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Effects of emotion on memory specificity: Memory trade-offs elicited by negative visually arousing stimuli

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Abstract

Two different types of trade-offs have been discussed with regard to memory for emotional information: A trade-off in the ability to remember the gist versus the visual detail of emotional information, and a trade-off in the ability to remember the central emotional elements of an event versus the nonemotional (peripheral) elements of that same event. The present study examined whether these two trade-offs interact with one another when participants study scenes that elicit an emotional response due to the inclusion of a negative visually arousing object. Participants studied scenes composed of a negative or a neutral object placed on a background. Their memory was then tested for the "gist" and visual detail of the objects and the backgrounds. The results revealed that there is a pervasive memory trade-off for central emotional versus peripheral nonemotional elements of scenes. With some encoding tasks, a trade-off for gist versus visual detail also resulted, but this trade-off occurred only when memory for the nonemotional background of a scene was assessed. There was no gist/detail trade-off for the emotional objects in a scene.

Keywords: Emotion; Arousal; Memory; Gist; Detail; Scenes; Trade-off; Central; Peripheral; Visual

Individuals often believe that they remember negatively emotional experiences vividly (e.g., Dewhurst & Parry, 2000; Kensinger & Corkin, 2003; Ochsner, 2000), and at least some types of details are more likely to be remembered about negative items than about nonemotional ones (e.g., Doerksen & Shimamura, 2001; Kensinger & Schacter, 2006). However, numerous lines of research have suggested that memory is not enhanced for all aspects of negative, arousing experiences. Rather, memory for these events may be best described by *trade-offs*: Some aspects of an event are better remembered because of its emotional salience, whereas other aspects are more likely to be forgotten (reviewed in Buchanan & Adolphs, 2002; Reisberg & Heuer, 2004).

The exact nature of the memory trade-offs elicited by negative emotional arousal is unclear. Two predominant proposals have been put forth to describe the types of costs that may be associated with such memories. The first proposal is that negative arousal causes a narrowing of attention, such that details spatially and temporally associated with the emotional item are attended to and later remembered, while information peripheral (i.e.,

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not of central relevance)[1] to that item is likely to be forgotten (e.g., Easterbrook, 1959; Loftus, 1979; referred to here as the *central/peripheral trade-off*). For example, when an individual is shown a scene that includes a negative visually arousing element, they often remember the emotional aspect of the scene, but not the peripheral elements. Thus, individuals remember scenes as having been "zoomed in" on the emotional element (i.e., they believe the emotional element took up a larger proportion of the scene than it did in reality), likely because they remember the visually arousing information in the scene but not the information at the periphery (Safer, Christianson, Autry, & Osterlund, 1998). People also often show poorer recognition of information in the periphery if an emotional item was included in the scene than if only nonemotional items were present (e.g., Brown, 2003; Christianson & Loftus, 1991; Deffenbacher, 1983; Easterbrook, 1959; Kensinger, Piguet, Krendl, & Corkin, 2005; Pickel, French, & Betts, 2003; Shaw & Skolnick, 1994; Wessel & Merckelbach, 1997). A similar effect is thought to underlie the "weapon-focus" effect, in which an individual who is a witness to a crime often remembers the weapon used by the perpetrator but not other details such as the perpetrator's clothing or vehicle (e.g., Loftus, 1979; Loftus, Loftus, & Messo, 1987; Stanny & Johnson, 2000; Steblay, 1992): The information central to the source of arousal is remembered well, while peripheral information is forgotten.

The second proposed memory trade-off elicited by emotion focuses not on information's relevance to the emotional arousal, but rather on the level of detail remembered about the event (referred to here as the *gist/detail trade-off*). In particular, Adolphs and colleagues have suggested that emotion tends to enhance the likelihood that the "gist," or general theme, of an experience is remembered, while reducing the probability that specific visual details of that event are remembered. After showing participants emotional and neutral scenes, each accompanied by a short narrative, they have assessed "gist" memory by asking participants to recall or to recognize the verbal description of the scene (e.g., that a dead person had been found in the forest; Adolphs et al., 2001, Adolphs, Tranel, & Buchanan, 2005; Denburg, Buchanan, Tranel, & Adolphs, 2003). They have assessed memory for visual detail by asking participants to distinguish the studied image from foil images that have been altered (e.g., by changing the surface on which the dead body is lying; Adolphs et al., 2001; Denburg et al., 2003) or to choose the correct statement regarding the scene's visual details (Adolphs et al., 2005). Across these studies, emotion has enhanced performance on the tasks designed to assess "gist" memory, but has impaired performance on tasks requiring memory for the visual details of the studied images (Adolphs et al., 2001, 2005; Denburg et al., 2003).

The *gist/detail* trade-off, however, does not always seem to occur. In a prior investigation, we demonstrated that individuals can be *more likely* to remember specific visual details of emotional objects than of neutral objects (Kensinger, Garoff-Eaton, & Schacter, 2006). In that investigation, participants were presented with single objects (e.g., a snake, a chipmunk), each shown against a blank background. They later were better able to discriminate visually identical objects from similar (but not identical) objects when the items were negatively emotional than when they were neutral. In contrast, the studies that have revealed the *gist/detail* trade-off have assessed participants' memories of visual scenes (e.g., a dead body in a forest). It is possible that different processes act when individuals are presented with a complex scene containing an emotional object, rather than with a single emotional object in isolation. For example, gist-based extraction may be more likely to occur when participants encounter complex visual scenes that include many different components, rather than a single object (see Kensinger et al., 2006 for further discussion). Thus, perhaps individuals demonstrate a *gist/detail* trade-off for emotional items primarily when they are part of a broader visual scene, rather than when the emotional items are presented in isolation. It also is plausible that a *gist/detail* trade-off occurs primarily when participants are asked to focus on verbal descriptions of scenes or to follow a storyline regarding an emotional event, and that it is less likely to be elicited when participants process information in more of a visual manner (i.e., when the emotional response is elicited because of the presence of a visually arousing stimulus; see Laney, Campbell, Heuer, & Reisberg, 2004 for further discussion of the importance of distinguishing between "visual" and "thematic" evocation of emotional responses).

Another possibility is that the *gist/detail* trade-off may occur, but it may interact with the *central/peripheral* trade-off. This issue has remained relatively unexplored. The studies by Adolphs and colleagues, while separating gist from detail, have not examined memory for the gist and detail of the emotional aspect of the scene separately from memory for the gist and detail of information peripheral to the emotional aspect. In several of their studies, some details of the emotional object were manipulated (e.g., changing the orientation of the dead body) and other details associated with nonemotional elements of the scene were also altered (e.g., changing the forest floor on which the body was lying). In a more recent study (Adolphs et al., 2005), memory for "gist" was assessed primarily for the central emotional object, while memory for visual detail was ascertained primarily for the nonemotional peripheral elements.

[1] By "central" and "peripheral," we refer not to the information's spatial location in the scene, but rather to its relevance to the source of the emotional arousal (see Adolphs, Denburg, & Tranel, 2001 for further discussion).