

Stress and Olfaction: The Affective Link

Sahar Kaouk, B.S.

Department of Psychology, University of Dayton



University of
Dayton

BACKGROUND

- Olfaction, or the sense of smell is of interest because of its role in a wide array of psychological and sensory functioning.
- Presence of odor may change the way in which a visual stimulus is perceived, and that emotional state can influence olfactory function (Zald & Parado, 1997; Seubert et. al, 2009; Pollatos et. al, 2007).
- Sex differences are observed in both olfactory functioning and reaction to social and non-social stress.
 - In a negative affect state, both males and females had decreased olfactory detection sensitivity but only males rated odors as being more unpleasant and intense compared to females (Chen & Dalton, 2005)
 - Females experienced greater negative affect in response to social stress compared to males, who appear to experience greater negative affect following achievement stress (Stroud et. al, 2002).
- Regard to social functioning and behavior, olfaction has been shown to be an important mediator.
 - Depressed individuals had diminished olfactory functioning including a decreased level of olfactory discrimination, identification, and sensitivity as well as higher depression levels (Kohli et. al, 2016; Deems et al., 1991).
 - 59 percent of individuals with impairment in sense of smell, had weakened social interactions, including feelings of social insecurity and anxiety (Philpott & Boak, 2014; Croy et. al, 2013).
 - After patients with chronic rhinosinusitis and allergic rhinitis, received treatment and their olfactory functioning improved, depression levels, anxiety levels, and social functioning significantly improved as well (Katotomichelakis et. al, 2013).

SPECIFIC AIMS

This project intends to examine how negative affect state induced by perceived social or non-social stress affects odor detection sensitivity, intensity, and hedonics taking in consideration sex differences.

Aim 1: Investigate sex differences in the impact of stress conditions on affective state.

Aim 2: Investigate sex differences in the impact of social and achievement stress on olfactory function.

Aim 3: Investigate the relation between change in affect and change in olfactory function following social and achievement stress.

Aim 4: Investigate the influence of self-esteem, anxiety, and rejection sensitivity on affective change following social and achievement stress.

ACKNOWLEDGEMENTS

Thank you to Dr. Julie Walsh-Messinger for aiding in the development of this thesis proposal.
Please address all correspondence to Sahar Kaouk at
kaouks1@udayton.edu

PROPOSED METHODS

Sample

- Undergraduate students ($N = 128$) will be recruited through University of Dayton's SONA System and will receive course credit for their participation.

Measures & Materials

- *Positive and Negative Affect Scale* (PANAS; Watson & Clark, 1988) is a 20 item self-report measure of negative and positive affective states at the moment in which the participant is taking the measure.
- *State-Trait Anxiety Index* (STAI; Speleberg et. al, 1983) is a 40 item self-report questionnaire that measures state anxiety, or current distress, and trait anxiety, meaning more global feelings of stability and anxiety.
- *Rosenberg's Self Esteem Scale* (Rosenberg, 1965) is a 10 item self-report questionnaire that measures self-worth with questions regarding how participants feel about positive and negative aspects about themselves.
- *Brief Fear of Negative Evaluation Scale* (BFNE; Leary, 1983) is a 12 item self-report questionnaire assessing the level of social anxiety and fear of being rejected. E
- *Social Avoidance and Distress Scale* (SADS; Watson & Friend, 1969) is a 28 item self-report questionnaire examining the level of distress, discomfort, fear, and anxiety within a social setting.
- *Adult-Rejection Sensitivity Questionnaire* (A-RSQ; Berenson et. al, 2009) is a 9 item self-report questionnaire that asks participants to imagine they are in hypothetical situations and how they would react to them in order to measure how participants will perceive rejection.
- *Need-Threat Scale* (NTS; Williams 2009) is a 20 item self-report questionnaire assessing the level of social distress caused from rejection specifically following *Cyberball* activity.
- *Perception of Academic Stress Scale* (PAS, Bedewy & Gabriel, 2015) is an 18 item self-report questionnaire assessing the perception of stress induced by academic achievement.
- *Sniffin' Sticks Threshold Test* (Burghart Instruments, Wedel, Germany) will be used in order to assess odor detection sensitivity. This test dispenses odors using a pen-like device in which 32 pens are blank (no odor) and 16 pens contain varying concentrations of n-butanol (alcohol).
- *Sniffin' Sticks Identification Test* (Burghart Instruments, Wedel, Germany) will be used to measure olfactory intensity and hedonics. This includes 16 pen-like odor dispensing devices will deliver common odors—such as orange, rose, etc. Participants will choose from 4 multiple choice responses as a way to identify the smell. After participants are asked to identify the odor, they will be asked to rate how pleasant or unpleasant each pen was . **Figure 1**.
- *Cyberball* (Williams et. al, 2000) is an open access desktop computer program in which participants are engaged in a ball tossing game with other virtual players. *Cyberball* can be programmed in order to exclude participants resulting in feelings of social rejection.
- *Arithmetic test*. Participants assigned to the achievement stress condition will be given a computer based mathematical test in which there will be 24 difficult arithmetic and coding based on a hypothetical numbering system known as "New Roman" developed by Ben-Zeev (1995). Time pressure will be imposed in order to finish this activity within 30 minutes.

Procedure

- Participants will be randomly assigned to one of two conditions: social stress or achievement stress.
- Baseline testing of odor detection sensitivity, hedonics, and intensity, the PANAS, A-RSQ, STAI, SADS, FNE, and Rosenberg's Self Esteem Scale will be administered.
- Depending on condition assignment, participants will then play *Cyberball* or take an arithmetic test. Immediately after completing the stressor task, participants will undergo repeat olfactory testing and complete the PANAS, NTS, and PAS.

ANTICIPATED RESULTS

Hypothesis 1: Females will have greater odor detection sensitivity than males.

Hypothesis 2: Males in the achievement stress condition and females in the social stress condition will experience greater negative affect compared to males in the social stress condition and females in the achievement stress condition.

Hypothesis 3: Males in the achievement rejection condition will have decreased olfactory detection sensitivity compared to all females and males in the social stress condition

Hypothesis 4: Females in the social stress condition will have decreased odor detection sensitivity compared to males in the same condition and females in the achievement stress condition.

Hypothesis 5: Males in the achievement rejection condition will rate unpleasant odors as more unpleasant and intense compared to females in the same condition and males in the social stress condition.

Hypothesis 6: Females in the social stress condition will rate unpleasant odors as more unpleasant and intense compared to males in the same condition and females in the achievement stress condition.

Hypothesis 7: Low self-esteem, high anxiety, and high rejection sensitivity will moderate changes in affect following stress conditions.

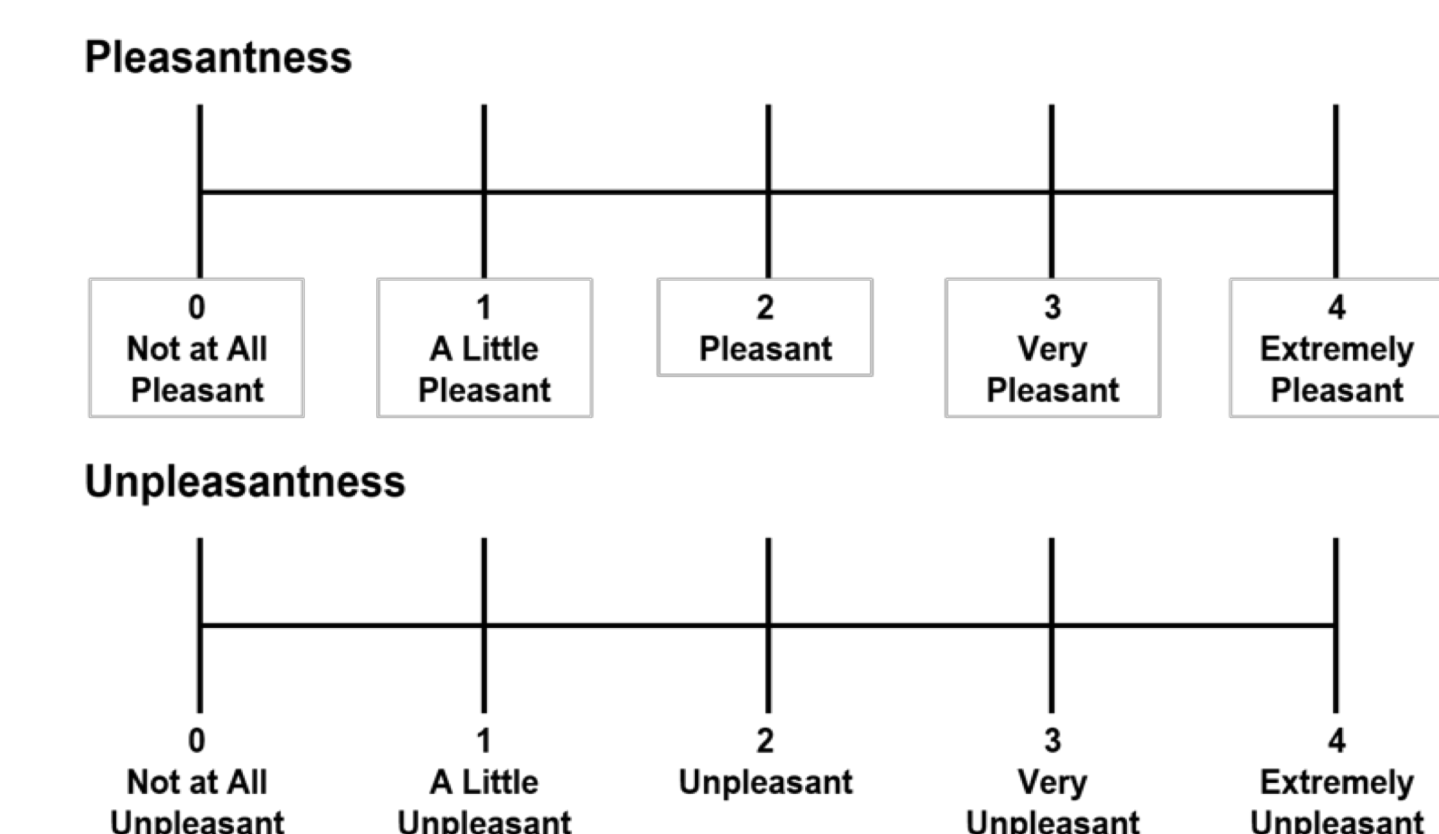


Figure 1. Sniffin' Sticks Identification Test (left) and Olfactory Hedonics Rating Scales (right)

SIGNIFICANCE

- No study to date has used stress conditions to induce negative affect and alter olfactory functioning; only visual modalities have been used.
- Social impairment is present across a number of psychiatric disorders and given that olfaction is highly related to social functioning, further understanding the impact of social versus non-social stress on affective state and olfactory function, could advance prevention and treatment of common disorders such as anxiety and depression.
- Sex differences are often overlooked in the field of psychology.
- This project will further the understanding of the important differences between males and females regarding olfactory functioning, emotional regulation, as well as reactions to stress conditions.