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The effect of simulated feedback about psychophysiological synchronization on perceived empathy and connectedness

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Abstract. Social interaction technologies have increasingly become available to psychotherapeutic practice. Despite evidence for their efficacy and other unique benefits, adoption among therapists is still relatively low. A main barrier for therapists is their perception that the ability to empathize and connect with their clients is compromised in technology-mediated interactions. However, the unique affordances of technologies also offer opportunities that could help overcome this barrier and possibly even enhance the empathic interaction. One potential direction is to augment social interaction with feedback derived from psychophysiological measures. A specific interpersonal psychophysiological phenomenon that seems particularly relevant is psychophysiological synchronization, the occurrence of substantial levels of synchrony in human physiology between persons, which has been linked to empathy. The current study investigates the effect of (simulated) feedback about psychophysiological synchronization on perceived empathy and connectedness. Sixty-six participants received simulated feedback, indicating high or low synchronization, while watching an emotionally salient movie simultaneously with a confederate in a separate room. Participants receiving feedback indicating high synchronization reported higher levels of perceived empathy and connectedness compared to the low synchronization feedback group. This study suggests that feedback about physiological synchronization might be used to influence levels of empathy and connectedness in remote interactions, which could potentially be applied to increase empathy between therapists and clients in technology-mediated psychological treatment.

Keywords. technology-mediated interaction, psychophysiological synchronization, empathy, e-mental health

1. Introduction

Over recent decades, technology-mediated psychological treatment has shown a level of efficacy comparable to that of unmediated treatment [1], and has been associated with several unique benefits such as increased convenience, and accessibility of mental health care [2, 3]. However, adoption of technology in clinical practice of mental health care professionals remains relatively low [2]. Among a variety of reasons, one important barrier of practitioners is their concern that mediated interactions do not allow for sufficient empathic understanding [3]. Empathy, or the process by which an individual is able to understand and, to some extent, feel what another individual is feeling, is a crucial ingredient of successful psychotherapy [4]. The expressed concerns on reduced empathic understanding seem to originate in having less access to important social cues, such as eye gaze and posture [5]. The more traditional approach to overcome this is to try to simulate face-to-face interactions as closely as possible, for example by implementing eye gaze correction technologies. Another, complementary approach is to
use unique affordances of technology to transform the interaction in a way that could add value above and beyond what is possible in unmediated interactions [6].

A possibility along this line is interpersonal psychophysiology, i.e., using psychophysiological signals as social and affective cues [7]. In the past decade, technologies to measure physiological signals have rapidly advanced. These developments in the field of biosensing have made physiological measurements less costly and much easier to conduct, especially with the increased availability and quality of wearable devices. Thereby, the application of psychophysiology for social interaction purposes has come within reach. At the same time, since these developments are relatively new, it is a largely unexplored area with many questions that still need to be addressed (for a review, see [7]). A specific interpersonal psychophysiological phenomenon that might be particularly relevant to enhance empathic interactions is psychophysiological synchronization, the phenomenon that the physiology of two persons can show substantial synchronicity, e.g., heartbeats that run in synchrony [8]. Psychophysiological synchronization has been studied in relation to empathy, especially in close relationships, and findings generally show that feelings of empathy tend to be higher with higher levels of synchronization [8].

While evidence for the existence of psychophysiological synchronization is accumulating [8], the underlying mechanisms and potential effects are still under-researched. For instance, it has rarely been studied how providing feedback about the level of psychophysiological synchronization affects social interaction. Studies that provided feedback on physiological signals (i.e., heart rate) of an interaction partner found that this could enhance interpersonal intimacy [9] and closeness [10]. If these findings also hold for feedback on psychophysiological synchronization, this could be a valuable addition to solve the lack of non-verbal cues in remote interactions and facilitate empathic understanding in social and therapeutic interactions. Results of a first exploratory study of psychophysiological synchronization feedback during a meditation exercise in Virtual Reality were promising; they found that higher synchrony in respiration rates was related to higher feelings of empathy [11]. To further investigate the potential of psychophysiological synchronization feedback, the current study aims to investigate the effect of (simulated) feedback about the level of psychophysiological synchronization on perceived empathy and social connectedness during a remote interaction.

2. Methods

2.1. Participants

The sample consisted of 66 participants (53% male, age ranging from 18-81 years, M = 28.9) recruited through the J.F. Schouten participant database of the Eindhoven University of Technology. Most of the participants were students (80%). The participants received a monetary compensation of €3 for their participation.

2.2. Materials and measures

In this lab-experiment, participants watched a 3-minute emotionally salient videoclip from the movie "The Champ" from 1979, where a child cries over his father who just died. This videoclip has been shown to elicit high levels of sadness [12-13]. During this video, a colored border around the screen was shown which represented (simulated) feedback on the level of physiological synchronization with the other participant. This representation was chosen based on a short pilot study (N = 6), mainly because it was found easy to interpret and does not require direct focus, in contrast to for example a graph or numerical value. The border varied between three colors: green referred to high synchronization, orange to medium, and red to low. Participants were randomly assigned to one of two conditions: high synchronization (76% of time green border, 24% orange) or low synchronization (76% red, 24% orange).

Perceived empathy was measured with seven statements on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree". These items were based on the questionnaire used in [14], adapted to the context of this experiment (α = .75). Social
connectedness was measured with the Inclusion of Other in Self (IOS) scale [15], a single-item pictorial measure in which participants have to pick one of seven options of increasingly overlapping circles that best represents their closeness to the other participant. To measure subjective closeness, we included the Subjective Closeness Index (SCI) [16], which consists of two statements on a 7-point Likert scale ranging from “not at all close” to “very close”.

2.3. Procedure

The participant was picked up from the waiting area, while a confederate (a 19-year-old woman) was already in the lab. After giving informed consent and introduction of the experiment, the participant and the confederate were seated in separate booths. The skin conductance sensors were applied to the participant and he or she was instructed “to wait while the sensors were being applied to the other participant” (the confederate). After an appropriate waiting time and a neutral video (i.e., images of an aquarium), the sadness evoking video with the colored border was shown, followed by a digital survey consisting of the questionnaires and additional questions on demographics and control variables. Last, participants were debriefed and received their compensation. The entire procedure lasted approximately 15 minutes.

3. Results

Independent-samples t-tests were performed to test the effect of high vs. low (simulated) synchronization feedback on perceived empathy and social connectedness. Both effects were statistically significant: the high PS feedback group gave a higher score on perceived empathy ($t(62.9) = -4.54, p < 0.001, d = 1.10$) and social connectedness ($t(43.6) = -4.14, p < 0.001, d = 1.01$) compared to the low synchronization group. No significant effect of the conditions was found on subjective closeness ($z = -1.35, p = 0.18$), although differences were in the expected direction. A regression analysis to check for age- and gender related differences did not yield significant results. Table 1 shows the descriptive statistics of the scores on the measures for both conditions.

Table 1. Descriptive statistics for the scores on the dependent measures for both conditions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Perceived empathy</th>
<th>IOS</th>
<th>SCI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>95% CI</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Low synchronization</td>
<td>2.57 (0.58)</td>
<td>2.36-2.57</td>
<td>1.67 (0.74)</td>
</tr>
<tr>
<td>High synchronization</td>
<td>3.17 (0.51)</td>
<td>2.99-3.35</td>
<td>3.00 (1.70)</td>
</tr>
</tbody>
</table>

4. Discussion

This is a first study exploring the effect of (simulated) psychophysiological synchronization feedback in social interactions. The results generally support our hypotheses, indicating that receiving feedback of high synchronization with another person increases feelings of perceived empathy and connectedness with that person, compared to feedback of low synchronization. These results are in line with earlier studies indicating that sharing physiological signals can support intimacy and empathy [9, 10]. This is especially relevant in the context of (online) psychological treatment, as one of the main concerns of practitioners is the lower ability to empathize and connect with clients in technology-mediated interactions [2, 3]. The current findings suggest that there might be an opportunity for psychophysiological synchronization feedback to overcome this barrier and even add an extra element to the interaction, in mental health care but also in other contexts, such as online dating, gaming, and remote collaboration.

The results of this study also appear to be in line with previous research that found a relation between psychophysiological synchronization and empathy [8]. Two major differences with these studies though, is that they used genuine physiological signals and did not provide feedback to the interactional partners on their level of synchronization. A logical next step, then, would be to investigate how these findings relate to each other.
Whereas simulating the feedback enabled us to control the differences between conditions, real physiological synchronization will most likely not show a variation that is as clear cut as the differences between high and low synchronization presented in the current experiment. So, it will be of interest to investigate if the measured effects persist if genuine feedback with realistic levels of synchronization is provided, as results of a first exploratory study suggest [11]. Further studies with control conditions and actual measurements will also help to clarify questions regarding whether and how synchronization feedback, actual synchronization, and feelings of empathy are related, and in which direction. Do people feel empathy and then synchronize, do they synchronize and then feel empathy, or is it a continuous bidirectional process? And how does receiving feedback on one’s level of synchronization influence this relationship?

Another important factor is the task that is performed by the participants, and in particular the level of interaction during their activity. In the current experiment there was only minimal contact between partners. It is reasonable to assume that tasks that involve higher levels of interaction have more effect on feelings of empathy, but more research is needed to clarify its exact working. Another possibility requiring further investigation, is that the synchronization feedback not necessarily has to be psychophysiological in nature, but that any kind of perceived similarity affects affiliative outcomes. Perceived similarity has been associated with increased liking between persons [18], although evidence for a link with increased empathy is mixed [19].

A limitation of the current study is that it used red, orange, and green colors, colors that we have strong evaluative associations with [20], potentially confounding the interpretation of the feedback. A future study could use colors that do not have strong associations, colors such as yellow and purple. More generally, future studies are necessary to investigate how different kinds of representation influence the found effects.

In short, the current study finds support for earlier work indicating that physiological feedback can be used to facilitate empathic interactions. With the accumulating evidence for the existence of physiological synchronization and its link to empathy, the application of psychophysiological synchronization feedback seems particularly promising for social interaction purposes, and the current study provides first evidence that justifies future investigations.

References