Neuropsychologia 50 (2012) 2546–2565

Contents lists available at SciVerse ScienceDirect

Neuropsychologia

journal homepage: www.elsevier.com/locate/neuropsychologia

Familiarity in source memory

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ARTICLE INFO

Article history:
Received 15 November 2011
Received in revised form
27 June 2012
Accepted 30 June 2012
Available online 10 July 2012

Keywords:
Recognition memory
Source memory
Familiarity
Recollection
EEG
ERP

ABSTRACT

Familiarity and recollection are thought to be separate processes underlying recognition memory. Event-related potentials (ERPs) dissociate these processes, with an early (approximately 300–500 ms) frontal effect relating to familiarity (the FN400) and a later (500–800 ms) parietal old/new effect relating to recollection. It has been debated whether source information for a studied item (i.e., contextual associations from when the item was previously encountered) is only accessible through recollection, or whether familiarity can contribute to successful source recognition. It has been shown that familiarity can assist in perceptual source monitoring when the source attribute is an intrinsic property of the item (e.g., an object's surface color), but few studies have examined its contribution to recognizing extrinsic source associations. Extrinsic source associations were examined in three experiments involving memory judgments for pictures of common objects. In Experiment 1, source information was spatial and results suggested that familiarity contributed to accurate source recognition: the FN400 ERP component showed a source accuracy effect, and source accuracy was above chance for items judged to only feel familiar. Source information in Experiment 2 was an extrinsic color association; source accuracy was at chance for familiar items and the FN400 did not differ between correct and incorrect source judgments. Experiment 3 replicated the results using a within-subjects manipulation of spatial vs. color source. Overall, the results suggest that familiarity's contribution to extrinsic source monitoring depends on the type of source information being remembered.

0. Introduction

Our everyday experiences consist of intricate details encoded from various levels of perception and attention, and memory is the key process in binding them into useful knowledge. Remembering the people, places, and things that we have previously encountered could be as basic as questioning whether you have had a previous experience with one of these, or as specific as needing to remember certain details from a particular previous event. Importantly, we remember different amounts of information for the variety of past situations that we have experienced. For example, you may or may not remember the circumstances, or source, of a particular event, like whether you heard about your graduate school acceptance via an email or a letter. Understanding the psychological processes and patterns of brain activity that correlate with either remembering or failing to remember prior episodes and their assorted contextual details is a basic and important objective to be explored by cognitive psychology and neuroscience.

In the dual-process framework of recognition memory, familiarity and recollection are the two main cognitive processes involved in remembering information (Parks & Yonelinas, 2007; Yonelinas, 2002). Familiarity is typically thought to involve a fast and automatic recognition process that allows for recognition of a previous experience without retrieval of details from the encoding episode, whereas recollection is a slower process that retrieves item-specific episodic information. Recent evidence clearly points to the existence of a dual-process recognition memory system (for reviews, see Curran, Tepe, & Piatt, 2006, Chap. 18; Eichenbaum, Yonelinas, & Ranganath, 2007; Parks & Yonelinas, 2007; Rugg & Curran, 2007; Skinner & Fernandes, 2007; Vilberg & Rugg, 2008; Yonelinas, 2002).

One general class of information that can be recollected about an episode is source information. In addition to recognizing a particular stimulus associated with an event, we also process the temporal, spatial, semantic, and other associated contextual aspects of the event. These aspects are called source information because they make up the circumstances from which an item originated (Johnson, Hashtroudi, & Lindsay, 1993; Mitchell & Johnson, 2009; Senkfor & Van Petten, 1998). Source memory is involved in remembering contextual details such as having a memory for the person from whom you heard a juicy rumor or discriminating between whether you said something out loud or just thought it internally. Source information is part of the array of episodic details to be retrieved from the encoding period, meaning that recollection should, almost by definition, contribute to correct source retrieval (Allan, Wilding, & Rugg, 1998; Cansino, Maquet,

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http://dx.doi.org/10.1016/j.neuropsychologia.2012.06.027

Dolan, & Rugg, 2002; Gruber, Tsivilis, Giabbiconi, & Müller, 2008; Rugg, Schloerscheidt, & Mark, 1998; Unsworth & Brewer, 2009; Wilding, 2000; Wilding & Rugg, 1996; Woroch & Gonsalves, 2010; Zimmer & Ecker, 2010). In fact, the retrieval of episodic information has essentially been defined as a property of the recollection process (Rugg et al., 1998; Tulving, 1985; Yonelinas, 2002), and accurate source recognition has been considered a defining feature of recollection (Jacoby, 1991; Wais, Mickes, & Wixted, 2008). However, computational models of familiarity-based recognition have been shown to be capable of supporting source recognition (Elfman, Parks, & Yonelinas, 2008; Ratcliff, Van Zandt, & McKoon, 1995), and a variety of empirical evidence reviewed next has also suggested that familiarity contributes to source recognition under some conditions. These familiarity effects have been indexed behaviorally (e.g., Diana, Yonelinas, & Ranganath, 2008; Duarte, Ranganath, Winward, Hayward, & Knight, 2004; Elfman et al., 2008; Hicks, Marsh, & Ritschel, 2002; Yonelinas, Kroll, Dobbins, & Soltani, 1999), by the FN400 event-related potential (ERP) component (e.g., Ecker, Zimmer, & Groh-Bordin, 2007a, 2007b; Mecklinger, 2006), by activity in the perirhinal cortex (which is thought to be related to familiarity; e.g., Diana, Yonelinas, & Ranganath, 2007; Ranganath et al., 2003; Staresina & Davachi, 2006), and in neuropsychological patients with hippocampal damage thought to impair recollection (e.g., Diana, Yonelinas, & Ranganath, 2010; Quamme, Yonelinas, & Norman, 2007).

A number of experiments have used the remember–know (RK) procedure to assess the correlates of recollection and familiarity in source memory. Here, "remember" and "know" responses are thought to be subjective indices of recollection and familiarity, respectively (Duarte et al., 2004; Düzel, Yonelinas, Mangun, Heinze, & Tulving, 1997; Klimesch et al., 2001; Rugg et al., 1998; Smith, 1993; Tulving, 1985; Vilberg, Moosavi, & Rugg, 2006;but see Wais et al., 2008). These experiments have generally shown that accurate source recognition is associated with recollection, but some have suggested that familiarity can contribute to remembering source information. For example, Hicks et al. (2002) used two experiments to investigate familiarity's contribution to source monitoring, one with perceptual source information (words that were either seen or heard) and one with reality monitoring (words that were either seen or generated internally by the participant). In the first, source accuracy for "know" responses was equal to that of "remember" responses, and in the second, "know" was more accurate than "remember" for seen items while the opposite was true for generated words (which were processed at a deeper level);overall, the authors suggest that the results indicate that a sense of familiarity is sufficient to contribute to successful source monitoring. Additionally, Duarte, Ranganath, Trujillo, and Knight (2006) found above chance source accuracy for "know" judgments (in addition to "remember" judgments) made by healthy young adults when remembering the study task for each old probe and interpreted this as both the familiarity and recollection processes contributing to source memory. Wais et al. (2008) also found above chance source accuracy for "know" judgments (where words above the center of the screen were studied in one font color and words below the screen in another font color, and color was the tested source dimension), but they cautioned against equating "remember" and "know" responses with recollection and familiarity processes because they assumed that source memory is necessarily associated with recollection. Related work has considered whether familiarity can contribute to associative recognition in experiments where pairs of items are studied (A–B, C–D, E–F) and participants are required to discriminate between intact (A–B) and rearranged (C–F) pairs at test. Similar to the source memory situation, it is sometimes assumed that associative recognition requires recollection, although some evidence is consistent with accurate familiarity-based associative recognition (e.g., Clark & Gronlund, 1996; Rhodes & Donaldson, 2007; Quamme et al., 2007; Yonelinas et al., 1999).

In addition to subjective behavioral reports, recollection and familiarity have been associated with particular ERP effects (e.g., Curran, 2000; Curran & Cleary, 2003; Curran & Dien, 2003; Duarte et al., 2004; Jäger, Mecklinger, & Kipp, 2006; Tsivilis, Otten, & Rugg, 2001; Wilding & Rugg, 1996; Woodruff, Hayama, & Rugg, 2006; for reviews, see Allan et al., 1998; Curran, Tepe et al., 2006; Friedman & Johnson, 2000; Mecklinger, 2006; Rugg & Curran, 2007). The *parietal ERP old/new effect*, a positive-going component peaking over the parietal scalp between 500 and 800 ms, is thought to reflect recollection. It is an "old/new" effect because it differentiates between correctly identified old (hits) and new (correct rejections) stimuli. It is often left lateralized, and is greater in amplitude when episodic information is correctly recollected compared to correctly identifying either new items or old items without episodic details (Curran, 2000; Rugg & Curran, 2007; Wilding, 2000). Additionally, the parietal old/new effect has been shown to index the amount of episodic information retrieved such that its amplitude varies with the amount of information remembered (Vilberg et al., 2006; Wilding, 2000; Wilding & Rugg, 1996). The other recognition process, familiarity, is thought to be indexed by a relatively early frontally distributed negative-going component that peaks around 400 ms, called the *frontal old/new effect* or the *FN400* because of these properties. Here, correct rejections produce a component with greater negative amplitude than hits. Though amplitude can vary with item recognition confidence (Woodruff et al., 2006; Yu & Rugg, 2010), the FN400 typically shows no differences between recognizing varying amounts of episodic information (Curran, 2000; Mecklinger, 2006; Rugg & Curran, 2007); however, this is not always the case, as is discussed below.

Some researchers have interpreted the FN400 effect as related to conceptual priming (Lucas, Voss, & Paller, 2010; Paller, Voss, & Boehm, 2007; Yovel & Paller, 2004). Specifically, they posited that test probe stimuli that are conceptually similar to those observed during the study period will produce an attenuated FN400 component compared to the component for conceptually different stimuli. However, others have contradicted this perspective by varying the amount of conceptual priming under conditions in which either recollection or familiarity should contribute to the recognition of stimuli (e.g., Stenberg, Hellman, Johansson, & Rosén, 2009; Stenberg, Johansson, Hellman, & Rosén, 2010). FN400 effects are also seen under conditions when there is no conceptual information to encode and instead there is only a perceptual congruency between the study and test presentations (Groh-Bordin, Zimmer, & Ecker, 2006; Speer & Curran, 2007).

Some research has focused on the nature of the encoding processes that determine whether source information and associations can be recognized via familiarity. According to this perspective, associations can be recognized through the familiarity process when study conditions encourage the storage of *unitized* item–source (or item–item) associations that are bound together within a single trace, whereas *non-unitized* associations can only be recognized through recollection (Diana et al., 2007, 2008; Montaldi & Mayes, 2010; Quamme et al., 2007). Depending on the encoding instructions and/or mental encoding processes, an item and its source features (or an associated item) can either unitize into a single bound representation or they can be encoded as unbound, non-unitized representations that are associated in memory. For example, Quamme et al. (2007) manipulated the unitization of word pairs by either promoting or discouraging unitization through different encoding instructions. They found that the patients, who were found to have impaired recollection but preserved familiarity due to medial temporal lobe damage and thus were using only familiarity-based memory, remembered