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Understanding how Unfamiliar Faces become Familiar:

Introduction to a Special Issue on Face Learning

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Introduction

The identity information that is carried by faces allows us to recognize the people around us, thereby providing fundamental structure to our interpersonal interactions. In the eye of the beholder, this facial identity information is carried on a continuum (see Clutterbuck & Johnston, 2002, 2004). On one end of this continuum are the faces of unfamiliar people, that we have only seen briefly - perhaps in only a single photograph. On the other end of this continuum lies the recognition of highly familiar people, such as family, friends, and colleagues, or famous people to which we are exposed extensively through various media. These familiar faces were, of course, at some point also unfamiliar to an observer. And, as the people that are familiar to one person are inevitably unfamiliar to someone else, both familiar and unfamiliar face recognition can be performed on the exact same visual stimuli (see, e.g., Armann, Jenkins, & Burton, 2015; Ritchie, Smith, Jenkins, Bindemann, White, & Burton, 2015). In this sense, familiar and unfamiliar face processing are clearly linked. However, increasing familiarity with a face exerts a transformational effect on the cognitive representations that underpin this process. As a consequence, the identification of unfamiliar and familiar faces is characterised by different properties (for reviews, see Hancock, Bruce, & Burton, 2000; Johnston & Edmonds, 2009).

To illustrate, familiar faces can be recognized quickly and accurately (see, e.g., Bruce, Carson, Burton, & Kelly, 1998; Bruce & Valentine, 1985), and over intervals of many years (Bahrick, Bahrick, & Wittlinger, 1975). They can also be recognized without conscious awareness (Morrison, Bruce, & Burton, 2000) or explicit memory (Jenkins, Burton, & Ellis, 2002), in the visual periphery (Bindemann, Jenkins, & Burton, 2005; Bindemann, Jenkins, & Burton, 2007), and from partial (Brunas, Young, & Ellis, 1990; Johnston, Barry, & Williams, 1996), degraded (Demanet, Dhont, Notebaert, Pattyn, & Vandierendonck, 2007; Lander, Bruce, & Hill, 2001), and distorted images (Bindemann, Burton, Leuthold, & Schweinberger,

2008; Hole, George, Eaves, & Rasek, 2002). The sum of evidence therefore suggests that the recognition of familiar faces is remarkably robust, even under challenging conditions.

By contrast, unfamiliar face identification is highly error prone, even under seemingly good conditions. When observers are asked to identify a target face from a concurrent lineup of ten possible matches, accuracy is typically at approximately 70% (Bruce et al., 1999; Bruce, Henderson, Newman, & Burton, 2001). Performance remains error-prone when this task is reduced to a simple pairwise comparison, in which observers decide whether two side-by-side faces depict the same person or different people (e.g., Bindemann, Avetisyan, & Rakow, 2012; Burton, White, & McNeill, 2010). This pattern is observed with high-quality images that depict the compared faces in the same frontal view, with a neutral expression, and under good lighting. Moreover, this difficulty is not restricted to photographs, but persists when observers match a live person to a face photograph (Kemp, Towell, & Pike, 1997; Megreya & Burton, 2008; White, Kemp, Jenkins, Matheson, & Burton, 2014) or moving video images (Davis & Valentine, 2009). Thus, unfamiliar face identification appears to be difficult even under optimized conditions.

These differences between familiar and unfamiliar face processing are striking, and the transition of how an unfamiliar face becomes familiar – how it is *learned* – is the topic of this special issue. Understanding face learning requires insight into the nature of the changes that cognitive representations undergo as faces progress along the familiarity continuum. Observers' initial cognitive representations of unfamiliar faces often represent only a "snapshot", or visual pattern, that is restrained by the limited experience with a new face (Longmore, Liu, & Young, 2008; Megreya & Burton, 2006). With increasing exposure to a person across different views, lighting conditions, emotional expressions and so forth, observers can extract more information about their facial appearance. This must include the stable identity-defining characteristics of a face that are shared across different encounters

(Burton, Jenkins, Hancock, & White, 2005; Jenkins & Burton, 2011), but also how a person can vary in their appearance (Burton, Kramer, Ritchie, & Jenkins, 2015; Jenkins, White, Van Montfort, & Burton, 2011). This information must then be applied in turn to disentangle which aspects of an incoming face stimulus reflect identity information and which are more reflective of the conditions under which a person is encountered. A key attribute of this process must be that a cognitive identity representation emerges with increasing familiarity that is generalizable across many different encounters with a person (Burton et al., 2005; Jenkins & Burton, 2011).

This transition from image-bound to stable and generalizable face representations is addressed by several papers in this special issue. Longmore, Santos, Silva, Hall, Faloyin, and Little (2017) explore observers' ability to generalize recognition to novel images of a learned face by manipulating apparent age. Etchells, Brooks, and Johnston (2017) also focus on generalisation by studying the recognition of newly learned faces across different views. One important aspect of these studies is that initial exposure to a face and its subsequent recognition is assessed across different exemplars. While the other-race effect in face recognition has been researched extensively, studies that contrast learning of same- and other-race faces across such different exemplars are limited. In this special issue, Hayward, Favelle, Oxner, Chu, and Lam (2017) also provide such a demonstration, across naturalistic images that were taken from Facebook photo albums.

Whereas these three papers focus on face recognition across different exemplars, other reports in this special issue examine the benefit of providing such variability at the learning stage. Ritchie and Burton (2017) investigate whether exposure to sets of images that depict people under high-variability, by providing variation in lightning, head angle, expression and age, facilitates face learning compared to image sets in which a person's appearance does not vary as greatly. Jones, Dwyer, and Lewis (2017) provide an interesting

extension of this research, by exploring whether computer-generated views can provide additional images for face learning when multiple naturalistic photographs of a person are not available. Butcher and Lander's (2017) research report then provides insight into whether a similar effect is apparent for familiar faces, by investigating correlations between the amount and distinctiveness of faces' motion and their recognition.

The remaining articles in this special issue focus on a variety of aspects of face learning. Millen, Lorraine, Hillstrom, and Hope (2017) use eye-tracking to examine familiarity, by comparing eye movements to newly learned, famous and personally known faces. A specific aim here is to determine whether eye movements can expose deception, by revealing memory of a face even when observers are overtly lying about its recognition. Estudillo and Bindemann (2017) then use eye movements to examine how observers might update representations of their own face. This is explored with a gaze-contingent procedure in which an onscreen face mimics changes in observers' eye direction to create an effect akin to looking at oneself in a mirror.

We complete this special issue by focusing on our earliest learning experiences of faces, in infants that are only 1- and 3-months old. Sugden and Moulson (2017) explore this issue with a neat procedure, in which infants wear head-mounted video cameras to capture their perspective of faces in the visual field. This footage is then examined to determine how frequently faces are seen alone and up close in the visual field, and in frontal and upright views. Webb, Neuhaus, and Faja (2017) close this special issue with a review of face perception and learning in autism spectrum disorders. This review is wonderfully structured to compare typical and atypical observers in early development, childhood, and adolescence and adulthood, and provides an insightful breakdown of face processing into attention, perception, and learning and memory.

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