Research report

The neuropsychology of first impressions: Evidence from Huntington's disease

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ABSTRACT

Impairments of emotion recognition have been widely documented in Huntington's disease (HD), but little is known concerning how these relate to other aspects of social cognition, including first impressions of traits such as trustworthiness and dominance. Here, we introduce a novel and sensitive method to investigate the ability to evaluate trustworthiness and dominance from facial appearance, with control tasks measuring ability to perceive differences between comparable stimuli. We used this new method together with standard tests of face perception to investigate social cognition in HD. We found that a subgroup of people with HD was impaired at perceiving trustworthiness and dominance, and that perceiving trustworthiness and dominance were correlated with impaired facial expression recognition. In addition, we used diffusion tensor imaging (DTI) to provisionally identify candidate brain regions associated with social cognition by contrasting regional functional anisotropy (FA) measures between subgroups of HD participants showing normal or impaired perception of trustworthiness and dominance, and by correlating these regional brain abnormalities with behavioural performance on tests of emotion recognition. In this way we show for the first time alterations in perception of trustworthiness and dominance in people with HD and link these to regions which may map the boundaries of the social brain. The pattern of breakdown seen in this neurodegenerative disease can thus be used to explore potential inter-relationships between different components of social cognition.

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1. Introduction

Huntington's disease (HD) is a hereditary, progressive neurodegenerative disorder, caused by a single gene mutation on chromosome 4. The neuropathology of HD is widespread and variable, affecting predominantly the basal ganglia, but other cortical regions as well, albeit to a lesser extent. The disorder is characterised by involuntary choreiform movements, cognitive deterioration (Dumas, van den Bogaard, Middelkoop, & Roos, 2013; Papoutsi, Labuschagne, Tabrizi, & Stout, 2014; Paulsen, 2011), affective disturbances (Duff, Paulsen, Beglinger, Langbehn, & Stout, 2007; Sprengelmeyer, et al., 2014), and impaired emotion processing (Rees, et al., 2014; Sprengelmeyer, Schroeder, Young, & Epplen, 2006; Sprengelmeyer, et al., 1996).

Facial emotion recognition has been the most widely studied aspect of social cognition in HD. A number of studies have found a disproportionately severe deficit in disgust recognition in the pre-symptomatic (Gray, Young, Barker, Curtis, & Gibson, 1997; Hennenlotter, et al., 2004; Sprengelmeyer, et al., 2006) and symptomatic stages of the disorder (Rees, et al., 2014; Sprengelmeyer, et al., 1996; Wang, Hoosain, Yang, Meng, & Wang, 2003), and there are findings indicating that the experience of disgust itself can also be affected (Hayes, Stevenson, & Coltheart, 2007; Mitchell, Heims, Neville, & Rickards, 2005). In these studies, however, the disproportionately severe deficit with disgust is mostly found within the context of more widespread problems in emotion recognition, and especially recognition of anger (Calder, et al., 2010). Some studies however only find a more generalized deficit, with all negative emotions affected (Johnson, et al., 2007; Milders, Crawford, Lamb, & Simpson, 2003).

Although studies of emotion recognition in HD have thus generated mixed findings concerning *which* emotions are most severely affected, all studies find some degree of overall impairment in facial expression recognition. However, social cognition entails more than recognising facial expressions. In particular, in social encounters people make rapid inferences about strangers derived from a multiplicity of cues from their faces, voices, body shapes, posture and gestures. These first impressions cover a wide range of traits that have been most extensively studied in the case of first impressions derived from facial cues. It is now well-established that these impressions are easily created by faces and that they can affect real-life decisions (Castle, et al., 2012; Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2015), but nothing is at present known about how HD affects the ability to form these social trait impressions. This is an important issue both clinically and scientifically. Its clinical importance stems from the fact that people with HD need to rely increasingly on others the further their disease progresses and the more they lose their autonomy. Failure to appropriately interpret social signals and form impressions of others may therefore negatively affect both people with HD and their carers. Scientifically, the importance lies in the possibility of using the pattern of breakdown seen in a neurodegenerative disease to investigate the inter-relationships between different abilities involved in social cognition. This tactic of investigating patterns of breakdown in neurodegenerative disorders has been very fruitful in other areas (Hoffman, Meteyard, & Patterson, 2014; Patterson & Hodges, 1992).

The scientific part of this agenda depends heavily on identifying the most appropriate theoretical questions. An important advance in understanding how neurologically normal individuals derive first impressions from facial cues has come from the work of Oosterhof and Todorov (Oosterhof & Todorov, 2008), who used Principal Component Analysis to find the underlying structure of 15 traits commonly perceived in faces. Their analysis showed that these traits could be organised into a two-dimensional space in which the first principal component closely corresponded to perceived trustworthiness while the second principal component was approximated by perceived dominance.

Although Oosterhof and Todorov's (2008) work clearly establishes the usefulness of a dimensional approach to first impressions derived from facial cues, it does not in itself establish where these dimensions come from. An appealing hypothesis is that they relate to fundamental mechanisms of social threat appraisal present in other primate species (Fiske, Cuddy, & Glick, 2007; Olivola, Funk, & Todorov, 2014), whereby conspecifics are evaluated in terms of their likely intention to help or harm (trustworthiness) and their ability to carry out such intentions (dominance). Inferences about trustworthiness and dominance from faces can therefore result in important behavioural responses such as approaching or avoiding a person (Winston, Strange, O'Doherty, & Dolan, 2002).

Against this background, the relation between social trait inferences and facial expression recognition is an interesting question. Although research has often looked separately at facial expression recognition and social inferences from faces, a growing body of evidence points to a possible relationship between both processes, as summarised in the emotion overgeneralisation hypothesis (Montepare & Dobish, 2003). This behaviourally established relationship suggests that facial expression recognition and inferences of trustworthiness may share some of the same neural mechanisms (Mattavelli, Andrews, Asghar, Towler, & Young, 2012; Said, Haxby, & Todorov, 2011). Importantly, trustworthiness ratings of faces by neurologically normal perceivers are particularly low when the faces show expressions of disgust and anger (Sutherland, Young, & Rhodes, in press; Willis, Palermo, & Burke, 2011). These are emotions whose recognition, as noted above, is often particularly affected in HD.

Oosterhof & Todorov's (2008) perspective offers insight into why there might be common neural mechanisms for perceiving facial expressions of emotion and trustworthiness. In particular, the good or bad intentions inferred in evaluating the trustworthiness dimension may be linked either to an overt emotional expression (Secord, 1958; Sutherland, et al., 2013) or to the subtle resemblance of a target's static physiognomy to an emotional expression (Oosterhof & Todorov, 2008). For example, an overt expression of happiness or the subtle resemblance of a neutral face to a happy expression is judged as trustworthy, while an overt or subtle resemblance to an angry expression is judged as untrustworthy (Adams, Nelson, Soto, Hess, & Kleck, 2012; Montepare & Dobish, 2003; Oosterhof & Todorov, 2008; Zebrowitz, Kikuchi, & Fellous, 2007).