The Tell-Tale Heart: Perceived Emotional Intensity of Heartbeats


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ABSTRACT

Heartbeats are strongly related to emotions, and people are known to interpret their own heartbeat as emotional information. To explore how people interpret others' cardiac activity, the authors conducted four experiments. In the first experiment, they aurally presented ten different levels of heart rate to participants and compare emotional intensity ratings. In the second experiment, the authors compare the effects of nine levels of heart rate variability around 0.10 Hz and 0.30 Hz on emotional intensity ratings. In the third experiment, they combined manipulations of heart rate and heart rate variability to compare their effects. Finally, in the fourth experiment, they compare effects of heart rate to effects of angry versus neutral facial expressions, again on emotional intensity ratings. Overall, results show that people relate increases in heart rate to increases in emotional intensity. These effects were similar to effects of the facial expressions. This shows possibilities for using human interpretations of heart rate in communication applications.

Keywords: Communication, Emotion, Facial Expressions, Heart Rate, Heart Rate Variability, Multi-Level Modeling

INTRODUCTION

Perceiving someone's heartbeat can be a powerful experience. One would normally perceive only one's own heartbeat or the heartbeat of someone (physically) very close, by putting one's ear the other person's chest. This is clearly an intimate experience. Also, heartbeats are used in different media. For instance, in movies, playing the sound of the heartbeat of a character can enhance the excitement or tension in the movie. Similar effects are sometimes used in games by giving, for instance, haptic feedback through a game controller at the rhythm of a heartbeat (e.g., in Metal Gear Solid). Furthermore, Werner, Wettach, and Hornecker (2008) and Janssen, Bailenson, Ijsselsteijn, and Westerink (2010) showed that feeling someone else's heartbeat

DOI: 10.4018/jse.2013010103
can be a very intimate experience. This suggests that perceiving someone else’s heartbeat can create strong social experiences.

Perceiving another person’s heartbeats might create a strong social experience because heartbeats are strongly related to emotions (Kreibig, 2010), and emotions are an important component of many social interactions (e.g., Frijda & Mesquita, 1994; Keltner & Haidt, 1999; Keltner & Kring, 1998). To give a few examples, emotional displays promote trust and reconciliation (Keltner, 1995), facilitate attachment (Bowlby, 1969), and elicit social contact (Schachter, 1959). Emotions also help to create common ground in social interactions by eliciting expressed emotions in a perceiver of those emotions (Hatfield, Cacioppo, & Rapson, 1994; Shortt & Pennebaker, 1992). Furthermore, emotions have the property that they elicit the sharing of emotions (Rime, 2009). Hence, emotions propagate through social networks (Rime, Philippot, Boca, & Mesquita, 1992), which can be useful for, for instance, obtaining help, support, or advice, arousing empathy, gaining attention, receiving comfort, or letting off steam (Rime, 2007). Hence, emotions are at the core of many social and intimate interactions.

The relation between emotion and heart rate (HR) and heart rate variability (HRV) has been widely investigated. In fact, HR is the most often adopted physiological measure of emotion (Kreibig, 2010). After a review of 134 studies, Kreibig (2010) concluded that HR increases with both negative and positive emotions (e.g., Hess, Kappas, McHugo, Lanzetta, & Kleck, 1992; Adsett, Schottstaedt, & Wolf, 1962; Khalifa, Roy, Rainville, Dalla Bella, & Peretz, 2008; Gehricke & Fridlund, 2002; Boiten, 1996; Tugade & Fredrickson, 2004; Robin, Alaoui-Ismaïli, Dittmar, & Vernet-Maury, 1998; Murakami & Ohira, 2007). This can be explained by the fact that emotions trigger a behavioral reaction (sometimes called a fight-or-flight response; Cannon, 1927), which requires increased blood flow to the muscles. A few exceptions included emotions comprising an element of passivity (e.g., contentment, non-crying sadness, affection), which may result in decreases in HR (e.g., Christie & Friedman, 2004; Hess et al., 1992; Nyklicek, Thayer, & Van Doornen, 1997) as they do not trigger a behavioral reaction.

Beside HR, HRV has also been shown to relate to emotions. HRV is often separated into low frequency HRV (LF; 0.05 - 0.15 Hz) and high frequency HRV (HF; 0.15 - 0.40 Hz; Bernstein et al., 1997). The LF component is mostly related to activity of sympathetic branches of the nervous system (Malik et al., 1996). As shown by Kreibig (2010), the LF component has not been consistently associated with emotions. In contrast, the HF component has been related to emotions. The HF component is mostly related to vagal tone (or parasympathetic activity) and is also referred to as respiratory sinus arrhythmia (RSA; Grossman & Taylor, 2007). Higher levels of tonic HF HRV have been associated with higher emotional reactivity (Butler, Wilhelm, & Gross, 2006; Beauchaine, 2001). Moreover, more acute HF HRV decreases are likely to be due to increases in emotion regulation with a fight-or-flight activation pattern, which involves vagal withdrawal and increased sympathetic activation (Butler et al., 2006; Porges, 1995). In other words, HF HRV decreases can signal a change due to a stressor or emotional stimulus (Beauchaine, 2001). Hence, the HF component of HRV is associated with emotional reactivity and regulation.

People are likely to be able to interpret the HR of others. Evidence for this comes from Valins (1966), who gave participants false feedback on their own heart rate. His results showed that false HR feedback influenced participants’ perceptions of their own emotional state. In Valins’ view, the perception of a heightened HR triggers a cognitive process that tells the perceiver that an emotional process is going on. Several other researchers have repeated and confirmed Valins’ findings under different conditions (Detweiler & Zanna, 1976; Goldstein, Fink, & Mettee, 1972). Although there are discussions about the exact processes underlying the effects found in Valins’ study (see
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