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Review

Person recognition and the brain: Merging evidence from patients and healthy individuals

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ABSTRACT

Recognizing other persons is a key skill in social interaction, whether it is with our family at home or with our colleagues at work. Due to brain lesions such as stroke, or neurodegenerative disease, or due to psychiatric conditions, abilities in recognizing even personally familiar persons can be impaired. The underlying causes in the human brain have not yet been well understood. Here, we provide a comprehensive overview of studies reporting locations of brain damage in patients impaired in person-identity recognition, and relate the results to a quantitative meta-analysis based on functional imaging studies investigating person-identity recognition in healthy individuals. We identify modality-specific brain areas involved in recognition from different person characteristics, and potential multimodal hubs for person processing in the anterior temporal, frontal, and parietal lobes and posterior cingulate. Our combined review is built on cognitive and neuroscientific models of face- and voice-identity recognition and revises them within the multimodal context of person-identity recognition. These results provide a novel framework for future research in person-identity recognition both in the clinical as well as basic neurosciences.

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1. Introduction

The ability to recognize the identity of other persons is a prerequisite for many social interactions in everyday life, and the inability to recognize persons is socially restricting (Gruter et al., 2008; Sasson et al., 2013; Schweich et al., 1992; Valentine et al., 2006). Impairments in person-identity recognition occur due to brain lesions with various aetiologies (e.g., stroke, tumour, or neurodegenerative disease), and psychiatric conditions, or also as selective congenital deficits (Gainotti, 2007a, 2011, 2013a; Gainotti et al., 2009; Gainotti and Marra, 2011; Gruter et al., 2008; Hailstone et al., 2010; Hailstone et al., 2011). Person-recognition disorders can occur selectively for faces, voices, and names as well as a combination of these different features (Gainotti, 2007a; Hailstone et al., 2011; Neuner and Schweinberger, 2000). In patients with brain lesions impairments of person-recognition abilities are relatively common: a behavioural study showed that more than a third of patients randomly selected from a neuropsychological rehabilitation ward was impaired in visual and/or auditory person recognition as compared to preserved object recognition (Neuner and Schweinberger, 2000). Person-recognition deficits due to congenital impairments are also frequent, for example, the prevalence for a congenital face-identity recognition deficit is about 2.5% (Kennerknecht et al., 2006, 2007).

Most of what we currently know about the neural basis of person-identity recognition is based on neuroscientific studies investigating face-identity recognition and its disorders, e.g., prosopagnosia (Bodamer, 1947; McConachie, 1976). Here, standardized testing tools are available (Benton et al., 1994; Duchaine and Nakayama, 2006; Warrington, 1984), which can be used on the clinical ward as well as in experimental neuroscience experiments (Arnott et al., 2008; Fox et al., 2008; Garrido et al., 2009b; Gruter et al., 2008; von Kriegstein et al., 2006). However, recent advances have also been made in our knowledge of voice-recognition mechanisms in healthy participants (Belin et al., 2002, 2004; von Kriegstein et al., 2003; von Kriegstein and Giraud, 2004, 2006) as well as voice-recognition deficits, e.g., phonagnosia (Garrido et al., 2009a; Van Lancker and Kreiman, 1987; Van Lancker and Canter, 1982; Van Lancker et al., 1989). Recognition of other persons based on seeing their faces or hearing their voices is often considered successful when the name of the person is recalled (Bruce and Young, 1986). Names can, however, also be used as input information to recognize a person: for example, when we hear the name “Barack Obama”, we can immediately recall his face, voice, and person-related semantic information.

The aim of the present work is to advance our knowledge of the mechanisms of person-identity recognition by closing two major gaps in the literature. First, a systematic link between knowledge gained from patient studies and meta-analytic evidence from neuroimaging studies on healthy people is missing. Although excellent reviews on patient studies and descriptions of neuroimaging studies on face (Gainotti, 2007a,b, 2011; Gobbini and Haxby, 2007; Gross and Sergent, 1992; Stone and Valentine, 2003) and voice (Badcock and Chhabra, 2013; Belin et al., 2004) recognition exist, recent developments to analyse neuroimaging studies with meta-analytic techniques allow us to revisit and enrich the current understanding of person-identity recognition in the human brain. Closing the gap between patient studies and neuroimaging studies on healthy people would be important for making causal claims about specific activations found consistently in the neuroimaging literature. Second, person-identity recognition is essentially multimodal; however a systematic review of multimodal impairments in patients and multimodal neuroimaging investigations is missing. Here, we integrate the evidence of studies investigating person-identity recognition based on different modalities, i.e., faces, voices, names, and biographical information. Currently it is unclear whether some of the modality-specific networks overlap and how different modalities are integrated to afford recognition of famous, familiar, and unfamiliar persons (Blank et al., 2011; Gainotti et al., 2008, 2009; von Kriegstein and Giraud, 2006). For instance, recently an anterior face patch in the human brain that codes face identity has been reported (for review see Von Der Heide et al., 2013), however it is unknown whether the same area might also code identity in other modalities, like voice identity. A multimodal perspective on person-identity recognition is largely missing, but would be important for understanding the person-identity recognition network as a whole and the associated person-identity recognition impairments (Gainotti, 2013a). To

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