

# Gender differences in empathy measurement by different methodologies

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**Abstract.** This article reviewed the literature on gender differences in empathy (defined as someone's emotional state causes one to experience what one perceives as a similar emotion). A total of five representative studies are examined according to the method they used to assess empathy, in which some studies used self-report questionnaires, others measured brain activities. All of the researches utilizing self-report questionnaires have consistent results favoring women in terms of empathetic abilities, while studies that measured brain activities concluded no discrepancies in initial empathetic abilities. It is suggested that the self-reports are influenced by social expectations, and discrepancy in results of researches in brain activities were impacted by the number of samples and the ongoing debate concerning the responsibility of particular brain areas for empathetic responses. To conclude, there is little discrepancy in the initial empathetic abilities between males and females. However, due to cultural and social factors, females may be more inclined to show more empathetic behavior.

**Keywords:** Empathy, gender differences, functional magnetic resonance imaging (fMRI), empathy measurement questionnaires.

## 1. Introduction

The definition of empathy has sparked intense debates among scholars, and problems such as non-comparability between research findings and related confusion have ensued. Thereupon, providing a solid definition of empathy before further discussion is imperative as it avoids unnecessary confusion and enhances the specificity and credibility of the article. The fundamental conflict of the empathy definition debate centers around 'cognitive' empathy and 'emotional' empathy (Davis, 1980). 'Cognitive' empathy, also known as theory of mind or mentalization, is the capacity to recognize or understand the thoughts or feelings of other people (Fonagy & Allison, 2014). 'Emotional' empathy or affect sharing, on the contrary, involves sharing and experiencing an emotion---similar to what one perceives someone is feeling---because of the emotional state of others. In this literature review, the definition of empathy only concerns 'emotional' empathy, while 'cognitive' empathy is categorized into theory of mind rather than empathy itself. This specificity of the definition is necessary when people consider the cases of conduct disorder and autism spectrum disorder. Teenagers with conduct disorder have an intact capacity for mentalization, while they experience a lack of affect sharing (Roberts, 2020). By contrast, people with autism spectrum disorder experience a deficit in theory of mind while having perfect affect sharing abilities (Santesteban, 2021). It is undeniable that generalizing the definition of empathy through integrating the concepts of theory of mind and affect sharing would result in undue confusion in both cases. Thereupon, the separation of the two concepts is indispensable.

It is commonly acknowledged that empathy is a prosocial behavior that is conducive to the development of human society and motivates us to support individuals in distress. Thus, examinations of the social impact of empathy are fundamental. Empathy serves a valuable function in interpersonal relationships, for it is the driving force of caring and guiding others out of afflictions. Empathizing with others under strain motivates people to consider what might enlighten their mood in similar circumstances, leading to possible consolation or other prosocial behaviors. McDonald and Messinger (2011) re-examined, after the examination of several significant experiments and literature reviews (e.g. Waal, 2008), concluded that empathy is a direct mechanism for motivating prosocial behavior and altruistic behavior. Apart from significant social impacts, empathy left its mark in clinical fields. According to Han and Pappas (2018), the use of empathy had a profound

impact on physician communication styles, improving patient outcomes, diagnostic accuracy, and reducing physician burnout and malpractice risk. These accomplishments are solid evidence of empathy's imperativeness in therapeutic measures and its potential for prospects in future society.

According to Han, 2007, there is a widely held view that women serve to facilitate interpersonal harmony within the family. Consequently, the stereotype of women being more empathetic than men is so prevalent that it is generally recognized as common sense. As the accuracy of this statement remains a question mark, examination and analysis of correlated researches are of paramount importance. It should be underscored that identifying gender discrepancies (if there are any) in empathy paves the way for a wide range of issues. The stereotypical image of women being caring is a good case in point. Instead of entirely ascribing this stereotype to the social environment, evidence that concerns inherent advantages in empathetic abilities could be analyzed. Additionally, as empathy is associated with other social behaviors, sex differences in a myriad social habits could be provided with coherent explanations.

To summarize, the purpose of this literature review is to identify how different methodologies measuring gender differences in empathy could potentially affect research results. A total of five representative studies are examined according to the method they used to assess empathy, in which some studies used self-report questionnaires, others measured brain activities. A comparison is presented in regard to the patterns between studies, the discrepancies in results, and the traits of each methodology. An evaluation is also provided for which method is relatively more objective and reliable to utilize. This would help minimize the methodology-based errors when measuring gender differences in empathy, allowing researchers to achieve more accurate results.

## **2. Researches on different methodologies:**

There are a vast number of methodology psychology researchers has used to test gender differences in empathy, and this literature review would be focused on the comparison of two specific ways: the measurement of brain activities, and self-report questionnaires. These two methodologies are compared because they highly represent the two major categories of research methodology: Subjective and objective.

### **2.1 Subjective**

Researches have shown that women have higher empathetic abilities than men. Endresen et al. (2001) and Rueckert et al. (2008) approached gender difference in empathy by collecting data from different types of self-report questionnaires. Yet, both of them received the same result. Endresen et al. (2001) investigated using the The Empathic Responsiveness questionnaire with a total of 2286 participants, all of which were from 6-9th grades. The results implied a direct trend in girls, in which empathetic responses increased with age for both gender stimuli. In contrast, the boys had shown a clear decreasing trend in empathetic concerns for other boys in affliction, while having increased empathy for girl stimulus with the progression of age. Data further revealed a strong predominance of high-empathetic girls and low-empathetic boys.

Similar results are reached in the study conducted by Rueckert et al. (2008), which used the Mehrabian and Epstein (1972) Empathy Questionnaire (MEEQ) to assess gender differences in empathy. This questionnaire has been proven by numerous previous studies as valid. The score ranges from -132 to 132 and higher scores suggest higher empathetic abilities. According to the results, men and women had a mean score of 21.95 and 40.4795 respectively. Such significant differences lead to the conclusion that men have lower empathetic abilities than women.

Additionally, Michalska et al. (2013) further implied a trend of higher empathy in female than male that is correlated to age. This study measured sex differences in empathetic arousal using self-report dispositional empathy. Participants consist of children aged from 4-17 years old, who answered questionnaires after watching animated clips showing people being hurt. The questionnaire included the Bryant Empathy Scale, the empathetic sadness (ES) scale, and two

questions probing empathetic concern for the victim in the video, ranging from 0-100. Females scored higher than males on the questionnaire, a pattern proportional to age.

## 2.2 Objective

Researches have shown discrepancies in results when it comes to the measurement of brain activities. Despite this, their conclusion remain consistent on the fact that two genders have the same initial empathetic responses. Singer et al. (2006) and Han et al. (2008) are two representative studies using differential experimental designs for the measurement of empathy differences. Singer et al.'s team recruited both male and female volunteers, engaging them in an economic game, in which two confederates played fairly or unfairly. The brain activities of volunteers were then measured with functional magnetic resonance imaging (fMRI) of the peak voxels of activation in bilateral FI as they observed the fair and unfair players receiving pain. The research team found that neural responses in empathy in the brain of both sexes had very small discrepancies towards fair players. Conversely, huge distinctions were found in the unfair scenario. Males had elicited no increase in empathic activity in FI when the unfair person received pain, while females experienced a relatively small reduction in activity. The results further revealed that men showed significantly higher activation than women in left nucleus accumbens, which correlates with stronger desire for revenge. It appears that although male and female have no differences in empathetic abilities, empathetic responses in males are more inclined to be influenced by the social behaviors of others, suggesting further motivational differentials between men and women.

Similarly, Han et al. (2008)'s study found no gender discrepancies in the automatic short-latency empathetic responses by investigating gender differences in empathy in pain utilizing an event-related brain potential study (ERP). It compared the empathetic responses of thirteen male and female adults by showing them pictures of hands that are in painful and neutral conditions while measuring their brain activities that relates to the intensity of observed pain. They were also asked to perform a counting task that directed their attention away from the pain stimulus or a pain judgment task that needed attention toward the pain cues. Both males and females were observed to have a short-latency response at 140ms and a long-latency response at 380ms. Although no gender discrepancies were found in the automatic short latency response, females had stronger modulations by task demands, and their subjective questionnaire of the degree of the pain of others and self-unpleasantness correlated to the ERP amplitude around 140ms. However, there are certain flaws in the experimental design that should be addressed. Firstly, the intensity of the brain activity related to pain when the participants perceive the pictures were strongly correlated with their personal experiences. For instance, one's brain may be found with higher intensity of activity because he/she had experienced similar situations and felt excessive pain. On contrary, others who did not have such experienced may inaccurately estimate the amount of pain that he/she would be feeling in the particular condition. Thus, the result of brain activity was largely influenced by personal experiences instead of purely determined by the empathetic abilities in pain. Secondly, it was not guaranteed that the pictures presented were the only cause of brain activity related to the intensity of pain. Participants may have certain feelings or thoughts that affect their brain activities at that particular moment. Thirdly, the pictures of hands presented did not show obvious pain, which may lead to failure in triggering observations of pain or confusion in the participants. In both of the pictures in the painful scenario, there were no signs of harm (e.g. bruises, blood, etc.) or change that implies pain on the hand, it was only placed underneath an object that was supposed to induce physical harm. Therefore, the design of the pictures may also affect the results.

The fact that there is no gender differences in empathetic abilities were further enhanced by a study conducted by Michalska et al. (2013), in which sex differences in empathetic arousal is measured in children. Participants consist of children aged from 4-17 years old, whose brains were scanned using fMRI while watching animated clips showing people being hurt. The results shown no significant differences in pattern of neural activity between the two sexes. Sex-related

differentials of activation in hemodynamic responses, or affective arousal such as pupillometry, was not observed.

### 3. Discussion

#### 3.1 Patterns and results:

There was a consistent pattern throughout the studies conducted using self-report questionnaires: all of their results revealed that female has higher empathetic abilities than males. On the contrary, although all studies that measured empathy by scanning brain activities found no initial difference in empathetic abilities, various discrepancies in other aspects of results emerged. Singer et al. (2006) suggested motivational differentials between genders, Han et al. (2008) revealed females having a stronger correlation between immediate empathetic responses and answers in self-reports, and Michalska et al. (2013) indicated no further sex differences in physiological reactions. While the experimental design played a fundamental role in such discrepancies, other factors also left an impact on the results. Firstly, one possible factor is the lack of samples. Singer et al. (2006) investigated only 16 men and 16 women. Similarly, in Han et al. (2008), participants only included 13 men and 13 women. A small number of samples tested are likely to induce distinctions among results, as the results may only apply to a small group of people. Secondly, the age of the participants should also be taken into consideration. While Han et al. (2008) and Singer et al. (2006) examined empathy in adults, Michalska et al. (2013) measured empathetic abilities among children from 4 to 17 years old. Such age differences could lead to possible discrepancies since age influences the development of empathy (Zahn-Waxler et al., 1992). Thirdly, logical flaw, such as the one mentioned above by Han et al. 2008, is also a crucial factor that could impact the results.

#### 3.2 Affect on results by methodologies:

The strongest evidence on empathetic abilities favoring females comes from self-report questionnaires (Baron-Cohen and Wheelwright, 2004), with a vast number of studies revealing consistent results (e.g. Cohen & Strayer, 1996, Davis & Franzoi, 1991, Rueckert & Naybar, 2008). However, in a literature review and meta-analysis of Eisenberg and Lennon (1983), it is suggested that while self-report results favored women for empathetic abilities, research utilizing other methodologies, including functional magnetic resonance imaging (fMRI), did not reach such consistent conclusions. They indicated that the results of the self-report questionnaires were affected by the social characteristics of each gender. For instance, women may be more inclined to select the more empathetic items because their social image expects them to be caring and facilitate interpersonal harmony. Therefore, the data may be a result of social factors and gender stereotypes instead of the underlying differential psychological development between females and males. Furthermore, this methodology could be too subjective and there are also risks for people to deliberately over-rate or under-rate themselves in terms of empathetic abilities.

On the other hand, measurements for brain activities may also disturb the accuracy of the results. There are still ongoing debates on which specific part of the brain is correlated to the detection of empathy. While some suggested a special role in the right hemisphere for empathetic abilities (Rueckert and Naybar, 2008), other studies utilizing transcranial magnetic stimulation (TMS) indicated an increased activation of the sensorimotor and somatosensory cortex in empathic responses to others' pain (Avenanti et al., 2005, Bufalari et al., 2007). Researchers employing functional magnetic resonance imaging (fMRI) further suggested that empathic response correlates to brain areas such as the insula and anterior cingulate cortex (ACC) (Singer et al., 2004, Jackson et al., 2005). Therefore, the knowledge concerning the activation of empathetic response in brain areas was still limited, and researchers would have to decide on a particular theory to follow. This resulted in various discrepancies among the results of the measurements for neuropsychological conditions in empathy. Additionally, assessing empathy in neuropsychological conditions limit the number of samples, compared to self-report questionnaires in which samples are easily attainable.

Usually concerned with the measurement of brain activities or other indexes of the human body, the evaluation for neuropsychological conditions have high capital costs and generally takes a long time to complete. Consequently, it is harder for researchers employing this methodology to assess a vast number of samples. For instance, the two researches mentioned that measured brain activities(Han et al. 2008, Singer et al. 2006) both used a small number of samples, which is around 30 adults. In contrast, Endresen et al. (2001) employing the method of a self-report questionnaire had a total sample of 2,286 children. This disadvantage deteriorated the differences and inaccuracies in the results of the research. Furthermore, another inevitable factor impacting the results, particularly for this methodology is that the activation in certain parts of the participants' brains may not be purely a result of the source presented to them. To be more specific, in Han et al. 2008, the observed activities of the brain may not be induced by the picture of the hand. Participants may have certain feelings or thoughts that affect their brain activities at that particular moment. Similarly, this possible error applies to all other research that measures brain activities by presenting participants with a certain source of information.

Although it is undeniable that the methodology of brain activity measurement is limited, its limitations are insignificant compared to the ones in the self-report questionnaires. Firstly, the ongoing debate about the correlation between a specific part of the brain and empathetic response is relatively insignificant, because, in research concerning gender differences in empathy, the most decisive part of the observation is about changes in overall brain activity when participants were presented with sources of information. The overall change in brain activity reveals the effect of the source(e.g. an animation clip of people being hurt) on the participants, indicating their empathetic abilities. Although having profound knowledge of a specific brain area's relation with empathy could validate the research, it is not a fundamental factor that could significantly undermine the results. Secondly, despite a relatively small size of samples(around 30 participants), it is unlikely for the majority of the samples to be so unique that their results lead to momentous deviation in the conclusion. Thirdly, despite there are possibilities for participants to have certain feelings or thoughts that affect their brain activities at that particular moment, it is doubtful that this would occur too frequently and exert a prominent impact on the conclusion. On the other hand, the results of the self-questionnaire research were influenced by social expectations instead of purely determined by the underlying psychological differences. The subjectivity of the research further undermines its credibility as there are too many uncontrollable variables, such as the previous experiences, current emotions, and values of the participant. To conclude, the methodology of the measurement of brain activities is more valid than self-report questionnaires. Therefore, taking into account the results from both methodologies, what can be concluded is that there are little discrepancies in initial empathy between males and females(based on results from brain activities). However, due to cultural and social factors, females may be more inclined to show more empathetic behavior(based on results from self-questionnaires).

#### **4. Limitations of this literature review**

The most significant limitation of this literature is the lack of amount of studies analyzed. With only five studies taken into account, problems such as a lack of comprehensiveness are unavoidable. Despite selecting studies with relatively high citations, flaws in these studies may not be representative enough of all the significant limitations in research in this field. Similarly, the consistency or inconsistency of the results in these five studies may deviate from the general pattern in this area. Secondly, the perspective of this literature review is only limited to methodology. Other aspects worth examining, such as chronological aspects, were not mentioned. Thirdly, this literature review only looked at traditional gender(males and females) differences and did not include an investigation of other genders, such as transgender or gender neutral. Lastly, the cause of gender differences in empathy was not examined.

## 5. Conclusion

This literature review examined five studies that investigated gender differences in empathy in the methodology of brain activity and self-report questionnaires. All research utilizing self-report questionnaires has consistent results favoring women in terms of empathetic abilities, while studies that measured brain activities concluded no discrepancies in initial empathetic abilities. Comparisons and evaluations of the two methodologies are also discussed, concluding that studies that measured brain activities are more valid than self-report questionnaires. At last, this literature review concluded that females are more inclined to show their empathetic characteristics due to social factors, while there is no initial difference in empathetic abilities between males and females.

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