Introduction to the special issue on face perception: Experience, models, and neural mechanisms

The human face functions as the communications center for the individual: it is where spoken language is produced, where expressions of emotion, intent, and state of mind are displayed, where identity, race, and age, and signals for in-group vs out-group membership, status, and authority are all visible, and where gender and attractiveness guiding mate selection can be gleaned. Indeed given the many aspects of face perception relevant to survival, the impetus for building the required neural mechanisms and processes may well have shaped the evolution of the human brain. With the tremendous advances in our understanding that have taken place over the last few decades, a special issue of Vision Research devoted to face perception is particularly timely. Contained in this issue is an outstanding collection of recent studies on this topic.

Face perception—though a significant computational feat—feels effortless and instantaneous to the human observer. A typical individual remembers anywhere from many hundreds to several thousand faces, and is able to compare a given face with stored exemplars for recognition within a period of time of the order of tens of milliseconds. What neural mechanisms and processes support such extraordinary performance? Theoretically, a good representation, key to efficient processing, is a projection of a high-dimensional signal onto a low-dimensional space that captures the critical features of that signal in the context of a specific task. A face representation can be conceptualized through semantic dimensions such as facial features, or as a combination of basis functions that span the so-called face-space (Turk & Pentland, 1991; Valentine, Lewis, & Hills, 2016). Elucidating the properties of face representations in the brain has been an important avenue of investigation in the literature, and a topic explored in several studies in this special issue. Several papers examine the use of low-level information for face recognition including orientation pass-bands (Hashemi, Pachai, Bennett, & Sekuler, 2019; Pachai, Bennett, & Sekuler, 2019), chromatic information (Dupuis-Roy, Faghel-Soubeyrand, & Gosselin, 2019), specific geometric features (Meinhardt, Kurbel, Meinhardt-Injac, & Persike, 2019), and limited spatial and temporal information (Hacker, Meschke, & Biederman, 2019; Sadr & Krowicki, 2019). These papers are complemented by studies examining how experience (Civile, Obhi, & McLaren, 2019; Wang et al., 2019), aging (Creighton, Bennett, & Sekuler, 2019), and face familiarity (Abudarham & Yovel, 2019) affect the information used to recognize faces. Additionally, several studies examine the way representations are structured to support robust recognition in typical observers (Guo, Soornack, & Settle, 2019; Redfern & Benton, 2019), special populations (Dwyer, Xu, & Tanaka, 2019) and non-human primates (Rossion & Taubert, 2019).

A fundamental factor that shapes face representations is experience. The types of faces encountered by an individual, as well as the sheer quantity of exposure, determine behavioural outcomes of face perception. Exposure to a limited class of faces can lead to specializations such as the other-race effect (Malpass & Kravitz, 1969; Meissner & Brigham, 2001) and the face inversion effect (Maurer, Grand, & Mondloch, 2002; Yin, 1969), whereas lack of face exposure can lead to diminished (Balas & Saville, 2015, 2017), or even disordered (Oruc, Shafai, & Iarocci, 2018; Schultz, 2005; Weigelt, Koldewyn, & Kanwisher, 2012) face perception. This special issue includes a number of studies examining properties of typical exposure to faces and its effects on face perception in the developing, mature and aging visual system. Several explore novel aspects of the other-race effect (Thornton, Srismith, Oxner, & Hayward, 2019) and how its magnitude can be affected by various interventions (Cavazos, Noyes, & O'Toole, 2019; Proietti, Laurence, Matthews, Zhou, & Mondloch, 2019) and observer variables (Burns, Tree, Chan, & Xu, 2019). In addition to the effects on face recognition of biased exposure to faces (Sunday, Dodd, Tomarken, & Gauthier, 2019), the nature of face exposure (or the face "diet") is taken up by several contributors (Jayaraman & Smith, 2019; Oruc, Shafai, Murthy, Lages, & Ton, 2019; Sugden & Moulson, 2019).

Finally, several papers in the special issue address the relationship between face recognition and other mechanisms that contribute to person recognition. These include studies examining face and body perception (Buelthoff, Mohler, & Thornton, 2019; Pinna & Deiana, 2019) as well as the relationship between auditory and visual signals that contribute to face processing (Barry-Anwar, Hadley, & Scott, 2019; Moro, Hoover, & Steeves, 2019).

Together, this collection of papers, spanning a range of theoretical and methodological approaches, addresses exciting and fundamental questions in face recognition. As an accompaniment to these contributions, an overview article (Oruc, Balas, & Landy, 2019) examines, in depth, selected topics drawn from the broad spectrum covered by this special issue.

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