Chapitre d'actes   2015   Accepted version   Open Access

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Sharing emotions during a computer-mediated collaborative task: a dual eye-tracking study

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Abstract

With the development of distance learning programs, it is now usual for learners to complete collaborative tasks remotely. Even if audio and video channels are available, the subtle cues that allow to infer the partner's emotional states (e.g., interest, boredom, frustration) are seriously diminished. This study explores the impact of using a group emotion awareness tool on learners' interaction and perception. To achieve this goal, a dual eye-tracking approach was used in combination with an analysis of the number of positive and negative emotions shared during interaction. Results showed that participants mainly looked at and communicated positive emotions during collaboration. Interestingly, participants' attention was equally divided between their own- and their collaboration partner's emotional information. Finally, men spent more time looking at their partner's emotions compared to women. Results are discussed in terms of mutual modeling of partner's emotions during a remote collaborative task.

Introduction

The role of emotion awareness in collaboration has received little attention from computer-supported collaborative learning and work communities. However, studies have highlighted the importance of sharing emotions during computer-mediated collaboration (CMC) as this may contribute to a positive climate and may improve interpersonal understanding of emotions as well as group performance (Eligio et al., 2012). In the present study, an Emotion Awareness Tool (EAT) was designed to encourage co-learners to communicate their emotions to each other during CMC. We hypothesized that the EAT would facilitate the process of modeling emotions during interaction, and would have a positive effect on collaborative processes and outcomes. In a previous study (Molinari et al., 2013), we found that participants reported spending more effort understanding their collaboration partner's emotions in the EAT condition than in the condition without the EAT. Results also showed a positive effect of the EAT on the perceived quality of interaction but only for women. In the present paper, we aimed at understanding how users interacted with the EAT. To achieve this goal, we examined the number of positive and negative emotions communicated to the partner. We also conducted a dual eye-tracking analysis to explore learners' viewing behavior during interaction.

Method

Thirty-two women and 28 men ($M=23.4$ years) were assigned to 30 same-gender dyads. Peers worked remotely in the DREW environment and built a joint argument graph (Figure 1, AOI 1) with the aim to create an anti-bullying slogan for teenagers (45 minutes). Half of the dyads (8 women dyads and 7 men dyads) were assigned to the experimental condition and the other half to the control condition. In the experimental condition, learners were provided with the EAT (AOI 2) and had to communicate their emotions while interacting. Concerning the EAT, its lower portion included two lists of 10 positive emotions (happy, focused, interested, satisfied, empathic, confident, amused, relax, grateful, relieved ; AOI 2.3) and 10 negative emotions (stressed, annoyed, irritated, surprised, envious, anxious, unsatisfied, confused, frustrated, tired; AOI 2.4) presented as command buttons. A button "no emotion" concluded these lists (AOI 2.5). The emotions on which learners clicked were displayed in the upper part of the EAT: their own emotions appeared in the green area (AOI 2.1), their partner's emotions in the blue area (AOI 2.2). Learners' eye movements were recorded via 2 Tobii eye-trackers: a T120 (sampling rate/SR: 120 Hz) and a TX300 (SR: 300 Hz). Gaze position data was resampled at 60 Hz. For each participant, the proportion of time spent looking at each AOI over interaction was computed and analyzed.
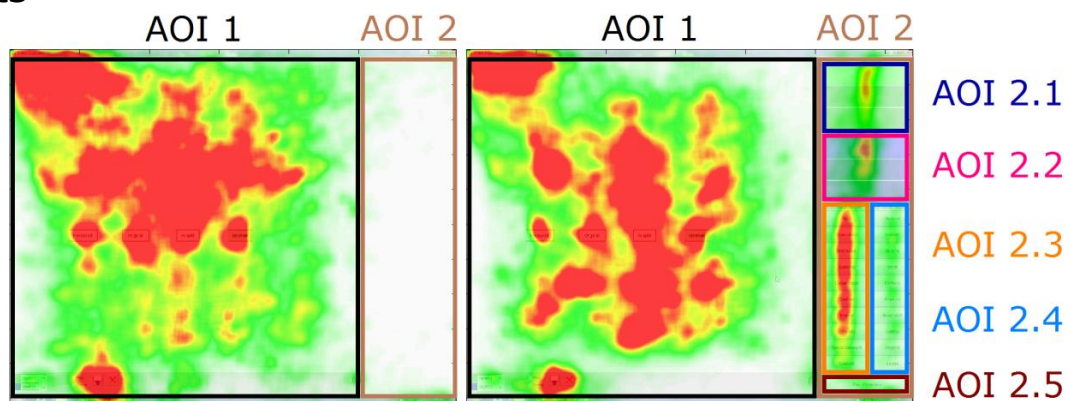
Results

Figure 1. Co-learners' viewing behavior in the EAT (right) and control conditions (left).

As expected, participants spent less relative time looking at the graph area (AOI1) in the EAT condition ($M = 82\%$, $SD = 5.6$) than in the control condition ($M = 88.7\%$, $SD = 7.5$), $t(47) = 3.52$, $p = .001$, $d = 1.03$. In the EAT condition, participants spent a similar amount of time looking at the area for the display of their own emotions ($1.5\% \pm 0.7\%$) as the time spent looking at the area for the display of their partner's emotions ($1.6\% \pm 0.7$), $t(22) = 1.08$, $p = .29$. In addition, participants spent more time ($4.8\% \pm 1.8\%$) looking at the list of positive emotions than at the list of negative emotions ($1.3\% \pm 1.0\%$), $t(22) = 11.35$, $p < .001$, $d = 4.84$. They also communicated more positive emotions (16.6 ± 7.5) than negative emotions (2.6 ± 3.6), $t(29) = 13.08$, $p < .001$, $d = 4.86$. Finally, the amount of time spent looking at the two emotion lists was

positively correlated with the amount of emotions shared to the partner (r = .51, p = .01).

A series of t-tests were performed in the EAT condition to evaluate the effect of gender on the percentage of time spent looking at the AOIs related to the EAT. Results showed that men spent more time looking at the EAT (M = 11.1%, SD = 3.4%) compared to women (M = 8.4%, SD = 3%), $t(21)$ = 2.07, p = .05, d = .90. In particular, men spent more time looking at the area for the display of their partner's emotions (M = 2.1%, SD = 0.6%) compared to women (M = 1.3%, SD = 0.6%), $t(21)$ = 2.99, p = .01, d = 1.31. This difference remained significant after Bonferroni correction for multiple testing, and cannot be explained by users' actions on the EAT. Indeed, no difference was found between men (22.8 ± 11.4 per hour) and women (17.8 ± 8.7 per hour) with respect to the amount of emotions shared, $t(21)$ = -1.17, p = .25, d = .51.

Discussion

Results showed that the most frequent emotions communicated to the partner were positive and that the participants' attention was oriented toward positive rather than negative emotions. This may be because the task was overall enjoyable, or may be that, as the literature showed, people tend to conceal negative emotions in social situations (Niedenthal et al., 2006). Surprisingly, learners gave the same amount of attention to their own emotion as to their partner's, suggesting that emotion comparison takes a substantial part in the mutual modeling process. Finally, men dyads spent more time looking at the partner's emotion than women dyads. We are currently conducting fine-grained multimodal exploration of emotional and socio-cognitive processes during collaboration in order to better inform the quantitative analyses.

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