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# Improving social connectedness: sharing physiological signals

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**Introduction**

Sustained feeling of social connectedness is one of the most important predictors of well-being [7] and positively contributes to supporting key social relationships [2]. Moreover, the lack social connectedness has strong effects on physical health, influencing, for instance, neuroendocrine and cardiovascular systems [4]. This importance of social connectedness has sparked research on systems and technologies in HCI that can improve our sense of belonging and help reduce our feeling of loneliness, such as awareness systems for families and friends (e.g., [1]) and devices supporting social connectedness for remote couples [8].

Our work explores if and how can sharing of physiological signals constitute a novel approach for technologies supporting felt social connectedness. Drawing on prior research mainly from the psychology literature, which suggested heartbeat as a prospective starting point, we have explored effects of sharing heartbeat in everyday life of couples through a technology probe deployment. We interviewed 13 pairs of participants using the probe in social scenarios in the lab, and 5 couples during a two-week long deployment into the homes. Key issue was on leaving the interpretation and making sense of the heart rate

feedback in the hands of users, rather than automated algorithms. A more detailed report on the study will be presented as a full paper at this year's CHI [6], focusing on understanding people's experiences with, interpretation of, HR sharing in their everyday life. Here, we take another angle on the results, foregrounding opportunities for systems supporting emotional well-being through facilitating connectedness and personal growth.

### **Study design and results**

We have developed a simple technology probe package based on heart rate belt paired with a standard laptop through Bluetooth connection. Two such packages were given to each couple, encouraging them to use the probe in any way they wish. Several feedback options were available: the system supported three types of *visual feedback* on the display of the laptop (e.g., water ripples displayed over an image, where the number of ripples shown simultaneously corresponded to HR); as well as audio feedback (e.g., sound of soft rain, with the volume increasing linearly with measured HR). The in-lab participants were provided with a default settings. Our results draw mainly on interviews conducted after the in-lab task, or at the beginning, middle and end of the home deployment.

One of the effects that we identified during analysis of interviews with both home/lab participants, suggests that participants understand HR feedback as a form of *direct*, open connection to a remote person, without the need for it to give any understandable information about the other's state. In other words, for this effect to appear, participants preferred if no context about the other's activities is available, i.e., for example when the

couple is physically apart and only HR is shared. Based on the interviews, we suggest that the felt connection can be explained by the idea that participants saw the HR as a *part* of the other – for example participants used statements like “*someone is living there*”, or “*she is present here with me*” to talk about HR feedback in this sense. The CHI paper also discusses when and how people tend to interpret HR feedback in terms of emotions.

None of the 5 couples from the home deployment had any privacy concerns regarding sharing his/her heartrate with the partner during the study, but expressed concerns with sharing such data with people he/she was less close with, or especially interacted with in work-related contexts. This suggests that although sharing HR data is generally felt as something very intimate, it might be less problematic to use it in design for close family contexts.

### **Implications and future work**

Our data provides several suggestions on how one could use physiological data to support feelings of social connectedness. As the most direct example, it suggests that including HR feedback to tokens people use to remind us of a close other (e.g., pictures or jewelry) with HR feedback might strengthen the felt connection to the other. In particular, the object might be no longer “just” help us remember the other, but is connected to him/her directly through the real-time HR feedback. Several our participants also suggested various systems that would place two or more heart rates together onto one screen/object, to bring representations of people together. Similarly, HR feedback seemed to fit well into social interactions with

close friends/family such as games, movie watching and similar.

It seems that heart rate or other physiological feedback could be also used in other contexts, where self-awareness and reflection on the on-going interaction are key, such as social skills courses or coaching. In particular, HR sharing in emotional moments could focus people more on what is happening "here and now"; and it's ambiguity could facilitate more in-depth reflection, similarly to the ways in which people used physiological data to reflect and find patterns in their stress levels during the day in the Affective Diary project [5]. In such settings, it might be also interesting to focus on presenting *composite signals*, i.e., indicators computed from physiological data streams of two or more people. For example, heart rate synchronisation has been implicated as indicators of empathy as well as social connection (e.g., [3]).

To summarise, our results suggest that heart rate feedback could be useful to support social connectedness, for example for remotely living couples and other family members. Moreover, we believe that further exploration of physiological signals sharing could lead to interesting applications also in the domain of personal growth, such as the mentioned social skills courses or coaching.

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