GENERAL DISCUSSION

The results of these two experiments demonstrate that verbalization can disrupt the process of retrieving relevant knowledge from one's past that has only a deep-structure mapping to the present situation. This effect seems likely to occur because surface-level features are more easily articulated than structural features (Sieck et al., 1999), and therefore more likely to cue prior knowledge that bears a surface-level rather than structural-level resemblance. This pattern of findings thus fits with research demonstrating that verbalization biases subjects toward verbalizable processes, and thereby disrupts the nonverbalizable information associated with insight problem solving (Schooler et al., 1993), face identification (Schooler & Engstler-Schooler, 1990), memory for taste (Melcher & Schooler, 1996), difficult-to-describe visual forms (Brandimonte, Schooler, & Gabbino, 1997), and affective decision making (Wilson & Schooler, 1991).

It might be suggested that verbalization disrupts analogical retrieval simply by introducing cognitive load. However, there is little evidence that thinking aloud drains cognitive resources, and numerous cognitively demanding tasks are unaffected by think-aloud instructions (for a review, see Ericsson & Simon, 1993). Moreover, when verbalization does interfere with performance, its effects are unrelated to task difficulty (contrary to what would be expected by a cognitive-load account), but rather depend on the verbalizability of the requisite processes. For example, Schooler et al. (1993) found that verbalization disrupted difficult-to-verbalize insight problem solving, but had no effect on solving comparably difficult logical problems. Similarly, DeShon, Chan, and Weissbein (1995) observed that regardless of problem difficulty, verbalization impaired performance on Raven's matrix problems requiring visual strategies, but had no effect on problems requiring verbal-analytic strategies. Given the repeated observation that verbalization specifically disrupts nonverbal processing, and the dearth of evidence that it drains resources, a cognitive-load account of the present findings seems unlikely.

In contrast, the present findings are consistent with the suggestion that verbalization induces a processing shift, wherein individuals rely on processes that are more commensurate with those associated with verbalization (Dodson, Johnson, & Schooler, 1997; Macrae & Lewis, 2002; Schooler, 2002; Schooler et al., 1997). Indeed, the present findings mesh with Schooler's (2002) speculation that verbalization may increase individuals' relative reliance on left-hemisphere processes while dampening those associated with the right hemisphere, as recognizing more distant relations between concepts represents an ability particularly associated with the right hemisphere (Fiore & Schooler, 1997; Winner & Gardner, 1977).

Finally, the results are consistent with arguments that structural features can play a role in reminding (e.g., Blanchette & Dunbar, 2000; Catrambone, 2002; Wharton et al., 1994; Wharton, Holyoak, & Lange, 1996), while at the same time illustrating the counterintuitive manner in which language can undermine this process. Verbal self-reflection undoubtedly plays an important role in a host of different learning tasks (e.g., Chi,

1996); however, in the case of attempting to access deep-structure analogies, it seems the old adage "think before you speak" aptly applies.

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