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Brief Report

# The effects of exposure to dynamic expressions of affect on 5-month-olds' memory

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ABSTRACT

The purpose of this study was to examine the behavioral effects of adults' communicated affect on 5-month-olds' visual recognition memory. Five-month-olds were exposed to a dynamic and bimodal happy, angry, or neutral affective (face–voice) expression while familiarized to a novel geometric image. After familiarization to the geometric image and exposure to the affective expression, 5-month-olds received either a 5-min or 1-day retention interval. Following the 5-min retention interval, infants exposed to the happy affective expressions showed a reliable preference for a novel geometric image compared to the recently familiarized image. Infants exposed to the neutral or angry affective expression failed to show a reliable preference following a 5-min delay. Following the 1-day retention interval, however, infants exposed to the neutral expression showed a reliable preference for the novel geometric image. These results are the first to demonstrate that 5-month-olds' visual recognition memory is affected by the presentation of affective information at the time of encoding.



At least since the time of Ebbinghaus philosophers and scientists have been interested in the behavioral and neurophysiological bases of memory. One factor that has been shown to influence memory in adults and children is emotion (Baker-Ward, Eaton, & Banks, 2005; Levine & Edelstein, 2009).

Research with adults demonstrates that emotional events, both positive and negative, are recalled with greater frequency and accuracy than affectively neutral events (Levine & Edelstein, 2009). While emotional events are recalled with greater frequency than neutral events, research is mixed regarding whether adults show more accurate recall of positive events (e.g., Breslin & Safer, 2011; Matlin and Stang, 1978) or negative events (Kensinger, Garaoff-Eaton, & Shacter, 2006). Research also demonstrates that in some contexts experienced emotional valence enhances, or focuses attention, thus improving memory for the target event (Hadley & MacKay, 2006; Levine & Burgess, 1997; MacKay & Ahmetzanov, 2005), and impairs memory for the peripheral attributes of an event (Christianson & Loftus, 1991; Christianson, Loftus, Hoffman, & Loftus, 1991). While differences and discrepancies exist within the adult literature, on the whole, however, it is clear experienced emotional events influence adults' memory and that emotional events are recalled more readily compared to non-emotional events.

From a developmental perspective, the question of how emotional events influence children's memories has also received attention. For example, research examining preschoolers' memory for personal events such as a birthday party or a trip to Disneyland reveals that children show reliable memory for these events throughout their childhood (e.g., Fivush, 1993,

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1998). Similarly, and within the context of a traumatic event, e.g., 1992 hurricane Andrew, research demonstrates that 3–4 year-olds recall many features and details associated with the hurricane 3–4 months afterward and some children recalled an even greater number of details surrounding the hurricane 6-years later (Fivush, Sales, Goldberg, Bahrick, & Parker, 2004). Similarly, children between 3- and 13-years of age show reliable memory for a physical injury requiring their hospitalization five years after the injury and three years after their last interview (Peterson & Whalen, 2001; see also Quas et al., 1999). Thus, like adults, children show reliable and robust memory for positive and negative emotional events (Hudson & Fivush, 1991; Ornstein, 1995). More broadly, research also reveals that emotional abuse and neglect have profound effects on children's recognition of affect, their development of memory, and their broader cognitive development (e.g., Pollak, Cicchetti, Hornung, & Reed, 2000; Pollak, Messner, Kistler, & Cohn, 2009; Shackman & Pollak, 2005). Finally, research also demonstrates that infants raised by a mother with depression show impaired memory, impaired associative learning, and delayed cognitive development (e.g., Kaplan, Burgess, Sliter, & Moreno, 2009; Kaplan, Danko, Diaz, & Kalinka, 2011). Thus while much is known regarding adults and children's memories for emotional events (see Blaney, 1986 for a review) including the broader effects of physical and emotional abuse on early memory and cognitive development, little is known about the effects of emotion at the time of encoding on children's or infants' visual recognition memory.

Within the domain of infant memory, research has examined how various contextual and methodological factors such as the pattern printed on a crib lining, color of a mobile, time to process/encode an event, various retention intervals, and the presence or absence of retrieval cues, etc. affect infants' visual recognition memory (see Hayne, 2004; Rovee-Collier, 1999 for reviews). Unfortunately, however, research has not examined the effects of emotional or affective expressions on infants' memory. Given the ubiquitous nature of affect in early communicative and social exchanges, it is important to examine whether and how emotion, or more accurately the context of emotion, at the time of encoding influences infants' memory. It is also necessary to reiterate that much of the literature reviewed above examines how *experienced* or *felt* emotion affects adults and children's memory. The current experiment, however, examines, and as a first step, whether *exposure* to different affective expressions affects infants' memory. Because infants cannot describe or state their experiences, and because we cannot (and should not) intentionally expose them to traumatic events, we are limited in how we can ethically examine the effects of emotion on infants' memory and learning. Still, within their daily life nearly all infants are exposed to positive (i.e., happy) and negative (i.e., angry) expressions of affect and these communicated expressions of affect likely influence their memory. Thus the purpose of this experiment was to examine the behavioral effects of an adult's communicated affect on 5-month-olds' visual recognition memory.

Five-month-olds were chosen because between 5- and 7-months of age, infants show reliable discrimination and recognition of affective expressions as communicated in an adult's face and voice (Flom & Bahrick, 2007; Walker-Andrews, 1997). In addition, and by 3-months of age, infants show reliable visual recognition, i.e., memory, of shape, color, faces, and various geometric patterns following retention intervals ranging from 5-min to 3-months (Bahrick & Pickens, 1995; Fagan, 1971, 1978; Schwartz & Day, 1979).

We assessed memory across retention intervals of 5-min and 1-day. The choice of these two intervals was based on research generated by Bahrick & colleagues' Four-Phase Model of Attention (Bahrick & Pickens, 1995; Bahrick, Hernandez-Reif, & Pickens, 1997). Specifically, this research demonstrates that visual preferences of infants often shift across retention interval from novelty, to null, to familiarity, reflecting changing memory accessibility. Moreover, given sufficient familiarization time for successful encoding, recent memories (following short delays such as 5-min or 1-day) are typically exhibited by a preference for the novel event, intermediate memories (e.g., delays of 1–2 weeks) are exhibited by a null preference, and long-term memories (e.g., delays of 1–3 months) are expressed by a preference for the familiar event (Bahrick, Gogate, & Ruiz, 2002; Bahrick et al., 1997; Bahrick & Pickens, 1995; Flom & Bahrick, 2010). In addition, research from other labs has provided converging evidence for the Four-Phase Model of Attention in both infants and adults (e.g., Barr & Hayne, 2000; Courage & Howe, 1998, 2001; Richmond, Colombo, & Hayne, 2007; Spence, 1996).

## 1. Method

### 1.1. Participants

One hundred twenty 5-month-olds (64 females) participated, with a mean age of 152 days ($SD = 4$ days). Twenty-five additional infants participated; however, their data were not included in the final analysis due to side bias ($n = 12$), fussiness ($n = 10$), prematurity ($n = 2$), and equipment failure ($n = 1$). One hundred sixteen of the one hundred twenty participants were White of Non-Hispanic Origin (96.7%), three were Hispanic (2.5%), and one was Samoan (.8%). All participants were full term infants born no more than 7 days before their due date ($M = -3.6$ days from due date). Parents of the infants were contacted and recruited via telephone.

### 1.2. Stimuli

Stimuli consisted of two dynamic videos of two adult females talking in an angry, happy or neutral voice and four geometric kaleidoscope images. The kaleidoscope or geometric images were created with custom Matlab scripts (Law et al., 2005) and Adobe Illustrator (see Fig. 1). The affective video events consisted of each female actor saying the phrase "Hi baby, look at you." in an angry, happy, or affectively neutral voice while conveying a congruent facial expression. Each actress was