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Fear of missing out (FOMO) is associated with activation of the right middle temporal gyrus during inclusion social cue

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ABSTRACT

Aim of this research was to investigate the neurobiological correlates of fear of missing out in response to the social exclusion and social inclusion cue.

Fear of Missing Out scale (FOMOs), Social Media Engagement Questionnaire (SMEQ), and Attachment Style Questionnaire (ASQ) were administered to twenty-six healthy participants. Afterward, EEG activity was acquired during a visual task showing exclusion and inclusion social images.

Event Related Potentials (ERP) and sLoreta analyses were performed.

In the ERP analyses the main effect of condition was found in temporo-parietal and frontal montages. sLoreta analyses showed a greater intensity of the left secondary somatosensory cortex (BA7) in inclusion compared with exclusion condition and a greater intensity of left temporal-parietal junction (BA41, BA42, BA43) and left prefrontal cortex (BA47) in exclusion *versus* inclusion condition. Moreover, the main finding of correlations analyses was that the FOMOs score was positively correlated with ASQ-need for approval and with right middle temporal gyrus (BA21) only during inclusion condition.

Findings sustain that fear of missing out is associated to a greater sensitivity towards social inclusive experiences rather than social exclusion and with need of belong.

1. Introduction

Internet has become an important tool for education, entertainment, communication and information sharing. Easy of access and Social Networking are two internet aspects that facilitate addictive behavior (Krishnamurthy & Chetlapalli, 2015; Young, 2015).

In particular, in recent years the social media such as Facebook, Instagram, Twitter, Youtube have been very successful, as they allow real-time access of a wide range of online or offline social activities in which the subject might be involved. The extensive use of social media has driven interest in the concept of *Fear of Missing Out (FOMO)* defined as a pervasive preoccupation that the other might be having rewarding experiences from which one is absent and this increases the desire to stay connected with what others are doing (Przybylski, Murayama, Dehaan, & Gladwell, 2013).

The first study about the *Fear of Missing Out (FOMO)*, conducted by Przybylski and colleagues in 2013, showed that the range of age in which the phenomenon is more present is 18–33 and allowed the construction of two self-report scales, *Fear of Missing Out Scale* that measure levels of FOMO and *Social Media Engagement Questionnaire* that measure how individuals use social media in their daily lives. The FOMO is firmly associated with social media engagement, $b = 0.40$, $p < 0.001$ (Bpath) (*ibidem*).

The researches on psychological needs that lead to the social media engagement showed that the need to belong and the need for self-presentation (Mäntymäki & Islam, 2016; Nadkarni & Hofmann, 2012; Seidman, 2013), as well as the avoidance of negative emotional states such as loneliness (Burke, Marlow, & Lento, 2010) and boredom (Lampe, Ellison, & Steinfield, 2007) could favour the use of different social media (Przybylski et al., 2013).

1.1. Fear of Missing Out (FOMO), social pain and social exclusion

The Fear of Missing Out seem to be related to the fundamental need to belong, defined as desire for interpersonal attachments as a fundamental human motivation (Baumeister & Leary, 1995;

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Nadkarni & Hofmann, 2012; Seidman, 2013) that can be hindered by social exclusion. Eisenberger and Lieberman. (2004), using the social exclusion paradigms, explain how the experiences arising from the perception of actual or potential psychological distance from close others or social group can cause "social pain". Social pain arises from unpleasant situations and events that represent a threat to the social relationships (e.g. bereavement, relationship break-up, and exclusion from social activities) and to the attachment system in general (Bowlby, 1982; Novembre, Zanon, & Silani, 2015).

Physical and social pain seem to have a shared system that helps to identify and prevent situations of threat (Eisenberger, Lieberman, & Williams, 2003) Many neuroimaging studies showed the same brain activation in conditions of the social exclusion and physical pain involving the anterior cingulated cortex, insula, prefrontal cortex and secondary somatosensory cortex (Eisenberger et al., 2003, 2007; Burklund, Eisenberger, & Lieberman, 2007, DeWall et al., 2012; Kross, Egner, Downey, Ochsner, & Hirsch, 2007, 2011; Chester, DeWall, & Pond, 2016).

1.2. Background

The exclusion causes cognitive and behavioral changes which have the aim to regulate the individual's belonging status (Kawamoto, Nittono, & Ura, 2014). Recent researches support that people who are excluded by others activate an outer and adaptive system called "social monitoring system" (SMS) (Pickett & Gardner, 2005) that increase perceptive and attentive responses to social exclusion and inclusion cues and social information (Gardner, Pickett, & Brewer, 2000; Pickett, Gardner, & Knowles, 2004; Bernstein et al., 2008; DeWall, Maner, & Rouby, 2009). Prior studies on neuronal correlates of SMS have showed that the brain areas involved are the prefrontal cortex, temporo-parietal junction and precentral gyrus, that are activated during attribution of intention to others and mirror neuron networks involved in social cognition (Beyer, Munte, & Kramer, 2014; Kawamoto et al., 2014; Moor et al., 2012; Powers, Wagner, Norris, & Heatherton, 2013; Will, Crone, & Guroglu, 2015).

Recent studies on social media showed the association between psychological aspects, such as personality traits (Mäntymäki & Islam, 2016), the fundamental needs of belonging, self-presentation (Nadkarni & Hofmann, 2012; Seidman, 2013), motivational and emotional involvement (Przybylski et al., 2013) with the increase of social media engagement. However, there are not studies that investigated the neurobiological correlates of "social monitoring system" in association to social media use or Fear of Missing Out.

The aim of this research was to investigate the neurobiological correlates of Fear of Missing Out in response to the social exclusion and social inclusion cue. The hypotheses was that the fear of missing out is positively correlated with the activation of brain areas related to areas involved in social cognition.

2. Method

2.1. Participants

The research project was approved by the Ethical Committee of the Department of Dynamic and Clinical Psychology of Sapienza University. The study was carried out at the Clinical Neuroscience Lab of the same Department. Twenty-six participants volunteers (12 males and 14 females; age M = 24.0 ± 2.5) took part in the study. All subjects had an adequate level of literacy for the understanding of the questionnaires, declared that they do not use to take drugs and all of them signed informed consent for participation.

After applying EEG data cleaning, the data of twenty participants (11 males and 9 females; age M = 24.1 ± 2.8) were included in the analysis.

2.2. Stimuli

The visual stimuli consisted of 90 color digital still images, 30 for each of the three condition (exclusion, inclusion and neutral), obtained by searching the web.

Specifically, the images of social exclusion showed people outside the peer group, leave aside or desire, while the images of social inclusion showed people having fun, laughing with their peers, family, colleagues or sharing activities with others. Images of the neutral condition showed objects commonly used.

Each image has been edited by Photoshop, made to the size of 400 × 600 px and rendered in black and white, because the colors could have been the distracting elements.

2.3. Psychological questionnaires

Before the EEG recording, the following self-report questionnaires were administered to participants:

- Fear of Missing Out Scale (FoMOs; Przybylski et al., 2013) is a self-administered questionnaire used to measure the fear of being excluded. It consists of 10 items that are rated on a 5-point Likert scale and Individual scores can be computed by averaging responses to all ten items. It is a reliable composite measure ($\alpha = 0.87$ to 0.90). (Przybylski et al., 2013).
- Social Media Engagement Questionnaire (SMEQ) (Przybylski et al., 2013) is a self-administered questionnaire that measure how individual use social media in their daily lives. It consists of 5 items that are rated on an 8-point Likert scale.
- Attachment Style Questionnaire (ASQ; Feeney, Noller, & Hanrahan, 1994) was used in the Italian version (40 items) (Fossati et al., 2003) for the assessment of attachment styles.

The questionnaire consists of 40 items, rated on a 6-point Likert scale, designed to measure five dimensions of adult attachment: confidence (8 items), discomfort with closeness (10 items), need for approval (7 items), preoccupation with relationships (8 items), and relationships as secondary (7 items). The use of the scores is on dimensional scales rather than in discrete categorizations. Internal consistency coefficients of the five dimensions in both clinical and non clinical samples was good (0.64 < Cronbach alpha <0.74) (Fossati et al., 2003).

2.4. Experimental procedure

After administration of the questionnaires, subjects were positioned 80 cm away from a monitor (27 cm, 75-Hz, 1024 × 768) in a quite dimly lit room for the acquisition of their EEG activity during visual task. The visual task was presented from E-Prime software (v. 2.0.8.90; Psychology Software Tools, Inc.; Pittsburgh, PA, USA) and it began with the following instructions: "Now the images will be presented on the screen. Please, pay attention to images trying to make even less possible movements. Press start when you are ready."

Each trial started with a fixation cross displayed for 1000 ms, followed by the stimulus (exclusion vs. inclusion vs. neutral) presented for 2000 ms, with an inter-stimulus interval varying between 400 and 600 ms. A total of 30 trials for condition were presented in a random order (Fig. 1). The experimental task duration was about 6 min.