



The role of visual perspective in information processing

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ABSTRACT

Social events can be described from the perspective of either a person in the situation in which the event occurs (e.g., “John came into...”) or that of an outside observer (“John went into...”). We find that when individuals are disposed to form visual images, they have difficulty comprehending both verbal statements and pictures when the perspective from which the event is described differs from the perspective from which they have encountered similar events in daily life. Furthermore, the disposition to form visual images increases the intensity of emotional reactions to an event when the event is described from the perspective of someone in the situation in which it occurs. These effects are not evident, however, among individuals who typically process information semantically without forming visual images.

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People can employ at least two different strategies in comprehending the description of a social event. On one hand, they might interpret the information in terms of semantic concepts pertaining to the type of event described or the situation in which it occurred. In this case, their reactions to the event are likely to be similar regardless of the form in which the information is presented. Alternatively, recipients might try to form a visual image of the event being described and base their reactions on this image. In this case, their reactions are likely to depend on characteristics of the information that influence the type of image they construct and the difficulty of forming it.

The tendency to construct visual images from verbal information can depend on how the information is presented. Adaval and her colleagues (Adaval, Isbell, & Wyer, 2007; see also Adaval & Wyer, 1998), for example, found that when the events that occurred in the life of a politician were described in a temporally-ordered narrative, participants appeared to form a mental image of the sequence of events as a whole. In this case, accompanying the verbal event descriptions with a picture facilitated their construction of this image and increased the extremity of the evaluations they based on it. When the same events were described in an ostensibly unordered list, however, recipients appeared to evaluate the semantic implications of each event independently without forming images. In this case, pictures interfered with recipients' integration of these semantic implications and decreased the extremity of their evaluations.

The present research examined not only *whether* individuals construct visual images from verbal descriptions of behavioral events but also *how* they form these images. Of particular interest

was the perspective from which images are constructed. For example, “the man went into the prison” is likely to elicit an image of the event from the perspective of someone outside the prison, whereas “the man came into the prison” elicits an image from the perspective of someone inside. The ease of constructing this image may depend on the frequency with which similar events have been encountered from these perspectives in the past. The importance of this possibility is suggested by research on the impact of perceptual fluency (for reviews, see Schwarz, 1998, 2004). That is, if individuals find it difficult to extract the implications of information they receive, they typically react less favorably to the information and its referents than they otherwise would (Winkielman & Cacioppo, 2001; Winkielman, Schwarz, Fazendeiro, & Reber, 2003). In the present context, this suggests that when individuals are disposed to form visual images on the basis of verbal information, their unfamiliarity with the perspective from which they form these images could decrease the favorableness of their reactions to the event or the persons involved in it. Note, however, that this difference in comprehension difficulty, and thus in the evaluations that result from it, should not be evident if individuals process the information semantically without forming visual images.

On the other hand, the perspective from which people imagine an event could have an impact independently of ease of processing. For example, the statements “The terrorist went into the restaurant and shot 12 customers” and “The terrorist came into the restaurant and shot 12 customers” describe the same event. However, the first statement elicits a visual image of the event from the perspective of someone outside the restaurant, whereas the second elicits an image from the perspective of someone inside. Therefore, individuals who construct visual images in the course of comprehending the two statements may have different emotional reactions to them. As in the previous example, however, the

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descriptive implications of the two statements are the same. Consequently, individuals who construe the semantic implications of the statements without forming visual images should react to them similarly.

These examples emphasize that people's comprehension of verbal information and reactions to it cannot be inferred from the descriptive implications of the information alone. In addition, one must understand the nature of the visual images that are elicited by the information and when these images will actually be constructed. The present research attempted to provide this understanding. To provide a framework for evaluating this research, we first discuss more generally the role of visual images in the comprehension of social information and the role of perspectives in the construction of these images. We then consider the implications of situational and individual differences in the disposition to form visual images. Finally, four experiments are reported that explore implications of these differences for both comprehension and judgment.

Theoretical background

Visual imagery in comprehension

A mental image is a mental representation of an object, event or situation whose features are spatially and temporally organized (cf. Kosslyn, 1975; Kosslyn, 1976; Kosslyn, 1988; Shepard & Metzler, 1971). The construction of such a representation can be based on direct experience with its referent, a picture, or a verbal description. To this extent, an image is somewhat analogous to a "picture in the head". The validity of a visual image construct has sometimes been questioned (e.g., Anderson, 1978; Pylyshyn, 1973; for a review, see Tye, 1991). However, Kosslyn (1988) and Kosslyn et al. (1999) showed that instructions to form visual images activated areas of the brain that are specifically associated with visual information processing. More recently, Kirchoff and Buckner (2006) found that self-reported tendencies to process information visually are correlated with fMRI indices of activity in the occipital temporal lobes of the brain whereas tendencies to process information verbally are associated with activation of prefrontal regions. In short, self-reported dispositions to engage in visual or verbal processing are associated with brain activation in areas implied by this processing.

The utility of a visual image construct in conceptualizing comprehension and judgment processes is incontrovertible. For example, Bransford, Barclay, and Franks (1972) found that people's memory for apparently anomalous sentences (e.g. "The haystack was important because the cloth would rip".) is improved substantially by adding a cue word (e.g. "parachute") that facilitates the construction of a mental image of a situation in which the statement was meaningful. Although these results could perhaps be interpreted without referring to the imagery construct, an explanation in terms of mental imagery is more parsimonious.

Mental images are often formed spontaneously in the course of comprehension (Garnham, 1981; Glenberg, Meyer, & Lindem, 1987). However, only a few conceptualizations of social information processing have explicitly taken visual imagery into account. Carlson's (1994) multi-modality conception of processing postulated that visual processing and semantic processing were governed by different cognitive systems. This difference in processing was subsequently formalized in a theory of social comprehension by (Wyer, 2004; Wyer & Radvansky, 1999). According to this theory, individuals who comprehend a statement about persons or objects first construct a semantic equivalent of the statement in the form of a subject-predicate proposition. Then, if the predicate denotes an action or state of affairs that is temporally and situationally constrained, they construct a mental simulation of the situation or

event depicted, or *situation model*. This model has both a metalinguistic component (e.g., a semantic representation of the proposition) and a nonverbal, image component.¹ Thus, for example, the model of "the boy kicked the ball" would consist of both a linguistic representation of the proposition itself and a visual image that conveys the spatial and temporal relatedness of the actor, the action, and the object. If the configuration of actor and object described in the statement has not previously been encountered but if visual representations of its components exist in memory, these components can function as perceptual symbols (Barsalou, 1999) that are extracted and combined to form a new representation. (Thus, for example, an image of "a lion walked into the classroom" can be constructed by retrieving a previously formed representation of walking into a classroom and substituting the perceptual symbol of a lion for the actor.)

According to Wyer and Radvansky (1999), however, image-based situation models are formed spontaneously only if the information describes events that are situationally and temporally constrained. For example, the event described by "the man bought a car" occurred at a particular time and place and so an image-based situation model would theoretically be formed of it. However, "the man owns a car" is not temporally specific and would not elicit a verbal image. Rather, it would be coded only metalinguistically (Radvansky, Wyer, Curiel, & Lutz, 1997).

The effect of perspective in image-based processing

Although the role of visual imagery in comprehension and judgment is well established, little research has examined the particular characteristics of a visual image that have an impact on these processes. The present research focused on one specific characteristic of visual images, namely, the perspective from which the images are constructed. The potential importance of considering this characteristic is suggested by early research on social attribution. Storms (1973), for example, showed that participants who watched a videotaped conversation between two persons attributed more responsibility to the individual who was prominent from the vantage point at which the tape was videoed. (For more recent evidence that the camera angles from which pictures are taken can affect viewers' person impressions, see Kraft, 1987; Meyers-Levy & Peracchio, 1992). However, Regan and Totten (1975) found that participants' attributions could be affected similarly by simply instructing them to imagine a conversation from the perspective of one party or the other.

The perspective from which verbally described situations are imagined could have similar effects. For example, the image of "George went into the bordello" is formed from a perspective of someone outside, whereas the image of "George came into the bordello" is formed from someone who is already inside. If the content of these images and the relative salience of these features differ, comprehension and judgments could differ correspondingly.

Effects of perspective on comprehension

We know of only one previous attempt to investigate the impact of visual perspective on the comprehension of verbal information. Black, Turner, and Bower (1979) found that when a shift in visual perspective was required to imagine the events described by a pair of statements, the statements were more difficult to comprehend. Thus, for example, participants took less time to comprehend "Mary was reading a book in her room. John came in to talk to

¹ A distinction should of course be made between a picture and a visual image. For one thing, an image may be less detail, omitting features that would be essential in a picture. For example, the image formed of "The boy kicked the ball" might contain a representation of a boy engaging in this action but might not indicate the color of his shirt.

her” than to comprehend “Mary was reading a book in her room. John went in to talk to her”. In comprehending the first statement of each pair, participants apparently formed an image of the event from the perspective of someone inside the room, and this gave rise to an expectation that subsequent events would be viewed from the same perspective. Consequently, when an image of the second event required a shift in perspective (to that of someone outside the room), comprehension difficulty was increased.

We examined further implications of this possibility. Situation models of the events that people encounter in daily life, like other mental representations, are presumably stored in memory and are later retrieved and used as bases for comprehending information that is acquired subsequently. To this extent, the perspective from which these previously constructed models have been formed could have effects analogous to those that Black et al. (1979) identified. That is, the verbal description of an event might be more difficult to comprehend if the image it elicits is from a perspective that differs from the perspective from which the event is normally viewed in daily life.

Effects of perspective on judgments

To the extent that individuals construct visual images of an event from different perspectives, they are likely to have different reactions to it. For example, individuals are likely to experience more intense emotional reactions to an event if they imagine themselves being in the situation in which the event occurs. To repeat an earlier example, suppose people read a description of someone entering a restaurant and shooting several customers. They are likely to experience more intense reactions to the event if they imagine it from the perspective of someone in the restaurant than if they imagine it from the perspective of someone outside. This difference, which may depend on how the statement describing the event is written, could be independent of the difficulty of comprehending the statement.

Situational and individual differences in image formation

The disposition to process information visually or verbally can be experimentally induced by instructions to engage in the two types of processing (Kosslyn, 1975, 1976; Petrova & Ciardini, 2005). However, chronic individual differences in the disposition also exist (Childers, Houston, & Heckler, 1985). The effects of chronic and situationally induced differences in the accessibility and use of declarative knowledge are theoretically and empirically similar (Bargh, Bond, Lombardi, & Tota, 1986; Förster & Liberman, 2007; Higgins & Bargh, 1987; Wyer, 2008). The effects of chronic and situationally-primed dispositions to process information visually and verbally are also parallel (Jiang, Steinhart, & Wyer, 2008; see also Wyer, Hung, & Jiang, 2008).

In two studies by Jiang, Steinhart, and Wyer (2008), for example, individuals evaluated a hotel based on an advertisement composed of two pictures, each followed by a verbal description. In some cases, the picture and verbal description in each pair pertained to the same general location (either the interior of the hotel or the exterior). In other cases, they described different locations. Thus, although the information presented in each ad (two descriptions of the interior and two descriptions of the exterior) was controlled, the picture and statement that immediately followed it could be easily integrated into a single visual image in the first ad but not in the second.

In one study, participants before being exposed to the advertisement were primed to process information either visually or verbally by performing either a hidden figure task (which required the identification of geometrical figures that were embedded in a complex visual display) or a hidden word task (which required the identifica-

tion of words embedded in a 2-dimensional array of letters). In a second study, participants' chronic disposition to process information visually vs. verbally was inferred from their self-reported preference for engaging in this processing. The results of the two studies were virtually identical. That is, individuals with a disposition to process information visually presumably found it more difficult to construct an image of the hotel when the picture and verbal description referred to different locations than when they referred to the same location. Consequently, they evaluated the hotel significantly less favorably in the former case than the latter, and this was true both when the disposition was situationally-primed (7.56 vs. 6.55, respectively, along a 0–10 scale) or chronic (7.75 vs. 6.80, respectively). In contrast, verbal information processors evaluated the hotel similarly regardless of how the information was presented, and this was also true when the disposition was both primed (7.32 vs. 7.50) and assessed (7.57 vs. 7.63). Other results reported by Jiang et al. (2008) have similar implications.

These results indicate that visual and verbal processing strategies have different effects on the comprehension of information and that these strategies can be both situationally induced and chronic. In the present research, we considered the effects of chronic differences, based on responses to Childers et al.'s (1985) style-of-processing scale. This scale, which has both predictive and discriminant validity (Childers et al., 1985) and predicts differences in the disposition to engage in visual or verbal processing independently of the ability to do so (Childers et al., 1985; Pham, 1998). The relative tendency to process information visually (vs. verbally) is correlated positively with ad-induced imaging and negatively with ad-induced analyzing (Oliver, Robertson, & Mitchell, 1993). Furthermore, the scale predicts the favorableness of individuals' attitudes toward television and the frequency of watching it (Darley, 1999). We therefore considered the scale to be a valid and reliable index of the dispositions it purports to measure.

The present research

Four experiments are reported. Experiment 1 provided preliminary evidence that the ease of comprehending verbal statements depends on the similarity of the perspective from which images of the situations were constructed to the perspective from which similar situations were encountered in daily life and showed that this difference is independent of participants' familiarity with the events themselves. Experiment 2 showed that the effect of perspective familiarity on comprehension depends on differences in processing style as well as the perspective from which similar events are likely to have been viewed in daily life.

Experiment 3 showed that differences in processing style influence the extent to which individuals construct visual images of events described in pictures as well as in words. This study also confirmed our assumptions that (a) the individual differences we assessed reflect differences in the disposition to form visual images and not the ability to do so and (b) the effects are the result of differences in the difficulty of constructing the images under the conditions in which they are formed. Finally, Experiment 4 showed that the disposition to form visual images from verbal event descriptions affected the intensity of the emotional reactions to social events that were described from different perspectives.

Experiment 1

People should theoretically find it easier to construct an image-based situation model of an event if the perspective from which the image is formed is similar to that of previously formed models of the same type of event. For example, students may observe people going into a professor's office more frequently than they observe people coming into it. In contrast, the professor may

observe the latter more frequently than the former. To this extent, students should comprehend “A person went into the professor’s office” more quickly than “A person came into the professor’s office”, whereas the professor should comprehend the second statement more quickly than the first.

Experiment 1 provided preliminary support for this possibility. In doing so, it distinguished between (a) the effects of familiarity with the perspective from which an event is imagined and (b) the effects of familiarity with the event itself. For example, students are likely to be more familiar with entering a classroom than with entering a prison. Consequently, they should find it easier to construct an image of the former event than the latter one and should take relatively less time to comprehend a statement that describes it. However, they are equally familiar with coming into a classroom and going into one, and so the difficulty of comprehending these two events should not differ. In contrast, they are likely to be less familiar with coming into a prison than with going into one, and so they should have more difficulty comprehending a description of the former event than the latter one.

Method

Overview and design

One hundred thirty three undergraduate students participated in a within-subject design. Each participant read a series of 40 statements with instructions to indicate whether they understood them. Among these statements were four target descriptions, two of which described a familiar event from a familiar perspective and the others of which described an unfamiliar event from a familiar perspective and an unfamiliar event from an unfamiliar perspective. The time to comprehend each statement was evaluated in a series of planned comparisons to assess (a) the effect of event familiarity, holding perspective constant and (b) the effect of perspective familiarity holding event familiarity constant.

Stimulus materials

Four target statements, shown in the top half of Table 1, were selected. The events described in the statements composed a 2 (Location: classroom vs. prison) \times 2 (Action: coming in vs. going in) design. However, we assumed that the statements differed in terms of both the familiarity of the event they described and the familiarity of the perspective from which the event was typically encountered. That is, two statements (“Frank went into the classroom” and “Frank came into the classroom”) described familiar events that were likely to have been observed with equal frequency from both perspectives. The other two statements (“Frank went into the prison” and “Frank came into the prison”) described events that were relatively unfamiliar. In addition, we assumed that the perspective from which “going into a prison” would be imagined was more familiar to college students than the perspective from which “coming into a prison” would be imagined.

Table 1
Stimulus statements and comprehension time (in s) as a function of event familiarity and perspective familiarity—Experiment 1.

	Familiar perspective	Unfamiliar perspective
<i>Event descriptions</i>		
Familiar event	Frank went into the classroom Frank came into the classroom	–
Unfamiliar event	Frank went into the prison	Frank came into the prison
<i>Comprehension times</i>		
Familiar event	2.32 _a (0.96)	–
Unfamiliar event	2.79 _b (1.72)	3.48 _c (2.53)

Note: Cells with unlike subscripts differ at $p < .01$. Standard deviations are shown in parentheses.

These assumptions were confirmed on the basis of pretesting. Fifty-five participants were asked how common it was to see a picture of the events that was taken from the perspectives under consideration along a scale from 0 (*not at all*) to 10 (*very*). Participants thought it was equally common “to see a picture that is taken outside a classroom, showing persons going in” ($M = 6.18$) and “to see a picture that is taken inside a classroom, showing persons coming in” ($M = 6.40$). However, they thought it was less common “to see a picture that is taken inside a prison, showing persons coming in” ($M = 3.89$) than “to see a picture that is taken *outside* a prison, showing persons going in” ($M = 7.16$, $F(1, 54) = 39.92$, $p < .001$).

In addition to the four target statements, 36 filler statements were constructed that were either comprehensible or incomprehensible. The four target stimuli were positioned 5th, 15th, 25th, and 35th in the 40-statement list. Each participant read all four target stimuli. However, the stimuli were presented in four different orders, with the particular stimuli rotated over the four positions in the series. Thus, pooled over orders, each of the four stimuli occurred with equal frequency in each of the four positions in the statement list.

Participants and procedure

The study was conducted in groups of 4–5 participants in a small computer laboratory. Participants were told they were participating in an experiment to help the university language center pretest some test materials. They were instructed that a series of statements about people and events would be presented on the computer screen, to read each statement, and to indicate whether the statement was comprehensible by pressing a designated key on the keyboard. To convey what we meant by comprehensibility, we provided examples of statements that were either comprehensible (e.g. “Mary drank a cup of coffee”) or incomprehensible due to unknown words or impossibility (e.g. “Mary ate a gordania”).

Participants reported their judgments of each statement by pressing either “1” or “2” on the keyboard to indicate whether the statement was comprehensible or not. The time between stimulus onset and response was used as an index of comprehension time. (In both this and other experiments, of course, participants were unaware that their response times were being recorded.)

Results

Eleven participants (8.3% of all participants) judged one or more target statements to be incomprehensible or reacted to the stimuli particularly slowly (more than 10 s). These data were not included in the analyses to be reported (Ratcliff, 1993).

As noted earlier, the four target statements composed a 2 (Type of action: going into vs. coming into) \times 2 (Action location: classroom vs. prison) design. However, two of the statements, “Frank came into the classroom” and “Frank went into the classroom” both described a familiar event from a familiar perspective, and preliminary analyses indicated that response times to these statements did not appreciably ($M = 2.27$ s and 2.37 s, respectively; $F < 1$). These times were therefore averaged.

Response times to the three types of descriptions shown in Table 1 were then analyzed in a one-way within-subjects analysis of variance. The overall effect of statement type was reliable, $F(2, 242) = 18.60$, $p < .001$. Planned comparisons indicated that holding perspective familiarity constant, participants responded more quickly to familiar events than to unfamiliar ones (2.32 s vs. 2.79 s, respectively), $F(1, 121) = 9.79$, $p < .01$. Furthermore, holding event familiarity constant, participants responded more quickly to events that were likely to be imagined from a familiar perspective than events that were likely to be described from an unfamiliar one (2.79 s vs. 3.48 s), $F(1, 121) = 11.77$, $p < .01$. Thus, the ease of com-

prehending event descriptions was a positive function of both event familiarity and perspective familiarity.

Experiment 2

An alternative interpretation of Experiment 1's results should be noted. That is, the difference in time to comprehend verbal statements might conceivably depend on the frequency with which the verbal statements themselves have been encountered in the past, independently of the frequency of observing the events they describe. If "went into the prison" is a more familiar phrase than "came into the prison", this alone could account for the faster response time to the former item.

Experiment 2 eliminated this alternative interpretation. First, we identified events with which all participants were likely to be familiar. However, individuals were expected to differ in terms of the visual perspective from which the events were typically experienced. In particular, the events concerned either entering a men's restroom or entering a ladies' restroom. Males and females are unlikely to differ appreciably in the frequency with which they observe people going into the two types of restrooms. However, coming into a men's room is less familiar to females than to males, whereas coming into the ladies' room is relatively less familiar to males than to females. We therefore expected that although male and female participants would not differ appreciably in the time required to comprehend verbal descriptions of people going into the two types of restrooms, they would differ substantially in the time to comprehend people coming into the two rooms.

If differences in comprehension time are a reflection of differences in the difficulty of imagining events from the perspectives, however, these differences should only be evident among individuals who are disposed a priori to process information visually. That is, people who typically process information semantically without forming visual images should find it equally easy to comprehend the information regardless of the visual perspective from which the events might be imagined. This possibility was examined.

Method

Forty-six male and eighty-nine female undergraduate students participated. They were asked to comprehend 40 stimulus statements. Of these, four target statements varied with respect to the familiarity of the perspective from which with the events they described were likely to be imagined. The time to comprehend the target statements was analyzed as a function of two between-subject variables (participants' sex and their disposition to process information verbally or visually) and one within-subject factor (the perspective from which the events described in the statements could be imagined).

Stimulus materials

Each participant was presented a series of 40 statements. Of these, four were target statements that occupied the same serial positions in the series as the target statements in Experiment 1: (a) "A person went into the men's room", (b) "A person went into the ladies' room", (c) "A person came into the men's room", and (d) "A person came into the ladies' room". Thus, all four statements described familiar events. Furthermore, as indicated in Table 2, the perspective from which the first two events were described was expected to be equally familiar to both males and females. However, the perspective from which the third event was described was expected to be unfamiliar to females and the perspective from which the fourth event was described was expected to be unfamiliar to males.

Table 2

Target statements as a function of perspective familiarity and participants' sex—Experiment 2.

	Familiar perspective	Unfamiliar perspective
<i>Target statements</i>		
Male participants	A person went into the men's room A person came into the men's room A person went into the ladies' room	A person came into the ladies' room
Female participants	A person went into the ladies' room A person came into the ladies' room A person went into the men's room	A person came into the men's room

Procedure

The procedure was exactly the same as in Experiment 1. After participants finished the statement comprehension task, however, they completed Childers et al.'s (1985) style-of-processing (SOP) scale. This scale assesses people's propensity to process information visually versus verbally. It contains 22 items, 11 of which assess the propensity to process visually (e.g., "My thinking often consists of mental 'pictures' or images") and the other 11 of which assess the propensity to process verbally (e.g., "I enjoy doing work that requires the use of words"). The scale's construct validity has been documented by Childers et al. (1985).

As we noted earlier, the two processing styles were unlikely to be mutually exclusive. Rather, visual and verbal processing strategies may both exist in memory as part of procedural knowledge and their use in any given instance may depend on situational and individual difference factors that influence their relative accessibility. Thus, as Childers et al. (1985) recommended, the relative disposition to process information visually was inferred from the difference between the mean response to the visual items and the mean response to the verbal items. In the analyses to be reported, participants who scored above the median ($M = 0.36$)² were designated as *visualizers* and those who scored below the median were designated as *verbalizers*.

Results

Twelve participants (8.9% of all participants) judged one or more of the four target statements to be incomprehensible or took more than 10 s to respond. These data are not included into the following analysis.

Males' responses to statements about events that were written from a familiar perspective (specifically, "A person went into the men's room", "A person went into the ladies' room", and "A person came into the men's room") did not differ appreciably ($F < 1$), and this was true of both visualizers (1.99 s, 2.00 s, and 2.00 s, respectively) and verbalizers (2.13 s, 2.30 s, and 2.30 s, respectively). Similarly, females' response times to the three statements about events that were written from a familiar perspective ("A person went into the men's room", "A person went into the ladies' room", and "A person came into the ladies' room") did not differ ($F < 1$) and this was also true of both visualizers (2.03 s, 2.04 s, and 2.23 s, respectively) and verbalizers (1.98 s, 2.03 s, and 2.27 s, respectively). In each case, response times to the three statements were averaged.

Comprehension times are summarized in Table 3 as a function

² Since we used a 7-point scale, the possible averaged difference scores could range from +6 to -6, and so a median of 0.36 is very close to the midpoint.

Table 3

Comprehension time (in s) as a function of perspective familiarity, participants' sex, and processing style—Experiment 2.

	Familiar perspective	Unfamiliar perspective
<i>Visualizers</i>		
Male participants	2.00 (0.60)	2.81 (1.78)
Female participants	2.10 (0.66)	2.62 (1.18)
<i>Verbalizers</i>		
Male participants	2.24 (0.53)	2.22 (0.99)
Female participants	2.09 (0.66)	2.00 (0.77)

Note: Standard deviations are shown in parentheses.

of gender, perspective familiarity and processing style. Although the overall effect of perspective familiarity was significant, $F(1, 119) = 7.44, p < .01$, this effect is clearly contingent on processing style, as evidenced by an interaction of these variables, $F(1, 119) = 10.57, p < .001$. Specifically, visualizers took longer to comprehend descriptions of events from an unfamiliar perspective ($M = 2.72$ s) than descriptions of events from a familiar perspective ($M = 2.05$ s), $F(1, 119) = 13.36, p < .001$, whereas verbalizers' response times to the two types of statements did not differ (2.11 s vs. 2.16 s, respectively), $F < 1$.³

A supplementary analysis compared males' and females' responses to the two statements describing events that they presumably imagined from different perspectives (i.e., "A person came into the men's room" vs. "A person came into the ladies' room"). Male visualizers comprehended the first sentence faster than female visualizers did ($M = 2.00$ s vs. 2.62 s, respectively), $F(1, 119) = 4.93, p < .05$, but took more time to comprehend the second sentence than female visualizers did ($M = 2.81$ s vs. 2.23 s, respectively), $F(1, 119) = 2.80, p < .09$. Verbalizers, however, did not show these differences (all F s < 1).

Experiment 3

The results of Experiment 2 were consistent with our hypotheses. However, it is unclear whether the difference in processing strategies we detected simply results from a difference in the disposition to generate visual images from verbal information per se or whether it reflects a more general difference in the disposition to form visual images that occurs regardless of the modality in which information is conveyed. These possibilities have different implications. Suppose the only difference between visualizers and verbalizers is that visualizers attempt to construct visual images from verbal descriptions but verbalizers do not. If this is the case, presenting pictures of the events described, which would render differences in the modality transformation process irrelevant, would eliminate the processing differences observed in Experiment 2.

It seemed more likely, however, that visual and verbal information processors would differ more generally in their disposition to use visual imagery independently of the modality in which information is presented. That is, visual information processors may have a disposition to imagine the events they learn about regardless of whether the information is conveyed verbally or in pictures. In contrast, verbal information processors may extract the semantic implications from pictures as well as from verbal information and may process these implications without imagining the actual events described. If this occurs, verbal and visual processors might

be differentially affected by the perspective from which pictures of the events are taken in much the same way they are affected by the perspective from which descriptions of the events are written.

We investigated this possibility in Experiment 3. Stimulus materials paralleled those used in the second experiment. However, the events were conveyed in pictures rather than words. That is, participants saw pictures of a man coming into a men's room, a man going into a men's room, a woman coming into a ladies' room, and a woman going into a ladies' room. We expected that response times to the events would be an indication of the difficulty that participants spontaneously encountered in comprehending them.

After viewing all of the pictures, however, participants reviewed the pictures a second time and indicated how difficult it was to imagine the events portrayed. These data served two purposes. First, although the use of comprehension time as an indication of comprehension difficulty is fairly common in both cognitive and social psychology (Black et al., 1979; Radvansky & Zacks, 1991; Wyer & Radvansky, 1999), it seemed desirable to confirm this assumption in the present context.

Second, judgments of imagination difficulty provided indirect evidence of the extent to which the style-of-processing measure assessed differences in the disposition to form visual images rather than in the ability to do so. Suppose verbal information processors have less ability to construct visual images than visual processors have. Then, they should report relatively greater difficulty in imagining the situations described by the pictures than visualizers do and this should be true regardless of the perspective from which the pictures are taken. In contrast, suppose visualizers and verbalizers are equally able to form visual images if they are explicitly asked to do so. In this case, the difficulty they encounter in constructing these images should be affected similarly by the nature of the image they are asked to construct.

Method

Eighty-five undergraduate students participated for extra course credit. Participants were told they were participating in an experiment to help the social science division of the university pretest some materials to be used in a later survey. They were instructed that a series of pictures of different events would be presented on the computer screen, and to indicate whether the picture was comprehensible by pressing a designated key on the keyboard.

On this pretense, they were shown 16 pictures. Four target pictures depicted (a) a male student going into a men's room on campus (taken from outside the room), (b) a male student coming into a men's room (taken from inside the room), (c) a female student going into a ladies' room, and (d) a female student coming into a ladies' room. The remaining pictures showed other events that varied in the difficulty of comprehending them. The four target pictures were positioned 4th, 8th, 12th, and 16th in the series. As in previous experiments, the stimuli were presented in four different orders so that pooled over lists, each target picture occurred once in each serial position.

After participants finished the picture comprehension task, however, they were shown all pictures again and indicated how difficult it was to imagine the scene depicted in the picture along a scale from 1 (*not at all difficult*) to 9 (*very difficult*). Finally, they completed Childers et al.'s (1985) style-of-processing scale, and were subsequently divided into visualizers and verbalizers according to the criteria used in Experiment 2 ($M = 0.36$).

Results

Five participants (5.9% of all participants) reacted to the stimuli particularly slowly (more than 10 s) and these data are not included into the following analysis. Responses to the four target pic-

³ An application of the general linear model in which style of processing was treated as a continuous variable along with perspective familiarity and gender confirmed these conclusions. That is, the interaction of perspective familiarity and style of processing was significant, $F(1, 120) = 5.93, p < .05$, as well as the main effect of perspective familiarity, $F(1, 120) = 7.41, p < .01$.

tures were analyzed in a manner analogous to that employed in Experiment 2. That is, males' responses to the picture of a woman coming into the ladies' room, and females' responses to a picture of a man coming into a men's room, were assumed to reflect reactions to pictures that were taken from an unfamiliar perspective. The average of participants' responses to the remaining three pictures was then used as an index of their reactions to pictures that were taken from a familiar perspective. Judgments of imagination difficulty and comprehension time were each analyzed as a function of perspective familiarity, participant sex and style of processing.

Imagination difficulty

Participants' estimates of the difficulty they had imagining the situations conveyed by the target pictures are summarized in the top half of Table 4. As expected, participants reported greater difficulty imagining the situation conveyed by pictures that were taken from an unfamiliar perspective ($M = 6.36$) than those that were taken from a familiar perspective ($M = 3.85$), $F(1, 76) = 55.69$, $p < .001$. This difference was somewhat greater among female participants (6.62 vs. 3.19) than among males (6.11 vs. 4.51), $F(1, 76) = 7.28$, $p < .01$. However, it was virtually identical regardless of whether participants were visualizers (6.32 vs. 3.78) or verbalizers (6.40 vs. 3.92), $F < 1$. Thus, visualizers and verbalizers reported equal ability to form visual images when they were explicitly asked to do so and the familiarity of the perspective from which the picture was taken had equal effects on both.

Comprehension time

Suppose visual and verbal information processors differ primarily in their disposition to transform verbal information into visual images. Then, their responses to pictures, which do not require this transformation, should be fairly similar. However, if visualizers and verbalizers differ more generally in the processing strategies they employ regardless of the modality of the stimuli, their responses to pictures may be influenced by differences in perspective in much the same way that their responses to verbal event descriptions are influenced.

Data summarized in the bottom half of Table 4 confirm the latter possibility. Visualizers took generally longer to comprehend target pictures ($M = 2.50$ s) than verbalizers did ($M = 1.99$ s), $F(1, 76) = 5.76$, $p < .02$. However, although the effect of perspective familiarity was also significant, $F(1, 76) = 9.48$, $p < .03$, this effect was qualified by an interaction of perspective familiarity and style of processing, $F(1, 76) = 6.48$, $p < .02$. Specifically, visualizers took more time to comprehend pictures that were taken from an unfamiliar perspective than those that were taken from a familiar one (2.92 s vs. 2.09 s, respectively), $F(1, 76) = 15.78$, $p < .001$. However, the time required by verbalizers was relatively short and independent of perspective familiarity (2.03 s vs. 1.95 s, when the perspective was unfamiliar vs. familiar, respectively).⁴

Thus, these data indicate that although verbalizers reported greater difficulty imagining events described by pictures that were taken from an unfamiliar perspective when they were explicitly asked to do so, they did not spontaneously attempt to form these images in the course of comprehending the events described in the pictures. Consequently, the time they took to comprehend the events was unaffected by perspective familiarity.

Experiment 4

Experiments 2 and 3 provide strong evidence that individual differences in the disposition to construct visual images affect responses to both verbal information and pictures. Visual processors have difficulty comprehending this information if the image elicited by the information is from a perspective that is inconsistent with their past experience in situations of the sort being portrayed. Verbalizers, on the other hand, typically do not construct visual images in the course of processing the information and so they are not affected by the perspective from which the information is conveyed.

These processing differences may be reflected not only in individuals' comprehension of the information but also in their reactions to the situations that the information depicts. Individuals are likely to experience more intense emotional reactions to an event if they imagine themselves being in the situation in which the event takes place. To this extent, visualizers should experience stronger reactions to an event if it is described from the perspective of someone in the situation in which the event occurs (e.g., "The terrorist came into the restaurant and shot six customers") than if it is described from the perspective of someone outside this situation (e.g., "The terrorist went into the restaurant and shot six customers"). In contrast, verbalizers, who process the information semantically, may have similar reactions regardless of the perspective from which the event is described.

Experiment 4 investigated this possibility. Participants were exposed to a series of 24 statements with instructions either to imagine the events described or simply to comprehend them. The series included eight target statements that varied in terms of the favorableness of the events they described and the perspective from which they were written. After reading each statement, participants indicated their emotional reactions to the event described. The results of Experiment 3 confirm the assumption that verbalizers and visualizers both have the ability to construct mental images and differ only in the disposition to do so spontaneously. This suggests that if participants are told explicitly to imagine the situation, they should do so regardless of their chronic disposition to engage in verbal or visual information processing. That is, visualizers and verbalizers should both report more intense reactions to statements that are written from the perspective of someone in the location where the event occurred than to statements that are written from the perspective of someone outside the location. When participants are simply asked to comprehend the statements, however, this difference should only be evident if they have an a priori disposition to process information visually.

Method

Stimulus materials

Twenty-four stimulus statements were constructed of which eight statements were targets. Four target statements described events that were likely to elicit favorable reactions: (a) "A girl came/went into the room and gave everyone a flower", (b), "A young man came/went into the restaurant and kissed his girl friend", (c) "The actress came/went into the room and sang a beautiful song", and (d) "A student came/went into the room and shouted, 'We won!'". Four others described events that were likely to elicit unfavorable reactions: (a) "A drunk came/went into the kitchen and threw up on the floor", (b) "A snake came/went to the picnic and crawled up someone's leg", (c) "A gunman came/went into the restaurant and shot 12 people", and (d) "The professor came/went into the classroom and announced an unexpected quiz". The remaining 16 statements referred to events that were likely to be interpreted similarly regardless of perspective (e.g.,

⁴ This conclusion was confirmed by applying the general linear model in which style of processing was treated as a continuous variable in an analysis along with perspective familiarity and gender. This analysis yielded a significant interaction of perspective familiarity and style of processing, $F(1, 77) = 5.28$, $p < .05$, as well as a main effect of perspective familiarity, $F(1, 77) = 4.27$, $p < .01$.

Table 4

Imagination difficulty and comprehension time (in s) as a function of perspective familiarity, participants' sex, and processing style—Experiment 3.

	Visualizers		Verbalizers	
	Familiar perspective	Unfamiliar perspective	Familiar perspective	Unfamiliar perspective
<i>Imagination difficulty</i>				
Males	4.58 (2.33)	6.22 (3.25)	4.43 (2.23)	6.00 (2.77)
Females	2.97 (1.70)	6.43 (2.64)	3.41 (1.84)	6.81 (2.64)
Mean	3.78	6.32	3.92	6.40
<i>Comprehension time</i>				
Males	1.94 (0.61)	2.75 (1.44)	1.97 (1.26)	1.87 (0.94)
Females	2.23 (0.98)	3.07 (1.55)	1.93 (0.85)	2.19 (1.20)
Mean	2.08	2.91	1.95	2.03

Note: Standard deviations are given in parentheses.

“The bear climbed the tree and ate an apple”, “The entertainer told a few jokes to begin the show”, etc.).

Four forms were prepared. In one form, two target statements about positive events and two target statements about negative events were written from the perspective of someone outside the location in which the event occurred, and the remaining target statements were written from the perspective of someone inside. These statements were distributed evenly throughout the set of 24. A second form was similar except that the perspective from which each target statement was written was reversed. In the remaining two forms, the eight target statements were presented in reverse order. Therefore, pooled over the four forms, both the perspective from which each target item was written and its mean serial position was controlled.

Procedure

Seventy-three undergraduate students participated. They were told that we were interested in students' emotional reactions to social events, that they would be asked to read a series of statements describing such events and to indicate their emotional reactions to the events along a scale from -5 (*very negative*) to 5 (*very positive*). Before responding to each item, however, participants in *Imagination* conditions were asked to “imagine that you are observing the event depicted”. In *Comprehension* conditions, however, no additional instructions were given. Finally, participants completed the style-of-processing scale that was administered in other studies and were classified as visualizers or verbalizers based on a median split ($M = 0.27$).

Results

Participants' reactions to target statements are summarized in Table 5 as a function of instructional conditions, processing style, the perspective from which the statements were written, and valence. An indication of the extremity of these ratings can be inferred from the difference between the ratings of positively-valenced events and ratings of negatively-valenced events, which is also shown in the table. Although the four-way interaction of instructions, valence, perspective and processing style was only marginally significant, $F(1, 69) = 2.91$, $p < .09$, the results under each instructional condition were quite consistent with our hypotheses.

Specifically, we expected that under imagination instructions, both verbalizers and visualizers would be able to imagine the events described and would experience more intense reactions if the statements were written from the perspective of someone in the location in which the event occurred than if it was written from the perspective of someone outside. This was clearly the case. The extremity of participants' reactions was inferred from the difference between their ratings of positively-valenced events and their ratings of negatively-valenced events. This difference is signifi-

cantly greater when the statement was constructed from the perspective of someone inside ($M_{diff} = 6.26$) than when it was constructed from the perspective of someone outside ($M_{diff} = 5.30$), as evidenced by an interaction of perspective and valence, $F(1, 69) = 6.60$, $p < .02$. Furthermore, this was true of both visualizers (6.09 vs. 5.20) and verbalizers (6.42 vs. 5.40).

In contrast, the effect of perspective in comprehension conditions depended on processing style, as evidenced by an interaction of valence, perspective, and processing style, $F(1, 69) = 5.03$, $p < .03$. The extremity of visualizers' ratings was appreciably greater when the statements were written from the perspective of someone inside the room ($M_{diff} = 6.84$) than when they were written from the perspective of someone outside ($M_{diff} = 5.47$), $F(1, 69) = 4.53$, $p < .04$. However, the extremity of verbalizers' ratings was virtually identical regardless of the perspective from which the statements were written (4.50 vs. 4.89, respectively).⁵

Discussion

Experiments 2 and 3 demonstrated that differences in the disposition to form visual images on the basis of visual and verbal information can influence the difficulty of comprehending the information. Experiment 4 showed that this disposition can influence emotional reactions to the events described by this information independently of the ability to comprehend it. The more extreme reactions to the events that are described from the perspective of someone in the situation might be attributed to differences in empathy. If this were the only factor that underlies these reactions, however, it should have been evident in individuals with a disposition to process the information verbally as well. Thus, to the extent empathy plays a role in the results we obtained, it was experienced only by individuals with a disposition to form visual images of the events described.

General discussion

The impact of visual imagery on comprehension and memory is well recognized (e.g. Garnham, 1981; Glenberg et al., 1987). However, the present research provides new insights into the nature of this impact. The first two experiments showed that verbal statements about an event are more difficult to comprehend when the perspective from which the events are described differs from the perspective from which the events are normally encountered

⁵ This conclusion was confirmed by applying the general linear models in which style of processing was treated as a continuous variable in analyses along with valence and perspective in each condition. In the imagination instruction condition, only a main effect of valence was significant $F(1, 34) = 248.89$, $p < .001$. However in the comprehension instruction condition, the analysis yielded a significant three-way interaction of style of processing, valence, and perspective, $F(1, 35) = 5.53$, $p < .05$, as well as a main effect of valence, $F(1, 35) = 138.18$, $p < .001$.

Table 5
Mean emotional reactions to target statements as a function of instructional conditions, perspective, valence, and processing style—Experiment 4.

	Visualizers			Verbalizers		
	Positive valence	Negative valence	M_{diff}	Positive valence	Negative valence	M_{diff}
<i>Imagination instructions</i>						
Outside perspective	2.41 (1.02)	−2.79 (1.43)	5.20	2.45 (1.29)	−2.95 (1.35)	5.40
Inside perspective	2.82 (1.03)	−3.27 (1.62)	6.09	2.87 (1.18)	−3.55 (0.91)	6.42
<i>Comprehension instructions</i>						
Outside perspective	2.42 (1.64)	−3.05 (1.62)	5.47	2.25 (1.26)	−2.64 (1.73)	4.89
Inside perspective	2.92 (1.31)	−3.92 (0.87)	6.84	2.19 (1.24)	−2.31 (1.74)	4.50

Note: Standard deviations are given in parentheses.

in daily life. These effects are independent of people's familiarity with the events themselves. However, they are only evident among individuals who have an a priori disposition to form visual images in the course of processing information. The evidence that information is interpreted with reference to previously acquired concepts and knowledge is not news. However, the fact that this knowledge can involve visual images, and that the structure as well as the content of these images can have an impact on the processing of new information, has not previously been established.

Two other experiments clarified the nature of the difference between visual and verbal processing strategies and their implications for social judgments. Experiment 3 indicated that the differences in processing strategy we identified are not restricted to differences in the tendency to construct visual images from verbal information. Rather, they reflect more general differences in the use of visual imagery that are evident in the processing of pictured events as well. The importance of these findings derives in part from evidence that the difficulty of comprehending information can have an adverse effect on evaluations of its referents (Schwarz, 2004; Winkielman et al., 2003). However, the fourth experiment demonstrated that these strategies can also affect the intensity of emotional reactions that are elicited by verbal descriptions of social events independently of comprehension difficulty.

The contingency of these effects on individuals' a priori disposition to process information visually qualifies Wyer's (2004); see also Wyer & Radvansky, 1999) assumption that image-based situation models are spontaneously constructed in the course of comprehending verbal descriptions of events that are temporally and situationally constrained. Although these constraints may be a necessary condition for the construction of visual images, they are apparently not sufficient. The contingency of our results on self-reported dispositions to process information visually versus verbally suggests that the tendency to form visual images is not universal and, in contrast to Wyer's (2004) assumption is often deliberative rather than automatic.

Although individuals may differ in their ability to form visual images, the effects we observed are unlikely to be attributable to this difference. As noted earlier, Childers et al. (1985) reported that the style-of-processing measure we employed in the present research is uncorrelated with the ability to construct visual images. Further evidence that the measure assesses disposition and not ability is provided by Jiang et al.'s findings that situationally-primed differences in the disposition to engage in visual versus verbal processing have an impact very similar to the chronically assessed differences. The results of Experiments 3 and 4 provide further support for this conclusion. Visualizers and verbalizers reported similar difficulty in imagining the events described in Experiment 3 when they were explicitly asked to do so. Furthermore, explicit instructions to imagine the events described in Experiment 4 eliminated individual differences in processing that were observed when participants were simply told to comprehend the information. This suggests

that verbalizers can in fact construct visual images if they are required to do so and that the difficulties they encounter are similar to those encountered by visualizers. Unlike visualizers, however, they do not construct these images spontaneously, and so the difference in comprehension difficulty that visualizers manifest is not evident. Note, however, that this difference in processing can be situationally induced (Jiang et al., 2008; see also Wyer et al., 2008). Thus, as Wyer et al. (2008) conclude, both verbal and visual processing strategies are stored in individuals' mental library of procedural knowledge and their use depends on their accessibility in memory, much as the use of other types of knowledge (Förster & Liberman, 2007; Higgins, 1996; Wyer, 2008).

The effects of processing strategies on emotional reactions to social events identified in Experiment 4 were largely independent of differences in the difficulty of constructing images of the events. When the use of these strategies differs in comprehension difficulty, it may influence judgment for this reason. As noted earlier, the influence of ease of processing on reactions to information and evaluations of its referent is well documented (Schwarz, 1998; Schwarz, 2004; Winkielman & Cacioppo, 2001). Evidence of the effects of processing dispositions on judgments when both pictures and verbal information are provided together was obtained by Jiang et al. (2008) and Wyer et al. (2008) in the study cited earlier. The statements we employed in Experiments 1–3 of the present research described mundane events, and so an evaluation of the effect of processing style on judgments of the events was not meaningful. It is nonetheless interesting to speculate that when people hear an event described in informal conversation, their disposition to construct visual images of the event, and thus their evaluations of the event and the protagonists involved in it, may depend on the way the event happens to be described. Future research might explore this possibility.

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