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The picture superiority effect in recognition memory: A developmental study using the response signal procedure

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ABSTRACT

Items studied as pictures are better remembered than items studied as words even when test items are presented as words. The present study examined the development of this picture superiority effect in recognition memory. Four groups ranging in age from 7 to 20 years participated. They studied words and pictures, with test stimuli always presented as words, and time to respond to test stimuli was manipulated. The picture superiority effect showed a clear developmental trend. In the condition in which participants had ample response time, a significant picture superiority effect appeared in all but the youngest group. With short response time, a significant picture superiority effect appeared only among 11- and 20-year-old groups, while a significant reverse of the picture superiority effect was detected in the youngest group. These results were interpreted as suggesting that different memory processes (familiarity and recollection) contribute differently to the picture superiority effect at different stages of development.

1. Introduction

The picture superiority effect in recognition memory tasks refers to the observation that items studied as pictures are better remembered than items studied as words even when targets are presented as words during the testing phase (Mintzer & Snodgrass, 1999; Paivio, 1971). While this robust effect has been extensively studied in adults, very limited knowledge is available about its developmental

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trajectory. Borges, Stepnowsky, and Holt (1977) found that, unlike adults, 4th–6th graders did not show the effect. Unfortunately, however, recognition memory for targets followed their free recall, making it difficult to evaluate the effect of development on the picture superiority effect. The present study is intended to fill this gap. We employed the response signal methodology (Boldini, Russo, Punia, & Avons, 2007) and relied on the theoretical framework provided by dual-process models of memory to guide our predictions.

1.1. A dual-process account of the picture superiority effect in recognition memory

Global matching models (Clark & Gronlund, 1996) invoke a single process to support recognition memory. Recognition decisions are made on the basis of a continuous index of memory strength, familiarity. When a test item exceeds the individual's criterion of memory strength, the stimulus is judged as old; otherwise it is deemed new.

A second class of theories—so-called dual-process models (Diana, Reder, Arndt, & Park, 2006; Yonelinas, 2002)—maintain that a single continuous index such as familiarity is insufficient. Recognition memory can better be accounted for by two processes: the continuous index of strength (familiarity) and a second—recollection, a recall-like process based on recollection of specific qualitative information about the prior occurrence of a target (Jacoby, 1991; Mandler, 1980, 2008). Although differences exist between dual-process models (Mandler, 2008), familiarity is considered to be a rapid, automatic process, sensitive to manipulations of the perceptual features of target items (Lamberts, Brockdorff, & Heit, 2002), while recollection is considered to be a slower, intentional process. Empirical evidence supports the view that recollection is sensitive to manipulations affecting semantic or conceptual encoding, such as level of processing (Boldini, Russo, & Avons, 2004; Ghetti & Angelini, 2008). Furthermore, the use of event-related brain potentials (ERPs) in the study of recognition memory has revealed an early ERP component, at about 300–500 ms, associated with familiarity, and a later component, at about 400–800 ms, associated with recollection (Curran, 2000; Rugg & Curran, 2007).

Boldini et al. (2007) used the response signal procedure to assess the contribution of recollection and familiarity in supporting recognition memory for items studied and tested in either the same or different format (picture–word vs. word–word). In the response signal procedure participants are presented with individual items at test, either studied or new, each followed by a response signal. The response signal indicates the participant must promptly decide whether or not the stimulus is old. Manipulating the interval between test stimulus and response signal allows control of the amount of time available to retrieve the target. Therefore, this technique can be used to plot increments in recognition accuracy as a function of time available to process test stimuli. Because familiarity and recollection processes are presumed to operate at different rates, one critical manipulation is to regulate the time allowed for retrieval prior to decision. On the premise that familiarity is a fast-acting process and recollection a slow-acting process (Mandler, 1980, 2008), it should be possible to trace their contribution to recognition memory by assessing the effect that different variables, expected to selectively influence these two processes, have on recognition accuracy at short and long response times.

Boldini et al. (2007) reasoned that if a perceptually based familiarity process mainly supports recognition memory at short response deadlines, changing the format in which items were presented between study and test should negatively affect recognition accuracy. Consistent with this rationale, a picture 'inferiority' effect was detected at short response-time conditions (studied pictures were less well recognised than studied words), indicating that familiarity primarily supported recognition memory when adults have limited time to process test items. At longer response times, the standard picture superiority effect emerged (studied pictures were better remembered than studied words). The encoding of distinctive sensory/perceptual features of pictures is considered to be at the root of the picture superiority effect (Nelson, 1979). Hence, the distinctive sensory/perceptual features of studied pictures appeared to be more available at long response times. On the basis of this result, Boldini et al. (2007) argued that the "presentation of a target word at test does not necessarily elicit the corresponding studied picture with its distinctive features. Therefore, if it does, this may be regarded as recollection" (p. 122). The picture superiority effect is thus associated with recollection of distinctive