7 Expectancies, emotion, and memory reports for visual events

Deborah Davis  
University of Nevada, Reno  
Elizabeth F. Loftus  
University of California, Irvine

1. INTRODUCTION

Previous chapters in this volume have considered memory for objects, faces, and scenes, as well as consequences of those memories for visually guided action and behavior. In this chapter, we consider the quality of memory for objects, faces, and scenes when they must be interpreted and remembered in the context of real-life events. Centering our discussion on eyewitness memory for emotionally charged, crime-related events, we focus on systematic predictable distortions affecting memory at all stages, from encoding through retrieval.

Eyewitness testimony can be distorted at the earliest stages of perception by strong emotions and existing beliefs and expectations that guide processing and interpretation of unfolding events—and therefore what is originally encoded into memory. But this belief- and emotion-generated distortion does not stop at the point of original encoding. Instead, it pervades memory at all stages, from encoding and storage through multiple efforts to retrieve and report on the original events. Therefore, in this chapter we consider the myriad ways in which beliefs, expectations, and emotions can cause predictable distortions at these sequential stages of the memory process. Although relevant to memory for a variety of visual and autobiographical events, here we focus our illustrations specifically on memory for visual objects (including persons).

We begin with a discussion of the impact of beliefs at encoding. We focus much of our discussion of encoding processes on the causal role of racial stereotypes in memory errors, because the stereotype literature has provided a wealth of relevant research illustrations, because it has been the source of some of the more creative and promising new methods for studying relevant processes, and because many relevant stereotype studies involve crime-related stimuli. We then turn to discussion of the influence of such factors as emotion and stress on memory. Finally, we consider a variety of postevent influences on memory for what was previously observed.

2. INFLUENCE OF BELIEFS AND EXPECTATIONS DURING EVENT ENCODING

Eyewitness memory errors begin with mistakes in what is encoded during the original witnessed event. Encoding mistakes may be the result of such factors as inadequate or misdirected attention or personal or contextually based perceptual difficulties that generally impair accuracy. But beliefs, expectations, and emotion can cause specific kinds of errors—as illustrated in a series of studies using a novel method referred to as the “weapons false alarm” paradigm (WFA).

The “weapons false alarm” research was inspired by the 1999 case of an unarmed Black man—Amidou Diallo—who died after being shot 41 times by NYC police officers who believed he was armed, brandishing a weapon instead of showing his wallet. Shortly after the Diallo incident, psychologists began to address the issue of whether racial stereotypes associating Blacks with violence might cause such misidentifications of weapons in the hands of Blacks—a phenomenon dubbed the “weapons false alarm.” Efforts to understand the phenomenon soon began to address specific effects of beliefs and expectations on four levels of processing at encoding: (a) deployment of attention, (b) ease of categorization, (c) criteria for categorization, and (d) the content of categorizations or interpretations of unfolding events—all factors affecting the accuracy of what is encoded. Here we consider the further possibility that activation of particular concepts, expectations, or beliefs at encoding may generate automatic emotional or behavioral responses that reciprocally influence the preceding processes. A person may automatically react to thoughts activated by a stereotype with fear or defensive behaviors that themselves reciprocally reinforce activation of the thoughts that generated them, along with related material in memory. And, in the process of making attributions for the cause of these reactions, a person may be prone to biased interpretations consistent with the activated schemas (e.g., “I shot him because he was acting strangely and appeared dangerous”).

Some readers may recognize such effects as widely investigated features of schematic processing and as consistent with more recently documented automatic behavioral and other sequelae of activated thoughts and emotions (such as direct links between perception and action). Here we review demonstrations of these familiar effects to document the processing effects of beliefs, expectations, and emotion on object identification (i.e., on what is encoded into memory). Specifically, for the sake of coherence in our examples, we focus on illustrations of the effects of stereotypes associating Blacks with crime on misidentification of weapons and on distortions in facial perception (for broader reviews of the effects of schematic processing on witness memory see Davis & Follette, 2001; Davis & Loftus, 2007).

2.1. Deployment of attention

A large body of literature has shown that activation of specific schemas is associated with selective attention to schema-relevant information. In part, selective-
attention effects have been inferred from the fact that, given activation of a specific schema, schema-relevant information is remembered better than schema-irrelevant information (e.g., Wyer, 2004). But recent research has turned to more direct measures of attention. For example, Eberhardt, Goff, Purdie, and Davies (2004) used such direct measures to show that when specific schemas are activated, visual attention is selectively directed toward schema-relevant stimuli. Specifically, reflecting stereotypes associating Blacks with crime, just as crime-related primes induced selective attention to Black faces, so priming Black faces selectively induced attention to crime-related objects.

To illustrate the former association, Eberhardt et al. (2004) used a modification of the dot-probe task used extensively in the personality disorders literature (e.g., Macleod, Mathews, & Tata, 1986). In a first step, described as a vigilance task, half of the participants were subliminally primed with crime-relevant objects (such as weapons). Immediately afterward, participants began the dot-probe task. A Black and a White face were simultaneously displayed on the computer screen. When they disappeared, a dot probe appeared in the previous visual location of either the Black face or the White face. Theoretically, the Black face would be more likely to capture the attention of participants previously primed with crime-relevant stimuli, since the activated crime schemas would selectively direct attention to crime-relevant stimuli (i.e., the Black rather than the White face). Indeed, the dot presented in the location of the Black face was detected more rapidly for crime-primed participants, and the dot presented in the location of the White face was detected more slowly. This effect was replicated using police officers as participants and also in a conceptually similar study using positive primes stereotypically associated with Blacks (e.g., basketball-related stimuli).

To the extent that schemas selectively direct attention to relevant objects and events, one might expect that memory would be more accurate for those stimuli. After all, memory follows the focus of attention! However, as subsequent sections illustrate, while attention provides the opportunity to encode at all, and potentially to encode more accurately, under some conditions it may actually facilitate errors.

2.2. Ease of categorization

Another well-documented effect of schematic processing is greater ease in the identification of stimuli and events (e.g., Bransford & Johnson, 1972) (for detailed discussion of schemas in scene memory, see chapter 4, section 2.5.2). When a schema is activated, comparison and categorization of incoming stimuli is more rapid and efficient. Indeed, without schemas, we would have no concept categories with which to identify stimuli. Hence, it follows that schema activation will facilitate the speed at which relevant stimuli are identified. This may mean the difference between whether a briefly observed stimulus can be encoded or not, and therefore whether a witness can report at all on certain features of a rapidly unfolding event. Or (as illustrated in subsequent sections), if the stimulus cannot be confidently categorized within the available time, the witness may adopt less strict criteria for categorization, leading to errors in what is encoded and therefore included in later memory reports.

In the first study published in the wake of the Amadou Diallo incident, Keith Payne (2001) used a sequential priming paradigm to test the speed of categorization hypothesis with respect to the activation of race-related stereotypes and identification of weapons. After first priming participants with either a Black or a White face on a computer screen, he then presented either a gun or a tool, requiring participants to indicate as rapidly as possible which was displayed. As expected, those primed with a Black face were quicker to identify the gun. However, since Payne presented the primes overtly, it is difficult to know whether participants responded more rapidly after a Black face prime because they identified the gun more easily or because their expectations led them to react in anticipation of clearly seeing one. Hence, Eberhardt et al. (2004) examined the point at which participants would identify an object that began as severely degraded and was progressively clarified over time. Participants subliminally primed with Black, White, or no male faces were to indicate the moment when they could identify crime-relevant (e.g., gun or knife) or crime-irrelevant (e.g., camera, book) objects, and then to name the object. Primes did not affect the identification of crime-irrelevant objects, but crime-relevant objects were detected most quickly following subliminally presented Black faces and least quickly following White faces.

Other studies used computer programs presenting Black or White persons holding weapons or neutral objects to examine the effect of racial primes on speed in the identification of weapons. Participants had to decide as rapidly as possible whether to shoot. Consistent with earlier findings, these studies revealed that participants were quicker to shoot Black than White figures holding weapons (e.g., Correll, Park, Judd, & Wittenbrink, 2002; Greenwald, Oakes, & Hoffman, 2003). Racial stereotypes also appear to facilitate speed of classification of positive stimuli associated with race, such as sports objects (see Judd, Blair, & Chapleau, 2004).

The reverse effect—quicker classification of faces following primes with stereotype-related objects—has also been demonstrated in several studies not specifically related to weapons. For example, participants are quicker to classify faces as male or female following presentation of gender-related primes such as “flower” or “diet” (e.g., Blair & Banaji, 1996), and speed of racial categorization of faces is facilitated by the presentation of race-related primes (e.g., Kawakami & Dovidio, 2001; Kawakami, Dovidio, Moll, Hermsen, & Russin, 2000).

2.3. Criteria for categorization

Although activation of stereotypes or other beliefs and expectations may sometimes facilitate ease of recognition, their effects may also derive from changes in the criteria for categorization. For example, if expectations for violence are sufficiently high, the perceiver may adopt a mentality whereby the weakest or most subtle cues are sufficient to lead him or her to classify and react to an object
or person as dangerous. In such a case, a speedier response would not necessarily reflect ease of classification but, rather, the weaker criterion for categorization.

To illustrate this point, imagine a situation in which an observer views a figure cloaked in a hooded robe, from behind. Were he to encounter the figure in a sauna area of an all-male club, he could reasonably classify the figure as “male” without waiting to see its face; in the context of an integrated club, however, he would be more likely to require additional cues such as size, gait, body shape, or a full-face view before being willing to identify the figure’s gender. In the former instance, the expectation that only males would be in the sauna of the all-male club would serve to lower criteria for identifying gender, causing the person to feel no need for gender-specific cues to make the presumptive classification. In other words, the observer would require a less comprehensive comparison of the features of the observed object to the features of the category to determine a match. Consistent with this reasoning, those with stronger race-based expectations—such as more negative biases against Blacks (e.g., Payne, 2001), stronger race-based stereotypes (Correll et al., 2002), and more negative implicit biases against Blacks as measured by the Implicit Attitudes Test (e.g., Payne, 2005)—show enhanced racial bias in the WFA paradigm.

Finally, it should be noted that strong emotions may affect encoding in part through selectively lowering identification thresholds for emotion-related stimuli. For example, fear and the resulting activation of self-protection goals may lower thresholds for identification of threatening stimuli such as weapons. Such selective lowering of identification criteria could serve evolutionary survival functions, as suggested by research on the amygdala (the brain’s center of “emotional” processing) and perception of emotional stimuli (see later sections).

In fact, Amadou Diallo may have been victimized by such lowered criteria. The officers had stopped Diallo because he matched the description of a suspect. When Diallo reached for his pocket, one officer shouted “Gun!” and the rest opened fire, not waiting to see that the “gun” was really only a wallet. Expectations associated with suspicion that Diallo was the suspect they were searching for, along with racist stereotypes associating Blacks with violence and strong emotions such as fear of harm to themselves or others, may have led them to adopt looser criteria for classifying the object in his hand as a gun. In this case the shooters were confronted with their mistakes, in that no weapons were found. But in many instances, interpretations or classifications made on the basis of emotion- or expectation-weakened identification criteria, unchecked by disconfirming evidence, enter long-term memory uncorrected and become the basis of distorted witness reports. This very possibility has been explored in the body of research on “change blindness.”

2.3.1. “Change blindness” and weakened criteria for stimulus classification

In 1998 Daniel Simons and Daniel Levin began a rather startling series of demonstrations of observers’ failures to detect surreptitious substitutions of one person for another during apparently continuous real-world events. Across a number of studies, participants failed to notice that persons with whom they were directly conversing had been replaced by another person, or that a person they were watching in a video had been replaced by another (for review, see Simons & Ambinder, 2005) (for further analysis, see also chapter 4, section 2.4). A common feature in these studies was that participants would expect the person to remain the same.

For example, in one study, while participants were giving directions to a pedestrian who had stopped them on campus, two confederates passed between them carrying a large door. As the door passed, the person receiving directions changed places with another who emerged to continue the conversation (Simons & Levin, 1998). In another, a clerk interacting with a student bent down behind the counter, whereupon another person emerged to continue the interaction (Levin, Simons, Angelone, & Chabris, 2002). And in a video, a person working in one room appeared to hear a phone ring and get up to answer it, whereupon the camera cut to the hallway where a different person answered (Levin & Simons, 1997). In each of these studies, large proportions of participants failed to detect the change between people. Presumably, superficial processing prevented observers from engaging in the specific-feature comparisons that would help them distinguish one person from another. This tendency to engage in superficial processing would likely be enhanced when the person’s expectations of continuous identity led them to adopt very loose criteria (or none at all) for categorizing the person as the same.

Davis, Loftus, Vanous, and Cucciare (2008) illustrated this problem in the context of studying mistaken eyewitness identifications. Participants watched a video involving the theft of a bottle of liquor in a grocery store. In addition to the perpetrator, two innocent people were shown in immediate contiguity to the perpetrator. One (the continuous innocent, or CI) walked down the liquor aisle and passed behind a stack of boxes, whereupon the perpetrator emerged and stole the liquor. The other (the discontinuous innocent, or DI) appeared immediately after the theft, shopping in the vegetable section. The authors argued that expectations for continuous identity would be strongest when the innocent and perpetrator were shown in the apparently continuous-action sequence in which the CI walked down the liquor aisle and disappeared behind the boxes and the perpetrator emerged. Therefore, they expected participants to be less likely to notice the difference between the CI and perpetrator than that between the DI (the innocent shown in the discontinuous location of the vegetable aisle) and the perpetrator. Distracted participants were expected to be less likely to notice these differences than undistracted participants, and failure to notice the difference was, in turn, expected to lead to more misidentifications of the CI as the perpetrator.

Indeed, this is what Davis et al. (2008) found. Distracted participants were less likely to notice the difference between the actors. In turn, participants who failed to notice the difference between the CI and perpetrator were more likely to misidentify her as the perpetrator than to identify either the DI or others who
had not been in the video. In contrast, those who did notice the difference were more likely to misidentify the DI than either the CI or others who had not been in the video. Just being in the video increased the likelihood of being misidentified as the perpetrator. However, the greatest likelihood of misidentification was for the CI, among participants who never realized that two different people had been in the liquor aisle.

Similar results were obtained by Davies and Hine (2007), who found that 61% of participants failed to detect the substitution of one burglar for another in a film of a burglary, and that detection of the change was related to accuracy in identification of both burglars. Furthermore, relevant to “earwitness” identification, Vitevitch (2003) found that more than 40% of participants failed to detect a change in speakers.

The change blindness research has provided very compelling illustrations of processes underlying mistakes in real-life eyewitness identifications. If, after a few seconds, one cannot remember the person with whom one was interacting well enough to know that he or she has been replaced by someone new, what can we expect from eyewitnesses after days, weeks, or months have elapsed?

2.3.2. Speeded judgments and classification criteria

Central to real-life situations is pressure to identify dangerous objects or situations quickly enough to react and avoid injury. Such time pressure and speeded judgments appear to enhance expectation-based errors such as the racial bias in “weapons false alarms” (e.g., Payne, 2001, 2005)—that is, the greater tendency to misclassify harmless objects as weapons in the hands of Black targets (discussed below). In the absence of sufficient time, the observer may be unable to engage in the comprehensive feature matching necessary for enforcing strict identification criteria.

2.3.3. Automatic versus controlled processing

Payne and his associates (Payne, 2005; Payne, Jacoby & Lambert, 2005; Payne, Shimizu, & Jacoby, 2005) suggested that the racially biased WFA effect should be greatest when controlled processing is limited by time pressures or by failures of executive functioning. Arguably, both factors can inhibit enforcement of stricter, reality-based criteria for classification and interpretation (facilitating misclassifications) as well as impair the ability to override automatic-response tendencies generated by racial stereotypes (facilitating known but uncontrollable errors). Supporting this reasoning, depletion of self-regulatory resources (Muraven & Baumeister, 2000) through several hundred trials in the Stroop color-naming task induced greater race-biased WFAs (Govorun & Payne, 2006). Furthermore, working memory capacity (an index of executive functioning; Govorun & Payne, 2006), measures of attentional control (e.g., Payne, 2005), and neurological activity consistent with detection of conflict between current and intended states (necessary for controlled processes) are negatively related to the magnitude of the race bias. Furthermore, activity consistent with stronger emotional reactions to threatening stimuli (reflecting automatic negative race-based reactions) is positively related to the magnitude of the bias (Amador et al., 2004; Correll, Urland, & Ito, 2006).

2.4. Interpretation

As the previous discussion of lowered criteria implied, lax identification criteria can both speed identification and create errors such as a WFA or mistaken identifications of innocent bystanders, as illustrated in the change blindness research. But the specific nature of errors is not random. Instead, errors in perception or interpretation of unfolding events tend toward consistency with activated schemata (for review, see Wyer, 2004). Not surprisingly, the WFA research has repeatedly shown that in addition to directing attention to stereotype-related objects, which lowers identification criteria and/or speeds their identification, activation of racial stereotypes also leads to their misclassification—specifically, to the misclassification of neutral objects as weapons. That is, priming with a Black face led to more misclassifications of neutral objects as weapons than did priming with a White face, whereas the reverse was true for classification of tools (e.g., Payne, 2001; regarding errors in classification of both positive and negative stereotype-relevant objects, see also Judd et al., 2004); and the likelihood of erroneously “shooting” a Black person holding a neutral object was greater than that of “shooting” a White person holding a neutral object (Correll et al., 2002; Greenwald et al., 2003).

These biases appear to be strong, uncontrollable, and pervasive. Even Black persons are susceptible (Correll et al., 2002), and it occurs whether participants act without instructions, are told specifically to use race as a cue, or are instructed about the potential of race to bias responses and are told to avoid it (Payne, Lambert, & Jacoby, 2002). In fact, when race is made salient, either by instructions to use it or to avoid using it as a cue, its effects are enhanced, indicating that regardless of intentions or the reason for activation of racial stereotypes, once activated, they still exert their automatic effects. Though focused on racial stereotypes, such results are consistent with the wider literature illustrating schema-consistent errors in memory (for review, see Wyer, 2004), including eyewitness memory (see Davis & Loftus, 2007).

2.4.1. Automatic activation of behavioral responses

The race-biased WFA effect has commonly been discussed as the result of the misclassification of neutral objects as threatening, which leads the person to shoot (the illusion perception explanation; see Correll et al., 2002; Greenwald et al., 2003; Payne, 2001). More recent evidence has shown, however, that some participants are well aware of their errors in response and can correct them if given time (even without the stimulus still in view; e.g., Payne,
Shimizu, & Jacoby, 2005). They seem to fail to override automatic reactions to salient race-related stereotypes when responding to an accurately perceived object (the executive failure hypothesis). However, such a view assumes two things: (a) that the object can be accurately perceived, and (b) that conscious classification precedes response (however well- or ill-controlled). But, in situations where accurate perception can be difficult, where racial stereotypes or situational scripts may lead the perceiver to feel threatened, and where response time can affect survival, an additional mechanism may come into play, involving direct links to behavior—indeed, independent of conscious classification.

Expectations that a particular person or situation poses a threat to oneself or others may directly activate such goal-related scripts as “protection” or “defense” involving shooting or otherwise disabling the threat (for discussion of cognitive and behavioral effects of goal activation, and for evidence of automatic cognitive and behavioral links between goals and means of attaining them, see, e.g., Bargh, 2005, 2006; Chartrand & Bargh, 2002; Shah, 2005). Similar behavioral scripts may also be directly activated by emotions such as fear, or directly by situational cues associated with danger (with or without conscious awareness or expectations of danger). Subliminally presented Black faces, for example, produce greater activation of the amygdala than do White faces, a difference that is reduced when the faces are presented more slowly (Cunningham et al., 2004). In turn, the amygdala can drive automatic fight-or-flight responses prior to conscious intention (see below). As is often the case in criminal incidents, alcohol can impair executive functions (including control of automatic race-based response tendencies, e.g., Bartholow, Dickter, & Sestir, 2006), leaving automatic effects on behavior unchecked.

The concept “shoot” is likely to be among activated self-protective behaviors, particularly among police officers trained to use weapons in response to such threats or among laboratory participants set on choosing only between “shoot” and “don’t shoot.” Once activated, such concepts or scripts may directly potentiate associated behaviors such as shooting, evading, or yelling threats (for a review of links between subliminal activation of emotions and overt emotion-driven behaviors, see Winkielman & Berridge, 2004). These cognitive and behavioral responses may occur before the person becomes consciously aware of either their triggers or their existence.

Interestingly, self-protection goals can reciprocally influence perception of the stimulus that triggered them, as illustrated by recent findings that activation of self-protection goals led to perception of greater anger in Black and Arab male faces (a tendency that was greater among those with stronger stereotype associations of the target’s race with threat). Such reciprocal influences possess great potential to bias subsequent eyewitness identifications (see section 4.1; for illustration and for a review of a variety of effects of goals on social perception and memory, see Maner et al., 2005).

In addition to automatic behavioral reactions to goal activation, research on unconscious mimicry (see Bargh, 2005; Dijksterhuis & Bargh, 2001; Jonas & Sassenberg, 2006) has shown that priming a social category can lead targets to behave consistently with stereotyped behavior for that category (as, for example, when activation of elderly stereotypes leads to slower walking speed). Furthermore, observations of specific behaviors can automatically activate mimicry of the behavior (for review, see Chartrand, Maddux, & Lakin, 2005). A mechanism for such automatic mimicry of behavior is suggested by studies of “mirror neurons” (Buccino et al., 2001; Rizzolatti & Arbib, 1998) found in the premotor cortex of animals and humans. Mirror neurons are activated in the same functionally specific regions of the premotor cortex when watching others engaging in a behavior and when performing it oneself—suggesting a direct connection between seeing and doing. Thus, seeing a person apparently reaching for a gun might well automatically activate the urge to shoot.

Police with extensive weapons training are less susceptible than less trained police or citizens to racially biased WFs (Correll et al., 2006). This may be the result of better discrimination between weapons and nonweapons, which is what those authors suggest, or it may be that trained officers are simply better able to override automatic impulses to shoot when feeling threatened or fearful, which in turn provides them with time to adopt stricter criteria for identification of situations in which shooting is appropriate. Generally, the racially biased WFA effect is greater among people with stronger automatic racial feelings and attitudes, and weaker among those with stronger executive-control functions (e.g., Payne, 2005). Presumably, police training enhances the latter, although training (through exposure to many trials in which race is unrelated to possession of a weapon) can also reduce race-biased WFA among police officers through modification of automatic associations (e.g., Plant & Peruche, 2005; Plant, Peruche, & Butz, 2005; see also, for more general examples of reduction of automatic biases, Kawakami et al., 2006).

Once a person has reacted in a dramatic and unusual way—such as shooting another human being—the reaction itself also has great potential to reciprocally influence the preceding processes of encoding. That is, by virtue of the response itself (shooting the person), or in the process of interpreting or explaining strong emotional and behavioral responses, the person may enhance or maintain the activation of the original expectations (e.g., Blacks are dangerous) or emotions (e.g., fear) that triggered these responses. In doing so, the person will be susceptible to biased conclusions concerning the causes of these reactions. For example, in thinking about why he felt fear, the person may mistakenly assume it must have been because the target looked or acted dangerous, rather than because his racial stereotypes cause him to fear all Blacks. Imagine the following sequence, for example:

A White policeman responding to a report of a prowler sees a young Black male in a dark alley near the source of the report. The young man turns as he hears the policeman approach, and as the man’s right shoulder and arm follow his body’s movement toward the officer, the latter feels threatened, shoots, and, then, labeling and attribution processes catch up with auto-
matic behavioral responses to emotion and he mistakenly perceives the cell phone in the young man’s hand as a weapon as he falls to the street. Memory for sequence being susceptible to error, and with expectations associating Blacks with violence activated by the young man’s race, the situation, and his own reactions, he mistakenly “remembers” seeing the “gun” before he shot.

Although it is difficult to test this explanation with the WFA paradigm, there is substantial evidence that activation of specific cognitions, emotions, or goals can directly promote affective, semantic, or motive-consistent judgments and behaviors—with or without awareness of the specific stimuli that triggered them (as discussed earlier). One has only to look at the vast and diverse research literature using subliminal priming to illustrate this point. Our review of the WFA research has clearly shown this with respect to subliminal priming of Black and White faces. However, effects of subliminal primes have been demonstrated across a wide swath of interpersonal behaviors and judgments, health motives and behaviors, consumer behaviors (as reflected in research on subliminal persuasion), and many others (for examples of the effects of subliminal priming on interpersonal goals, judgments, and behaviors, see reviews in Forgas, 2006; Mikulincer & Shaver, 2007; for a variety of reviews of unconscious influences on thoughts and behavior, see Hassin, Uleman, & Bargh, 2005).

Recent neuroscience research has also used subliminal primes to study activation within specific processing areas of the brain that precedes conscious awareness—for example, research showing amygdala activation in response to subliminally presented fearful faces. In turn, this early preconscious activation of the amygdala has two effects that, in combination, enhance processing of threat-relevant stimuli: (a) modulation of attention toward threatening stimuli, and (b) activation of the visual cortex, resulting in greater perceptual sensitivity and enhanced potentiation of the perceptual benefits of attention (see review by Phelps, 2006). Phelps reviewed evidence that signals of emotion are processed and reacted to automatically by the amygdala, irrespective of attention or awareness. Also included was some evidence of the existence of specialized subcortical pathways allowing the amygdala to perceive and drive reactions to threatening stimuli prior to completion of standard perceptual functions such as explicit recognition (although cognitions activated prior to exposure to the stimuli can also affect the amygdala’s reactions). Given that Black faces evoke greater amygdala reactions among White persons (Cunningham et al., 2004; but for evidence that this race-specific activation is dependent upon currently activated processing goals, see Wheeler & Fiske, 2005), such findings are compatible with the possibility that defensive reactions such as shooting can occur prior to conscious interpretive and controlled processes.

When such preconscious (and/or conscious) cognitive and behavioral reactions occur, they can become part of the context in which the original threat is identified and interpreted once brought fully into awareness. The tendency to engage in attributions concerning causes of behavior is enhanced for unusual, unexpected, or unfamiliar behaviors (e.g., Weiner, 1985)—such as shooting someone. Moreover, in the aftermath of shooting a person holding an ambiguous object, labeling and attribution processes have great potential to affect “memory” for the object, particularly in the context of self-justification motives demanding just cause for the action (on self-justification and memory distortion, see Tavris & Aronson, 2007).

One’s own emotional reactions and behaviors may also exert more direct effects through activation of relevant knowledge structures—as, for example, when shooting a person might reciprocally activate concepts related to threat and danger, including “gun.” In fact, behavior itself is tied to associated affective and cognitive structures, as illustrated by the growing literature on “embodied cognition” (for reviews, see Anderson, 2003; Garbarini & Adenzato, 2004; Markman & Brendl, 2005; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). That is, overt body positions and behaviors—such as facial expressions, posture, or specific movements or actions—have been shown to directly activate associated cognition, affect, or behavior and, conversely, to inhibit inconsistent reactions. Similar effects have been predicted by “common-coding theory” (Hommel, Müsseler, Aschersleben, & Prinz, 2001) and the theory of internal models (e.g., Wolpert & Kawato, 1998), and tests of these theories have shown that overt actions can affect visual and auditory perception (see Repp & Knoblich, 2007).

Generally, these literatures would suggest that the action of shooting would indeed activate (or feed already activated) goals, schemas, and affect triggered consciously or preconsciously by a potentially dangerous object, as well as objects associated with the action. This, in turn, would enhance the likelihood of labeling the object as “gun” and of “remembering” associated contextual features and characteristics of the target and his behavior as “aggressive” or “dangerous.”

Essentially, the embodied cognition literature suggests that “sensory and motor processes, perception, and action are fundamentally inseparable in lived cognition” (Garbarini & Adenzato, 2004, p. 101; emphasis added). Of particular interest, actions (e.g., shooting) are associated with specific objects or types of objects one uses to perform the action (e.g., guns). This is shown in part by the fact that if a canonical neuron (bimodal neurons responsive to motor and visual stimuli) fires while performing a particular action, it also fires when one sees an object with which this action can be performed (see Garbarini & Adenzato, 2004). Such findings are interpreted to mean that the actions that can be performed with the object are part of the cognitive representation of the object itself—and, therefore, activation of one entails activation of the other. Furthermore, “mirror neurons” fire when performing or seeing an action and even when hearing a sound associated with the action (such as when hearing a gunshot evokes the concept of “gun,” i.e., as part of the action of shooting; see Garbarini & Adenzato, 2004), again suggesting that all three embody the concept of the action in question.
3. A NEW LOOK AT EMOTION AND MEMORY FOR VISUAL EVENTS

The foregoing discussion provokes a reexamination of the way eyewitness researchers have thought about the role of emotion in eyewitness memory. One of the current party lines—particularly in regard to the role of emotion in later eyewitness identifications of criminal perpetrators—goes as follows (Reisberg & Heuer, 2007): Memory for emotional events is often superior to that for more mundane events; however, although memory for central features, or the gist, of the event is enhanced, memory for peripheral features is generally impaired. This “tunnel memory” (e.g., Safer, Christianson, Autry, & Osterlund, 1998) is presumably caused by narrowing attention to central event features at the expense of peripheral features. Since memory follows the focus of attention, memory will be superior for the better-attended central stimuli.

This narrowing of attention can be due to two processes. First, emotional properties of the stimulus itself, such as threatening behavior or objects, may “capture” attention—a phenomenon that is enhanced among those who fear the specific stimulus (Lipp & Waters, 2007). This process is considered responsible for the “weapons-focus” effect—that is, the tendency of weapons to draw attention at the expense of attention to the perpetrator or to other details. Research has documented the attention-capturing effects of weapons by, for example, tracking eye fixation during encoding (e.g., Loftus, Loftus, & Messo, 1987; Stann & Johnson, 2000) and has generally shown that the weapon itself (and the hand that holds it) may be well remembered, but witnesses are less accurate in identifications of perpetrators for events involving weapons, and the strength of this effect increases as arousal increases (e.g., Peters, 1988; for a meta-analysis, see Steblay, 1992; for recent review, see Reisberg & Heuer, 2007).

Second, attention may narrow as a result of arousal itself. As originally proposed by Easterbrook (1959), arousal causes a decrease in the “range of stimulus cues” that an organism can attend to. Attention thus narrows to aspects of the environment of most interest or importance. That is, arousal might be viewed as enhancing the already present stimulus-driven tendencies for selected stimuli to capture attention at the expense of others. Such a view is consistent with the previously noted role of the amygdala in modulating attention and perceptual sensitivity toward important or threatening stimuli.

This picture is complicated by findings indicating that whereas important, threatening, or emotion-provoking stimuli may affect processing through attentional capture, high stress may generally impair memory (e.g., Deffenbacher, 1994; Deffenbacher, Bornstein, Penrod, & McCoy, 2004; Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; Morgan et al., 2004). Stress in this context is described as consisting of high levels of physiological arousal and associated biological reactions—such as activation of the HPA (hypothalamic-pituitary-adrenal) axis and hormonal effects following from this activation—along with associated psychological reactions such as perceived threat and acute anxiety (e.g., Payne, Nadel, Britton, & Jacobs, 2004). These authors argue that whereas emotion serves to activate the amygdala—and hence facilitates memory for the gist of an event (regarding the amygdala and memory, see also Adolphs, Tranel, & Buchanan, 2005; LaBar, 2007; LaBar & Cabeza, 2006; Phelps, 2006)—high stress disrupts the functioning of the hippocampus, impairing spatiotemporal processing and memory for event structure and sensory detail (for evidence that anxiety selectively disrupts visuospatial working memory, see Shackman et al., 2006).

While a full discussion of the role of physiological processes involved in emotion and memory is beyond the scope of this chapter, even without considering such issues, the traditional “tunnel-memory” view of the effects of emotion on memory is overly simplistic. That is, it rests on a very simple, but questionable, chain of logic: First, attention is captured by the most important (e.g., interesting, threatening) features of an event. These stimulus features alone capture attention, but emotion can cause attention to be narrowed such that this already selective attention will become even more so, at the expense of other features of the event or context. Attention leads to more accurate encoding. Therefore, the central features of an emotional event will be remembered better, whereas other features will be remembered more poorly.

We suggest that there are two fundamental flaws in this logic. First, emotion may not narrow the focus of attention in all cases, and particularly not to entirely predictable stimuli. Stress impairs the operation of executive functions (see reviews in Baumeister & Vohs, 2004)—including the ability to control attention—with the potential result that stressful emotions could cause attention to be more stimulus-driven (so far consistent with the tunnel-memory view). Laboratory studies typically present a narrow range of event features for attentional capture—perhaps only a single candidate (such as a dangerous weapon or dangerous person) that stands out above the rest. But during real-life stressful events there are often multiple central concerns and therefore multiple pulls for attention, some internal and some external—such as the need to monitor threatening persons, the need to control one’s own reactions and plan strategies for survival, concerns regarding vulnerable children or the elderly, searching for and monitoring opportunities for protection or escape, and so on. In essence, negative emotions such as fear may well facilitate detection and monitoring of threat-related stimuli, but they can also lead to activation of automatic fight-or-flight goals that demand wider deployment of external attention, active internal processing and planning, and stronger self-regulation, which can in turn deplete cognitive resources—including attention and processing resources. Attempts to control emotion or suppress emotional expression can themselves impair memory for the events (for illustrations with memory for distressing films and for conflictual conversations, see Richards & Gross, 2006; for demonstrations regarding memory of one’s own stressful speech, see Egloff, Schmukle, Bums, & Schwerdtfeger, 2006). Such concerns compromise the ability to make clear-cut predictions concerning what features of real-life stressful events will be remembered better or more poorly.
7. Expectancies, emotion, and memory reports for visual events

Moreover, independent of selective stress-related effects on the brain, such processing of details of the attended stimuli, and greater likelihood of engaging in biased elaboration of the observed details. And in addition to processing the visible target (such as a criminal perpetrator), the observer may engage in schema-driven interpretations of the target's feelings, intentions, underlying motives, character, and much more—each conclusion with potential bias on the other judgments.

Emotion has related, but more complicated, effects. Stress, for example, can enhance automatic schema-driven processing through inattentional blindness and encoding (for reviews, see Banerjee & Veendorp, 2004). Moreover, emotion has been shown to hinder selective processing of negative responses (e.g., in the discrimination paradigm, where no previous discrimination is established by the flip of a coin; cf. DeSteno, Dapuzzo, Baran, & Capaldi, 2004). This suggests that negative biases in processing explicit and implicit tones toward social groups with whom one is emotionally attached. However, anger may have the opposite effects, possibly because of its role in social facilitation (e.g., DeSteno et al., 2004).

The second emotion may provide information that is used to interpret the stimulus (the affect-as-information mechanism). The observer fails to process all the relevant aspects of the stimulus: instead, the observer prefers the affect-related information to the stimulus. For example, when a2 is shown (e.g., the photo of a target, which is assumed to be positive or negative), the observer is more likely to produce accurate and consistent judgments when the affect-as-information mechanism is active. Alternatively, the opposite is true: when the affect-as-information mechanism is less active, the observer is less likely to produce accurate and consistent judgments.

At this point, it becomes clear that these consequences of attention—where the observer's cognitive and behavioral responses while focusing on the target—have great potential to determine the exact content encoded into long-term memory. It is at this level that attention can be enhanced and constricted, encouraging encoding, as well as elaborative encoding, which can in some cases promote memory retrieval and related assumptions. Further research is needed to determine how much is encoded.

The second fundamental problem with the "schema-memory" hypothesis is the assumption that attention promotes encoding. In fact, attention seems to have the opposite effect: distracting stimuli are more likely to be remembered than are distracting stimuli. Further evidence for this idea is provided by the finding that emotional stimuli are not necessarily more salient than non-emotional stimuli. For example, it is well known that emotional stimuli are more likely to be perceived as novel and interesting than non-emotional stimuli. This finding suggests that emotional stimuli are more likely to be remembered than non-emotional stimuli. This is because emotional stimuli are more likely to be encoded at all, and that greater attentional encoding of details is required. Furthermore, emotional stimuli are more likely to be encoded because they are inherently more interesting and relevant to the individual. This finding is consistent with the idea that emotions play a role in attentional processes.

While it is clear that emotional stimuli are more likely to be encoded, it is also clear that emotional stimuli are not necessarily more memorable. For example, it is well known that emotional stimuli are more likely to be classified as emotional than non-emotional stimuli. This finding suggests that emotional stimuli are more likely to be encoded at all, and that greater attentional encoding of details is required. Furthermore, emotional stimuli are more likely to be encoded because they are inherently more interesting and relevant to the individual. This finding is consistent with the idea that emotions play a role in attentional processes.
as crime, shooting, or death and promote defensive overt behaviors. Thus, the nature of the affect-priming-driven bias can be somewhat more complicated that that of the affect-as-information mechanism. That is, the bias would be, in part, simple affect congruence due to the activation of congruent information in memory, but would also manifest as congruence with the content of information and schemas activated by the affect.

According to the “affect-infusion model” (AIM, Forgas, 2002), the affect-priming mechanism will affect judgments most strongly when some form of constructive processing is used, therefore leading to the somewhat counterintuitive prediction that the more elaborative processing the person engages in, the more affect will bias judgments. Indeed, more unusual or difficult processing tasks and situations invoking longer processing produce greater affect congruence in judgment (see Forgas, 2002; 2006). Such effects are consistent with the notion that attention, particularly prolonged attention involving elaborative processes, can result in more affect or schema-driven biases in encoding.

The above findings suggest clear situational and stimulus-driven differences in how emotion will affect encoding. Likewise, this reasoning predicts individual differences in reactions to emotion. That is, individuals can differ in (a) the content and elaboration of information and knowledge structures linked to affect in memory, (b) the accessibility of this knowledge, and (c) the tendency to focus attention and to think elaboratively about specific stimuli or situations. The former two will affect the likelihood and extent to which affect will activate associated material in memory (providing greater potential for both the “affect-as-information” and the “affect-priming” mechanisms to affect encoding). The latter will affect the extent to which the primed knowledge will be brought to bear upon processing of the stimulus at hand (i.e., the likelihood that “affect priming” will affect encoding). Consistent with this reasoning, people who tend to engage in more elaborative processing show greater schematic and affect-consistent judgments, as those with stronger, more elaborate relevant attitudes or knowledge structures (e.g., see Petty, 2001). These processes can also lead to greater constructive and reconstructive distortions over time.

Finally, affect can drive the selection of processing strategies. Positive and negative mood states, for example, promote differences in specific strategies (see Bless & Fiedler, 2006; Forgas, 2006). Of more pertinence to real-life forensically relevant situations, specific negative emotions, such as anger versus fear, may involve qualitatively different processing strategies. Levine and Pizzarro (2004), for example, have complained in their “grumpy overview” of emotion-memory research that our understanding of how emotion affects memory has been seriously limited by focus on the broad construct of “emotional arousal,” rather than on the specific processing effects of discrete emotions. The authors put this colorfully: “Arousal is to emotion what brightness is to color; an essential component to be sure, but one that fails to capture some of the most fundamental properties of the phenomenon” (p. 539).

Rather than focusing on processes of affect-congruent priming or affect-as-information mechanisms, Levine and Pizzarro (2004) focus on the application of cognitive appraisal theories to the effects of emotion on information processing. Emotions are alleged to occur when observers perceive that environmental changes have promoted or interfered with one’s well-being or achievement of goals. In turn, emotions are presumed to direct attention to aspects of a situation that are functional or are relevant for responding. Such a viewpoint is consistent with our earlier argument that emotion will not necessarily narrow attention, but may deploy it rather widely as the person attempts to assess the situation, assess and select between potential responses, and plan their execution. Such goals would require researchers to consider broader issues than simply differences in affect congruence, schema consistency, or whether the information is central or peripheral.

For example, fear is presumed to trigger attention to a threat, as well as goal-related processing relevant to means of avoiding the threat. Anger, on the other hand, is presumed to trigger attention to sources blocking one’s goals and means of removing them. Consistent with Foggas’s (2002) affect-infusion model, negative emotions are presumably associated with analytic, data-driven processing strategies targeted toward the goal of assessing and addressing the threat. Therefore, attention, and hence memory, are focused upon a range of threat-appraisal and threat-management-relevant information.

In contrast, positive emotions occur when goals are unobstructed or satisfied and in the absence of threats of all kinds. Therefore, the person has no immediate problem to solve, attention and processing can be more unconstrained and free-ranging, and hence processing strategies and memory can be broad and inclusive, involving both general knowledge and environmental input, but without being as narrowly targeted (for reviews of the relationship of specific emotions to the types of information recalled, see Forgas, 2002; Levine & Pizzarro, 2004). Broadly, the literature on automatic consequences of goal activation is consistent with this view, in that goal activation results in selective attention to and memory for goal-relevant information and in evaluation and interpretation of incoming information in light of its relationship to the goal (Barth, 2005; Chartrand & Bargh, 2002; Shah, 2005).

Other perspectives on emotion-specific effects on processing strategies have also been offered. For example, some have distinguished between certainty-versus uncertainty-oriented appraisals and the emotions associated with them, providing evidence that certainty-oriented emotions (such as anger) promote heuristic or schematic processing, whereas uncertainty-oriented emotions (such as fear) promote systematic processing (e.g., Nabi, 2002; Tiedens & Linton, 2001). This and other proposed emotion-specific bases of differences in processing strategies (e.g., Watson & Spence, 2007) suggest complex effects of emotion on biases in processing and memory.

3.1. Summary

Clearly, a rather wide range of processing issues must be considered to reasonably investigate the relationship between emotion and memory for events. Rather
than the narrow “tunnel-memory”-based theorizing and investigations that have largely characterized eyewitness research to date, the field might profitably move toward consideration of the broader processing issues involved. Although we did not delve deeply into the rapidly expanding body of neuroscience research on physiological mechanisms affecting memory for emotional events, the way in which such processes promote or impair the mechanisms of attention and processing must be considered along with the issues involving the interaction of emotion and schematic and goal-driven concerns driving attention and processing of emotional events. Additionally, a comprehensive model of the effects of emotion on memory for events must consider individual differences impacting each process involved.

Although such a complete model would be challenging to develop and test, the analysis presented here suggests several new directions for eyewitness researchers to pursue. For example, emotion-driven enhanced schematic processing would be expected to promote specific schema-consistent errors in memory of centrally attended features of events. For example, fear might distort memory for the facial expression of a centrally attended robber toward greater anger or hostility, or for the general appearance of a Black perpetrator toward stereotypically “Black” features (see below). The latter effect should be particularly strong for observers with strong racial stereotypes. We should also expect event characteristics relevant to emotion-driven goals to elicit attention and be more likely to be remembered. For example, among bank patrons held hostage by the armed robber, attention should go to the gun as well as to potential means of achieving escape or help, such as an open door or a potentially available cell phone. In other words, there are a number of hypotheses to be tested that involve (a) the specific kinds of errors that might be enhanced by emotion, as opposed to the overall error rates; (b) the distinctive targets of selective processing that are distinctive to specific emotions; and (c) individual differences relevant to all cognitive and physical bases of these effects.

4. INFLUENCE OF BELIEFS AND EXPECTATION ON STORAGE AND RETRIEVAL

As with encoding, beliefs, expectations, and schematic processing continue to affect memory and memory reports as observers experience their memories through time and begin to retrieve and report their memories to others. These influences occur, in part, as a result of the continuing effects of beliefs and expectations held prior to, and during the encoding of, the original event. However, as the witness proceeds forward from the point of original witnessing, multiple processes add to or alter existing beliefs and thereby affect memory and memory reports.

The act of “remembering” consists of subjective internal representations of an event, combined with judgment criteria for determining whether these representations correspond to a previously experienced index event. Internal repre-

sentations can consist of verbatim visual images (elaborate visual reproductions, essentially “seeing” the event again) and/or gist traces of the essential semantic meaning or generalized physical form of objects and events. Furthermore, judgment criteria can range from the strict requirement to be able to fully picture and clearly describe the entire object or event to very lax criteria, such as fuzzy unelaborated fragmented gist traces. Generally, the stronger the verbatim and gist traces and the weaker the judgment criterion, the more likely a person is to label the experience as a “memory.” All three relevant entities can be affected by postevent processes.

Verbatim traces, for example, decay over time. But they may also be strengthened or altered by activities that reinforce the original images or that substitute new images. This can happen through internal rehearsal processes, active imagining, or exposure to new external representations of the event. Semantic-gist traces tend, instead, to strengthen over time. But they can also be altered by activities that alter the visual verbatim images, as well as through activities serving to develop or alter relevant beliefs and therefore to change semantic-gist memory representations. Finally, the judgment criterion itself can be altered, as, for example, when—based on a strong belief in the person’s guilt garnered through suggestive postevent influences—a witness identifies a specific suspect as the perpetrator of a crime in the absence of a clear verbatim “memory” of the perpetrator’s face (for review of these processes, see Brainerd & Reyna, 2005; Loftus & Davis, 2006). In this instance, a weaker judgment criterion is applied to the memory representations themselves because additional beliefs support their veracity. In the remainder of the chapter we illustrate these processes of postevent influences on memory representations and judgment criteria as they apply to eyewitness reports.

4.1. Expectation, belief, and eyewitness identification

Over the past century, researchers have produced countless articles documenting the antecedents and consequences of failures in eyewitness identification (for reviews, see the recent Handbook of Eyewitness Psychology: Vol. 1, Toglia, Read, Ross & Lindsay, 2007; Vol. 2, Lindsay, Ross, Read, & Toglia, 2007). Although many determinants of eyewitness accuracy have been identified, we focus on postencoding factors that exert their influence via effects on beliefs concerning the features or identity of the perpetrator.

4.1.1. Internal constructive and reconstructive processes and face memory

There is substantial evidence that schema activation affects encoding of faces such that immediate ratings and later memory of the faces are biased toward congruity with the label (for discussion of additional issues related to face memory, see chapter 3, section 4). Furthermore, goal activation promotes schematic processing. For example, “self-protection” goals led Whites to perceive
4. Memory conformity and the effects of co-witnesses.

In addition to internal reconstructive influences, the witness may be subject to external reconstructive influences from other witnesses, which can perseverate and affect memory. Among these, information from other witnesses, which can perseverate and affect memory, may lead to memory errors. For example, a witness may be influenced by the memory of another witness, leading to the construction of a false memory. This is known as the 'Mayo Hysteria' effect, where a witness may adopt the memory of another witness and construct a false memory. This effect has been observed in a variety of situations, including eyewitness testimony and the construction of false memories.

Such shifts toward prototypes, which have yet to be specifically investigated for errors in eyewitness memory, are of interest for further research. As mentioned, such shifts may be due to the fact that witnesses are more likely to be influenced by the memory of other witnesses, leading to the construction of false memories. This effect has been observed in a variety of situations, including eyewitness testimony and the construction of false memories.

A related question arises concerning the previously noted convergence of memory with facial emotion labels over time. The faces that witnesses must remember, such as intense negative emotions, may become more neutral or even positive over time. This may affect the likelihood that the target witness will make a similar identification.
Other witness reactions can have an impact as well, such as gasping or other outcries. In one of our cases, for example, a teller who had been robbed fainted immediately upon the sight of a suspect brought before 15 witnesses for a show-up ID. It is for such reasons that the *Eyewitness Guide* published by the National Institute of Justice (NJ Guide: Technical Working Group for Eyewitness Evidence, 1999) and based on years of eyewitness research specifies that all attempts should be made to avoid cross-contamination between witnesses, in part by instructing witnesses not to do anything to convey to other witnesses their own opinions concerning a specific perpetrator identification or the nature of any identification decisions they make.

In addition to memory for what happened or who did it, co-witness reports can affect the confidence of the target witness in these memory. In turn, inflated confidence in the veracity of a “memory” can lower the judgment criteria applied to the event traces such that the witness is more willing to report his belief as a memory in front of a jury. Inflated confidence can occur as a result of information that supports the target’s memories or beliefs about what happened. This has been demonstrated specifically for information from co-witnesses (for review, see Davis & Loftus, 2007; Skagerberg, 2007) and other sources such as the police (for review, see Douglass & Steblay, 2006). This is among the most dangerous of the effects of co-witness influence, as jurors are known to give great weight to witness confidence in assessing credibility (for review, see Davis & Follette, 2001).

Unfortunately, in addition to affecting witness confidence, confirming information tends to affect other witness reports that jurors would rely on to assess witness accuracy—including encoding conditions such as clarity of view, duration of exposure, and so forth (see section 4.1.3.3 on effects of police feedback). In other words, once witnesses believe they are correct, they tend to infer in hindsight that the opportunity to observe must have been good and that any verbatim and semantic event representations they have are veridical “memories.”

Clearly, co-witnesses have great potential to influence the beliefs of the target witness, and hence the reported memory. However, other overarching beliefs affect how the target witness will respond to such co-witness information. That is, witnesses appear to use “metacognitive knowledge” about how memory works to assess the credibility of information from their co-witnesses. If the co-witness information violates what the target witness believes about how memory works, it will be seen as less credible and will have less impact. For example, if the co-witness claims to have seen something the witness believes she/he would have remembered if it happened, she/he is likely to give little credence to the co-witness account. In contrast, a co-witness account may be given more credibility when the witness feels that his or her own accounts may be in error due to poor encoding conditions, or that the others’ account is likely to be true (because additional witnesses also agree or because the co-witness had better opportunity to observe or had more expertise). In other words, our memory reports are affected not only by what we believed happened, but also by how we believe we can evaluate and verify our own accounts and those of others (for review, see Davis & Loftus, 2007).

### 4.1.3. Belief-enhancing effects of police procedures

Based on years of research on the effects on witness accuracy of what eyewitness researchers refer to as “system variables” (factors under the control of the justice system), the previously referenced NJ Guide offers a variety of specific guidelines for how to interview witnesses and conduct identification procedures that are specifically intended to avoid influencing witnesses to report beliefs regarding what must be or probably is true, rather than what they specifically remember. Essentially, these recommendations advocate procedures (a) that will not contaminate verbatim or semantic representations of the original event and (b) that encourage reliance on stricter memory-judgment criteria for reporting information or perpetrator identifications (as opposed to inference, assumption, or deference to the interviewer).

#### 4.1.3.1. Suggestive interviewing and the cognitive interview

Suggestive interviewing involves procedures during which the interviewer (a) directly or indirectly suggests something is or is not true; and/or (b) selectively reinforces witness reports such that some information is attended to, responded to as if important and true, and followed up on, whereas other information results in lack of attention, nonresponse, disapproval, overt disagreement, or trivialization. Although suggestive interviewing may result in witness errors through additional mechanisms, a primary mechanism involves influence on witness beliefs about what is probably true. That is, assuming that the interviewer must have relevant knowledge—perhaps greater than that of the witness—the witness adopts beliefs about what happened consistent with interviewer suggestion. Or, she or he may simply comply with interviewer suggestions (while still disagreeing) in order to avoid overt disagreement or disapproval.

Suggestion may entail subtle differences in language, such as “Did you see the (rather than a) broken headlight?” or “How fast was the car going when it smashed (versus hit or bumped) the other car?” These subtle differences result in witness reports consistent with suggestion, such as more reports of seeing a broken headlight, greater speed estimates, and mistaken reports of broken glass consistent with higher speeds. Suggestion may also be more representational, as in the use of anatomically correct dolls, photographs, or other illustrative props, or more direct, such as when the interviewer directly implies a fact (e.g., “What kind of hat was he wearing?”) or tells the witness what she or he believes happened (“The evidence from the crime scene and the other witnesses tells us that Johnny was the shooter”). (For reviews of suggestive interviewing and sources of chronic or acute vulnerability to its effects, see the Handbook of Eyewitness Memory, Vol. 1, Toglia et al., 2007; Vol. 2, Lindsay, Ross, Read, & Toglia, 2007.)
In an effort to avoid suggestive influences on eyewitness accounts while maximizing the amount of accurate information elicited, the “Cognitive Interview” was developed in the early 1980s (Geiselman et al., 1984; Geiselman, Fisher, MacKinon, & Holland, 1985) and later revised (Fisher & Geiselman, 1992). The cognitive interview (CI) is designed both to maximize the motivation and comfort of the witness through effective communication and development of rapport and to effectively use knowledge of cognition and memory processes to enhance the accuracy and completeness of interviewee reports. In part, this entails minimization of suggestion through the use of open-ended, nonleading questions, as well as maximization of retrieval through effective use of multiple contextual cues spanning multiple modes (e.g., visual, olfactory, auditory, emotional, or touch), multiple starting points (e.g., beginning from different points during the event), different perspectives, and so on (see Fisher & Geiselman, 1992). The procedure has proven effective in increasing the amount of correct information generated, but it has sometimes been found to increase the amount of incorrect information (for a recent review, see Wells, Memon, & Penrod, 2006).

4.1.3.2. Lineup procedures

The NJI guidelines recognized two general processes that can compromise eyewitness identifications: (a) inferential processes in which witness inferences about what is likely to be true guide his or her selection of the perpetrator, and (b) social-influence processes with potential to affect the above inferences—and thereby, the witness’s choice of perpetrator, confidence in that choice, or the nature of related reports bearing on witness accuracy (such as original viewing conditions).

4.1.3.2.1. Inferential processes. When a witness is asked to participate in an identification procedure, a natural inference is that police have targeted a suspect they believe may have committed the crime. Some witnesses may conclude that police have caught the actual perpetrator and that they must make the identification to facilitate prosecution of the case. They assume that the perpetrator must be in the lineup (or why else were they asked to see it?) and that their job is to pick which lineup member is the perpetrator—NOT, whether any lineup member is the perpetrator. Hence, they do not enforce strict criteria for matching the suspect’s face to a verbatim memory trace of the perpetrator. Instead, they adopt a looser criterion (best match rather than absolute match) and choose someone from the lineup, often guessing on the basis of either which looks most like what they remember (see Steblay, Dysart, Fulero, & Lindsay, 2001; Wells, 1984) or which looks most likely to be the perpetrator for other reasons (looks suspicious or dangerous, or photo characteristics are suggestive).

Wells (1993) demonstrated “relative judgment” by exposing witnesses to a staged crime to a lineup that included either the perpetrator and five foils, or simply the same five foils without the perpetrator. With the perpetrator present, 54% of witnesses correctly identified him, another 25% misidentified a foil, and 21% selected no one. But when the perpetrator was removed, 68% misidentified a foil, with 38% identifying the foil that might be regarded as the “best-fit” match to the original perpetrator. Only 32% failed to make an identification, instead of the 75% that would be expected if all who had originally correctly identified the perpetrator had moved to making no choice when he was not in the lineup. In other words, witnesses appeared to assume that the perpetrator was in the lineup, and when he was actually not there, their choices moved to the foil providing the “best fit” to their memory of the perpetrator. Their inferential processes led them to the belief that the foil must be the perpetrator. Since Wells’s original demonstration, the relative-judgment effect has been shown to apply to both sequential (see below) and simultaneous lineups, and to be greater when memory is weaker (e.g., Clark & Davey, 2005).

Relative judgment can also apply across different identification procedures, as the witness begins to compare current candidates not only to one another, but to others encountered in previous procedures. For example, a witness who once identifies an innocent is more likely to persist in identifying that same innocent in subsequent identification procedures (for reviews see Behrmann & Davey, 2001; Deffenbacher, Bornstein, & Penrod, 2006; Dysart, Lindsay, & Hammond, 2001). A single witness can be exposed to quite a number of different procedures as the case proceeds, beginning with field show-ups or working with a police sketch artist or composite procedures, through to looking through a mugbook, exposure to one or more photo lineups, subsequent live lineups, and in-court identifications at preliminary hearings and trial. At each proceeding, the witness may compare the current candidates to previous selections.

This sequential relative-judgment process can be exacerbated when a particular suspect is the only one to appear in multiple procedures. This can strengthen the inference that the person must be the perpetrator. It can also increase the familiarity of the face and thereby enhance the risk that the person will be identified due to the witness’s mistaken attribution that the face is familiar because the person was the perpetrator, rather than because he had been seen in previous identification procedures. Such mistaken beliefs about why a face is familiar have been implicated as the cause of mistaken identifications of innocents previously seen in a variety of contexts, including as bystanders to the crime, in previous identification procedures, and in other irrelevant contexts (such as on TV; see review by Deffenbacher et al., 2006).

Recommendations have been offered to minimize relative-judgment processes themselves, as well as their effects (see NJI Guide; for reviews documenting the effectiveness of these recommendations, see Clark, 2005; Steblay, 1997; Steblay et al., 2001; Wells et al., 1998, 2006 ). First, one can encourage witnesses to use stricter verbatim absolute-matching criteria by instructing them that the perpetrator may or may not be in the lineup. Such an instruction has been shown to dramatically reduce the incidence of misidentifications in target-absent lineups, while exerting minimal effects on the rate of true identifications in target-present lineups. Second, a lineup member should not either (a) draw attention for irrelevant reasons (such as unique clothing, demeanor, or photograph characteristics)
or (b) draw attention because he is most similar to the witness's description. If all members fit the witnesses' gist representations, witnesses will be forced to rely on stricter absolute-match criteria to choose. Third, inferential processes may be reduced by using sequential rather than simultaneous lineups. Theoretically, this should suppress the tendency to use relative judgment in favor of an absolute comparison between the specific candidate and memory for the perpetrator. Laboratory tests of sequential versus simultaneous lineups have shown sequential lineups to suppress the overall rate of identification, but with stronger suppression of mistaken than accurate identifications. Unfortunately, field tests of sequential procedures have suffered serious methodological problems, rendering results uninterpretable (see Wells et al., 2006).

4.1.3.3. Social-influence processes and police procedure

If police have identified a suspect and asked eyewitnesses to attempt an identification, they can be highly motivated to obtain confirming identifications, often knowing that the perpetrator cannot be successfully prosecuted without them. Unfortunately, standard practice for administration of lineups is for the detective investigating the case—the very person with the most motivation for the witness to make an ID—to be the one to administer the lineup. In light of the extensive literature on experimenter-expectancy effects, it is not surprising that when lineup administrators know who the suspect is, the chance that the eyewitness will identify that suspect (innocent or not) is increased (e.g., Haw & Fisher, 2004; Phillips, McAuliff, Kovera, & Cutler, 1999), and if that suspect is identified, the witness's confidence in the identification is enhanced (e.g., Garrioch & Brimacomb, 2001).

Although administrators in these experiments did not convey awareness of the suspect's identity bluntly or coercively, in practice, police administrators can convey beliefs about the identity of the perpetrator to witnesses either subtly or bluntly (and sometimes coercively) and thereby affect witnesses' beliefs about the perpetrator's identity—leading them not only to identify the administrator's choice, but also to feel enhanced confidence in that choice. For this reason, the NIJ Guide and eyewitness researchers have recommended that lineups be administered by personnel who are not aware of which member is the suspect, or via a laptop-computer program (McLin, Zimmerman, & Malpass, 2005; Technical Working Group for Eyewitness Evidence, 1999; Wells et al., 1998).

Whether or not police influence the witness's identification of a specific lineup member, they may yet exert considerable effect on the witness's confidence in the identification through reactions that appear to validate his or her choice. Beginning with the early demonstration of Wells and Bradfield (1998), a host of studies have shown that postidentification feedback to the witness (e.g., “Good, you identified our suspect!”) can both inflate witness confidence in the identification and profoundly distort reports relevant to the reliability of the identification. Suspects given such feedback report, for example, that their original ability to observe the perpetrator was better—for example, that they paid more attention to the target's face, had a better view of the face, and so forth. The effect occurs across witness populations (young and old laboratory populations and actual witnesses to crimes) and types of witness decisions (positive ID and "not there") and is greater for mistaken than for correct witnesses. Ironically, those who report that they are not affected by the feedback are actually affected more (for meta-analysis and review, see Douglass & Steblay, 2006; Wells et al., 2006).

Beginning with this immediate feedback, witnesses can be subject to a number of additional confidence-enhancing forces prior to any identification made in court before the jury. These can include other witness identifications, media reports, the very fact that the suspect is charged and brought to trial, participation in preliminary hearings and other pretrial activities (many entailing repeated exposure to the suspect), and exposure to other "evidence" of guilt—all serving to solidify the belief that the suspect is indeed the perpetrator, to impair the relationship between witness confidence and accuracy, and to encourage the witness to rely on weaker verbatim image or gist-match criteria to make an identification (see Wells et al., 2006).

4.1.3.3.1. Direct influences of emotion during encoding on accuracy at identification. In addition to the many belief-enhancing influences that can impair the relationship between confidence and accuracy, there is evidence to suggest that the intense emotions experienced by many witnesses to real-life criminal events may themselves promote confidence independent of accuracy. That is, evidence from several lines of research has shown that emotions tend to enhance the subjective experience of memory accuracy, even in circumstances where emotion is unrelated or negatively related to accuracy (for reviews, see LaBar & Cabeza, 2006; Phelps, 2006; for evidence of distinctive neural systems reflecting dissociations between confidence and accuracy, see Chua, Rand-Giovannetti, Schacter, Albert, & Sperling, 2004).

Perhaps most directly relevant to the issue of eyewitness identification are studies using the remember/know procedure to study recognition of previously presented stimuli. During the recognition phase of a memory task, participants are asked to indicate whether each candidate is "new" (not previously presented), "known" (familiar, but without specific recollection of details for the encoding context), or "remembered" (recalled with details of the encoding context). Emotion enhances the proportion of "remembered" judgments, despite having no effect on overall accuracy (see Phelps, 2006). This suggests that witnesses experiencing strong emotions may be no better at discriminating between innocents and perpetrators, but that they may be more willing to make a positive ID (whether correct or not) and/or express greater confidence in that ID based on the greater subjective sense of "remembering" that the person committed the crime, rather than just "knowing" that they looked familiar.

4.1.3.3.2. Behavioral commitment and dissonance-reduction processes. A witness can also be subject to internal self-justification processes that enhance confidence, reinforce commitment to their identification decisions, and increase
the likelihood of sequential confirming identifications across procedures (for discussion of self-justification processes, including in memory and the legal system, see Tavris & Aronson, 2007). Beginning with the first identification of the target, self-justification motivations can become more extreme as the consequences for the target become more serious and, therefore, the idea that one could have been mistaken more aversive.

4.1.3.3.3. Implications for jurors. These influences on the confidence-accuracy relationship make it difficult for jurors to detect inaccurate witnesses. We know that jurors base their judgments of witness accuracy in large part on witness confidence. Moreover, by the time the witness reaches trial, confidence-inflating forces such as discussed above can eliminate any relationship between confidence and accuracy. Thus, the NIJ Guide adopted eyewitness researchers' recommendations that confidence should be assessed and recorded immediately after the identification, before any form of feedback is encountered (NIJ Guide; see also Wells et al., 2006).

4.1.3.3.4. Summary. Eyewitness identifications are strongly affected by beliefs about what must be—or probably is—true, combined with the strength and nature of verbatim and semantic-gist memories of what actually occurred. Inferential processes such as relative judgment and social influence from other witnesses, interviewers, or administrators of identification procedures exert greater influence on witnesses with weaker memories or on those who for reason lack confidence in their own memories. These and other factors that compromise accuracy at encoding or retrieval cast doubt on the probabilistic value of eyewitness testimony—that is, the weight it should be given as a predictor of guilt. Essentially, the more potentially compromising influences the witness encounters, during encoding or while progressing through the legal system, the less probative value his or her testimony will have.

5. CONCLUSIONS

Given the many and varied sources of errors in witness memory, eyewitness errors are likely to remain the primary source of wrongful conviction for the foreseeable future. While the legal system has begun processes of reform intended to minimize errors caused by police procedures (as reflected in the recommendations of the NIJ Guide), these reforms are not pervasively enacted, and they cannot prevent the many additional sources of error such as those covered in this review. It remains for eyewitness experts to educate jurors as to the sources of error in eyewitness testimony, with the hope that they will consider such factors when attempting to assess the accuracy of an individual witness. In the absence of such testimony, jurors tend to assume that a confident eyewitness is, indeed, accurate (see Wells et al., 2006)—an assumption unlikely to be diffused through normal trial processes. As John Bargh has put it, “only conscious, controlled pro-

cesses can ‘time-travel’” (Bargh, 2006, p. 1), in that they can be subject to recall and examination. But, unfortunately, as our review has made clear, much of what determines the nature of what is encoded into memory and “remembered” and retrieved over time is determined by unconscious inaccessible processes that cannot be brought to light under cross-examination, viewed by legal scholars as the “greatest legal engine ever invented for the discovery of truth” (Wigmore, 1974, vol. 5, 1367, at 32).

6. REFERENCES

7. Expectancies, emotion, and memory reports for visual events


8. The visual world in memory


9. Immunology and memory reports for visual events

7. Expectancies, emotion, and memory reports for visual events


Experiencing emotion, memory, and memory reports for visual events. 212


8 Visual mental imagery: More than “seeing with the mind’s eye”

Giorgio Ganis
Harvard Medical School
William L. Thompson and Stephen M. Kosslyn
Harvard University

1. INTRODUCTION

We are able to perceive and understand objects, faces, scenes, and events in the environment because our brains construct internal representations of these entities on the basis of information conveyed by our sensory organs. These internal representations are not only activated by information coming from the sensory organs, during perception, but can also be reactivated endogenously in the absence of any external stimulation, during mental imagery. Although mental imagery can take place in all modalities (visual, auditory, tactile, and so on), here we focus on visual mental imagery, the most studied modality. We also discuss motor imagery, a distinct form of mental imagery that relies on the motor system and that often accompanies visual mental imagery.

In the case of visual mental imagery, to answer a question such as “What shape are a cat’s cars?” one usually visualizes a cat and then “zooms in” on parts of the image containing the animal’s cars to assess their shape. This process of reactivation and inspection of an internal representation in the absence of any external stimulus is at the core of mental imagery. More formally, during visual mental imagery one activates visual representations in long-term memory and uses them to construct a representation in working memory; this representation can then be processed further, such as by reinterpreting or transforming it (Kosslyn, Ganis, & Thompson, 2001; Kosslyn, Thompson, & Ganis, 2006). From this definition it is already evident that there is a tight link between mental imagery and memory processes. Additional in-depth discussion of the relationship between visual mental imagery and visuospatial working memory is provided in chapter 1, sections 3 and 4.

However, we stress that, just as memory is a constructive process, visual mental imagery goes beyond the mere reactivation of visual representations of specific events that have been actually experienced: One not only must construct an image on the basis of incomplete information stored in memory, but also can use visual mental imagery to extract new information (i.e., information that had not been encoded explicitly) by parsing and reassembling them in new ways (Finke, Pinker, & Farah, 1989). This is one reason why visual mental imagery
Current Issues in Memory
Series Editor: Robert Logie
Professor of Human Cognitive Neuroscience, University of Edinburgh, UK

Current Issues in Memory is a series of edited books that reflect the state of the art in areas of current and emerging interest in the psychological study of memory. Each volume is tightly focused on a particular topic and consists of seven to ten chapters contributed by international experts. The editors of individual volumes are leading figures in their areas and provide an introductory overview. Example topics include: binding in working memory, prospective memory, memory and ageing, autobiographical memory, visual memory, implicit memory, amnesia, retrieval, memory development.

The Visual World in Memory

Edited by
James R. Brockmole

Ψ Psychology Press
Taylor & Francis Group
HOVE AND NEW YORK
Contents

List of contributors
Preface vi

1 Fragmenting and integrating visuospatial working memory
   ROBERT H. LOGIE AND MARIAN VAN DER MEULEN 1

2 Visual memory for features, conjunctions, objects, and locations
   YUHONG V. JIANG, TAL MAKOFSKI, AND WON MOK SHIM 33

3 Remembering faces
   VICKI BRUCE 66

4 Memory for real-world scenes
   ANDREW HOLLINGWORTH 89

5 Visual memory in motor planning and action
   MARY M. HAYHOE 117

6 Visual memory, spatial representation, and navigation
   AMY L. SHELTON AND NAOHIDE YAMAMOTO 140

7 Expectancies, emotion, and memory reports for visual events
   DEBORAH DAVIS AND ELIZABETH F. LOFTUS 178

8 Visual mental imagery: More than “seeing with the mind’s eye”
   GIORGIO GANIS, WILLIAM L. THOMPSON, AND STEPHEN M. KOSSLYN 215

Author index 251
Subject Index 265