

‘Prosocial’ virtual reality as tool for monitoring engagement in intergroup helping situations

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Abstract— The aim of the present work is to test a non-invasive procedure to test attentive and emotional resources in helping situations where person in need belongs to another group in terms of ethnicity. At this purpose, we created a set of virtual scenarios by crossing two main crucial variables for help decision: ethnicity (white vs black actor) and helper appearance (business man, casual and beggar). During the VR session the participant’s attention, distraction and engagement were measured by means of EEG tool. Results pointed out that white helpers show higher levels of attention and engagement in counter-stereotypical situations during the giving session. The attention and engagement measures in VR settings shed a light on the role played by the helper’s expectations concerning ingroup/outgroup features and their potential effects on the helping decision.

Keywords—Virtual Reality, helping relations, EEG, Engagement, attention

I. INTRODUCTION

The aim of the present work is to test attentive and emotional dimensions of intergroup helping interactions using a Virtual Environment. According to the classical socio-psychological literature the decision of giving and seeking help is associated to psychological costs. In fact in the case of giving help it can be associated to a potential personal evaluation (I’m capable? It can be useful my help?) that can lead or not to the final decision [1]. While in the case of seeking help it can correspond to an explicit admission of incapability, reinforcing our state of dependence toward the donor [2]. In particular when the helper/helpee is a person perceived dissimilar as in the case of a person belonging an outgroup these costs usually increase [3] and the decision to help or to request become lower. Starting from these psychological considerations we plan a pilot experimental study within Virtual Reality environment where participants were inducted to seeking and giving help to a virtual helper/helpee with three different type of ‘social appearance (business man, casual and beggar). Results emerged from EEG measures (attention, distraction and engagement) pointed out that participants tend to pay attention and be engaged in every life situations mainly in counterstereotypic conditions. The rest of the paper is organized as follows: Section 2- presents the classical works on helping and intergroup relations, by looking also to the studies using VR. Section 4 illustrated the performed experiment with the discussion on the results. Conclusions and future work directions are discussed in the last section.

II. HELPING AND INTERGROUP RELATIONS

According to psychological studies, cognitive processes based on prosocial decisions are strictly associated with emotional processes [4]. Classical studies on prosocial behaviours have tested how positive emotions like empathy [5], [6] can promote these behaviours and, more generally, how low-arousal emotions can drive other-oriented cost-benefit processing rather than automatic and more intuitive processing, which is used when emotions are stronger and more difficult to regulate [7]. This in general, but what happens when the helpee is an immigrant or a refugee? In this case, the decision to help or not has been largely studied with the theoretical model of intergroup helping relations as status relations [8], which stresses that giving help can perpetuate the social dependency of people in need. Within this framework, outgroup people in need are perceived by ‘powerful’ helpers as people with low competency and possibilities and thus they can receive a type of help since they elicited emotions of sadness or pity. [9]. From this perspective, the helping process should depend on helpers’ expectations. Refugees and immigrants are generally described as criminals (‘cimmigration’) or on the contrary usually associated with the stigma of dependence; they are perceived as dependent people (e.g. as ‘parasites’), in need of humanitarian protection. The stigma of dependence can increase the perceived costs associated toward immigrants. Furthermore, these representations rely on negative expectations in terms of dominance. Thus, immigrants can be perceived as ‘dangerous’ or ‘helpless’ [10;11], and, therefore, they can be associated with negative emotions such as anger [12] or with emotions like pity and sadness. Based on prior studies, the intergroup helping interactions are mediated by the helpees’ expectations and perception of dissimilarity which can be associated to the motivation of defending the ingroup image [13; 3]. When the dissimilarity is high the helper can perceive more psychological costs and then can avoid taking helping decision. The aim of this preliminary study is to observe potential differences in terms attention, engagement and distraction in relation to helpee’s ethnicity (black or white) and in terms of helpee relative autonomy-dependence.

III. HELPING AND VIRTUAL REALITY

Schutte and Stilnovic (2017) [14] have shown that prosocial behavior is closely related to the degree of involvement in VR, which in turn can increase user empathy. In this regard, the experiment conducted by Groom and colleagues (2009) [15] was significant, showing that an

experience in VR (job interview) with an avatar of a different skin color may be related to the prejudice since interaction with a black avatar generated negative appreciation and a greater level of implicit bias. A more recent study by Peck et al. [16], on the contrary, obtained results in the opposite direction. Through sophisticated technology in body transfer into avatars, Peck and colleagues found that when participants embodied the color of black skin, they tended to present fewer racial implicit biases than those who embodied an avatar with white skin. Along the same lines is the study by Gillath et al. [17] where participants, seated at a bus stop, witness an accident involving a blind man's dog. The verbal reactions to man's request for help have shown that VR scenario is able to arouse positive behavioral emotions and tendencies towards virtual people in need similar to those raised by needy people in the real world. However, the study done by Eastwick and Gardner [18] showed that the helping relationship in VR follows a certain logic. We tend to help people similar helpee in the sense that in their experiments white helpers tended to give less help to black-colored avatars than the white ones. More recently Gamberini et al. [19] have analyzed the helping behavior in a VR emergency that generally increases the level of anxiety by showing how time pressure worsens the ingroup favouritism effect by giving less help to black victim.

IV. THE PILOT STUDY

Research Question: The great part of the cited studies within involved VR contexts that elicit negative emotions of anxiety or concern and less attention has been paid to helping decision within familiar contexts, where an outgroup member can be in a temporary state of need. The research goal of this pilot study is then exploring potential differences in terms attention, engagement and distraction in relation to helpee's ethnicity (black or white) and in terms of helpee relative autonomy-dependence in a simulated helping situation.

A. Method

1. Participant and experimental design

Participants were 40 (19 women and 21 men, mean age 23.76) equally distributed across the experimental conditions. The study consists of an experimental design 2 x 3 between subjects, in which we manipulated the helper/helpee ethnicity (black vs white) and the social appearance of helper/helpee (business man VS casual VS beggar) as independent variables, assuming an effect on the following dependent variables: giving help (behavioral variable), attention, engagement and distraction in giving help.

B. Procedure and tools

The experimental procedure involved three phases. In a first phase, the participants were subjected to a pre-test with the aim of exploring previous experiences in VR. Later, participants were involved in the second phase of the experiment, that corresponded to the VR session. The virtual reality experience had a medium level of immersion since participants can, from their point of view, be partially present physically in the context (a familiar context), they can decide and respond to the actors but they cannot influence the virtual scene (low level of agency of the user). For the recording, we used Ricoh Theta V monoscopic camera at 4K by having an experience of 360 Video and audio. The 360 videos were seen by wearing HTC Vive headset that can also

track users' position in the space, by enlarging the level of immersion. After the instructions provided on the use of the display and positioned the EEG sensors for Attention, Distraction, Engagement, the participants began to see a video, corresponding to one of the six experimental conditions. The video introduced the participant to the virtual environment through a training session, appropriately designed to familiarize him with the device and to provide him with the instructions necessary to interact with the actors of the scenes and with the pop-up system inserted in the sequence. During the training the participant was also shown his "travel" kit consisting of a metro pass, two metro tickets and four 50 cents coins, which he could have used during his experience. Each participant did not have anything else with them. The training scene was followed by an environment scene in which a guiding voice was inserted, which would accompany the participant along the entire route. The participant then entered the heart of the experience and was projected at the entrance of a metro station, where he met a "hurried" friend, who informed him of a party with friends and invited him to reach the location of the appointment, giving him the name of the street. In the next scene, called the "Google maps" scene, the participant met a potential helper (Ingroup Vs Outgroup x Business man / Casual / Beggar), who could help him find the way. Through the pop-up system the participant made the choice to ask / not ask for help and provided the reasons for his choice and moved to the next scene. This, called the scene "Ticket Office", presented the opposite situation (in this study we'll focus mainly on this help giving phase): the participant became a helper in front of a potential helpee (Ingroup Vs Outgroup x Business man / Casual / Beggar), who asked him for help for a metro ticket. In this case the participant had more possibilities: give a generous help (the ticket), partial help (offering to change his coins or one of the tickets available to him in the kit) or not give help. Again, through the pop-up system the participant go on with the scene and land to a final scene, with the aim of leaving a positive message: the helpee present in "Ticket Office" helped in turn a passerby who had dropped his wallet from his pocket. Subsequently, the helpee was also found to be a friend of the "hurried" friend who appeared in the first scene which, at this point, as a unifying element, would lead the participant and the helpee together with the party. At the end of the VR experience, the participant was finally introduced to the third and final phase of the experiment in which participant fulfilled some scales on immigrant attitude and prosociality. The post-test phase was followed by a debriefing session.

C. Measures

EEG data were recorded (sampling rate 100 Hz) using Emotiv EPOC® helmet (www.emotiv.com). Raw EEG data were stored for each virtual scenario session and for each participant and processed off-line using Matlab2019a to 1) reject of the artefacts, 2) select automatically the channels with high SNR, 2) band-pass filter the data (frequency range 3- 48 Hz), 4) estimate the spectral power density (SDP). Then, to compute the EEG Index, SDP was segmented into the following EEG bands, from which the power contained in each one was then calculated: α [8-13Hz], β [13-30Hz], β_{low} [13-15Hz], β_{high} [23-30Hz], and θ [4-8 Hz].

Engagement Index (EI)

The EI index is obtained by considering alpha, beta and theta activities (see Eq.1): an increase of beta activity is directly related to task engagement; an increase of alpha and beta activities reflects relax, low level of alertness and a decrease of information processing [22; 23]. An increase of EI index reflects an increase of engagement level [24].

$$EI = \beta / (\alpha + \theta) \quad \text{Eq.1}$$

Attention Index (BBR)

The BBR index is calculated considering the ratio between the upper beta band and the lower beta band (see Eq.2) [25]. In particular, it was shown that an increase of β_{high} is linked to an increase of the alertness and of the brain [26], while an increase of β_{low} could be linked to an increase of the inattention [25]. Therefore, an increase of BBR may signal an increase of the attention level.

$$BBR = \beta_{high} / \beta_{low} \quad \text{Eq.2}$$

Inattention index (TBR)

The TBR index is calculated considering the ratio between the beta band and theta band (See Eq. 3) [27]. The index is negatively correlated to the attention and to the anxiety [27], conversely it increases when the level of attention decreases [28].

$$TBR = \frac{\theta}{\beta} \quad \text{Eq.3}$$



Fig. 1. Two conditions of the 'Ticket office' phase.

V. RESULTS

First of all data analysis was aimed at checking how the two manipulations, group type and helper/helppee appearance, affect the helper/helppee perception; results pointed out how the helper appearance affect the elegance [F(1, 38)=2,90;p<0.05] or sloppiness perception [F(1, 38)=7,84;p<0.001] in the sense that the business man is evaluated more elegant and less slopy than in casual and beggar condition group; also the group belongingness affect the perception of distance is higher since in the outgroup condition helper is perceived more distant than in the ingroup

condition. The decision of helping in a disinterested way depends on group type. In the sense that from a chi square analysis emerged that while in the case of an ingroup participants tended to give partial help to the businessman (33%) while the casual and the beggar helppee received a the 'generous' help (the ticket given for free) [$\chi^2(38)=2,90;p<0.05$]. Differently in the case of the outgroup condition helper appearance do not differ his/her behavioral response but they give a similar type of help regardless of helppee appearance.

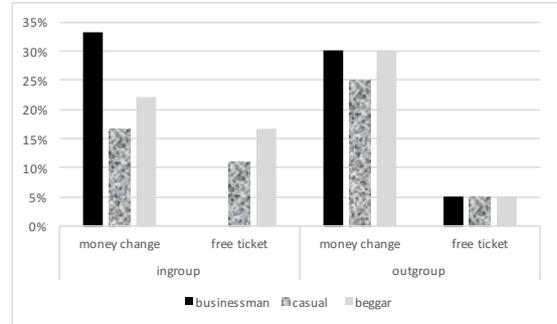


Fig. 2. Type of help given ('Instrumental' vs 'Generous') *Experimental condition

When we consider the level of attention, engagement and distraction extracted from the EEG, group type resulted significant factor in the Anova. The main effect of group type on attention [F(1, 38)=3,80;p<0.05], on engagement [F(1, 38)=3,63;p<0.05] and distraction attested that both in help seeking and giving higher level of attention and engagement and less level of distraction in outgroup condition compared to the ingroup condition.

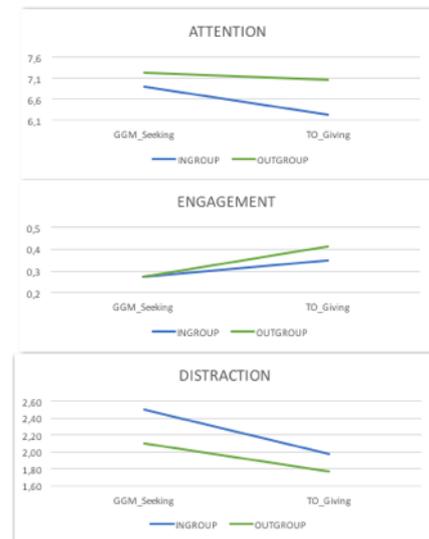


Fig. 3. EEG Measures*Group type in Help seeking and Giving

The interaction effects across the experimental conditions clarified the direction of the attention [F(1, 38)=2,80; p<0.05], engagement [F(1, 38)=3,40; p<0.05] and distraction [F(1, 38)=2,99;p<0.05] during the VR session. As showed in Figure 3a and 3b the level of attention and distraction is strongly affected by the counter-stereotypic situations: higher level of attention and lower level of distraction were detected in the condition of outgroup-businessman and in the ingroup-beggar one thus pointing out that during the helping session

participants tend to screen the helpee's appearance mainly when it is far from his/her social expectations.

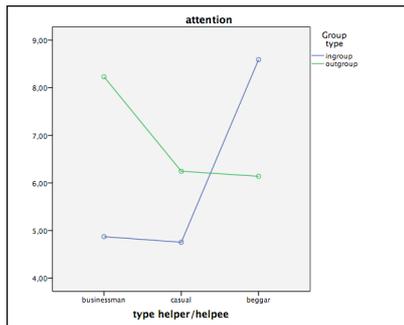


Fig. 4. Attention extracted from EEG Measures*Group type in Help situation (Interaction Effect)

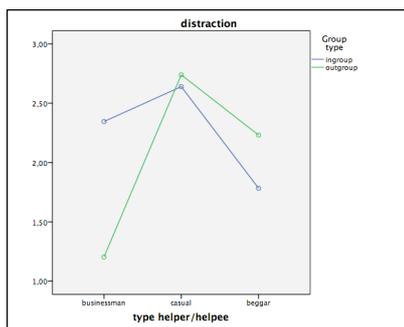


Fig. 5. Distraction extracted from EEG Measures*Group type in Help situation (Interaction Effect)

Given this results on attention and distraction also the level of engagement [29] – resulted from the sense of control /mastery on the situation (skill and challenge)– was higher in outgroup businessman condition since the challenge with situation so distant from the participant expectations required more involvement. On the contrary in the case of ingroup was the beggar condition. The rich black man and the white beggar were distant from participant's expectations and thus they required more engagement during the help giving.

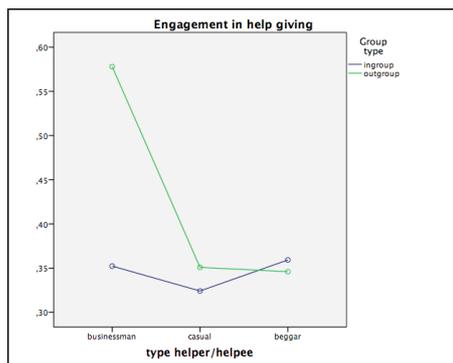


Fig. 6. Engagement extracted from EEG Measures*Group type in Help situation (Interaction Effect)

Discussion and conclusion

Helping decision in VR has been explored in a calm and familiar situation by differentiating the helpee ethnicity and social appearance. Our preliminary results pointed out that while in ingroup condition (white ethnicity) people tend to give a generous help (free ticket) taking into consideration their state of need by considering their effective state of need, by giving higher levels of generous help in beggar condition, in the outgroup condition they give a minimal help

across conditions with no difference. This can be partially explained by the data on Attention, Distraction and Engagement extracted by means of EEG measures, that pointed out that white helpers are more attentive and less distracted only in the counterstereotypic condition (far from their expectations), in the case of black helpee by the businessman status, while in the case of white by the beggar. These two conditions were also the conditions where the white helper was more cognitively engaged since they must consider novelty elements in that helping situation. Future studies will test these attentional and engagement processes as a measures of coping with unknown and counterstereotypical situations, even with a larger sample.

ACKNOWLEDGMENT

All the authors are in debt with prof. Isabella Poggi for her suggestions and our collaborators Antonietta De Sanctis, Dieuseul Anouleko, Valerio Contegiaco, Giulio Ventre and Lorenzo Federici who support this study during the experimental phase.

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