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Research Report

The gender you are and the gender you like: Sexual preference and empathic neural responses

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ABSTRACT

Background: Empathy relates to the ability to share the emotions and understand the intentions and emotions of the other. Although it has been suggested that women have superior empathic abilities as compared to men, it is unknown whether it is the gender or the sexual preference of the individual that affects empathy. Given that sexual attraction has been reported to affect social behavior, the present study explored the possibility that sexual orientation affects behavioral measures of empathy as well as empathy related activations.

Methods: Fifty two heterosexual and homosexual women and men were scanned while performing an emotional judgment task involving emotional understanding of a protagonist.

Results: The behavioral and neuroimaging results indicate that empathy is related to the gender as well as the sexual preference of the participant. Individuals sexually attracted to men (heterosexual women and homosexual men) showed greater empathy than subjects attracted to women (heterosexual men and homosexual women). Furthermore, brain imaging data reveal that regions within the temporo-parietal junction (TPJ), showed sensitivity to the sexual orientation of the individual, such that it was activated more in subjects attracted to men than in subjects attracted to women while evaluating the emotional state of the other. Moreover, the activation in the TPJ was found to be correlated with the degree to which subjects were empathizing.

Conclusions: These results suggest that individual differences in empathy are related to the gender as well as the sexual orientation of the subject.

1. Introduction

Social cognition links together a vast array of abilities that help us function appropriately in interpersonal relationships in our everyday lives. Proper function in social circumstances depends, to a great measure, on our successful understanding of the people around us. Empathy is a central mechanism of understanding the other, which helps us sense the other's

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feelings and emotions (Rogers, 1957). Empathy is a multidimensional construct and comprises the cognitive as well as the emotional reactions of individuals to events experienced by other individuals. Thus, empathy may involve reactions such as emotion recognition, perspective taking and emotional contagion which may occur simultaneously or separately (Shamay-Tsoory, 2011).

Empathy and its various constructs have been shown to be sensitive to individual differences, particularly to gender related differences (Schulte-Ruther et al., 2008; Yang et al., 2009; Derntl et al., 2010; Pavlova et al., 2010). Indeed, several studies have supported the view of female superiority in empathy-related tasks, such as decoding non-verbal communication, picking up subtle nuances from tone of voice or facial expression, and judging a person's character (Klein and Hodges, 2001; Hall and Matsumoto, 2004). Although several studies failed to find gender differences in empathy (Bandstra et al., 2011; Roth-Hanania et al., 2011) it has been reported that women score higher than men on self-report measures of empathy (Davis, 1994; Baron-Cohen and Wheelwright, 2004). The findings regarding sex differences in empathy are in accordance with the fact that various psychiatric disorders, such as autism spectrum disease, conduct disorder, and antisocial personality disorder, which are often characterized by impaired empathy, are far more common among men (Chakrabarti and Baron-Cohen, 2006).

Recent meta-analyses have shown that empathy related activations include a series of different brain regions including the anterior cingulate, supplementary motor area and bilateral anterior insula (Fan et al., 2011; Lamm et al., 2011). On the other hand more cognitive aspects of empathy, including metalizing related tasks have repeatedly shown to activate the medial prefrontal cortex (MPFC), the temporo-parietal junction (TPJ), and the superior temporal sulcus (STS) (Frith and Frith, 2003; Vogeley and Fink, 2003; Decety and Lamm, 2007; Schulte-Ruther et al., 2008; Van Overwalle, 2009). Specifically, the TPJ is thought to be important in various social behaviors. The TPJ has a critical role in empathic processing (Cheon et al., 2011) and seems to be engaged in self-reference thoughts (Johnson et al., 2002), mentalizing about the other (Lombardo et al., 2010) as well as in emotion evaluation (Zysset et al., 2002; Winston et al., 2003), and has been shown to respond atypically in autism during mentalizing (Saxe and Wexler, 2005; Lombardo et al., 2011). A common denominator underlying these behaviors may be the integration and comparisons between self and other mental state. Thus, it might be speculated that the TPJ is a key region where the decoupling of self versus other representations occurs. While the TPJ seems to be responsible for self–other decoding, the MPFC appears to be involved in more abstract inferences about self and others. It has been shown that this region is recruited in self-knowledge, person perception, and mentalizing processes, all of which underlie empathy (Decety and Chaminade, 2003; Gallagher and Frith, 2003).

To date, few behavioral and neuroimaging studies (Canli et al., 2002; Bandstra et al., 2011; Lamm et al., 2011; Mercadillo et al., 2011; Roth-Hanania et al., 2011; Chun et al., 2012; Decety and Svetlova, 2012) have investigated gender differences in empathy. While several studies did not find any gender differences (Geangu et al., 2010; Bandstra et al., 2011; Roth-Hanania et al., 2011), some functional imaging studies have found evidence for sex related differences in empathy (Schulte-Ruther et al., 2008; Derntl et al., 2010; Chou et al., 2011). For example, Singer et al. (2006) showed that empathy-related activations are differently modulated in men and women by learned preferences, which are gained through social interactions. In line with this finding, it has also been found that women tend to recruit areas containing mirror neurons, such as the inferior frontal region, more prominently than men (Schulte-Ruther et al., 2008). Hence the question whether gender influences empathy skills is an open one which needs more exploration.

However, no study to date has examined sexual preference of the subject relates to different empathic abilities. Although sexual preference has been shown to be critical to social behavior (Liu et al., 2011), little is known about the relationship between sexual orientation and empathy and its underlying neural mechanism.

Sexual orientation is defined as the degree of sexual attraction to either men or women (Ellis and Ames, 1987). Studies on sexual preference have focused mainly on genes (Liu et al., 2011), prenatal hormones, and brain neuroanatomy (Bem, 1996; Rahman, 2005). It has been suggested that in homosexual men, the interstitial nucleus 3 of the human anterior hypothalamus is more female-like (Le Vay, 1991) and that in homosexual women, the grey matter in the perirhinal cortex, a region associated with social bonding, displays a more male-like structural pattern (Ponseti et al., 2007). Recently, Savic and Lindstrom (2008) demonstrated differences in brain asymmetry and connectivity related to sexual preference. They found that homosexual men showed similar amygdala connectivity patterns to heterosexual women (i.e., connections with the caudate, putamen, and prefrontal cortex), while the pattern of connectivity of homosexual women resembled that of heterosexual men (i.e., connection with the cingulate cortex).

In accordance with these anatomical findings, a considerable amount of personality and behavioral findings have demonstrated that homosexual men are more feminine than heterosexual men and that homosexual women are more masculine than heterosexual women (Haslam, 1997). Homosexual and heterosexual individuals are also found to differ on measures of masculine instrumentality and feminine expressiveness (Lippa, 2000). Furthermore, investigations of cognitive skills have shown that homosexual men demonstrate female-typical responses in cognitive-related tasks, such as spatial location memory, recall of spatial landmarks during navigation, and phonological and semantic fluency (Rahman, 2005), indicating similarities between the brains of heterosexual women and homosexual men.

Collectively, these findings support the possibility that individual differences in empathy may be related not only to gender, but also to sexual preference. If indeed women show higher levels of empathy and homosexual men show similar neural and behavioral patterns, then it is possible that individuals attracted to men (homosexual men, heterosexual women) would show higher levels of empathy than individuals attracted to women (homosexual women, heterosexual men). To the best of our knowledge, no brain imaging study has investigated sexual preference differences in social