Vegetative States Research Group

18th of May

2023

Induction of Anger and its Physiological Measurements

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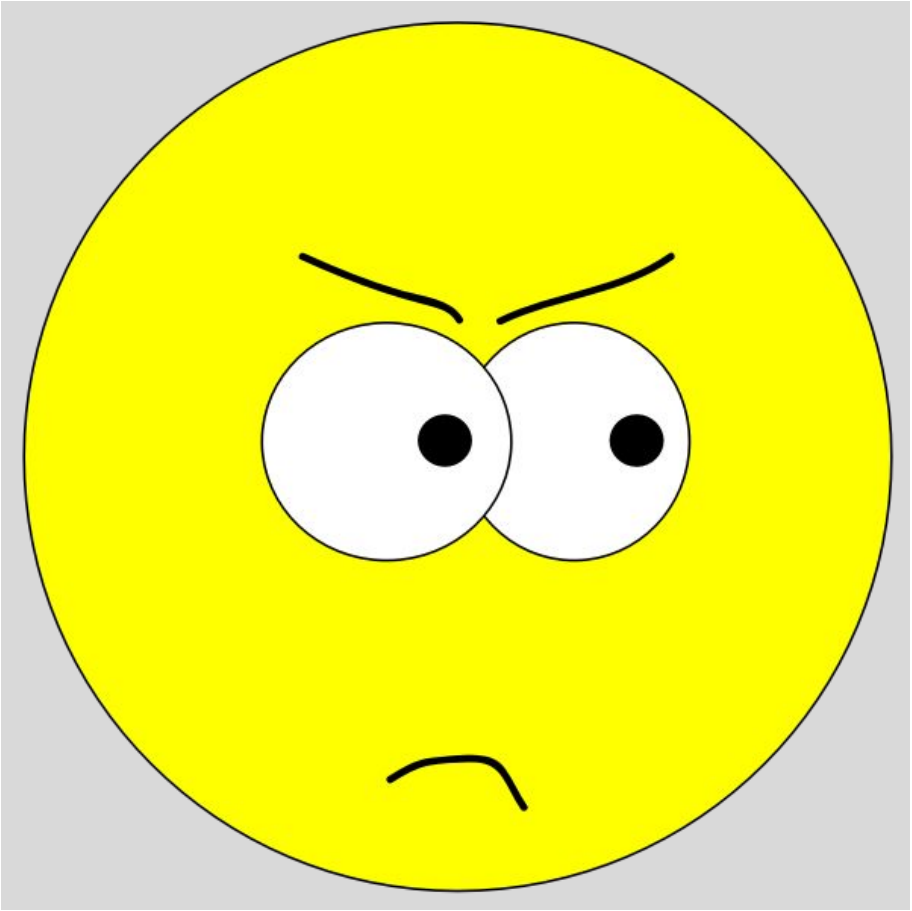
- MSc in Cognitive Sciences and Technologies (2022/2024)

Why should we study anger?

While past research has focused mainly on the psychological aspects of anger, such as how it is expressed or its cognitive determinants, psycho-physiological research considers the physiological changes that occur in response to anger, such as changes in heart rate, cortisol levels, and blood pressure.

This approach allows for a more comprehensive understanding of anger and its effects on the individual.



Empirical measurements of Anger

1. Heart rate
2. Blood pressure
3. Facial expressions
4. Cortisol levels

Induction of Anger and its Physiological Measurements

Heart rate

Measuring anger in response to a social stressor using heart rate variability index" - Takahashi, M. et al. (2018) -

The article investigates the use of a heart rate variability (HRV) index to measure anger in response to a social stressor.

The study involved 16 healthy young adult participants who were exposed to a social stressor. Heart rate and HRV were recorded before, during, and after the stressor, and anger was assessed using a self-report measure.

The results showed that individuals with higher trait anger had reduced HRV after the stressor, suggesting a greater impact on their physiological responses.

Apparatus used

The HRV was measured continuously throughout the study using a chest strap monitor which measured the interbeat intervals of the participants.

The HRV data was then converted into an index which quantified the moment-to-moment changes in the subject's heart rate data.

Measuring anger in response to a social stressor using heart rate variability index" - Takahashi, M. et al. (2018) -

The effect of expressing anger on cardiovascular reactivity and facial blood flow in Chinese and Caucasians" by Peter Drummond and Saw Han Quah - 2007

This study aimed to investigate the physiological responses of expressing anger in different ethnicities.

The study involved 64 participants, with 32 individuals from Chinese ethnicity and 32 from Caucasian ethnicity, and they were asked to express anger and report their level of anger while their cardiovascular and facial blood flow were measured.

The results showed that expressing anger in both ethnic groups caused significant increases in blood pressure and heart rate, indicating cardiovascular reactivity.

However, there were no significant differences between the Chinese and Caucasian groups in terms of cardiovascular responses.

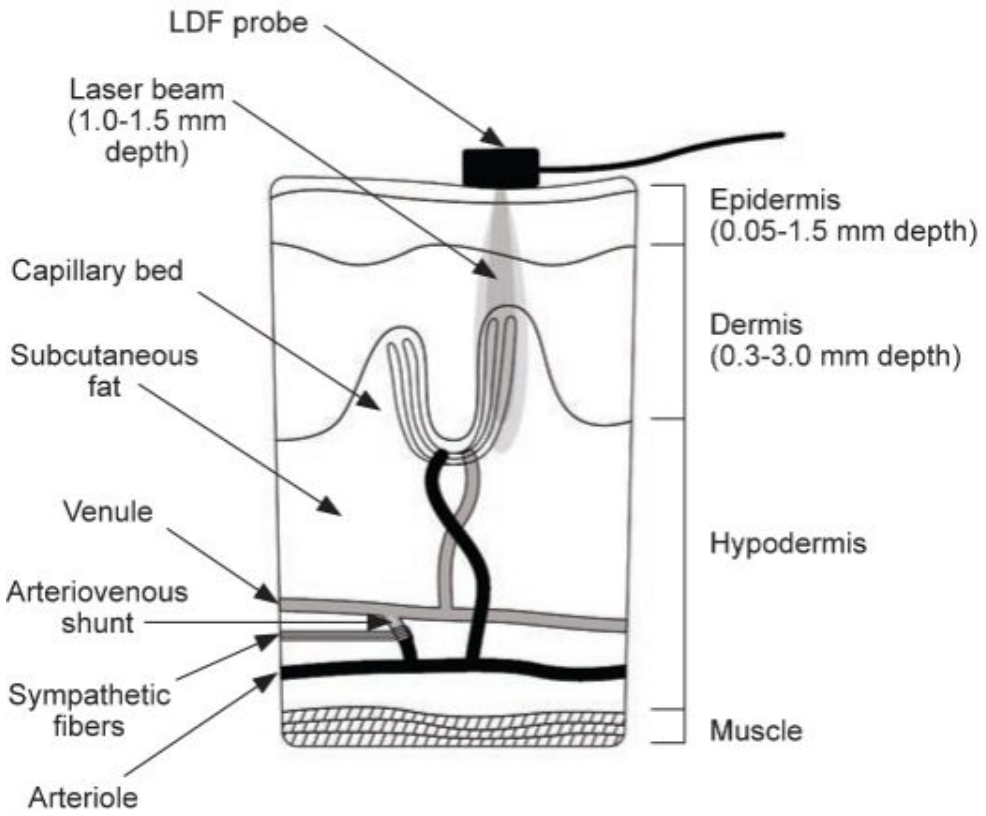
Procedure

The procedure involved measuring the cardiovascular reactivity and facial blood flow of each participant while they performed the tasks. Blood pressure and heart rate were recorded with a non-invasive blood pressure monitor, and facial blood flow was measured with a laser doppler flowmeter.

Before the task began, baseline measurements were taken of each participant's blood pressure, heart rate, and facial blood flow.

For the speech task, participants were given time to prepare their speech and then delivered it to a video camera while blood pressure, heart rate, and facial blood flow were recorded.

For the mental arithmetic task, participants were given a series of calculations to complete as quickly and accurately as possible, with blood pressure, heart rate, and facial blood flow recorded throughout



Blood pressure changes during various degrees of anger expression." - Tse, Mimi M., et al. (2016)

Changes in blood pressure during different degrees of anger expression.

Mild to moderate anger expression leads to an increase in blood pressure, while severe anger expression results in a larger and longer-lasting increase.

Prolonged or chronic anger expression can lead to hypertension and increase the risk of cardiovascular disease. Effective anger management strategies may help to regulate blood pressure and reduce the risk of hypertension and associated health problems

Procedure

Non-invasive oscillometric blood pressure monitor to measure blood pressure changes during different degrees of anger expression.

The researchers recruited 180 healthy participants and asked them to complete a self-report questionnaire to assess their anger expression levels. Then the participants were randomly divided into three groups: mild, moderate, and severe anger expression.

Each group was instructed to recall a recent personal experience that had provoked mild, moderate, or severe anger and express their anger verbally for two minutes in front of the experimenter. During the anger expression task, the participants' blood pressure was measured at baseline, 30 seconds, one minute, and two minutes.

Blood pressure changes during various degrees of anger expression."
- Tse, Mimi M., et al. (2016)

Krumhuber, E., Manstead, A. S. R., Kosinski, M., & Kappas, A. (2013). - Facial expressions

The study investigated the temporal dynamics of facial expressions of emotions, including anger, in response to verbal and nonverbal stimuli.

The study found that facial expressions of various emotions, including anger, showed differences in their temporal dynamics based on the stimuli used to elicit the emotion.

PRocedure

Laboratory-based experiment to investigate the temporal dynamics of facial expressions of emotions.

The apparatus used in the study included a high-speed camera capable of recording facial movements at 50 frames per second and a computer software program for coding and analyzing the recorded footage.

The camera was positioned to capture the participant's facial expressions during the experiment, and the software was used to identify specific facial movements and track their temporal dynamic.

Krumhuber, E., Manstead, A. S. R., Kosinski, M., & Kappas, A. (2013)

Deuter, C. E., Wolf, O. T., & Reuter, M. (2016) - Cortisol levels

The study by Deuter, Wolf, and Reuter (2016) aimed to investigate the relationship between cortisol levels and anger.

They analyzed the cortisol responses of participants before and after exposure to an anger-inducing task and found that those who exhibited high cortisol responses before the task were more likely to show stronger anger reactions.

Procedure

The procedure used in the study involved measuring the participants' cortisol levels before and after the anger-inducing task.

Before the task, the researchers collected cortisol samples by making the participants give a saliva sample.

The samples were collected at four different time points: 30 minutes before the task, right before the task, immediately after the task, and 20 minutes after the task.

Deuter, C. E., Wolf, O. T., & Reuter, M. (2016) - Cortisol levels

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Anger Induction methods.

Study 1 - (Chester et al., 2013)

The interactive effect of social pain and executive functioning on aggression: an fMRI experiment

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Social rejection often increases aggression, but the neural mechanisms underlying this effect remain unclear. This experiment tested whether neural activity in the dorsal anterior cingulate cortex (dACC) and anterior insula in response to social rejection predicted greater subsequent aggression. Additionally, it tested whether executive functioning moderated this relationship. Participants completed a behavioral measure of executive functioning, experienced social rejection while undergoing functional magnetic resonance imaging and then completed a task in which they could aggress against a person who rejected them using noise blasts . We found that dACC activation and executive functioning interacted to predict aggression. Specifically, participants with low executive functioning showed a positive association between dACC activation and aggression, whereas individuals with high executive functioning showed a negative association. Similar results were found for the left anterior insula. These findings suggest that social pain can increase or decrease aggression, depending on an individual's regulatory capability.

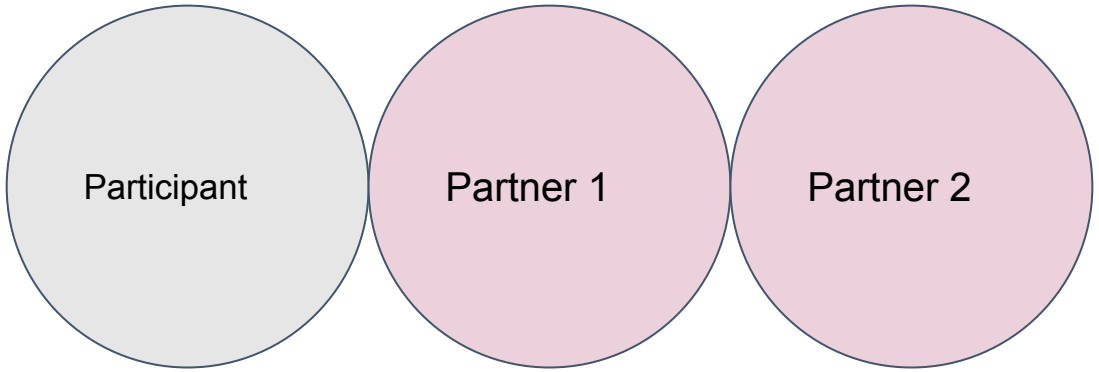
Keywords: social pain; social rejection; aggression; executive functioning; fMRI; dACC

Procedure

1. Pre-scan measure of executive functioning
2. Scanner task
3. Post-scan aggression measure

Scanner Task

1. Conducted in MRI scanner
2. Preset Computer Program
3. 1 participant, 2 same-sex partners



Procedure - Scanner Task

- Participants were informed that they would play three rounds of a computerized ball-tossing game (Cyberball) in an MRI scanner with two same-sex partners located in nearby scanners (Williams et al., 2000).
- In reality, participants played with a preset computer program that was designed to produce a within-participants experience of both social acceptance and rejection.
- Cyberball was implemented in the MRI scanner as a block design with three rounds (60s each). Before each round, participants were presented with instructions to rest for 10s.
- This was followed by a screen instructing them to ‘get ready’ for the upcoming round (2s).
- In rounds 1 and 2, participants were accepted for the entire duration of the task, receiving one-third of all ball tosses.

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Procedure - Post scan aggression measure

- Participants then completed a behavioral measure of aggression. Participants were told they would play a computerized game against one of their partners from Cyberball.
- a competitive reaction-time task in which the winner could deliver aversive and prolonged noise to the loser through headphones.
- nine trials.
- Prior to each trial, participants set the volume of the noise blast their partner would receive if the participant won the round, ranging from Level 1 (60 dB) to Level 10 (105 dB) in 5 dB intervals.

Procedure - Post Scan Aggression Measure

- A non-aggression option, Level 0, was also provided.
- Participants also controlled how long their opponent suffered by setting the duration of the noise blast, which could range from 0 to 5s in half-second intervals.
- After each trial, participants saw whether they won or lost, as well as the volume and intensity settings their partners had ostensibly set for them.
- Participants won five trials and lost four trials (determined randomly, despite being told that their performance was what determined the outcome of each trial).
- Basically, within the ethical limits of the laboratory, participants controlled a weapon that could be used to blast their opponent with unpleasant noise.

The construct validity of this task is well established (Bernstein et al.,1987; Giancola and Zeichner, 1995; Anderson and Bushman, 1997).

It has been used for decades as a reliable and valid measure of laboratory aggression (Taylor, 1967).

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Thank you for your attention! Any questions