



Review article

How the brain reacts to social stress (exclusion) – A scoping review

Huiying Wang^{a,b,c}, Christoph Braun^{b,d}, Paul Enck^{a,*}^a Department of Psychosomatic Medicine and Psychotherapy, University of Tübingen, Germany^b MEG Centre, University Hospital Tübingen, Germany^c Graduate Training Center of Neuroscience, IMPRS for Cognitive and Systems Neuroscience, Tübingen, Germany^d CIMeC, Center for Mind/Brain Sciences, University of Trento, Italy

ARTICLE INFO

Keywords:

Social exclusion
Cyberball
Neural activity
fMRI
EEG

ABSTRACT

Objectives: The Cyberball paradigm is often used to study social stress by exclusion/rejection. We aimed to review the existing neuroimaging literatures in order to provide an overview of the neurophysiological mechanisms of social exclusion.

Method: Literature search was conducted to identify neurophysiological studies that investigated effects of social exclusion on neural activity using the Cyberball game and the relevant influential factors on these effects.

Results: In total, 42 studies using different neuroimaging methods were considered. Regions of the insula, anterior cingulate cortex, temporal and prefrontal cortex were activated to social exclusion. These neural activities were pronounced at latencies ranging from 200 to 400 ms, and between 400 and 900 ms. Influential factors were identified and categorized as intrinsic and extrinsic factors.

Conclusion: An integrated framework describing neural activities under social exclusion in terms of both, temporal and spatial processes is provided. Furthermore, the summary of influential intrinsic and extrinsic factors may help us to understand the diversity of the processes and may guide clinical therapy of stress related disorders.

1. Introduction

A peer relationship is very important in adolescence and adults. Ostracism and rejection by peers or by significant ones cause social pain (Eisenberger, 2012; Eisenberger et al., 2003). Chronic experience of the social exclusion may also be regarded as a stressful situation, which may lead to development of depression.

A number of studies have used a standardized paradigm called ‘Cyberball game’ to study ostracism (Williams and Jarvis, 2006). In this game, participants believe that they are playing an online ball-tossing game with two players, while these two players are actually programmed. Participants are socially rejected in the so called ‘exclusion condition’, by receiving the ball only a few times and less often than the other players. The ‘exclusion condition’ is always compared with the ‘inclusion condition’, during which participants receive the ball equally often as the other players. This paradigm has been proven reliable and valid to induce feelings of rejection in adults and adolescents (Eisenberger et al., 2003; Williams and Jarvis, 2006). According to a post-game questionnaire with a ‘Need Threat Scale’ and ‘Mood Scale’, participants indicated lower levels of belonging, self-esteem, control and meaningful existence, and also higher distress after completing the

exclusion block as compared to the inclusion block (Williams and Jarvis, 2006; Zadro et al., 2004). A recent published meta-analysis of Cyberball studies showed a fairly large average ostracism effect (Hartgerink et al., 2015).

Technical development in neuroimaging methods allows researchers to investigate how the human brain responds to the exclusion situation during its occurrence rather than after the game, and to explore the mechanisms that underlie the subjective feelings reported after the game. Studies using different methods such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have discovered widely distributed brain regions involved in social exclusion versus inclusion. Regions such as cingulate cortex (the anterior and posterior parts) and insula are activated, which are related to affects and emotions (Bolling et al., 2011a; Masten et al., 2009). Being excluded, these neural activations appear to represent negative emotions of sadness and distress. The activation of the prefrontal cortex (PFC) has been taken as index of attention control and emotion regulation (Sebastian et al., 2011). As yet, one quantitative meta-analysis aimed to explore if the pain matrix was activated by social rejection during Cyberball, by analyzing 12 fMRI studies with a total of 244 participants (Cacioppo et al., 2013). However, the authors stated

* Corresponding author at: Department of Psychosomatic Medicine and Psychotherapy, University Hospital Tübingen, Frondbergstr 23, 72076 Tübingen, Germany.
E-mail addresses: huiying.wang@uni-tuebingen.de (H. Wang), christoph.braun@uni-tuebingen.de (C. Braun), paul.enck@uni-tuebingen.de (P. Enck).

that the evidences from the included studies were not sufficient to reach an unambiguous conclusion. While numbers of studies have provided information about brain activations during social exclusion/rejection, so far results have only been pooled partly, ignoring studies using EEG to a large part. Although fMRI studies have given us a clear insight in specific locations of functional brain regions, they have limitations in measuring precisely the temporal sequence of when neural activations occur.

Therefore, currently we conduct a scoping review on relevant literatures that have conducted neuropsychological measurements such as using fMRI and EEG to investigate the neuronal processes underlying responses to social stress induced by the Cyberball game. Through mapping included studies according to their methodologies and results, we aim to identify a common spatio-temporal pattern of neural activations related to social exclusion and to analyze influential factors modulating neural activations.

2. Method

The current scoping review was guided by the methodological framework proposed by Arksey and O'Malley (2005). The framework outlines a five-stages approach that includes identifying the research question; searching for relevant studies; selecting studies; charting data; and collating, summarizing, and reporting the results.

2.1. Identifying the research questions (stage 1)

We focused on following main research questions in our scoping review: How were the neural activities of social exclusion measured in currently existing literatures? What are the common features of the neural activities across studies? Which factors influence these neural activations?

2.2. Identifying relevant studies (stage 2)

Relevant studies were found by a search in the PUBMED databases. Articles from 1950 to April 2016 were initially identified using the search string “Cyberball”. We only included articles written in English. The first search was undertaken by analyzing titles, abstracts, and the key words describing the articles, to identify studies that met our inclusion criteria. A second search was conducted using citations from all identified reports and relevant review articles.

2.3. Selection of studies (stage 3)

Search results were screened on the basis of the titles and abstracts before full texts were assessed. The abstracts of the retrieved papers were screened for matching the following criteria: (1) the study included participants aged from adolescents to adults; (2) participants can be in different health status such as healthy control (HC), autism spectrum disorder (ASD) and borderline personality disorder (BPD), etc.; (3) the study used methods recording functional brain activity, including fMRI, positron emission tomography (PET), transcranial magnetic stimulation (TMS), magnetoencephalography (MEG), EEG, etc.; (4) the study measured neural responses during the Cyberball game and compared a social rejection/exclusion condition (exclusion block and/or exclusive throw) with an inclusion condition (inclusion block and/or inclusive throw). Those that only analyzed effects of factors on neural response to social exclusion without comparing exclusion with inclusion conditions were not included in our study. All studies that did not meet our criteria were regarded as irrelevant studies.

2.4. Charting data (stage 4)

The following data of the eligible articles were extracted for assessment: first author, year of publication, country focus, type of

measurement method, population characteristics, experimental comparisons, and the primary outcomes measures of interests.

2.5. Collating, summarizing, and reporting results (stage 5)

We synthesized the data according our predefined research questions. The study characteristics were summarized and shown according to country, study method (fMRI/EEG/TMS), study design (within/between-subject design), and experimental comparison. Then, main features of each study results were summarized for each study method respectively.

3. Result

3.1. Study selection and characteristics

The literature search yielded an initial total of 123 citations, 4 of which were identified through other sources. After a first screen of the titles and abstracts of these articles, 52 studies were considered eligible for our review, after excluding 71 studies only had behavioral measurement. The full versions of these articles were reviewed and 10 studies were excluded due to absence of a comparison of neural responses between conditions of exclusion and inclusion. In total, 42 studies remained for data analysis (Fig. 1).

Table 1 illustrates main characterizes of the included studies. Among these studies, neural recording methods focused on EEG ($n = 13$) (Catassi et al., 2013; Cristofori et al., 2015; Crowley et al., 2009, 2010; Gutz et al., 2011, 2015; Kawamoto et al., 2013; McPartland et al., 2011; Sreekrishnan et al., 2014; Themanson et al., 2013; van Noordt et al., 2015; Weschke and Niedeggen, 2013, 2015), fMRI ($n = 28$) (Bolling et al., 2011a, 2011b, 2011c, 2015; Bonenberger et al., 2015; Cascio et al., 2015; Cristofori et al., 2015; Domsalla et al., 2014; Eisenberger et al., 2003, 2007a, 2007b; Gonzalez et al., 2015; Luo et al., 2016; Masten et al., 2011a, 2011b, 2011c; Maurage et al., 2012; Moor et al., 2012; Nishiyama et al., 2015; Onoda et al., 2010; Preller et al., 2016; Puetz et al., 2014; Rudolph et al., 2016; Sebastian et al., 2011; van Harmelen et al., 2014; Will et al., 2015, 2016; Wudarczyk et al., 2015), and rTMS ($n = 1$) (Fitzgibbon et al., 2016) in these studies. Nearly half of the studies were conducted in the USA,

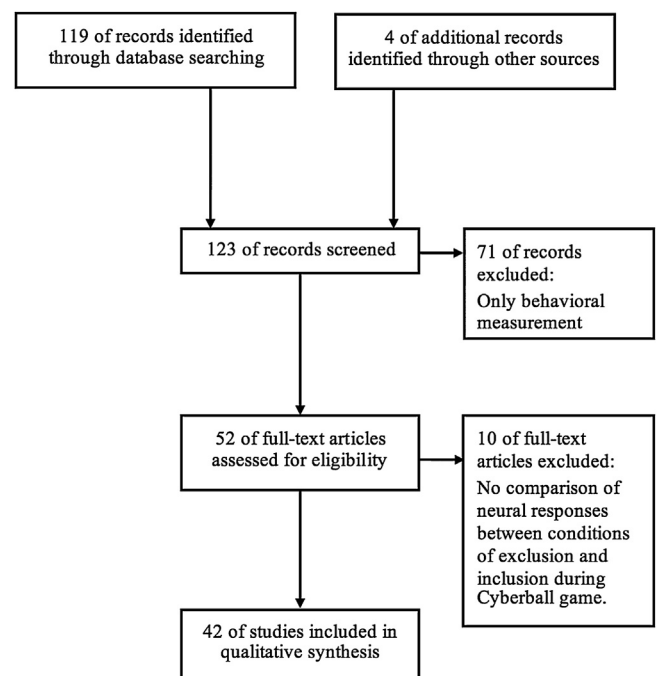


Fig. 1. PRISMA scheme of retrieved literature.

Download English Version:

<https://daneshyari.com/en/article/5043435>

Download Persian Version:

<https://daneshyari.com/article/5043435>

[Daneshyari.com](https://daneshyari.com)