Leader-employee emotional “interpersonal tuning”.An EEG coherence study

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ABSTRACT

Empirical management research has focused more on the investigation of important interpersonal factors that could be beneficial for a company’s well-being, including emotional and empathic engagement between managers and employees. The capacity to understand and mirror others’ feelings could result in a mutual adaptation that generates interpersonal tuning (IT). In the present study, we measured IT by applying a hyperscanning approach with simultaneous recording of electroencephalographic (EEG) signals from two participants interacting together. Eleven leaders and 11 employees were recruited and asked to role-play an employee performance review with a rating (R) or no rating (NR) condition. In the NR condition leaders describe by words the employee’s proficiency, while in R they provided a quantitative rating. The NR condition emerged as a more engaging situation in terms of empathic responses and mirroring. This difference was detectable from the localization of neurophysiological effects over the frontopolar and frontal brain areas, and the higher synchronization of EEG delta frequency coherence. Behavioral results also revealed an increase of self-perceived emotional tuning, agreement on content, and interpersonal cooperation in the NR condition compared to R condition. These effects were present in both leaders and employees and have several implications for social and company well-being.

1. Introduction

In recent years, empirical management research has increasingly focused on the investigation of interpersonal factors that could be of fundamental interest for the company’s well-being, such as evidence-based practices, leadership styles, emotional engagement (Ashkanasy, 2013; Balconi & Bortolotti, 2012; Balconi & Canavesio, 2013; Balthazard, Waldman, Thatcher, & Hannah, 2012; Vanutelli, Gatti, Angioletti, & Balconi, 2017b; Waldman, Balthazard, & Peterson, 2009) and interpersonal dynamics (Balconi et al., 2019; Balconi, Venturella, Fronda, & Vanutelli, 2019; Stevens, Gorman, Amazeen, Likens, & Galloway, 2013; Tognoli, Lagarde, DeGuzman, &Kelso, 2007). Indeed, everyday life in a company setting entails many kinds of social interactions, including vertical and horizontal relationships. Within these con-texts, people try to understand and interpret each other’s behavior, feelings, and intentions.

Considering the complexity of such social dynamics, and the presence of mechanisms related to emotions, goals, intentions, expectations, and cognitive bias, recent research in the field has increasingly embodied a neuroscientific approach (Paulus et al., 2009). Indeed, social and affective neuroscience strives to develop and apply methods that reveal a broader and more in-depth understanding of the way people interact with each other, including empathic and emotional mechanisms (Balconi & Canavesio, 2013; Balconi & Vanutelli, 2017; Venturella, Gatti, Vanutelli, & Balconi, 2017). A leading example of what has been called a “second person” social neuroscience (Schilbach, 2010) is the hyperscan-ning technique, a realistic and ecological paradigm which allows simultaneous recording of the cortical activity from two or more participants interacting together (Balconi, Gatti, & Vanutelli, 2018b; Montague, 2002). With these methods,

people's behavior and associated brain activity patterns are no longer considered individually, but part of complex dynamics continuously adjusting and contaminating each other. The intersection of social neuroscience research and organizational/management research needs has been termed neuromanagement.

Interestingly, it has been shown that a functional and mutual understanding needs a certain level of consonance among participants (Hari, Himberg, Nummenmaa, Hämäläinen, & Parkkonen, 2013), which can be prompted by empathic mechanisms (Preston & de Waal, 2002; Vanutelli & Balconi, 2015). Empathy refers to the capacity to perceive, understand and share others' affective experiences, as well as to respond accordingly (Decety & Jackson, 2006; Hooker, Verosky, Germine, Knight, & D'Esposito, 2008; Ickes, 1997; Preston & de Waal, 2002). This ability is fundamental for social species like humans who have the need to create meaningful social bonds, with subsequent positive effects such as self-satisfaction, mental and physical well-being, and reduced personal distress (Blackburn & Epel, 2012; Brennan & Shaver, 1995; LeMoult, Chen, Foland-Ross, Burley, & Gotlib, 2015; Mikulincer & Shaver, 2012; Pietromonaco, Uchino, & Dunkel Schetter, 2013).

It has been proposed that this mutual adaptation can generate an alignment at the behavioral level (Konvalinka, Vuusta, Roepstorffa, & Frith, 2010; Richardson, Marsh, Isenhower, Goodman, & Schmidt, 2007; Shockley, Santana, & Fowler, 2003), as well as the biological level of interpersonal tuning (IT) reflected by peripheral autonomic indices such as respiration, heart rate and skin conductance (Konvalinka et al., 2011; McFarland, 2001; Smith et al., 2011; Venturella et al., 2017), but also between brain responses (Astolfi et al., 2011; Balconi et al., 2018b; Balconi, Pezard, Nandrino, & Vanutelli, 2017; Dumas, Nadel, Soussignan, Martinerie, & Garnero, 2010). However, no specific research has directly tested whether there is an effect of increased IT induced by empathic behavior in the social context of employees-managers, particularly with a hyperscanning paradigm. Therefore, the first aim of this study was to test the hypothesis that [. . .] elucidate the mechanisms underlying interpersonal tuning during the interaction between leader and employee, by using electroencephalographic (EEG) coherence measure. In the present study, IT was defined as interpersonal coordination of specific physiological processes between two or more subjects in interaction with each other. We propose that an increased IT will be supported by evidence of an increased coherence level of EEG during the interchange when the manager-employee dyad shows an adequate level of empathic engagement.

A second main recent research question concerned if and how the presence of a quantitative rating as part of employee performance review could influence IT. It was suggested that an employee being scored could involve emotional and cognitive processes triggered by the perception of an asymmetrical social power dynamic and generate negative feelings. Traditionally, the rating was thought to help employees improving their performance (Dixon, Rock, & Ochsner, 2010), but in a meta-analysis, Kluger and DeNisi (1996) showed how feedback interventions were associated with performance improvement in less than one-half of cases. More specifically, Rock (2008) has hypothesized the possibility of considering the evaluation as a threat because it provides

judgment on the ranking and a subsequent sense of status. This represents a relevant point, considering that fear and threat involve a condition defined as social pain (Lieberman & Eisenberger, 2008), related to a more negative working condition. With these concerns in mind, organizations recently have tried to revise traditional management feedback in favor of new forms of performance assessment. A central point of this renewal derives from the possible differential effects of quantitative and qualitative feedback. In fact, as shown by Smither and Walker (2004), empirical findings revealed that a more qualitative (narrative) approach engages employees' attention more than quantitative comments. Thus, our second aim was to investigate if the use of a quantitative rating could impair inter-brain tuning, which can be considered a neural marker of IT. Specifically, based on previous research, we hypothesized that a quantitative rating would induce a more negative reaction in the leader-employee dyad, with a significant effect on inter-brain tuning.

Hyperscanning paradigm by EEG technique in leader-employee dyads role-playing during a performance review is a methodological approach that allows real-time neurophysiological recordings that can be related to cognitive and affective dimensions, as well as tuning between two (or more) brains. To the best of our knowledge, no previous research applied the hyperscanning paradigm to organizational research issues. A previous pilot study on leader-employee interactions (Venturella et al., 2017) identifies some neurophysiological markers related to leadership style (authoritative vs. participative) and the role played in the company (leaders vs. employees). However, it did not include tuning analyses. Starting from previous literature on hyperscanning in interactive situations (Balconi et al., 2018b; Balconi, Vanutelli, & Gatti, 2018; Liu et al., 2016; Liu, Saito, & Oi, 2015), we specifically focused on the prefrontal and frontal areas of the brain which are known to be involved in higher-order cognitive functions. Indeed, one of the fundamental requirements of organizational leaders is to regulate and monitor their and others' behavior (Zaccaro, Foti, & Kenny, 1991). The literature showed that frontal areas appear to play a significant role in executive functioning including coordinating activities of the organization, self-regulation, and social emotions (Lewis, 1997). In addition to planning and organization, the prefrontal cortex has been implicated in relational, affective, cognitive and social processes such as mentalizing, self-regulation and social cognition (Decety & Jackson, 2004; Shamay-Tsoory & Aharon-Peretz, 2007; Thirioux, Mercier, Blanke, & Berthoz, 2014).

To examine the tuning activity of the brain, cortical EEG oscillations can be considered a viable method to explore emotional behavior modulation and engagement during interactions. Specifically, delta band activity in the frontal lobe has been related to emotional processes (Balconi & Lucchiari, 2006), and the motivational system (Knyazev, 2007). Moreover, delta and theta bands have been associated with motivational and attentive responses evoked by relevant emotional stimuli (Balconi, Brambilla, & Falbo, 2009; Balconi & Pozzoli, 2009; Başar, Başar-Eroglu, Karakaş, & Schürmann, 1999). High-frequency bands, on the other hand, have been related to attentional processes. The beta frequency band, for example, has been more associated with attentive processes implemented under conditions of alertness and active thinking (Güntekin, Emek-Savaş, Kurt, Yener, & Başar, 2013). It is also important to consider possible brain lateralization effects, since previous research demonstrated the presence of hemispheric differences

related to the emotional valence within social contexts. For example, left-brain activation has been related to positive affect, more "approach behavior" and tuning dynamics, while right-brain activation has been related to negative emotions, avoidance reactions and less tuning dynamics (Balconi, Grippa, & Vanutelli, 2015a; Davidson, 1983, 1995; Harmon-Jones, Gable, & Peterson, 2010).

In summary, the aim of this study was to investigate the empathic synchrony through EEG hyperscanning recording in paired manager-employee dyads during a simulated employee's annual performance review. The experimental design examined two distinct conditions of presence or absence of a quantitative rating about employee performance (rating, R vs. no rating, NR), as well as the specific organizational roles of the participants (leaders vs. employees). We hypothesized that a more positive engagement would occur in the absence of a quantitative rating (NR), an effect that would be observable by both brain localization over frontal and prefrontal areas as well as to frequency band analysis, with specific engagement of low-frequency ranges in response to higher emotional situations. Also, we hypothesized an increase of IT in the NR condition, mainly over the frontopolar cortex, which may be related to social regulation in the case of increased inter-brain tuning. On behavioral data, we expected an increase in individuals' perception of cooperation and interpersonal tuning, evaluated in numerical terms, in the NR condition compared to R condition. Specifically, we hypothesized that higher scores would result from the NR condition compared to R condition in the different questionnaire dimensions: the degree of self-perceived interpersonal cooperation during conversation, as the perception of coordination between sub-jects during conversation; the degree of self-perceived emotional tuning, which measures the level of indivi-duals' perceived emotional empathic and emotional reciprocity during conversation; the degree of collaboration for conversation, which measures the level of participation during the exchange; and the degree of agreement on the conversational contents, which measures the level of individuals' communicative attunement.

2. Methods

2.1. Participants

Eleven leaders and 11 employees were recruited for the present experiment (22 subjects; age M = 43,88, SD = 7,65; 84% male). They were randomly paired in leader-employee dyads. Participants were recruited from three different companies; they voluntarily submitted to the experiment after giving their written informed consent, which reported the research aims. The research conduction was approved by the local ethics committee of the Department of Psychology of the Catholic University of the Sacred Heart and has followed the principles and guidelines of the Helsinki Declaration.

2.2. Procedure

Each dyad was composed of a leader and an employee, who was subject to evaluation. Dyads were required to role-play the annual performance review according to some specific issues about the

employees' productivity. To create a more realistic experimental condition, subjects were told that the role-playing and review format was designed to improve professional performance and that it would be used as a regular annual evaluation by the company. Indeed, it would be considered as a reliable report of the annual performance and both leader and employee had these respective roles in the company. Two participants at a time were seated next to each other, in a way that they could easily interact face to face. In the no rating condition (NR) leaders had to describe in words the observations made about the employee's proficiency. In the rating condition (R), leaders were also asked to include, within a wider evaluation, a quantitative rating of the employee. The sessions were continuously video-recorded, together with electrophysiological acquisitions. No established time intervals were given. Also, a 120s baseline was set before beginning the interviews (Figure 1).

In the R condition, the employee received rating feed-back in terms of numerical values (from 1 to 5) about the following aspects: teamwork and integration, employee development, programming and collaboration, decision and assumption of responsibility, external and internal customer orientation, openness to change and innovation. The R and NR condition generally furnished a good profile for all the employees in the present sample, with-out specific critical aspects.

A successive post-experiment debriefing was under-taken to explore other behavioral data, about the self-perception and representation by both leader and employee during the evaluation process. Measures assessed the degree of cooperation, IT and interpersonal synchronization, with a specific questionnaire, which included items such as: "What was the perception of your degree of interpersonal cooperation?", "What was the perception of your emotional tuning with the inter-locutor?", "What was the perception of degree collaboration related to the conversational level?", "What was the perception of the degree of agreement about the con-tents explored during the conversation?". The participants responded to these items by assigning a score on a Likert scale from 1 to 5, where 1 referred to the perception of non-synchrony/non-cooperation and 5 to the perception of great harmony and cooperation.

Subjects were trained with a specific explanation of the meaning for each expression/terms.

2.3. EEG recording and coherence analysis

EEG data acquisition was conducted with two 16-channel portable EEG-Systems (V-AMP: Brain Products, München. Truscan: Deymed Diagnostic, Hronov). Two ElectroCaps with Ag/AgCl electrodes grounded to the earlobes (10/5 system of electrode placement; Oostenveld & Praamstra, 2001) were applied. Electrodes were positioned over Fp1, Fp2, F3, F4 for both leader and employee. Data were acquired using a sampling rate of 1000 Hz, with a frequency band of 0.01–40 Hz. The impedance of the recording electrodes was checked before data collection and was always below 5 kΩ. An off-line common average reference was used (Ludwig et al., 2009) to prevent arti-facts related to signal-to-noise ratio. In addition, an EOG electrode was positioned on the outer canthi of the eye to acquire eye movements. For the successive analyses, only artifacts-free epochs were considered thanks to EOG cor-rection and visual inspection (rejected epochs, 2%) to increase specificity. Ocular artifacts, including eye move-ments and blinks, were adjusted by using a correction algorithm that applied a regression analysis together with artifacts averaging (Sapolsky,

2004). Digital EEG data (from all 12 active channels) were band-pass filtered in the following frequency bands: Delta (0.5–3.5 Hz), Theta (4–7.5 Hz), Alpha (8–12.5 Hz), and Beta (13–30 Hz). During data reduction, a band-pass filter was applied in the 0.01–50 Hz frequency band. For statistical analysis, data from specific electrodes over frontal areas were considered.

A set of analysis was run to obtain inter-brain connec-tivity (inter-subjective coherence) by calculating the partial correlation coefficient Π_{ij} for each pair of channels and for each dyad, applied to each frequency band. They were obtained by normalizing the inverse of the covariance matrix $\Gamma = \Sigma^{-1}$:

Compared to other techniques, such analysis allows quantifying the relationship between two sig-nals (i, j) irrespective of the other (Wheland et al., 2012) considering some specific frequency bands of interest, and their functional role. Also, this proce-dure has often been applied in other EEG-hyperscanning studies (Balconi and Gatti et al., 2018b; Balconi & Vanutelli, 2018), as well as to other neural signals and techniques, such as the hemodynamic activity with fNIRS (Balconi et al., 2018b, 2017). Thus, we opted for this analysis to promote consistency.

3. Results

A preliminary analysis was finalized to explore significant differences between Conditions (rating, R vs. no rating, NR), as well as the organizational Role (leader vs. employee) of participants for each specific item of the questionnaire. Mixed measures ANOVAs were applied to the dependent measures.

Two successive orders of analyses were per-formed: the first step included a general analysis (mixed measure ANOVA) about the modulation of the neurophysiological dependent variables throughout the task considering the different Conditions (2), as well as the specific organizational Role (2). A second step included the application of ANOVAs on synchrony indices as dependent variables (EEG coherence indices).

For all ANOVA tests, the degrees of freedom have been corrected using Greenhouse–Geisser epsilon where appropriate. Post-hoc comparisons (contrast analyses) were applied to the data. Simple effects for significant interactions were further checked via pair-wise comparisons, and Bonferroni correction was used to reduce multiple comparisons potential biases. Furthermore, the normality of the data distribution was preliminarily assessed by checking kurtosis and asymmetry (all dependent variables between −2 and +2; George & Mallery, 2010).

3.1. General analysis

About the questionnaire measures, ANOVA showed significant differences for Condition related to the cooperation ($F[1, 40] = 9.13$, $p \leq .001$, $\eta^2 = .36$), emotional tuning ($F[1, 40] = 7.74$, $p \leq .001$, $\eta^2 = .33$) and agreement on the content ($F[6, 40] = 9.09$, $p \leq .001$, $\eta^2 = .36$). In contrast, the degree of collaboration on conversation did not differ ($F[6, 40] = 2.34$, $p = .34$, $\eta^2 = .18$) (Figure 2).

The first set of analyses (mixed model ANOVA) applied to EEG frequency band dependent measure included three independent factors: Role (2), Condition (2) and Electrode site (7).

In the delta band analysis, there was a significant interaction effect for Condition x Electrode ($F[6, 40] = 7.34$, $p \leq .001$, $\eta^2 = .38$). Indeed, posthoc paired comparisons revealed increased frontal

(Fp1 and Fp2) activation more so for the NR than R condition (respectively, $F[1, 40] = 7.12$, $p \leq .001$, $\eta^2 = .36$; $F[1, 40] = 7.60$, $p \leq .001$, $\eta^2 = .37$) (Figure 3(a)).

Theta band analysis revealed a significant interaction effect for Condition x Electrode ($F[6, 40] = 8.76$, $p \leq .001$, $\eta^2 = .40$). Post-hoc paired comparisons revealed increased frontal (Fp1 and Fp2) activation more so for the NR than R condition (respectively, $F[1, 40] = 7.11$, $p \leq .001$, $\eta^2 = .36$; $F[1, 40] = 7.48$, $p \leq .001$, $\eta^2 = .36$) (Figure 3(b)).

Finally, beta Condition x Electrode analysis showed a significant interaction effect ($F[6, 40] = 8.55$, $p \leq .001$, $\eta^2 = .41$). Post-hoc paired comparisons revealed F3, Fp1 and Fp2 activation more for the NR than R condition (respectively, $F[1, 40] = 8,09$, $p \leq .001$, $\eta^2 = .39$; $F[1, 40] = 7.98$, $p \leq .001$, $\eta^2 = .36$; $F[1, 40] = 7.76$, $p \leq .001$, $\eta^2 = .35$) (Figure 3 (c)). No other effect was statistically significant.

3.2. Coherence analysis

The ANOVA applied to inter-brain indices for the dyads revealed significant effects. Indeed, for the delta band, the interaction effect of Condition x Electrode showed significant differences ($F[6, 40] = 8.21$, $p \leq .001$, $\eta^2 = .40$). Post-hoc paired comparisons revealed increased frontal coherence within the dyads for Fp1 and Fp2 more for NR than R condition (respectively, $F[1, 40] = 7.89$, $p \leq .001$, $\eta^2 = .37$; $F[1, 40] = 8.02$, $p \leq .001$, $\eta^2 = .40$) (Figure 4).

No other effect was statistically significant.

4. Discussion

This study aimed to investigate and assess the neurophysiological response and IT of managers and employees during a simulated performance review in the presence or absence of a quantitative employee rating (rating N vs. no rating NR conditions). A social neuroscientific approach by EEG was applied to allow the recording of manager-employee responses related to emotional and empathic engagement. EEG signals were analyzed with two different sets of analyses: the first one included an overall investiga-tion of the neural responses to the different conditions, roles, and brain areas; the second step was focused on the analysis of coherence indices and to the comparison of its strength throughout the same variables of interest.

Five main results could be identified from the ana-lyses: (I) the NR condition emerged as the most engaging situation in terms of empathic response and mirroring. This was visible from (II) the localization of the specific effect over the frontopolar and frontal brain areas, which have been linked to social behavior and social interaction (III) from the role of some specific frequency EEG bands (delta, theta and beta) and specifically (IV) from the higher tuning of delta coherence in the NR condition. (V) Interestingly, these effects were present in both leaders and employees, thus revealing a similar engagement in the dyad. (VI) From behavioral data, there emerged evidence of increased interpersonal tuning in the NR condition compared to R condition both in leaders and employees.

Looking at the first results in detail, the absence of a quantitative rating proved to be the better condition for the annual review in terms of empathic and emotional engagement. In fact, as revealed by EEG analyses, a higher prevalence of delta and theta emerged over the bilateral frontopolar cortex (Fp1 and Fp2 localization). Low-frequency EEG bands have often been associated with specific emotional processing. For example, the theta band has been associated with orienting responses to salient emotional cues, and it typically emerges in case of increased motivational demands (Balconi, Grippa, & Vanutelli, 2015b; Balconi & Vanutelli, 2017; Başar, 1999). Thus, we could hypothesize that the involvement of this frequency band signals a higher arousing condition. In contrast, the functional role of the delta band has been described in the previous research in relation to salience detection and motivational factors (Knyazev, 2007). Moreover, both delta and theta effects have been found over Fp1 and Fp1 brain areas, which correspond to the superior frontal gyrus. The activation of this area has been associated with higher-order emotional processes, such as emotional control (Volman, Roelofs, Koch, Verhagen, & Toni, 2011) and the regulation of social conduct (Moll, Eslinger, & de Oliveira-Souza, 2001), including moral behavior and moral learning (Moll & de Oliveira-Souza, 2007), thus suggesting the presence of a shared social condition based on reciprocity.

In parallel to theta and delta activity, however, a modulation of the beta band was also revealed. The beta band has been described as a neural marker of attention and cognitive processing (Başar, Başar-Eroglu, Karakaş, & Schürmann, 2001) and an alert state of mind. In our task, increased beta activation was found over F3, which localizes to the left dorsolateral prefrontal cortex (DLPFC) in addition to frontopolar areas. DLPFC is purported to mediate aspects of social cognition, including the theory of mind (Kalbe et al., 2010) and the commitment to significant relationships (Petrican & Schimmack, 2008). In addition, the effect we observed showed a lateralized distribution over the left hemisphere, which previous research has linked to positive emotions and approach behaviors (Balconi et al., 2015a; Davidson, 1983, 1995; Harmon-Jones et al., 2010). The heightened alertness over this region thus seems compatible with the social nature of the social condition, and with a generally positive feeling. Low frequency and beta activity responses seem to suggest a double mechanism supported by different networks: an increased emotional response (theta and delta over frontopolar regions), paralleled by the recruitment of higher-order cognitive areas devoted to empathy and mentalizing abilities.

These results are also supported by the coherence data (IV), assessing increased frontal tuning over Fp1 and Fp2 brain areas in the NR condition. Interestingly, a previous hyperscanning study based on a cooperative task with the Jenga game (Liu et al., 2016) found the recruitment of the superior frontal gyrus during decision-making processes based on the partner's suggestions, thus proposing that this area could be a feature of social decision-making when two people interact. This conclusion could be particularly suitable in the present study since the role-playing in the absence of a rating, strengths, and weaknesses of the employees were discussed in a narrative way. Moreover, the effect appeared only in relation to the delta band, thus reinforcing the presence of higher emotional engagement. However, despite the interesting effect and its specificity for one brain area, the coherence effect was quite limited in terms of magnitude. Therefore, future research is needed to investigate this aspect, to confirm the uniqueness of this brain area for interpersonal tuning or to integrate the present results with adjunctive evidence in favor of a more extended brain network.

Moreover (V), the described neurophysiological effects were present in both leaders and employees during the no rating condition, thus suggesting the presence of a shared purpose involving empathy and emotional understanding. Therefore, the “positive social” effect of NR condition for the dyad could predominate, pointing out the relevance of a more qualitative performance review, where the emotional engagement appears more proficient to induce an IT during the interaction.

Finally (VI), we observed from the behavioral data (responses of self-perception and representation questionnaire), an increase of self-perceived emotional tuning, agreement on content, and interperso-nal cooperation by both leader and employee in NR condition compared to R. We hypothesized that such effect could also be due to an increase in prosocial behavior and a broader social/affective bond among leaders and employees within this context. This result, as reported by previous studies (Balconi et al., 2017; Balconi & Vanutelli, 2017; Vanutelli et al., 2017b; Waldman, Balthazard, & Peterson, 2011), shows that greater interpersonal engagement between two individuals can lead to a significant gain for the coordination of communication and behavioral activities.

5. Conclusions

Results support the use of social neuroscientific techniques such as EEG hyperscanning to explore important constructs such as emotional tuning of leaders and employees interacting together during a performance review. The most important hint was that a review without a numerical rating was asso-ciated with more positive feelings, brain tuning, and increased dyadic engagement, as opposed to a quantitative judgment of employee performance.

One relevant point for future research might be that the same paradigm could also be used in other organiza-tional situations to assess individuals’ or groups’ engage-ment in company activities, to understand the natural social conditions in a company's life better. For example, starting from these initial evidence, future work could proceed to investigate further issues of interest, such as moral issues, group composition, and gender and age effects, in order to promote healthy, functional and profi-cient settings at the workplace. Also, other statistical analyses could also be applied in future developments to assess IT in specific moments throughout the task (using, for example, wavelet analysis), to explore the association between behavioral, emotional, and cognitive components in real-time everyday interactions.

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