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Whom Do Words Hurt? Individual Differences in Susceptibility to Verbal Overshadowing

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SUMMARY

The phenomenon of verbal overshadowing, in which describing memory for nonverbal stimuli (e.g. faces, tastes, or music) interferes with subsequent recognition performance, has previously been associated with situations in which participants' perceptual expertise exceeded their verbal expertise (e.g. Melcher and Schooler, 1996). Such findings suggest that individual differences in perceptual and verbal ability should predict who will be vulnerable to verbalization. In this study participants performed six trials of a standard verbal overshadowing procedure (viewing a face, verbally recalling it or engaging in an unrelated activity, followed by taking a forced choice recognition test). Perceptual ability was assessed using both a domain specific measure (face recognition ability) and non-specific measures (e.g. embedded figures). General verbal ability was determined on the basis of high school or college GPA. As predicted, verbal overshadowing (i.e. lower performance for verbalization relative to control participants) was greatest among participants with high perceptual expertise and low verbal expertise. This relationship was observed with both the domain-specific and domain-general measures of perceptual expertise. These findings suggest that individuals may be especially vulnerable to verbal overshadowing when their general perceptual abilities exceed their verbal abilities. © 1998 John Wiley & Sons, Ltd.

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Typical investigations of individual differences in susceptibility to memory distortions have focused on the specific attributes that may predispose individual to such errors. So, for example, scoring high on the Dissociative Experience Scale has recently been found to be an important predictor of individuals' propensity to generate false memories (e.g. Hyman and Pentland, 1996). Although marked progress has been made in identifying the *individual attributes* that are associated with a susceptibility to memory distortions, far less attention has been given to potential importance of the *relationships between attributes*. Moreover, there are certain of types of traits that are rarely considered in the context of memory distortions. For example, it is far from obvious why having a particularly *good* memory would *increase* one's susceptibility to memory distortions (although see Schooler and Loftus, 1993). However, recent research suggests that strong perceptual memory skills when juxtaposed with modest

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verbal abilities, may be the key factor in predicting at least one type of memory distortion: the impaired recognition performance that can occur when non-verbal memories are committed to words.

Though language ability is an especially important cognitive skill, people can accomplish many cognitive tasks, such as recognizing faces and using perceptual processes, without the use of language. Indeed, a growing body of evidence indicates that sometimes people's performance on nonverbal tasks is actually impaired by the use of language (for a recent review see, Schooler, Fiore and Brandimonte, 1997). For example, Schooler and Engstler-Schooler (1990) observed that individuals who were instructed to verbally describe a face were less likely to identify it in a line-up than people who had not described it. This disruptive effect of verbalization, termed *verbal overshadowing*, was attributed to the disparity between people's generally superior perceptual ability to recognize faces and their generally impoverished verbal ability to describe faces. In short, verbal overshadowing effects were hypothesized to occur when perceptual expertise exceeds verbal expertise.

Evidence for the centrality of disparities in verbal versus non-verbal expertise in mediating verbal overshadowing effects has come from two sources: task comparisons and expertise comparisons. With respect to task comparisons, if verbal overshadowing occurs in situations in which perceptual expertise outflanks verbal expertise, then it should disrupt anyone's performance in specific task domains that always rely on a significant amount of perceptual expertise. With respect to expertise comparisons, it similarly follows that the disruptive effects of verbalization should vary in two ways as the result of differential perceptual experience. It should vary as a function of people's degree of perceptual experience with different stimuli, and it should vary between groups of people with different perceptual experience with the same stimuli. In the following discussion we briefly review prior evidence for a relationship between expertise and verbal overshadowing. We then introduce the present study which examines additional predictions that the previous evidence suggests. Specifically, verbal overshadowing should vary with individual differences in the disparity between people's verbal and perceptual expertise as assessed by their performance on domain general measures of perceptual and verbal expertise.

THE RELATIONSHIP BETWEEN DOMAIN AND VERBALIZATION

Comparisons of the domains that have and have not been found to be vulnerable to verbalization are generally consistent with the hypothesis that verbalization primarily disrupts the application of non-verbal skill. For example, face recognition represents a classic case of a situation in which virtually all individuals possess marked perceptual expertise. People have a truly remarkable ability to recognize faces (e.g. Bahrick and Wittlinger, 1975). Nevertheless, people's proficiency at describing faces is quite minimal when assessed by their ability to characterize faces sufficiently to enable others to identify the face on the basis of the description (Ellis, 1981; Fallshore and Schooler, 1995). The discrepancy that occurs as a result of people's expertise in recognizing faces and their relative inability to describe them suggests that face recognition should be a domain of expertise which is vulnerable to verbalization. And indeed, we have observed that asking participants to describe (typically in writing) the appearance of a previously seen face can impair participants' subsequent ability to

recognize the target face among similar distractors (Schooler and Engstler-Schooler, 1990). This verbal overshadowing effect has been replicated numerous times in the Schooler lab (e.g. Ryan, 1992; Schooler, Ryan and Reder, 1996) as well as in other labs (R. Chaffin, 1990, personal communication; Dodson, Johnson and Schooler, 1997; Kelley, personal communication; Lovett, Small and Engstrom, 1992, (Experiment 2); Read and Schooler, 1994; Westerman and Larsen, 1997). Although see Lovett *et al.*, 1992, (Experiment 1) and Yu and Geiselman, (1993) for situations in which the effect has not been observed.

Other domains relying on non-verbal forms of knowledge have similarly been found to be disrupted by verbalization including: (a) insight problem solving (Schooler, Ohlsson and Brooks, 1993); (b) affective judgements (e.g. Wilson *et al.*, 1993; Wilson and Schooler, 1991); (c) implicit learning (Berry, 1984; Fallshore and Schooler, 1993); (d) visual imagery (e.g. Brandimonte, Schooler and Gabbino, 1997); (e) taste memory (Melcher and Schooler, 1996); (f) map memory (Fiore, 1994); and (g) music memory (Houser, Fiore and Schooler, 1998).

While verbalization has been found to impair the implementation of tasks critically relying on non-verbal knowledge or processes, more propositional domains have been shown to be invulnerable to verbalization and in fact often to benefit from it. These domains include: (a) memory for word lists (e.g. Darley and Glass, 1975); (b) memory for a spoken statement (Schooler and Engstler-Schooler, 1990); (c) memory for geographical routes (e.g. take a left at the stop sign; Fiore, 1994); (d) analytic problem solving (e.g. Gagne and Smith, 1962; Schooler and Melcher, 1995; Schooler *et al.*, 1993); and (e) learning declarative knowledge (Chi *et al.*, 1994).

In short, there is a growing body of research indicating that the effects of verbalization critically depend on the domain of knowledge in which the verbalization is being applied. When the knowledge is difficult to articulate, verbalization can be disruptive, presumably by leading participants to de-emphasize the very information that they need to use in order to successfully complete the task. When, however, the knowledge is readily verbalized, as in the case of propositions associated with verbal/declarative knowledge, verbalization is at a minimum benign and can even be helpful.

EVIDENCE THAT OVERSHADOWING INTERACTS WITH PERCEPTUAL EXPERTISE

The differential effect of verbalization on tasks that rely on verbal versus perceptual expertise has led to the hypothesis that verbal overshadowing may specifically occur in situations in which non-verbal abilities outflank verbal abilities (see Schooler *et al.*, 1997; Fallshore and Schooler, 1995). If this hypothesis is correct, then the negative effects of verbalization should interact with people's relative perceptual versus verbal expertise at a task. This possibility has been examined in two different domains in which perceptual expertise varied: face recognition and taste discrimination.

Other-race face recognition

People generally are better at recognizing faces of their own race than other race faces (Brigham and Barkowitz, 1978; Brigham and Malpass, 1985; Chance, Goldstein and McBride, 1975; Ellis and Deregowski, 1981; Malpass and Kravitz, 1969; Platz and

Hosch, 1988; Rhodes, Tan, Brake and Taylor, 1989). Fallshore and Schooler (1995) presented Caucasian participants with target faces that were either Caucasian or African–American. Using the standard verbal overshadowing paradigm, some participants verbally described the target face whereas control participants performed an unrelated filler activity. For the Caucasian faces, with which the participants had high perceptual expertise, the usual verbal overshadowing impairment occurred. However, for the other-race faces, with which the participants have less perceptual expertise, it did not occur.

In a second study, Fallshore and Schooler (1995) used a communication accuracy paradigm (e.g. Lantz and Volney, 1964; Lucy and Shweder, 1979) to provide further evidence for differential disparity between perceptual and verbal expertise for same and other race faces. In this study, subject-judges were yoked with each of the verbalization subjects from Experiment 1. Each subject-judge read the verbal description generated by their yoked verbalization subject counterpart and attempted to use the description to identify the target face from the recognition array. Strikingly, subject-judges' ability to use verbalization subjects' descriptions to identify the target face was actually numerically, though not significantly, greater for other-race versus own-race faces. This finding suggests that, although individuals' recognition performance tends to be better for own-race versus other-race faces, their ability to describe the two types of faces is quite comparable. In other words, as predicted, the increase in expertise associated with own-race face recognition appears to be primarily non-verbal in nature.

Taste discrimination

Another perceptual experience that often defies people's attempts at verbal description is odour and, by extension, taste, which is intimately connected with olfaction. For example, the perception of even familiar odours is hard for people to describe (Lawless and Engen, 1977). Like the other kinds of stimuli for which verbal overshadowing has been observed, odours are perceived in a non-analytic fashion (Engen and Ross, 1973). However, in contrast to people's ability to describe faces, which is generally poor regardless of their perceptual ability, people's verbal ability to describe certain tastes can vary. For example, researchers have found differences in the people's ability to describe wines based on their formal training with wines (Lawless, 1985; Lehrer, 1983). In addition, of course, as with same versus other-race faces, people's ability to perceptually discriminate between wines can also vary as a function of the familiarity they have with the perceptual experience. Since people's verbal expertise as well as their perceptual expertise regarding wine tasting can vary, wine tasting is an ideal task for examining the relationship between verbal and perceptual expertise within a particular domain.

Accordingly, Melcher and Schooler (1996) recruited non-drinkers who reported drinking wine less than once a month (low verbal and perceptual ability), untrained wine drinkers who drank wine regularly but had not taken any wine-drinking courses (low verbal, but high perceptual ability), and trained wine drinkers who were either wine professionals or had taken several wine courses (high verbal and perceptual ability). Using the standard verbal overshadowing paradigm, modified for wine as a stimulus, all participants first tasted a target wine. Then they either described the wine or not, and finally they rated four wines (one of which was the target) for similarity to

the target wine. Discrimination performance was measured by subtracting the average similarity rating for the distractors from the rating for the target wine. Consistent with the notion that verbal overshadowing is associated with a disparity between perceptual and verbal expertise, for the untrained wine drinkers (assumed to have low verbal expertise but high perceptual expertise), describing the wine-impaired discrimination performance compared to those who did not describe it. On the other hand, for the non-drinkers (assumed to be low on both types of expertise) and the trained wine drinkers (assumed to be high on both types of expertise) verbalization was actually slightly helpful.

Melcher and Schooler's (1996) interpretation of these findings was that verbalization reduced participants' ability to draw on their perceptual expertise, and thus primarily impacted those participants whose verbal and perceptual expertise were least commensurate. To further test this hypothesis, Melcher and Schooler examined the correlation between participants' performance in the two conditions, and their scores on independent measures of verbal and perceptual expertise. Verbal expertise was gauged by participants' responses to a wine-knowledge questionnaire. Perceptual expertise was inferred on the basis of how often participants reported drinking red wines. In the non-verbalization condition, perceptual expertise was the best predictor of discrimination performance, suggesting that when participants do not verbalize they tend to rely on their perceptual skills. In contrast, in the verbalization condition, verbal expertise was the best predictor of performance, suggesting that engaging in verbalization forces participants to rely on their verbal knowledge.

THREE LIMITATIONS OF PRIOR INVESTIGATIONS OF THE RELATIONSHIP BETWEEN EXPERTISE AND VERBAL OVERSHADOWING

The previously described studies support the view that verbal overshadowing effects are specifically associated with a disparity between individuals' verbal and perceptual expertise. Accordingly, the detrimental effect of verbalizing a non-verbal process occurs because verbalization causes people to rely on the impoverished verbal aspects of their memory at the expense of their superior perceptual memories. However, prior research has left open several questions regarding the nature of the relationship between verbal overshadowing and expertise.

Can the relationship between verbal overshadowing and expertise be demonstrated using performance measures?

In prior investigations of the relationship between verbal overshadowing and expertise, perceptual skill was inferred on the basis of experience. For example, in the case of own-race recognition, expertise was inferred by whether or not the participant was the same race as the stimuli/test faces. In the case of the wine-recognition study, perceptual expertise was assessed by individuals' self-reported wine-drinking experiences. In neither case were direct measures of perceptual proficiency employed. Thus, a critical extension of this work is the demonstration that it is perceptual ability *per se*, and not some other concomitant of experience, that mediates verbal overshadowing effects.

Does verbal and non-verbal expertise have to be domain-specific?

Prior investigations of the relationship between verbal overshadowing and expertise have exclusively relied on domain-specific measures of expertise. In the face-recognition study, perceptual expertise was inferred on the basis of whether or not the target/test faces were the same race as the participant. In the Melcher and Schooler (1996) wine-recognition study, perceptual expertise was inferred on the basis of participants' prior wine-tasting experience and verbal expertise on the basis of formal wine-tasting training. In neither case, however, were any more general measures of perceptual and verbal skill included. Although prior findings certainly support the claim that verbal overshadowing effects are associated with a disparity between *specific* verbal and perceptual expertise, it also seems quite plausible that more general differences in perceptual versus verbal abilities might also mediate verbal overshadowing effects. Indeed, recent investigations of the impact of verbalization suggest that, rather than simply disrupting memory for an individual face, verbalization may produce a rather generalized disruption of perceptual memory processing. For example Dodson *et al.*, (1997) showed participants two faces and then had them describe one of the faces. They found that verbalization comparably disrupted both the verbalized and non-verbalized faces. Similarly, Westerman and Larsen (1997) found that describing a car interfered with subsequent face-recognition performance. Such findings have been taken as evidence that verbalization may produce a relatively generalized disruption in the application of perceptual knowledge (see Schooler *et al.*, 1997). If verbalization does produce a generalized rather than task-specific disruption of perceptual abilities, then individuals who generally show greater proficiency with perceptual relative to verbal tasks may also be especially vulnerable to verbal overshadowing, even when those proficiencies are assessed in a domain-independent manner.

What about situations in which perceptual expertise is low and verbal expertise is high?

A central claim of prior considerations of the relationship between verbalization and expertise is that verbal overshadowing is the product of a *disparity* between verbal and perceptual expertise. Both the Melcher and Schooler (1996) and Fallshore and Schooler (1995) studies contrasted a condition in which perceptual expertise exceeded verbal expertise to conditions in which the two forms of expertise were assumed to be relatively commensurate; i.e. both low (other race recognition, non-drinkers) or both high (trained wine drinkers). In both studies, verbal overshadowing effects were exclusively observed in cases where there was a disparity between verbal and perceptual expertise (i.e. for own-race faces and untrained regular wine drinkers). However, both of these studies, by necessity, omitted investigating the impact of verbalization in cases where the disparity between verbal and perceptual expertise were reversed; i.e. where verbal expertise was high and perceptual expertise was low. Indeed, within the context of domain-specific measures such a population seems unfeasible because specific verbal expertise in a perceptual domain is apt to be associated with concomitant perceptual expertise. For example, wine experts who have devoted enough time to learn the vocabulary of various wine tastes have by necessity also developed a perceptual palate. Nevertheless, this 'missing cell' is

important for a complete assessment of the relationship between verbal overshadowing and expertise because it helps to determine whether the effects are specifically a consequence of cases in which perceptual expertise exceeds verbal expertise (hereafter called *positive disparity*), or whether any disparity between the two types of expertise is sufficient to elicit verbal overshadowing effects. Of course, a key prediction of the present approach is that verbal overshadowing should exclusively occur when perceptual expertise exceeds verbal expertise. When the disparity is reversed, that is, for people who have high verbal expertise relative to lower perceptual expertise, verbalization ought not to be harmful, and may well be helpful. Of course, the impact of such a reversed disparity can only be examined within the context of domain independent verbal ability.

INDIVIDUAL DIFFERENCE VARIABLES THAT SHOULD PREDICT VULNERABILITY TO VERBAL OVERSHADOWING

The present study addressed the above three issues within a standard face verbal overshadowing paradigm, in which participants viewed a face, described it, and later tried to identify it. The importance of ability *per se* in mediating interactions between expertise and verbal overshadowing was addressed by using performance rather than experience measures of expertise. The importance of general versus specific perceptual expertise in mediating verbal overshadowing effects was examined by varying the task specificity of the performance measures. As a domain-specific measure of face-recognition ability we simply examined individuals' ability to identify ten previously seen faces from an array of twenty faces. For a measure of general perceptual expertise we used the embedded figures measure (Witkin, Oltman, Raskin and Karp, 1971) which has been found to be a reasonable measure of perceptual skill (Shade, 1984). As a measure of general non-verbal proclivity we used Richardson's (1977) verbalizer/visualizer scale. This scale measures the degree to which individuals are inclined to process information verbally versus visually. The items are a subset of the imagery measure section of Paivio's (1971) Ways of Thinking (WOT) measure. Thus these three tests provided a range of task specificity with respect to the perceptual skill associated with face recognition. Accordingly, if the perceptual abilities disrupted by verbalization are extremely task-specific, then the hypothesized interaction between verbalization and perceptual expertise should be limited to measures of face-recognition ability. If, however, the disruption is more generalized, then verbalization should interact with more general measures of perceptual ability.

With regard to verbal ability, it seemed unfeasible to assess domain-specific verbal skills in the context of face recognition, since such skills are likely to be limited to very unique populations such as police artists. We therefore exclusively used a very general measure of verbal ability: college or high school grade point average. Although an indirect measure of verbal ability, GPA is correlated with other measures of verbal ability (e.g. vocabulary and verbal SAT; Nelum-Hart, 1997) and it is certainly general in scope. An additional benefit of using a very general measure of verbal ability is that it allowed us to assess the impact of verbalization on individuals with high verbal and low perceptual ability (the missing 'reverse disparity cell' of prior investigations of verbal overshadowing and expertise).

SUMMARY AND PREDICTIONS

In sum, the present study examined individual differences in susceptibility to verbal overshadowing of faces as a function of general verbal ability and both domain-specific and non-specific measures of perceptual ability. We had the following three predictions. First, if prior interactions between verbal overshadowing and expertise were a consequence of actual differences in relative verbal and perceptual abilities, then verbalization should interact with the performance measures used in this study in a manner comparable to that previously observed with experience measures used in prior studies; i.e. individuals with high perceptual ability, and low verbal ability (positive disparity) should be more vulnerable to verbalization than individuals who have either comparably high or comparably low levels of each. Second, if the disruptive effects of verbalization are specifically associated with expertise disparities in which perceptual expertise exceeds verbal expertise, then verbal overshadowing effects should not be observed in cases in which the disparity between these abilities is reversed; i.e. when verbal expertise is high and perceptual expertise is low. Indeed, in such cases verbalization might even be beneficial. Finally, if verbal overshadowing effects produce a generalized disruption of perceptual memory processes, then verbalization may interact with general measures of perceptual expertise (GEFT and VVQ) as well as with the domain-specific measure (independent measure of face recognition ability).

METHOD

Participants

The participants were 221 University of Pittsburgh undergraduates who took part in partial fulfilment of the requirements of their Introductory Psychology course. Although students of all ethnic groups were welcome to participate for credit, because Fallshore and Schooler (1995) had uncovered cross-race differences in the verbal overshadowing effect, only the data from the 166 Caucasian participants were analysed. Of those, 122 provided their present college GPA, or, if they were freshmen, their high school GPA.

Materials

The stimulus materials were photos taken from college yearbooks which were converted into slides for presentation to groups of participants. There were six different target/test sets. Each target/test set consisted of a photo of a target person to be used at acquisition, and a test set consisting of a different photo of the target person along with photos of five featurally similar faces. The target face for acquisition was a candid photo; the test faces were all posed portraits. The six test photos were arranged in two horizontal rows of three photos. The location of the target person in the array was varied randomly.

Design

Participants were randomly assigned to either the verbalization or control condition. There were six different orders of presentation for the six target/test sets that formed a

single Latin square with twelve cells formed by the six orders by two conditions. The participants were run in groups of anywhere from one to nine.[1]

Recognition procedure

The face-recognition procedure was administered first. This consisted of six trials of the basic verbal overshadowing face-recognition procedure. The individual difference measures were administered after the face-recognition procedure.

For the recognition procedure, the target face was projected onto a screen for 5 seconds. After viewing the target face for acquisition, the participants worked crossword puzzles for 2 minutes. The purpose of this activity was to provide a short delay between actually seeing the target face and beginning to describe it to ensure that the descriptions were based only on memory and not on the visual perception of the face. After working the crossword puzzles, the participants were instructed to begin the post-encoding activity. For participants in the verbalization condition, the activity was to write a description of the face they had just seen. Participants in the control condition engaged in a filler task. The Filler task was to list as many items from a given category as they could think of. Because there were six trials, six different categories were used. The categories were states, cities, animals, cars, nations, and foods. The order of the categories was randomized across trials. The participants were instructed to work on the post-encoding activity for 4 minutes.

After completing the acquisition and post-encoding activities, the participants were given a forced choice-recognition test. They were shown the test slide and allowed to view it for as long as they wished before indicating their choice on an answer sheet. This procedure was then repeated with each of the remaining five target/test sets.

Individual difference measures

Four individual difference measures were used to divide participants into high (above the median) or low (below the median) verbal and perceptual abilities. There were 35 ties at the median of the independent measure of face recognition and 39 ties at the median of the VVQ (each described below) which were divided randomly into the high and low groups. For other measures there were five or fewer ties. They were placed in the below the median group. College or high school GPA was used as a means of dividing participants into high and low general verbal ability.

The first measure of perceptual ability measured face-recognition ability independently of the experimental task. Participants spent 1 minute trying to memorize thirty faces (college yearbook portraits) presented on a handout before being tested. The GEFT (a 3-minute timed test described below) was administered between the memorization period and the test. After this delay, the participants were presented with twenty faces, ten of which had been used to construct the original handout and ten of which were new faces. The participants spent as much time as they needed indicating which faces were from the original handout (usually about 2 minutes).[2]

[1]It had been planned to run a minimum of nine participants per cell. However, because participants were run in groups, it was sometimes necessary to allow a cell to contain several more than nine. In addition, an experimenter error led to 24 participants being included in one cell. For these two reasons the verbal and non-verbal groups contained different numbers of participants.

[2]The degrees of freedom for the face recognition analysis is one fewer than for the other analyses because one participant did not provide face recognition data.

The second was the Group Embedded Figures Test (GEFT), which measures ability to perceptually differentiate a form from the field in which it is embedded (Dumsha *et al*., 1973). Participants who score high on the GEFT have high field independence.

The third was the Verbal/Visual Questionnaire (VVQ), a self-report measure consisting of 15 items questioning participants' verbal and visual cognitive style and preferences. A high score on the VVQ indicates a more visual versus verbal cognitive style (Richardson, 1977).

RESULTS

First we present the analysis of recognition accuracy on each face as a function of verbalization and trials without accounting for individual difference factors. Then we present the analysis of the average face-recognition accuracy (collapsed across the six trials) as a function of verbalization and verbal expertise (GPA). Next we present three analyses. Each examines average accuracy as a function of (a) verbalization, (b) one of the three perceptual expertise measure, and (c) verbal/perceptual equivalence (disparity versus no disparity). This section also includes the intercorrelations among the verbal and perceptual expertise measures. Finally, the correlations between the individual difference measures and average accuracy of the verbalizers and the non-verbalizers are presented.

Verbalization and trials

In prior verbal overshadowing studies (e.g. Fallshore and Schooler 1995, Melcher and Schooler, 1996; Schooler *et al*., 1996), trial effects have been observed such that the magnitude of the verbal overshadowing effect was larger in the first trial relative to subsequent trials. In order to examine the possibility of a trial effect, the difference between the performance in the verbalization and control conditions in the first trial was compared to that in all subsequent trials (see Table 1). A 2×2 mixed analysis of variance (ANOVA) using verbalization as a between-subjects factor and time of trial (first versus later) as a within-subjects factor revealed a marginally significant verbal overshadowing effect $F(1, 163) = 3.65$, $p = 0.058$, $MSE = 0.140$, but neither a main effect of trial effect $F(1, 163) = 0.64$, $p = 0.422$, $MSE = 0.111$, nor a significant interaction between verbalization and trial (the usual trial effect), $F(1, 163) = 1.84$, $p = 0.176$, $MSE = 0.111$. However, consistent with prior studies, simple effects tests revealed a significant verbal overshadowing effect for the first trial only, t(two tailed,

Table 1. Percent correct on first and later trials in verbalization and control conditions

	Time of trial		
Condition	First	Subsequent	Total
Verbalization ($N = 68$)	63	65	65
Control ($N = 97$)	77	68	70
Total	71	67	68

164) = 2.51, $p = 0.013$, but not for the later trials, t(two tailed, 164) = 0.53, $p = 0.59$. Because there was no verbalization by trial interaction in the present study, the data were collapsed across trials for all subsequent analyses.

Verbal overshadowing and GPA

Table 2 shows the average accuracy as a function of verbalization condition and GPA. There was no effect of GPA, $F(1, 118) = 0.24$, $p = 0.625$, $MSE = 0.039$. There was, however, a strong verbalization by GPA interaction, $F(1, 118) = 6.39$, $p = 0.013$, $MSE = 0.039$. *Post hoc* tests revealed that among participants who were low on GPA there was a significant effect of verbalization, t(two tailed, 60) = 2.95, $p = 0.005$, whereas among participants with high GPAs verbalization was slightly, although not significantly, beneficial, t(two tailed, 58) = 0.59, $p = 0.558$.

Table 2. Average accuracy (%) as a function of condition and GPA

	Condition		
GPA	Verbalization	Control	Total
Low (below the median)	58 (24)	73 (38)	67 (62)
High (above the median)	69 (24)	66 (36)	67 (60)
Total	63 (48)	70 (74)	67 (122)

Note: *N*'s are in parentheses.

Verbal overshadowing and disparity between verbal and perceptual expertise

Three analyses of variance (ANOVAs) were conducted, i.e. one for each of the three perceptual expertise measures. Each was a 2 × 2 × 2 between-subjects analysis which examined mean recognition accuracy as a function of verbalization (verbalization versus control), perceptual expertise (high versus low), and verbal/perceptual equivalence (disparity versus no disparity). Perceptual expertise was crossed with verbal/perceptual equivalence to create all four cells within which to examine verbal overshadowing. The disparity group consisted of the low perceptual/high verbal participants (the new reverse disparity condition) and the high perceptual/low verbal participants (the positive disparity condition used in previous research). The no-disparity group consisted of the low perceptual/low verbal participants and the high perceptual/high verbal participants.

Disparity and face recognition ability

There was a marginally significant main effect of verbalization, $F(1, 113) = 3.89$, $p = 0.051$, $MSE = 0.039$, but no other main effects or two way interactions. However, as illustrated in Figure 1, there was a three way interaction between verbalization, face recognition, and disparity $F(1, 113) = 7.18$, $p = 0.008$, $MSE = 0.039$. The interaction can be seen to be driven by the presence of a verbalization by face recognition interaction for the disparity participants, $F(1, 43) = 6.31$, $p = 0.016$, $MSE = 0.044$, but no such interaction for the no-disparity participants $F(1, 70) < 1$. The interaction for the disparity participants can be seen to be driven by the large

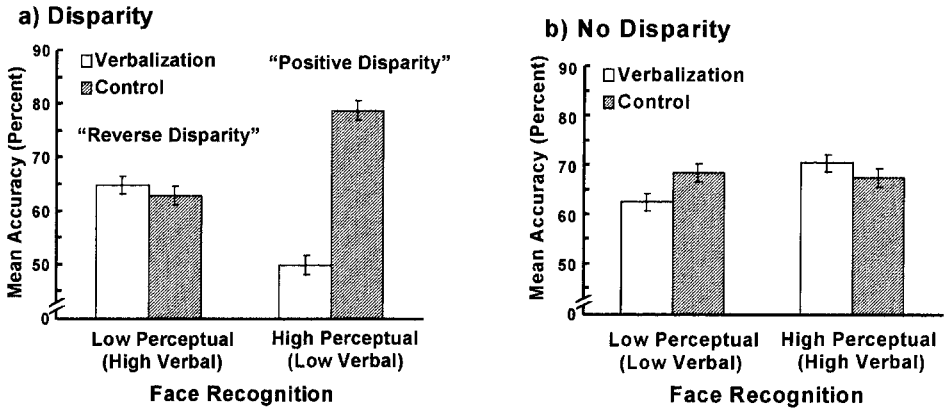

Figure 1. Mean recognition accuracy (%) as a function of verbalization and perceptual expertise (face recognition) for (a) the disparity, and (b) the no-disparity participants

verbal overshadowing effect (i.e. a difference of 29%) for the positive disparity participants, t(two tailed, 24) = 3.65, $p = 0.001$. For the reverse disparity participants there was a reversal of the direction of the effect, such that verbalization was numerically beneficial for face recognition, although the difference (about 2%) was not statistically significant, t(two tailed, 19) = 0.23, n.s.

Disparity and field independence (GEFT)

There were no main effects of verbalization, GEFT, or disparity. As shown in Table 3, there was an overall two-way interaction between verbalization and GEFT, $F(1, 114) = 4.26$, $p = 0.041$, $MSE = 0.039$. Among the high-GEFT participants, the verbalization participants performed worse than the control participants, t(two tailed, 81) = 2.30, $p = 0.024$. Among the low-GEFT participants, the verbalization participants performed slightly, but not significantly better than the control participants, t(two tailed, 81) = 0.45, n.s. However, as illustrated in Figure 2, this two-way interaction was superseded by a three-way interaction between verbalization, GEFT, and disparity, $F(1, 114) = 5.90$, $p = 0.017$, $MSE = 0.039$. The interaction, as with face recognition, can be seen to be driven by the presence of a strong verbalization by GEFT interaction for the disparity participants, $F(1, 54) = 9.02$, $p = .004$, $MSE = 0.043$, but no such interaction for the no-disparity participants $F(1, 60) < 1$. As before, the interaction for the disparity participants can be seen to be

Table 3. Average accuracy (%) as a function of condition and GEFT

	Condition		
GEFT	Verbalization	Control	Total
Low (below the median)	70 (32)	68 (51)	69 (83)
High (above the median)	61 (36)	71 (47)	67 (83)
Total	65 (68)	69 (98)	68 (166)

Note: *N*'s are in parentheses.

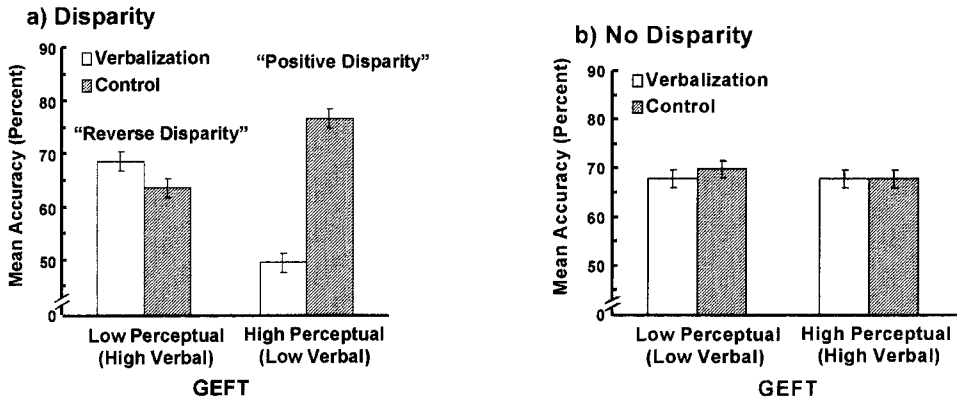

Figure 2. Mean recognition accuracy (%) as a function of verbalization and perceptual expertise (GEFT) for (a) the disparity, and (b) the no-disparity participants

driven by the large verbal overshadowing effect (i.e. a difference of 27%) for the positive disparity participants, t(two tailed, 28) = 3.65, $p < 0.001$. For the reverse disparity participants there was a reversal of the direction of the effect, such that verbalization was numerically beneficial for face recognition, although the difference (about 5%) was not statistically significant, t(two tailed, 26) = 0.67, n.s.

Disparity and visual cognitive style (VVQ)

There were no main effects of verbalization, VVQ, or disparity, nor any two way interactions. As illustrated in Figure 3, however, there was once again a three-way interaction between verbalization, VVQ, and disparity, $F(1, 114) = 4.60$, $p = 0.034$, $MSE = 0.039$. The interaction, as with face recognition and GEFT, can be seen to be driven by the presence of a strong verbalization by VVQ interaction for the disparity

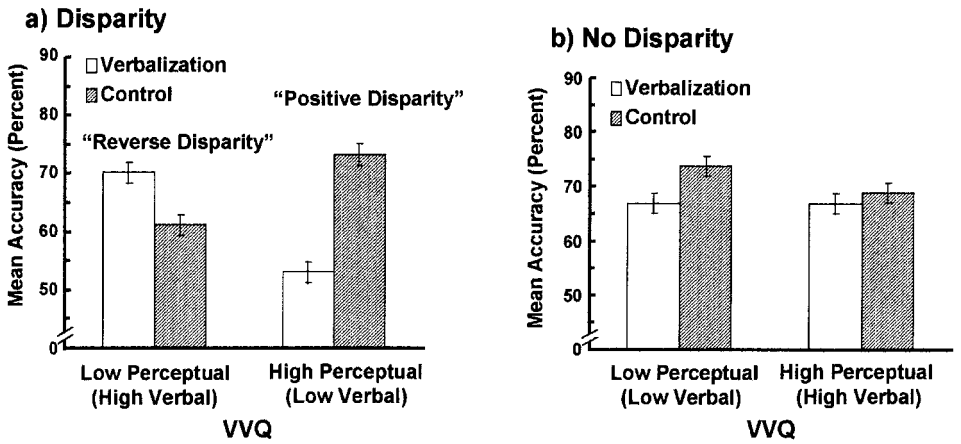

Figure 3. Mean recognition accuracy (%) as a function of verbalization and perceptual expertise (VVQ) for (a) the disparity, and (b) the no-disparity participants

participants, $F(1, 60) = 7.73$, $p = .007$, $MSE = 0.041$, but no such interaction for the no disparity participants $F(1, 60) < 1$. As before, the interaction for the disparity participants can be seen to be driven by the large verbal overshadowing effect (i.e. a difference of 20%) for the positive disparity participants, t(two tailed, 31) = 2.89, $p < 0.007$. For the reverse disparity participants there was a reversal of the direction of the effect, such that verbalization was numerically beneficial for face recognition, although the difference (about 9%) was not statistically significant, t(two tailed, 29) = 1.26, $p = 0.22$.

Correlations between expertise measures

Because the pattern of results for each of the expertise measures was so similar, it was important to determine whether they were independent, or were in fact measuring the same ability. Table 4 clearly shows that the underlying measures are virtually independent of one another. Only one correlation was even significant at the 0.05 alpha level, that between GPA and face recognition, and they only shared 4% of their variance. All the other correlations were extremely low.

It may at first seem inconsistent that the individual difference measures were not correlated whereas they nevertheless played a part in identifying those participants who were most vulnerable to verbal overshadowing. However, it should be remembered that it was not the individual difference measures themselves, but rather the disparity between GPA and one or the other of the perceptual expertise measures that performed this function. The combinations of GPA with each of the perceptual expertise measures can be used to form indexing variables which identify participants that fall into each of the four combinations of high or low verbal and perceptual expertise. Of course, as shown in Table 5, these combinations are correlated because each one is formed from the same verbal expertise measure.

Table 4. Intercorrelations between underlying measures of verbal and perceptual expertise

Measure	(1)	(2)	(3)	(4)
(1) GPA	–	0.21* (121)	−0.003 (122)	−0.12 (122)
(2) Face recognition		–	0.15 (165)	0.02 (165)
(3) GEFT			–	−0.005 (166)
(4) VVQ				–

Note: *N*'s are in parentheses, *$p < 0.05$ (two-tailed).

Table 5. Intercorrelations between combinations of verbal and perceptual expertise

Measure	(1)	(2)	(3)
		($N = 122$)	
(1) GPA and face recognition	–	0.46***	0.29**
(2) GPA and GEFT		–	0.27**
(3) GPA and VVQ			–

Note: **$p < 0.01$ (two-tailed), ***$p < 0.001$ (two-tailed).

Correlations between individual difference measures and average accuracy for verbalization and control participants

In prior investigations of the relationship between verbalization and expertise (i.e. Melcher and Schooler, 1996), additional evidence for verbalization's impact on the type of knowledge on which people rely at test was revealed by comparing the predictiveness of verbal and perceptual expertise in the verbalization and control conditions. Accordingly, in order to examine whether verbalization in this experiment may have similarly altered the knowledge base upon which individuals made their recognition decisions, the correlations between each of the individual difference measures and the average face recognition accuracy were conducted separately for the verbalization and control participants. In addition, a composite measure of perceptual ability was created by converting the three individual perceptual expertise measures to standardized scores and averaging them. Although the individual correlations were not significant, the combined perceptual measure did provide evidence that verbalization may cause a shift in individuals reliance on perceptual expertise.

Specifically, the combined measure of perceptual expertise was significantly correlated with face recognition performance of non-verbal participants, $r = 0.235$, $p < 0.05$ (two-tailed), $N = 97$, while this relationship was not significant (and in the opposite direction) for verbalization participants, $r = -0.127$, $p > 0.05$ (two tailed), $N = 68$.

DISCUSSION

The present study documented the critical importance of perceptual and verbal abilities in mediating the disruptive effects of verbalization on face recognition. With respect to the individual measures, verbalization was detrimental among participants with low verbal expertise (as indirectly assessed through GPA) but it had little effect on individuals with high verbal ability. The effect of verbalization was also mediated (albeit in the opposite manner) by performance on a general measure of perceptual ability (embedded figures), with participants who scored above the median on this measuring being more impaired by verbalization than those who scored below the median. However, by far the most dramatic interactions between individual difference variables and verbal overshadowing were observed when verbal and perceptual abilities were taken into account together.

Specifically, individuals who scored above the median on any of the various perceptual ability measures but below the median on GPA showed by far the largest verbal overshadowing effects. In contrast, individuals whose GPA was relatively high and perceptual ability (as measured by any of the various perceptual skill measures) was relatively low were numerically (although not significantly) better at recognizing faces following verbalization.

These results support prior claims that the disruptive effects of verbalization are associated with a disparity between verbal and perceptual expertise. As in prior studies comparing own-versus other-race face recognition (Fallshore and Schooler, 1995) and wine drinkers of varying degrees of expertise (Melcher and Schooler, 1996), verbal overshadowing effects were exclusively observed in those cases in which

perceptual expertise exceeded verbal expertise. The present findings extend these prior observations in a number of important respects, including: (a) illustrating the relationship between expertise and verbal overshadowing using performance measures; (b) confirming the prediction that verbalization should be the least detrimental, and perhaps helpful, when the disparity between perceptual and verbal expertise is reversed; and (c) demonstrating that detrimental effects of verbalization on specific non-verbal tasks can be mediated by relative disparities in types of verbal and perceptual expertise that are independent of the particular task domain that is impaired. We briefly discuss the theoretical and applied significance of these three general findings.

Predicting verbal overshadowing of face recognition on the basis of independent performance measures

Prior demonstrations of the relationship between expertise and verbal overshadowing did not use direct performance measures to assess perceptual ability. For example, Fallshore and Schooler (1995) inferred perceptual expertise in face recognition on the basis of the match between the race of the participant and the race of the encoding/test faces. Melcher and Schooler (1996) inferred perceptual expertise in wine tasting on the basis of the frequency with which participants reported consuming wine. Although these experience measures are likely to be associated with performance differences, they also are likely to be associated with a host of other variables (e.g. attitudes towards the stimulus) that may be completely unrelated to perceptual expertise. For example, own-versus other-race faces may elicit different affective reactions (Dovidio, Kawakami, Johnson and Johnson, 1997). Own versus other race faces may also be differentially prone to produce demand characteristics. For example, individuals might be especially cautious in describing members of other races, so as to avoid sounding prejudiced. Similarly, the relationship between verbal overshadowing and individuals' frequency of consuming wine might also be influenced by factors other than perceptual expertise. For example, individuals who drink wine less than once a month presumably like it less than individuals who drink it regularly. Regular wine drinkers might also have experienced a greater demand to attempt to use wine terminology in describing their taste experiences. Thus, although prior studies were certainly consistent with the notion that perceptual expertise is the key variable in mediating verbal overshadowing effects, they might also have been interpreted otherwise. The present finding that direct measures of perceptual expertise mediate verbal overshadowing effects in a pattern that mirrors prior findings using experience-based measures helps to strengthen the contention that the critical mediating variable in all of these studies was individuals' relative perceptual and verbal abilities.

The reversal of the usual disparity between verbal and perceptual ability

A central assumption of prior accounts of verbal overshadowing effects is that it results from a mismatch between the non-verbal processes/knowledge associated with perceptual memories and the verbal processes/knowledge associated with the process of verbalization. The present study further supports this *modality mismatch assumption* (cf. Schooler *et al.*, 1997) by the marked verbal disruption for the high perceptual/

low verbal individuals relative to the (at least numeric) advantage of verbalization for the low perceptual/high verbal participants. Although the beneficial effects of verbalization for low perceptual/high verbal participants was not statistically significant, the fact that the effect of verbalization was in the opposite direction to that of high perceptual/low verbal participants clearly suggests that verbalization had a qualitatively different effect on these two populations. Moreover, this interaction demonstrates that the negative effects of verbalization on high perceptual/low verbal participants is a consequence of the particular relationship between their respective skills; it is not an inevitable consequence of possessing disparate verbal and perceptual abilities.

The finding that verbalization disrupts individuals with high perceptual ability and low verbal ability also supports the notion that verbalization specifically impairs individuals' ability to rely on their perceptual knowledge. This claim was further supported by comparing the predictors of performance in the verbal and non-verbal conditions. For non-verbal participants, face-recognition performance was significantly correlated with their composite perceptual ability score (derived by averaging participants' standardized scores on the three perceptual skills measures). In contrast, this same measure was actually negatively (albeit not significantly) correlated with face-recognition performance for verbalization participants. This disruptive effect of verbalization on individuals' ability to rely on their perceptual proclivities mirrors a similar finding with verbal overshadowing of taste. Specifically, Melcher and Schooler (1996) observed that for non-verbal participants, wine-recognition performance was significantly correlated with wine-drinking experience, an (albeit indirect) measure of perceptual ability. However, this relationship was attenuated for participants in the verbalization condition, whose performance was instead predicted by their verbal wine knowledge.

The claim that verbalization specifically interferes with individuals' ability to apply non-verbalizable knowledge, while not affecting their ability to use verbalizable knowledge, is also consistent with recent examinations of the effects of verbalization on individuals self-reported reliance on verbal and non-verbalizable knowledge. Using a variation on Tulving's (1985) know/remember distinction, Schooler, Fiore, Melcher and Ambadar (1996) (described in Schooler *et al*., 1997) asked participants to distinguish between recognition decisions that were based on reportable reasons (*reason* decisions) and those that were not based on any reportable reasons (*just know* decisions). Consistent with the claim that verbalization exclusively disrupts the use of non-reportable knowledge, Schooler *et al*. observed, that verbalization disrupted the accuracy of those recognition decisions classified as 'just know' while having no effect on 'reason' decisions. These parallels between the effects of verbalization on non-verbal knowledge, as measured by self-report responses and individual differences, raises interesting questions about the relationship between these approaches. Accordingly, it would be quite worth while to investigate the frequency with which individuals with varying degrees of verbal and perceptual ability report relying on 'just know' versus 'reason' decisions. It seems quite plausible that individuals with high perceptual expertise and low verbal ability would be particularly apt to rely on 'just know' decisions (which are found to be vulnerable to verbalization). In contrast, individuals with high verbal ability and relatively low perceptual ability may be more inclined to rely on reason-based decisions (which have been found to be unaffected and in some cases marginally improved by verbalization).

The generality of the measures of expertise

A third advancement of the present study was its examination of the specificity of performance measures necessary to predict verbal overshadowing effects. As noted in the introduction, prior examinations of the relationship between expertise and verbal overshadowing have exclusively relied on domain-specific assessments of expertise. It is quite notable that the verbal vulnerability of perceptual expertise was observed both with the domain-specific measures of expertise (face recognition) and the domain-general (embedded figures, VVQ) measures of perceptual expertise. Moreover, the most pronounced effects of verbalization were observed for those participants who were above the median on any of these measures, and below the median on an extremely non-specific measure of verbal ability (GPA).

The fact that individuals' susceptibility to verbal overshadowing can be predicted on the basis of extremely non-specific measures of perceptual and verbal ability provides an important constraint on interpretations of the effects of verbal overshadowing. Specifically, this finding suggests that verbalization does not simply interfere with individuals' memory for specific faces, but rather disrupts individuals' ability to apply the general perceptual skills necessary for face-recognition performance. Such a claim would be consistent with recent findings that the disruptive effects of verbalizing one perceptual stimulus can interfere with the subsequent recognition of a different perceptual stimulus (e.g. Dodson et al., 1997). If verbalization disrupts the general application of non-verbal skills then it would make great sense that it would especially impair those individuals who are apt to particularly rely on such skills (i.e. those individuals who have above-average perceptual ability and below-average verbal ability).

The fact that individuals' susceptibility to verbal overshadowing of faces could be predicted using rather general measures of perceptual and verbal ability also suggests that these same general measures might also predict susceptibility to verbal overshadowing in other domains (e.g. visual forms, colours, maps) that have been found to be vulnerable to verbalization. In short, the predictive value of general measures of perceptual and verbal expertise suggests the likely existence of a general individual difference variable that might be characterized as a *susceptibility to verbal overshadowing*. Accordingly, if domain-independent measures of perceptual and verbal ability can predict verbal overshadowing for face recognition, it seems quite likely that individuals who excel perceptually but are limited verbally may be especially vulnerable to verbal overshadowing effects across domains. Such a situation would be especially likely to occur in educational settings in which learners were beginning to acquire knowledge in any of a number of domains that they might represent perceptually before being able to verbally articulate. For example, beginning algebra or physics students might understand problems in terms of a visual mental model of the situation described in the problem, whereas they would be unable to verbally explain the principles required for solving such problems (Ryan and Schooler, 1998). For such individuals the relationship between language and thought may be especially precarious, with language regularly threatening their otherwise superior perceptual skills. If, as the present findings suggest, a susceptibility to verbal overshadowing is a reliable and general individual difference variable, then future research needs to determine its breadth of application, and ideally to discover ways of protecting the non-verbal knowledge of this especially vulnerable population.

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