Affecting emotional experience with auditory-vibrotactile heartbeat false feedback

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Introduction

W. James (1890) hypothesized that emotions are our perception of physiological changes. Studies have demonstrated that induced physiological state changes can influence one's emotional responses to stimuli (e.g. Schachter & Singer (1962)). We tested how the presentation of false heartbeat feedback to participants (N=24) via auditory and/or tactile stimulation can affect their physiological state and likewise their emotional attitude to positive and negative images. In addition, distant versus close sound reproduction conditions (loudspeakers vs. headphones) were used to identify whether an *embodied* experience can occur, i.e. participants associating the heartbeat with their own, and modulate the emotional responses.

Stimuli

Parameters varied were:

- **3 sound conditions**: (1) no sound; (2) distant (loudspeakers - LS); (3) close (headphones – HP).

- **2 vibrations** under the seat: on / off.

- **2 rates of the false heart beat**: 60 bpm / 110 bpm.

- **2 valence values of the images** (positive / negative)

Pictures: from the International Affective Picture System (IAPS – Lang, 2005). Presented in the last 6 s of the trial.

- Arousal = 5 (over 9) for all pictures
- Valence = 7 for positive pictures
- = 3 for negative pictures

Method

- **Stimuli**

- **3 sound conditions**: (1) no sound; (2) distant (loudspeakers - LS); (3) close (headphones – HP).

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- **Task**

- **Rate reaction to picture**

- **6 s**

- **PLAYED VIA:**

- Loudspeakers
- Headphones
- No sound

- **2 RATES:**

- Slow (60 bpm)
- Fast (110 bpm)

- **Vibrations (under seat)**

- ON / OFF

- **Show Picture**

- **Auditory Imagery correlates with Vibration:**

- In the presence of vibrations & when facing negative pictures (p<0.001):
  - Good imagers → rate pictures as ‘less negative’
  - Bad imagers → rate pictures as ‘more negative’

Results

**Effects of Sound:**

- Effects on SAM ratings: Significant effect on valence & arousal (p<0.01) for positive pictures
- Effects on physiology: small (+1 bpm variation after 40 s) but significant (p<0.05)

Effects of Rate:

- False heartbeat feedback significantly amplified emotional responses to pictures (SAM ratings):
  - At average 13 from 32 pictures were recalled (data below is individually normalized)
  - Effect of rate on memory of pictures

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Conclusions

Experimental results show that false heartbeat feedback significantly affects emotional responses to pictures. High-rate heartbeat sound resulted in higher arousal ratings and enhanced picture memory. The small physiology adaptation could be related to the short exposure period (< 50 s) or the interaction with imagery (e.g. complex interactions with valence and arousal found in Lang et al., 1990).

Seat vibrations showed interaction with reproduction of the heartbeat sound depending on its spatial location (tactile capture of audition?) and picture type. A relationship between auditory imagery and vibratory stimulation has also been observed.

References:


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