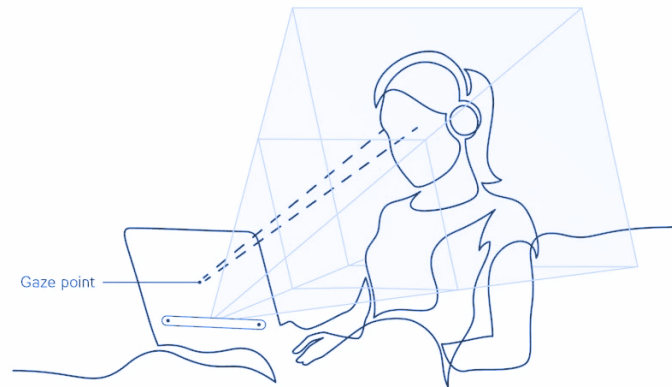


## Through the screen to your mind?



*'Hi, can you hear me? Can you see me? Speak up. Oh, I'm muted.'* - does it sound familiar? This kind of welcoming has replaced *'Hi, how are you?'* regardless of the culture we live in. It is hard to argue that online meetings have changed the way people communicate even much more than we could have expected. Despite the fact that computers are a great communication medium, it turned out that something is missing from online contact. To understand it, let us think for a moment about what is actually happening between people during face-to-face communication.

Even during an average conversation, various physiological processes take place between and within us. These processes have been studied by researchers in many fields and from many perspectives such as brain waves synchronization, visual attention synchronization or heart rate synchronization - in any case, there is no doubt that some physiological synchronization occurs when we are close to each other. But what exactly is it and how to catch it?

Synchronization is an aspect of coherence that describes the coordination between two or more events<sup>1</sup>. It refers to the assumption, where the whole is greater than the sum of its individual parts. A primary mechanism in mediating HRV synchronization among group members are Biomagnetic fields produced by the heart studied by quantum physicians<sup>2</sup>. We are probably not aware about the coherence that we create on a daily basis, but it can

---

<sup>1</sup> McCraty 2017, Mitkidis et al., 2015

<sup>2</sup> Brizhik, 2009; Bischof, 2013

be reflected by a feeling like we are on the same page with someone without even talking to each other.

The mutual understanding foundation is developed in the very first months of life between mother and a child. By following the eyes of the mother the child learns how to communicate and to regulate. A very crucial neural connection between the eye and heart is demonstrated by the **vagus nerve**. It is considered as a social nerve regulating heart and eye reactions. Infants who have difficulties in regulating the vagal brake (i.e., decreasing cardiac vagal tone) during social tasks have also difficulties developing appropriate social interactions<sup>3</sup>. Following and directing attention by gaze is the first behavioral way to understand the intentions and state of the mind of another person. This is called joint attention. Synchronization between partners<sup>4</sup> and joint attention are two of the strongest predictors of a good collaboration<sup>5</sup>. Recently even real-time feedback about HRV synchronization in pairs or groups of people is used to investigate whether learning to regulate physiological synchronization improves collaboration and decision making. Therefore, there is no doubt that we need each other to regulate our bodily processes during collaboration.



*Nevertheless, is it still possible during online collaboration where nonverbal communication is constricted?*



So far we conducted **three experiments** to investigate how physical distance may influence communication and collaboration. **The first study** examined the attentional mechanism of successful large-screen collaboration with an eye-tracking experiment. Three decision-making experimental conditions were tested: in-person collaboration, remote collaboration, and single user. Our main hypothesis was that collaboration focuses users' attention to key information which produces decisions and outcomes closer to an optimal solution. As expected, participants collaborating, whether in person or remotely, had significantly longer dwell times on key elements than single users. The distance between people may also influence their perception and processing. As the spatial distance between individuals increases, information processing is more abstract

---

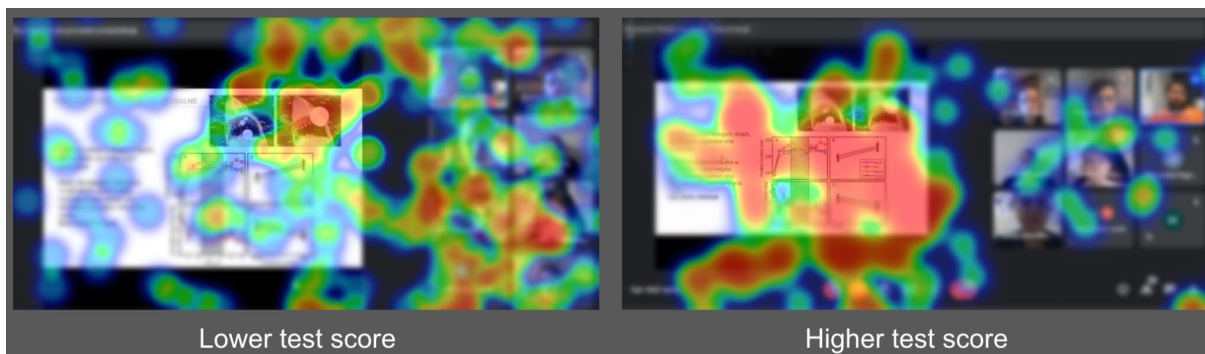
<sup>3</sup> Porges, 1992

<sup>4</sup> Dumas, 2011

<sup>5</sup> Barron, 2003

than concrete<sup>6</sup>. This in turn may affect ambient (more abstract) processing when we work apart from each other and focal processing (more concrete) during face-to-face interaction.

**In the second step** of the project we decided to verify how communication between teachers and students has changed in online learning and how it influences the learning process. Online learning has taken over the role of traditional in-class learning. Little is known about attentional mechanisms standing behind acquiring information during online classes. The aim of this study was to verify the effectiveness of information assimilation during lectures by registration of visual attention distribution in natural, ecological conditions. During online lectures we collected eye-tracking measures of students' visual attention via a computer webcam. After the lectures, students completed a knowledge test concerning the content of the lecture and self-reports about their level of concentration and overload. The results showed that students who remembered more during the lectures looked longer at the presentation and the teacher, and less on their image and other students, than students who remembered less from the lecture. Further, the knowledge test score was positively related to students' focal attention and their dynamics of visual attention focus. The self-report results also suggested that the level of concentration and cognitive load during the lecture was related to the assimilation of the class content.



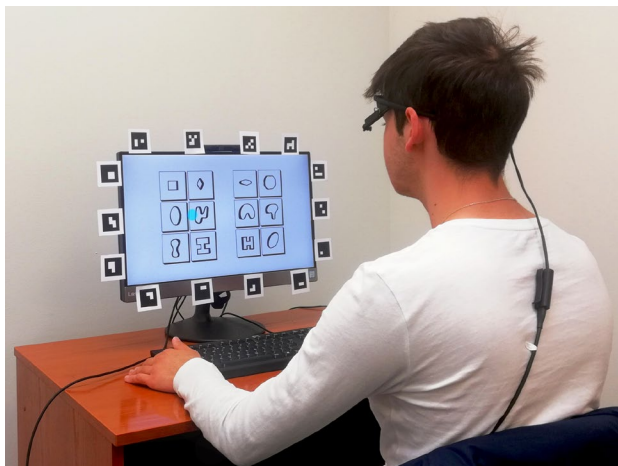
The results can be used in designing interfaces to help students focus on relevant information, or real-time alerting systems informing teachers about the level of students' concentration. On a daily basis, this kind of alerting system can inform us about our level of concentration during long-lasting work. It would not be possible without artificial intelligence which lately enabled us to detect eye movements by webcams. This may be

---

<sup>6</sup> Trope and Liberman, 2010

beneficial in creating gaze-based solutions enhancing quality of collaboration by e.g. gaze visualization of partners' attention without any special equipment.

**The last study** examined if visualization of collaborators' gaze may be used as an attention cue during computer-supported collaboration among self-focused individuals. As we already know, successful and satisfactory collaboration requires joint attention of collaborating partners, their mutual focus on an object. The study examined the extent to which visualization of collaborators' gaze may foster joint attention during computer-



mediated collaboration and enhance its effectiveness. The eye tracking experiment was conducted with high and low self-focused individuals solving logical Bongard Problems while their eye movements were visualized and presented to the partner in remote and co-located settings. The results showed that gaze visualization presented to the collaboration partners fosters joint attention, measured by the percentage of shared eye fixations on an object at the

same time, and enhances collaboration effectiveness measured by task accuracy. Therefore introducing visualization of gaze communication to remote computer-mediated systems may yield a partner-oriented perspective during long-distance collaboration.

Summarizing, there is a growing demand for various solutions that may help us collaborate remotely without difficulties. Enhancing joint attention during remote work has the potential to increase physiological synchronization between collaborators. However, we can not say that it is possible for 100% to replace the feeling of closeness during online collaboration. Moreover, the consequences of disrupted social processes that occur e.g. making close relationships in the class among adolescents and children are still unknown.

The quote from *Little Princess* *'Love does not consist in gazing at each other but in looking outward in the same direction'* may have a different meaning in the light of current gaze-based studies. Indeed, there is a potential to somehow get to others' minds through the screen of the computer. The question is whether we want computers to understand us more than we understand each other. We used to short online meetings to sort out problems and feel that our work is efficient in spite of the forced isolation.



Do we still remember that there is something more in everyday communication than tackling the issues? If not, perhaps it is good to take the

step back and try to appreciate face-to-face contact whenever we can. Some surprising observations might come through this experience of being with each other which might be beneficial not only for our collaboration quality, but the whole mind and body.