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That's my teacher! Children's ability to recognize personally familiar and unfamiliar faces improves with age



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ABSTRACT

Most previous research on the development of face recognition has focused on recognition of highly controlled images. One of the biggest challenges of face recognition is to identify an individual across images that capture natural variability in appearance. We created a child-friendly version of Jenkins, White, Van Montford, and Burton's sorting task (*Cognition*, 2011, Vol. 121, pp. 313–323) to investigate children's recognition of personally familiar and unfamiliar faces. Children between 4 and 12 years of age were presented with a familiar/unfamiliar teacher's house and a pile of face photographs (nine pictures each of the teacher and another identity). Each child was asked to put all the pictures of the teacher inside the house while keeping the other identity out. Children over 6 years of age showed adult-like familiar face recognition. Unfamiliar face recognition improved across the entire age range, with considerable variability in children's performance. These findings suggest that children's ability to tolerate within-person variability improves with age and support a face-space framework in which faces are represented as regions, the size of which increases with age.

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Introduction

Adults are experts in face recognition (see Maurer, Le Grand, & Mondloch, 2002). They can recognize individual faces at a glance and are able to do so under poor lighting conditions, across variability in expression and point of view, and even after faces have aged several years. Adults' expertise has been attributed to norm-based coding (Rhodes, Jeffery, Taylor, Hayward, & Ewing, 2014; Valentine, 1991), holistic processing (Hole, 1994; Young, Hellawell, & Hay, 1987), sensitivity to feature shape and spacing (Freire & Lee, 2001; Mondloch, Le Grand, & Maurer, 2002), and specialized neural mechanisms (e.g., Allison, McCarthy, Nobre, Puce, & Belger, 1994; Bentin, Allison, Puce, Perez, & McCarthy, 1996; Kanwisher, McDermott, & Chun, 1997). At what age face recognition and the underlying mechanisms become adult-like is a matter of ongoing debate.

To date, the focus has been on the development of underlying mechanisms rather than an absolute measure of children's face recognition per se. Qualitatively, the mechanisms underlying face recognition appear to be adult-like by early childhood. Holistic processing, most directly measured by the composite effect whereby perception of one half of the face (e.g., the top) is influenced by the other half (Hole, 1994; Young et al., 1987), is evident by 4 to 6 years of age (e.g., de Heering, Houthuys, & Rossion, 2007; Macchi Cassia, Picozzi, Kuefner, Bricolo, & Turati, 2009; Mondloch, Pathman, Maurer, Le Grand, & de Schonen, 2007). Evidence from the part-whole task, whereby recognition of a face part (e.g., Joe's eyes) is more accurate when the part is presented in the context of the face than when presented in isolation, is consistent with early emergence of holistic processing (Pellicano & Rhodes, 2003; Tanaka, Kay, Grinnell, Stansfield, & Szechter, 1998). Likewise, young children are sensitive to feature shape and spacing (e.g., Baudouin, Gallay, Durand, & Robichon, 2010; Gilchrist & McKone, 2003; Macchi Cassia, Turati, & Schwarzer, 2011; McKone & Boyer, 2006; Mondloch & Thomson, 2008; Mondloch et al., 2002; Pellicano, Rhodes, & Peters, 2006) and show adult-like patterns of norm-based coding (Anzures, Mondloch, & Lackner, 2009; Hills, Holland, & Lewis, 2010; Jeffery et al., 2010; Nishimura, Maurer, Jeffery, Pellicano, & Rhodes, 2008; Short, Hatry, & Mondloch, 2011), a process by which each face is individuated based on how much it deviates from an average or internal norm.

What continues to be debated is the extent to which there is quantitative improvement in face processing during childhood. Some researchers (Crookes & Robbins, 2014; McKone, Crookes, Jeffery, & Dilks, 2012; Weigelt et al., 2014) argue for quantitative maturity in face perception by 5 years of age, with any further improvements being attributed to general cognitive development. Others (de Heering, Rossion, & Maurer, 2012; Short, Lee, Fu, & Mondloch, 2014; Tanaka et al., 2014) argue that quantitative improvements in face processing continue beyond this age. For example, Short and colleagues (2014) showed that norm-based coding continues to be refined after 5 years of age.

Although understanding the development of the processes underlying face recognition is of theoretical importance, recent developments in the field of adult face perception highlight an aspect of face recognition that has been largely ignored in the literature—the ability to recognize a face's identity across a set of images that incorporate natural variability in appearance (Burton, 2013). The vast majority of studies investigating face recognition in adults and children have used tightly controlled stimuli. For example, Mondloch, Geldart, Maurer, & Le Grand (2003) and Mondloch et al. (2002) created a carefully controlled set of stimuli in which all images were taken from the same distance, with the same camera, and under identical lighting conditions. Hair was covered with surgical caps, clothing was covered with a cape, and blemishes were removed. Presenting such images minimizes the observer's ability to use non-face cues to identify and provides important information about our ability to discriminate between images/identities; however, it ignores the ability to recognize identity in natural images across which appearance varies naturally. This aspect of face recognition is crucial for daily interactions. It allows us to recognize our neighbor when she returns disheveled from a camping trip or our uncle after several years of aging.

In a seminal article by Jenkins, White, Van Montfort, and Burton (2011), adults were given 40 photographs and asked to sort them into piles such that each pile contained all of the images of one person. Images were downloaded from the Internet and incorporated natural variation in appearance (in hairstyle, lighting, expression, viewpoint, and makeup). Participants were not told that there

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