

Making the invisible visible

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Impact Paragraph

Most projects in the business world are realized through teamwork (Sawyer, 2011). Teams, by definition, work interdependently, and communication bonds team members. Team communication has many essential roles, enabling information sharing and promoting the exchange of ideas (Cross & Cummings, 2004). The effectiveness of team communication also influences almost every other aspect of cooperation. As such, poor communication has various adverse consequences, disrupting information flow, delaying progress, and, ultimately, causing projects to fail (Salas et al., 2008; Stempfle & Badke-Schaub, 2002).

Recordings and observations have traditionally been used to study team communication, a method that produces only limited data sets and requires significant labor expenditure from the researcher, who can only attend a single meeting at a time. Participant privacy is another issue associated with video and audio documentation, especially in the case of real-world business meetings, which frequently cannot be recorded because of confidentiality concerns. Emerging technology provides promising opportunities to automatically harness high-resolution, quantitative, time-series data about social interactions, enabling researchers to investigate the links between communication and team performance in more detail (Dávila-Montero et al., 2021; Parker et al., 2018).

This dissertation's main objective is to advance understanding of how these emerging technologies can be used to capture information about team interactions during face-to-face and virtual meetings and how researchers can utilize this data to develop means of improving communication. By advancing knowledge surrounding team communication behavior, the presented work enables the development of a visual support system for teams working on collaborative problem-solving (CPS).

Scientific Impact

The thesis demonstrates the value of combining multiple literature streams when investigating the relationship between team communication and team performance in the context of CPS. It draws from the fields of social signal processing (SSP), social network analysis (SNA), computer-supported collaborative work (CSCW), and psychology to show how these distinct domains can synergize to produce richer analyses of team behavior.

At its core, this work contributes to the scientific body of literature by demonstrating the value of utilizing SNA metrics for social signal modeling. Furthermore, by integrating insights from psychology on team cognition for social signal modeling, this thesis overcomes the limitations of existing studies, many of which have struggled to identify significant social signals in their analyses of combinations of problem-solving activities. These new insights can be used by researchers and practitioners working in the CSCW domain to develop automated support systems.

Finally, this thesis provides evidence for the effectiveness of analyzing social interactions and providing real-time feedback on team performance. This thesis takes a first step toward expanding the capabilities of present intelligent systems by enabling computers to understand the cognitive stage of a team to present relevant and actionable interventions.

Societal Impact

The findings of this thesis have significant implications for organizations looking to support their teams. Understanding how to effectively promote team communication is crucial for future business agendas, which will see teams meeting more frequently and handling a broader array of meeting formats, from remote to hybrid to face-to-face. The

system developed in Chapter 5 represents a first step toward developing a real-time support system for teams. Developing an understanding of the process for implementing this form of feedback is essential for developing effective team interventions and training tools because research on the effectiveness of feedback for skill development shows that real-time feedback is significantly more effective than near-real-time feedback.

Apart from the practical implications that can be derived from the knowledge generated by this thesis, the papers included also show that it is feasible to collect comprehensive data on team interactions without significantly violating team members' privacy. Although we recorded audio of interactions between subjects during the project's data collection phase, none of this thesis' analyses or findings depend on our ability to recognize the spoken words comprising the encounter's semantic content. Therefore, all insights generated are suitable for repetition in privacy-sensitive settings, and the procedures provide examples of avenues for researchers and practitioners to work within the restrictions of data protection and privacy regulations.

I have endeavored to disseminate the presented research results widely to ensure that the findings benefit other researchers, professional practitioners, and the broader community. Notably, because one of this project's goals was to develop connections between research domains of interest, I have tried to establish connections with these various research communities. Accordingly, these research results have been presented at various seminars, both locally at Maastricht University and internationally at research symposiums and conferences, including the 3rd Meeting Symposium, held in Brussels in May 2022, and the International Conference on Computational Social Science, held in the United States in 2020. Finally, the papers included here have been published in both social science and computer science journals.