Understanding the Role of Diagrammatic Properties of Virtual Work During Covid-19 in Constructing Shared Intentionality for Blind and Partially Sighted Employees

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1   Thesis topic and approach

The Covid-19 pandemic altered workplaces. For those with 'office jobs,' this meant working 'virtually,' or remotely, from home. This transition forced workplaces to adapt workflows and rely on Information and Communication Technologies (ICTs). However, Blind and Partially Sighted Individuals (BPSI) face challenges with digital accessibility, home office set-up, financing assistive devices, remote communications and employer support [1]. This project reports on a longitudinal participatory design study that included semi-structured interviews, observational research and co-design sessions to investigate the impact of remote working and training for BPSI. This study proposes a conceptual model to assist in understanding how ICTs convey diagrammatic properties for the construction of shared intentionality in Virtual Work Environments (VWE).

The first concept that underpins this model is how spatial-topological properties, or diagrammatic properties, of interactions, such as gestures, facial expressions, pictures, or diagrams are or are not conveyed through ICTs in an accessible way, as they might be in the real world. These perceptual cues of the physical environment, when perceived, inform your understanding of interactions that would be unavailable if you only had access to spoken language, or a text chat. The second concept is shared intentionality, an area of research and philosophical inquiry since ancient times, and across many disciplines. It is the capacity to engage with others in cooperative activities with joint goals and intentions [2, 3]. It is prevalent in our lives, for example, it is what motivates two or more individuals to raise a child, compete in team sports, or work in an office.

ICT-based VWE are composed of external representations we perceive through our senses. For example, the interface for videoconferencing is composed of rows of buttons labelled with text and icons. Through the computer's speaker, beeps and spoken language are also external representations, as are the moving images of a video conference call. In VWE you may experience both diagrammatic (e.g. charts) and sentential representations (e.g. text chat) [4]. However, BPSI vary in their abilities to access diagrammatic representations that are presented visually. A BPSI who relies on screen-reader technology has access to text-based tags and labels, text, and the spoken language of the video conference (if they are not deaf or hard of hearing). However, they will not be able to perceive the diagrammatic (spatial, topological, and geometric) properties of the video stream. Without non-visual diagrammatic properties in ICTs, spatial-topological ambiguity can impede the construction of shared intentionality. For example, consider the experience of a BPSI in a meeting where the screen share function is

used to demonstrate a chart. Charts contain spatial relations, or diagrammatic properties, between plotted points that are critical to infer meaning [5]. This study provides a model for better understanding this ambiguity in ICT-based VWE for individuals with sight loss, for whom diagrammatic properties are more difficult to perceive, which requires them to rely on language, or sentential properties [4]. An understanding of how scenarios in the workplace convey diagrammatic properties can be used to develop strategies to increase shared intentionality (see case studies below).
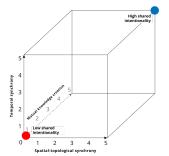
2   Work completed

Fig. 1. A model of shared intentionality in virtual work environments.

This study builds on Tomasello et al.'s concept of shared intentionality, their model assumes in-person interaction, for this investigation a way to discuss the construction of shared intentionality through ICT-mediated interactions was introduced [2]. For this, Larkin and Simon's concept of diagrammatic and sentential representations was used [4]. The dimensions of this model include: Spatial-topological synchrony which is the degree to which diagrammatic properties, through video, spatial audio, or haptics, offer implicit cues, such as gestures, body location, or visual-spatial representations (e.g. diagrams); temporal synchrony is the degree to which real-time interactions convey diagrammatic cues; mutual knowledge is the degree to which diverse perspectives facilitate the joint construction of new knowledge. The model will be demonstrated through two case studies. *Case study 1.* Participants reported a practice called "Skype Stalking," which is placed closer to 0,0,0 (Fig.1, red dot) in the cartesian coordinate system, this is a scenario where shared intentionality is difficult to foster. Remote work means that the manager did not observe if the employee was "at work," or how hard they were working through spatial-topological properties of objects and people in the room. Skype Stalking appears to be an attempt to compensate for the lack of cues by relying on internal representations based on memories of previous interactions. Further, Skype Stalking relies on an ICT display that claims to indicate the employee's status synchronously, however the indicator conveys no information about whether the employee is engaged in work, thus placing this example at low temporal synchrony. It was reported that managers may not possess the knowledge of disability, or had previous conversations, and is relying on assumptions of how work is done, thus placing this example at low mutual knowledge creation. Consider how the lack of shared intentionality could impact the working relationship and how teams complete tasks in the long-term. *Case*

study 2. The 'hand-over-hand' method is a technique that is used when teaching life skills, such as cooking, or gestures on a phone, the instructor places their hands directly on a BPSI's hands to show how to perform actions. Hand over hand falls at 5,5,5 (Fig.1, blue dot), a scenario where shared intentionality is fostered. BPSI make use of sensory modalities outside of vision to perceive cues of the physical environment. The instructor's hand-over-hand takes this further, indicating high levels of spatial-topological synchrony. The method is conducted both in-person and synchronously, placing it at high temporal synchrony. Participants found instructors with sight loss relatable as they possess the internal representations of learning skills for the first time and from these representations there is high mutual knowledge creation.

3   Expected contributions

The model can extend our understanding of the role of ICTs in conveying information in VWE and the impact of this on shared intentionality for BPSI. It can aid our understanding of digital accessibility, policies that lead to inclusive solutions, or remote-work workarounds, that aim to increase the diagrammatic properties that are made available through ICTs. Additionally, ICTs are critical to how individuals communicate in VWE, this model allows developers to design ICTs that convey cues in an accessible way. Areas of future work could involve research on haptic gloves and virtual reality, that are capable of transmitting spatial-topological properties. In addition, a catalogue of virtual work use cases or benchmarks, of qualitative or quantitative measures over time can extend our understanding of how shared intentionality is fostered. Lastly, this model can also be applied in broad contexts where we socialize and learn through ICTs.

References

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