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Review

The anatomy of empathy: Vicarious experience and disorders of social cognition

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HIGHLIGHTS

- The anatomy of vicarious experience in animal and human studies is reviewed.
- The ACC gyrus and anterior insula are central to vicarious experience.
- Vicarious experience can rely on both shared and non-shared neural responses.
- Aspects of vicarious experience may be atypical in psychopathy and autism.

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ABSTRACT

Empathy, the ability to vicariously experience and to understand the affect of other people, is fundamental for successful social-cognitive ability and behaviour. Empathy is thought to be a critical facilitator of prosocial behaviour and is disrupted in a number of psychiatric and neurological disorders. Research has begun to uncover the neural basis of such 'vicarious experience', which has been studied as a proxy measure of empathy. Together, these studies have identified portions of the insula and anterior cingulate cortex as critically involved. A key debate is whether overlapping or non-overlapping brain areas respond to personal and vicarious experience. This review will highlight emerging evidence for both types of brain response. Importantly, animal models have suggested that there are central divisions between the anterior cingulate gyrus and anterior cingulate sulcus that may be crucial for understanding social behaviour. Attention to this specific anatomy of vicarious processing could therefore help shed light on the functional profile of empathy. Studies in individuals with psychopathy and autism spectrum disorders have found that vicarious experience is atypical. However, the precise nature of these atypicalities is mixed. Understanding the mechanisms of vicarious experience can enhance our knowledge of the neural basis of empathy and, ultimately, help those with disorders of social cognition and behaviour.

Contents

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1. Introduction

Humans are highly social creatures, living in complex social environments and spending much of their lives interacting with, and thinking about, others. During social interactions, a crucial first step is to perceive events that will have an impact on others. Processing these events is key for empathising and successful social interaction. This includes resonating with others' pain, but also feeling the joy of other people. Studies in the field of social neuroscience have attempted to identify the neural substrates of such 'vicarious experience'. In human studies, overlapping neural responses to events for self and others have often been interpreted as a proxy measure of empathy [1,2].

Empathy is thought to be an important motivating factor for prosocial behaviour [1,3–6] and is altered in a number of psychiatric and neurological disorders including psychopathy and autism [7,8]. Understanding the mechanisms of empathy is therefore not only of scientific interest but, in the long term, could have practical implications for promoting prosocial interactions and helping individuals with disorders of social behaviour.

In this review, the background, definitions and structure of empathy will be addressed. Studies that have examined the neural basis of empathic/vicarious experience will be reviewed and it will be shown that findings support both overlapping and distinct neural responses to personal and vicarious experience. In particular, subdivisions in anterior cingulate cortex and insula are suggestive of relative specificity, as well as overlap, when processing information about others. Finally, the possible implications of the extant evidence base for understanding disorders of social cognition and future directions are critically discussed.

1.1. What is empathy?

The psychologist Edward Titchener first introduced the word "empathy" into the English language over 100 years ago, as a translation of the German word *Einfühlung* ("feeling into"). Whilst there is no complete consensus as to the precise definition of empathy, most theorists agree that empathy is, broadly, the ability to vicariously experience and to understand the affect of other people [1,6,9–11], but see [12] for a different perspective.

An important distinction within the structure of empathy is often made between emotional/affective and cognitive aspects. Affective empathy is commonly understood as an affective state (such as the experience of emotion, pain or reward), caused by sharing the state of another person through observation or imagination of their experience [1,5]. Although an observer's emotional state is isomorphic with that of another person, the observer is aware that someone else is the source of that state [5]. Cognitive aspects of empathy are commonly referred to as perspective taking, mentalising or theory of mind. Combined, these processes enable an observer to understand another person's beliefs, desires and emotions [13]. In this review, both components are seen as important contributors to the experience of empathy (in line with [9]). However, it is important to note that some authors define empathy as comprised only of the "affective" components and label the "cognitive" components as a separate but related construct of "theory of mind" or "mentalising" on the basis that they rely on largely distinct neurocognitive circuits (e.g. [14]).

It is generally agreed that affective empathy should be distinguished from emotion contagion, mimicry, empathic concern, compassion and sympathy [1,9]. Although these processes usually occur in similar contexts they have been distinguished from empathy conceptually. For example, a recent model of empathy, entitled the self-to-other model of empathy (SOME; [9]) highlights that emotional contagion is a key precursor to empathy but does not have to involve a distinction between self and other. Thus, although emotion contagion may be necessary for empathy, and is an instance of a vicarious experience, on its own it is not sufficient due to a lack of self-other distinction. Empathic concern, which is also called 'sympathy' or 'compassion,' involves 'feeling for' the other person [1] and is associated with motivation to alleviate their suffering. Empathic concern is frequently equated with empathy. However, because empathic concern does not necessarily involve any vicarious experience, it is distinguishable from affective empathy.

Various self-report and behavioural measures have been developed to capture variability in empathy. One of the first of these measures, the Interpersonal Reactivity Index (IRI, [15]) has been hugely influential in the field of empathy research. The IRI contains subscales measuring empathic concern, perspective taking, personal distress and fantasy. The perspective taking and fantasy subscales are suggested to measure cognitive empathy, whereas the empathic concern and personal distress subscales are thought to assess affective empathy. However, it is unclear how the different components of the IRI relate to empathy as defined in this review and the field more generally. For example, the fantasy scale contains items such as "I daydream and fantasize, with some regularity, about things that might happen to me" which does not measure feeling or understanding the affect state of another person. The personal distress subscale asks questions about personal responses to emergency situations e.g. "When I see someone who badly needs help in an emergency, I go to pieces." and such responses may involve both empathising and sympathising [16]. Moreover, the IRI possesses no specific measure of vicarious experience, only empathic concern (sympathy), and thus does not measure the conceptualisation of empathy adopted in the current review and in the field more generally (e.g [1,6,9,10]).

To overcome these limitations and to create an instrument that assesses the multidimensional nature of empathy more closely and reflects current definitions of empathy, the Questionnaire of Cognitive and Affective Empathy (QCAE) was developed by Reniers and colleagues [17]. The QCAE is an instrument devised to measure five key components of empathy. In the development of the QCAE, two raters selected items from other commonly used empathy measures (e.g. Hogan Empathy Scale (HES;[18])), Interpersonal Reactivity Index (IRI; Davis, 1983), Balanced Emotional Empathy Scale (BEES;[19]), and Empathy Quotient (EQ; [20]) if they were deemed to measure empathy (see items below). Items deemed to measure other processes (e.g. sympathy) were not included. These items were then subjected to an exploratory factor analysis to identify the underlying structure of their associations and then to a confirmatory factor analysis in a separate sample to confirm the