

It has been recently stressed out that, even in the absence of the objective social isolation markers, one's own perception of mismatch between actual and desired social relationships (perceived social isolation; 'loneliness'; PSI) may have deleterious effects on mental and physical health. Lonelier healthy adults are more likely to experience mental health problems, engage in physical health risk behaviors and be unemployed compared to non-lonely peers. Furthermore, large scale epidemiological studies have established links between PSI and increased likelihood of developing cardiovascular disease or Alzheimer's dementia, and concluded that long-term impact of the loneliness on mortality may exceed many known health-risk factors (e.g. hypertension or obesity). At the same time, in a recent survey of 20 000 adult Americans, nearly half of them (46%) reported sometimes or always feeling alone. Thus, the importance of investigating cognitive mechanisms elicited by perceived social isolation is currently highlighted. It is emphasized that due to the evolutionary significance of social connections, PSI activates a series of processes which are aimed at reconnecting with others (e.g. preferential processing of social over non-social signals). However, as cognitive mechanisms are biased toward self-preservation, mechanisms activated by PSI may decrease one's chances for reconnection by impacting the way one process and interpret social information. For example, one may increase social threats monitoring which may lead to inadequate interpretation of others' intentions and motivations. Furthermore, it is believed that mechanisms elicited by PSI, by increasing focus on self-preservation, reduce one's cognitive resources and prevent one from applying control over automatic response, which could counter biased information processing, e.g. emotion regulation techniques. These cognitive mechanisms were linked to abnormal activity of many brain networks. However, dysregulation of the structure (prefrontal cortex; PFC) which is involved in complex social cognitive processes and control over automatic responses to social threats, is believed to be a main cause of reduced ability to counteract abnormal social cognition by top-down regulation processes in LI. While many studies have examined the differences observed in the spatial patterns of neural activity in loneliness, a little is known about the time course of the neural activity associated with social information processing in lonely individuals. Neurophysiological methods (e.g. electroencephalography event related potentials – ERPs) can be used to study time course of neural activity elicited by external stimuli. This way, specific cognitive processes which are tied to different stages of stimuli processing, can be studied even in the absence of behavioral reaction. Thus, by analyzing the time course of neural activity elicited by social stimuli in lonely and nonlonely individuals, one may indicate which of the processes differentiate one group from another. Furthermore, ERP markers can be used to monitor the effects of the interventions which are aimed to change brain activity by using so called noninvasive brain stimulation methods (NIBS). The aim of the current project is to examine cognitive mechanisms of PSI by investigating the relationship between PSI and neurophysiological markers linked to social threat perception and top-down emotion regulation. Additionally, these markers will be used to investigate the effects of PFC activity regulation with NIBS on emotion regulation techniques in lonely individuals. The project will be divided into two studies. During the first study (Main Study (MS) #1) a group of 150 participants, sampled with regard to the distribution of the PSI scores in Polish population will complete an Emotion Processing and Regulation Task (EPRT) which is based on construing potentially emotion-inducing stimuli in a non-emotional way (e.g. by imagining that the presented negative content is just a scene from the movie), while their EEG and electrodermal activity (EDA) will be recorded. During the tasks participants will be presented with static pictures depicting complex social situations and dynamic actions of two agents, who will be displayed with a limited number of "point-lights" corresponding to the major parts of the body of each person. Stimuli which will be more prone to the PSI impact will be used in MS#2. During the MS#2 a group of 150 individuals, who did not participate in the previous study will be asked to complete two equivalent versions of the ERT, while their brain activity will be recorded via EEG. Sessions will be preceded by either active or inactive (to control for the placebo effect) PFC stimulation provided in a double-blind order. In a half of the participants (n=75) the stimulation will be delivered to the right dlPFC, while the other half of the participants (n=75) will undergo the left dlPFC stimulation, which will allow to establish the impact of the PFC stimulation on the main task outcomes. PSI is currently perceived as a major public health burden. Thus, the results of the current project, which is aimed to deepen the knowledge about the cognitive mechanisms of PSI may have impact on multiple research areas, also outside of the social neuroscience field.