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Recognizing the same face in different contexts: Testing within-person face recognition in typical development and in autism

Louise Neil [a,*], Giulia Cappagli [a,b], Themelis Karaminis [a], Rob Jenkins [c], Elizabeth Pellicano [a,d]

[a] Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London WC1H 0NU, UK
[b] Istituto Italiano di Tecnologia, 16163 Genova, Italy
[c] Department of Psychology, University of York, York YO10 5DD, UK
[d] School of Psychology, University of Western Australia, Crawley, Perth, Western Australia 6009, Australia

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ABSTRACT

Unfamiliar face recognition follows a particularly protracted developmental trajectory and is more likely to be atypical in children with autism than those without autism. There is a paucity of research, however, examining the ability to recognize the same face across multiple naturally varying images. Here, we investigated within-person face recognition in children with and without autism. In Experiment 1, typically developing 6- and 7-year-olds, 8- and 9-year-olds, 10- and 11-year-olds, 12- to 14-year-olds, and adults were given 40 grayscale photographs of two distinct male identities (20 of each face taken at different ages, from different angles, and in different lighting conditions) and were asked to sort them by identity. Children mistook images of the same person as images of different people, subdividing each individual into many perceived identities. Younger children divided images into more perceived identities than adults and also made more misidentification errors (placing two different identities together in the same group) than older children and adults. In Experiment 2, we used the same procedure with 32 cognitively able children with autism. Autistic children reported a similar number of identities and made similar numbers of misidentification errors to a group of typical children of similar age and ability. Fine-grained analysis using matrices revealed marginal group differences in

* Corresponding author.
E-mail address: l.neil@ioe.ac.uk (L. Neil).

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overall performance. We suggest that the immature performance in typical and autistic children could arise from problems extracting the perceptual commonalities from different images of the same person and building stable representations of facial identity.

Introduction

Face identity recognition is a complex skill performed rapidly and seemingly effortlessly by mature adults. The ability to discriminate between faces is present very early in development (Field, Cohen, Garcia, & Greenberg, 1984) and improves markedly between early childhood and adolescence (Bruce et al., 2000; Carey, Diamond, & Woods, 1980; Ellis, 1992; Mondloch, Geldart, Maurer, & Le Grand, 2003). Yet the emergence of adult face expertise follows a protracted developmental trajectory, with performance on tests of unfamiliar face recognition not approaching maturity until well into adulthood (Germine, Duchaine, & Nakayama, 2011; Susilo, Germine, & Duchaine, 2013). Much research has focused on the mechanisms underlying this lengthy course of development, including holistic, configural, and norm-based coding abilities (Crookes & McKone, 2009; Jeffery, Read, & Rhodes, 2013; Mondloch, Le Grand, & Maurer, 2002; Mondloch et al., 2003; Pellicano & Rhodes, 2003; Pellicano, Rhodes, & Peters, 2006; Taylor, Batty, & Itier, 2004; Turati, Sangrigoli, Ruel, & de Schonen, 2004), which continue to be the subject of much debate (McKone, Crookes, Jeffery, & Dilks, 2012).

This research, however, has focused on individuals' abilities to tell *different* faces apart (referred to here as *between-person* face recognition) or to match an image that differs in one experimentally manipulated way, such as facial expression or viewpoint, to a target image of the same identity (Bruce et al., 2000; Ellis, 1992; Mondloch et al., 2003; Sporer, Trinkl, & Guberova, 2007). Consequently, existing research cannot explain how we recognize the same "real" face in different contexts (Burton, 2013). Only one identified study has investigated individuals' ability to recognize the *same* identity across several naturally varying images of the same face (referred to here as *within-person* face recognition). Working on the assumption that muscular movement, lighting, resolution, and depth of contrast can lead to considerable variability in photographs of the same face, Jenkins, White, Van Montfort, and Burton (2011) gave adult participants 20 naturally varying images each of two unfamiliar Dutch celebrities sourced from the Internet and asked them to sort the photographs by identity. No participant arrived at the correct solution of two identities. In fact, the median solution was 7.5 identities, and solutions ranged considerably from 3 to 16. These findings suggest that adults find it extremely challenging to process the wide variability in "real" photographs of the same (unfamiliar) face.

The mechanisms necessary for the difficult task of within-person face recognition are as yet unknown, but it is possible that an averaged representation of facial identity, central to several models of between-face identity recognition (Bruce & Young, 1986; Burton, Jenkins, Hancock, & White, 2005; Valentine, 1991), plays a crucial role. According to norm-based coding models (Leopold, O'Toole, Vetter, & Blantz, 2001; Rhodes & Jeffery, 2006), a viewer creates an internal representation of an average face based on all of the different faces to which that particular individual has been exposed. Accurate between-person face recognition occurs through the positioning of facial identities as vectors from this norm in a multidimensional face space (Valentine, 1991). Burton et al. (2005) further proposed that a "population mean" is calculated for each *separate* facial identity and updated after every encounter to improve reliability. Successful within-person face recognition, therefore, may require a particularly fine-grained norm-based coding system in which an averaged internal representation is created separately for each facial identity. New images of the same face may then be coded as deviations from that particular identity's "norm." If judged to be close enough in multidimensional face