Testing the Sing-a-Song stress test – how is stress related to attention and social anxiety?

Author: Emma Smith
BSc Hons Psychology

Student number: 150665043
e.smith8@newcastle.ac.uk

Supervisor: Quoc Vuong
Institute of Neuroscience

School of Psychology,
Newcastle University

Introduction

When studying the physiological stress reaction, researchers ideally induce stress in an efficient and controllable manner. The goal is to be able to measure the stress response with no influence from body movements or sensations. Inducing stress with the Sing-a-Song stress test does just this.[1] The stress response activates the sympathetic nervous system, which increases heart rate and skin conductance, i.e. how well your skin conducts electricity, which is affected by sweat.

Exaggerated stress and emotional responses are related to anxiety, and anxiety vulnerability is related to attentional biases towards threatening stimuli, for example images of angry faces.[2] Attentional bias (i.e. the tendency to pay attention to some things, while ignoring others) towards threat is called vigilance for threat and increased vigilance for threat speeds up the perception of threat, i.e. more anxious participants may have faster reaction times towards threatening stimuli. Heightened vigilance for threat may lead to anxiety and stress related problems.

Aims

To see

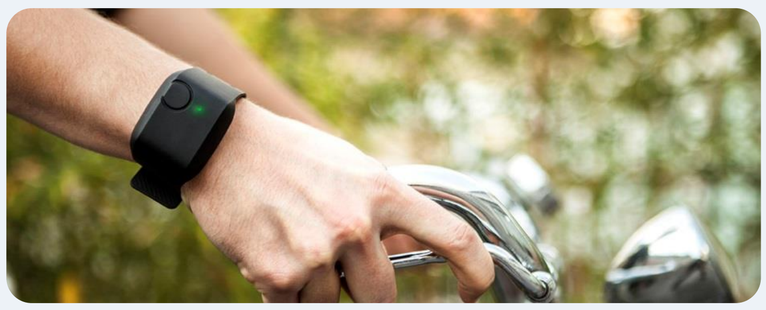
1. if a modified version of the Sing-a-Song stress test would produce a physiological stress response
2. whether we could reliably measure these responses using a wearable wrist-sensor

To see if the stress response is related to

1. increased vigilance for threat
2. social anxiety (using a questionnaire)

The Sing-a-Song stress test

- Participants wore a wrist-sensor
- They read neutral phrases on a computer screen silently with a 1 minute break in between each one
- During the break, a timer on the screen counted down the seconds (from 60) after each phrase
- After 9 control phrases, the experimental phrase contained instructions to sing a song **after** the following countdown timer reached zero -> finally participants sang a song
- They were not told beforehand that they would sing



Empatica E4 wrist-sensor

This commercial, developed for research, wrist-sensor is an unobtrusive and convenient way to measure physiological responses. We measured participants' heartrate and skin conductance.

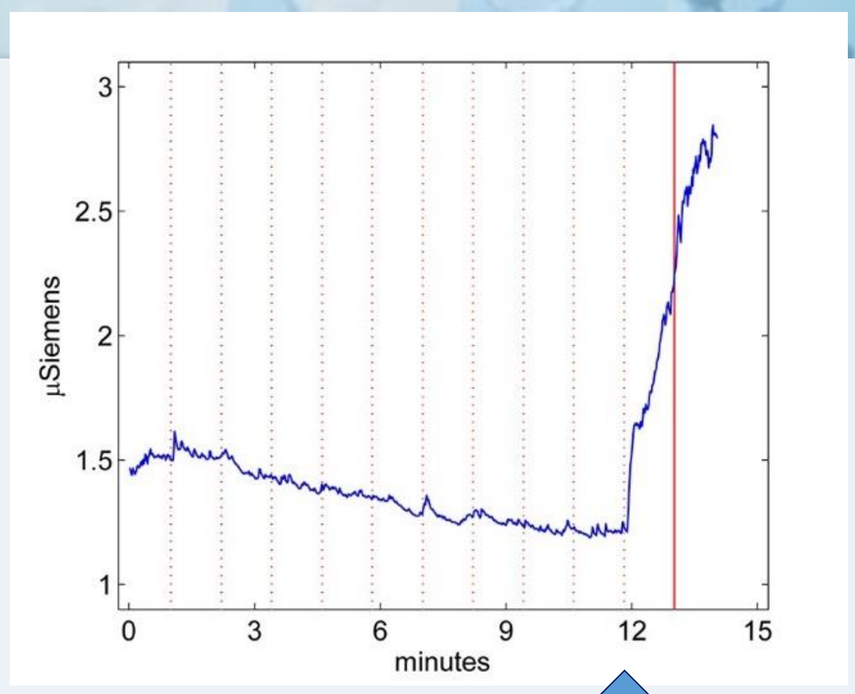
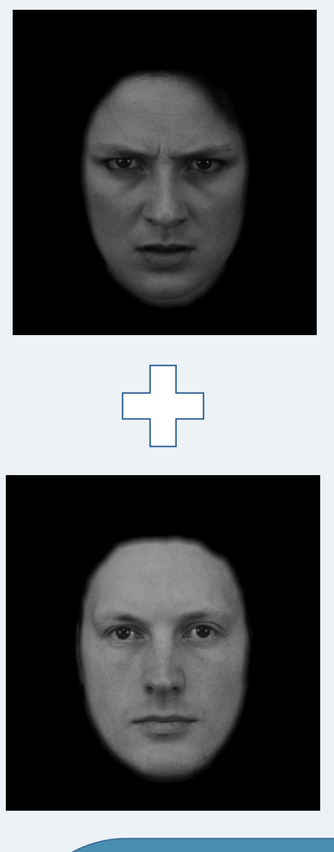


Fig.1. Average skin conductance response throughout the Sing-a-Song stress test - red dotted lines indicate the presentation of a phrase, the arrow indicates the sing-a-song instructions – heightened skin conductance is clear after the presentation of instructions

Measuring vigilance for threat: the dot probe task

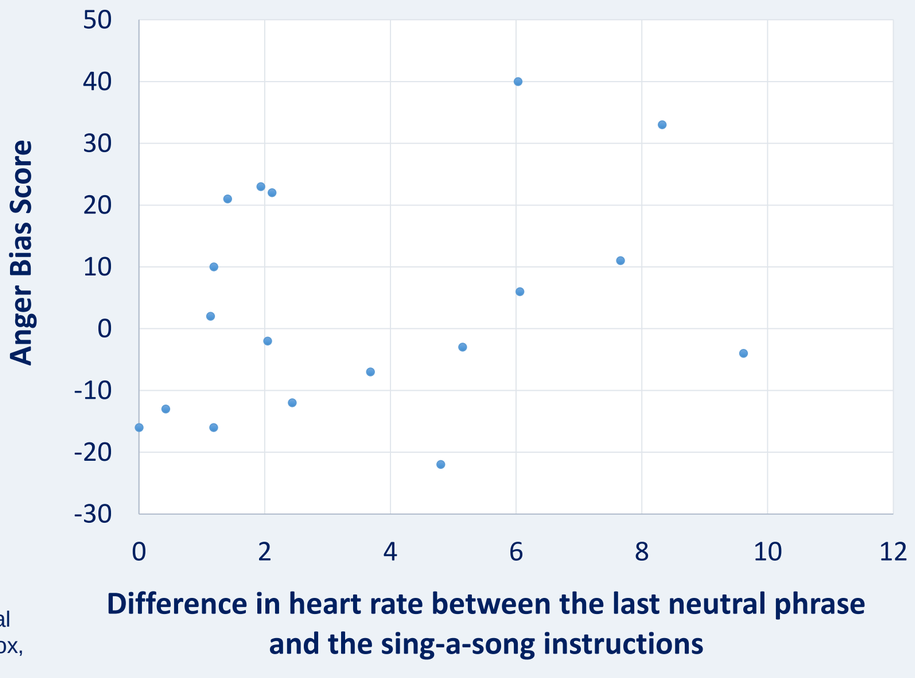
- Participants had to indicate whether two dots on a computer screen were vertically (:) or horizontally (. .) oriented by pressing a computer key
- Before the dots appeared, they were shown angry, happy, or neutral faces very briefly, two at a time, with the dots appearing in the location of one of the faces
- If the participants pressed the key faster when the dots replaced an angry face, they would have an attentional bias for threat, i.e. vigilance for threat



Participants would look at the fixation cross on the screen, two faces would flash, for example angry and neutral, followed by two dots at one of the two locations. Participants would respond to the dots, but their response times may be faster if they were paying attention to the angry face, and if the dots would appear at that location. This attentional bias is known as vigilance for threat.

Results

- Heart rate and skin conductance responses were significantly stronger after the sing-a-song instructions, than after the control phrases
- Vigilance for threat is indicated by anger bias scores, which represent the faster reaction times in response to angry faces
- We did not find significant vigilant responses to angry faces
- However we found a non-significant positive correlation between the anger bias scores and the heart rate increase in response to the sing-a-song instructions, r=0.26, p=.234 (N=18)
- We did not find the social anxiety scores to be related to physiological stress



Conclusions

- We produced a physiological stress response in participants by using the modified SSST
- However we did not find the stress response to be related to participants' threat-related attentional biases
- This may however be due to lack of power, i.e. a small sample size
- Future stress response studies could use the simplified SSST, as well as the simple-to-use wrist-sensor to produce streamlined, yet accurate research designs

Acknowledgments

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References: [1] Brouwer & Hogervorst (2014). A new paradigm to induce mental stress: the Sing-a-Song Stress Test (SSST). *Frontiers in neuroscience*, *8*. [2] Fox, Cahill, Zougkou (2010). Preconscious processing biases predict emotional reactivity to stress. *Biological psychiatry*, *67*(4), 371-377.