The influence of others' bodily emotion on interpersonal space regulation and its time course in autism

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Background

The distance we interpose between ourselves and others is named interpersonal distance (IPD) and represents the space into which another's intrusion causes a feeling of discomfort (1-2). Given the complexity of our environment, we learned to finely adjust IPD when relevant stimuli come close to us. Accordingly, a myriad of socio-emotional factors has proven to affect social distance (3) and one of these is the emotion conveyed by facial and bodily expressions. However, most of these studies investigated how facial emotions modulates IPD (4), whereas little is known about the role of bodily expressed emotions and the distinct contribution of face and body in spacing distance. Positive or negative connotations of non-verbal social interactions differently modulate individual response at behavioral and psychophysiological level, such as gaze direction and autonomic responses (5,6). Therefore, psychophysiological responses to emotional cues conveyed by the others' body need to be considered for a comprehensive model of interpersonal distance regulation.

Interestingly, recent evidence (7-9) showed that IPD regulation can be altered in a clinical population characterized by a profound social impairment, such as individuals with Autism Spectrum Disorders (ASD). Adopting the Comfort-Distance task, where participants indicate the distance at which they feel comfortable when an unknown adult approaches them, children with ASD have been found to choose a larger IPS compared to controls. Other studies on adult populations showed instead that ASD individuals prefer closer IPS, compared to controls (10-12). Overall, this literature suggests the importance of a better understanding of both the developmental time-course and the factors that can mediate social distance in ASD. Remarkably, not all these studies used the same methodology to assess IPD, which could at least partially account for these different results. To overcome this, a flexible and ecological methodology can be a useful tool to investigate social distancing in both healthy and clinical studies.

Aim

The aim of this proposal is to test the contribution of psychophysiological and behavioral factors underlying the role of emotion regulation on IPD. In particular, the current study will explore differences in social distancing in healthy and clinical populations, such as individuals with Autism Spectrum Disorders (ASD), across ages. Both adults and children with high functioning ASD and healthy age-matched controls will undergo a series of behavioral and physiological measures to assess the emotion-based regulation of IPD.

Declaration of commitment to request ethical approval

Before starting the study, the coordinator of the research project will submit a formal request of approval to the Ethics Committee.

Participants

For each experiment, the participants' sample size has been determined using a freely available sample-size calculating tool (G*Power) with a medium effect size ($\eta 2p = 0.25$) and an alpha power of 0.80. Healthy controls will be recruited according to the following inclusion criteria: no sensory-motor impairments and no history of previous neurological or psychiatric disorders.

Tools

The presence of cognitive impairment will be an exclusion criterion. All patients will be administered to a series of standardized neuropsychological tests, in order to assess several cognitive functions (i.e., attention, executive function and logical reasoning).

Experiment 1a

A group of high functioning Autism Spectrum Disorders (ASD) children (N=20; age range 10-14 yy) and a group of age-matched typical development (TD) children (N=20) will participate in the experiment.

Procedure

As a measure of IPD, we will adopt a Comfort-Distance task performed in immersive VR in which participants will wear an integrated eye-tracker head-mounted display (HMD), and judge their comfortable distance from an adult virtual confederate (avatar) exhibiting Happy, Angry, or Neutral emotions. At the beginning of the trial, the avatar will appear in front of participants and will frontally approach them. Participants will press a button on a controller to stop the avatar at their preferred IPD, i.e., the distance at which they feel comfortable with the avatar. This value will be adopted as an estimation of IPD extent.

To elucidate the role of psychophysiological measures in IPD regulation, gaze direction and autonomic responses will be recorded during the Comfort-Distance task. Gaze direction will be referred to distinct areas of interest (AOI) such as face, trunk, arms and legs. The autonomic responses will be measured by recording the Skin Conductance Response (SCR), the Heart Rate (HR), and Heart Rate Variability (HRV).

Expected Results and Implication

In TD children, we expect a larger distance for Angry and a shorter distance for Happy, as compared to Neutral Avatar. This pattern should in turn be reflected in different patterns of gaze direction as a function of the avatar's emotion. We also expect an increase in autonomic indexes, as assessed by SCR and HR and HRV, as the avatar approaches the participant.

For the ASD clinical population, two scenarios can be predicted: i) they could choose an overall larger IPD than controls, regardless of the avatar's emotion. This would indicate an alteration which does not allow them an appropriate emotion-based regulation of the IPD. ii) Alternatively, although their social distance is altered as they chose a larger IPD compared to controls, ASD participants might exhibit an emotional modulation of IPD: e.g., larger distance for the angry avatar compared to happy/neutral avatar. This pattern would indicate a more subtle and specific deficit in regulation of IPD.

Experiment 1b

A group of individuals with high functioning Autism Spectrum Disorders (ASD) (N=20; adults age range 20-40 yy) and group of age-matched (N=20) neurologically healthy controls will participate in the experiments.

Procedure

Participants will undergo the same procedure described in Experiment 1a.

Expected Results and Implication

In neurotypical adults, we expect avatar's emotion to modulate IPD (short distance for Happy, longer for Angry). For the ASD population, we expect adults with ASD may prefer shorter IPD than controls. We should also predict a modulation, to some extent of IPD, as a function of the avatar's emotion, due to compensatory strategies adults may have learnt.

Finally, analyses (ANOVA and regressions models) will carried out on the distance recorded in two the experiments to compare children and adults in both neurotypical and ADS samples. These final analyses will critically inform us about the time-course of the IPD regulation. Regression models will compute on gaze direction and autonomic response data to explore their relationship with IPD.

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Plan of activities:
The candidate will be requested to deeply review the scientific literature on the research topic. At the beginning of the study, he/she will validate the experimental procedure. Then, the candidate will be responsible for participants recruitment, patient clinical assessment, data collection and statistical analysis. Results of the project will be presented at scientific national and/or international conferences. Finally, the candidate will draft a scientific manuscript highlighting the contribution and the novelty of the study. The supervisor will schedule four project meetings to monitor the project progress and to discuss possible theoretical and methodological issues.

Timeline:
Months 1 – 2: Validation of experimental settings.
Months 2–10: Participants recruitment, Clinical Assessment and Data collection.
Months 7 – 10: Statistical analysis.
Months 10 – 12: Manuscript preparation for submission and data presentation at conferences.

Feasibility of the project:
Although we do not expect to encounter particular difficulties in achieving the objectives of the project, if problems arise, they will be handled in the following manner. Should technical difficulties arise during the acquisition and analysis of data from VR data, we plan to make use of expert technical advice that work at the INSERM of Lyon, with whom we are collaborating from twenty years. Should