

# Sex Differences in Relation to Affect and Social versus Non-Social Stress on Olfactory Functioning

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## BACKGROUND

- Olfaction, or the sense of smell is highly related to various psychological processes.
- There are sex differences in olfactory functioning: females are more sensitive to odorants (Doty & Cameron, 2009), better at labeling odors (Larsson et al., 2004), and rate odors as more unpleasant and intense compared to males (Doty & Cameron, 2009).
- Findings have shown emotional state, especially negative states, affects human odor perception (Chen & Dalton, 2005, Pollatos et al., 2007; Zald & Parado, 1997) and odor also influences affective state ((Walla & Deecke, 2010; Royet, Plailly, Delon- Martin, Kareken, & Segebarth, 2003).
- Social stress has been shown to induce distress as well as decrease olfactory functioning (Hoenen et al., 2017).
- There are also differences in how males and females react to stress: males are more distressed from intrapersonal stress, while females are more distressed from interpersonal stress (Kogler, Gur, & Derntl, 2015; Hoenen, Wolf & Pause, 2017) .
- To date, no studies have compared the effects of social stress and non-social stress and their association with negative affect and olfactory functioning.

## SPECIFIC AIMS

Investigate sex differences in the effects of social and non- social stress on the relation between affective state and olfactory functioning.

**Aim 1:** Does sex moderate in the impact of social and non-social stress on affective state?

**Aim 2:** Does sex moderate in the impact of social and non-social stress on odor detection sensitivity, odor identification, odor hedonic ratings, and odor intensity ratings?

**Aim 3:** Does affect mediate the sex differences in change in odor detection sensitivity, odor identification, odor hedonic ratings, and odor intensity ratings following social and non-social stress?

## ACKNOWLEDGEMENTS

Thank you to Dr. Julie Walsh-Messinger, Dr. Lucy Allbaugh, and Dr. Tracy Butler for aiding in the development of this thesis.  
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## METHODS

**Sample:** Undergraduate students ( $N = 90$ ) 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.
- Center for Epidemiological Studies Depression Scale – Revised** (CESD-R; Eaton et al., 2004) is a 20-item measure of depression severity designed for the general population.
- Generalized Anxiety Disorder 7-Item Scale** (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) is a self-report measure of generalized anxiety severity.
- 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.**
- Heart rate: As a manipulation check, heart rate will be measured using a Garmin Forerunner 25 watch and Garmin HR-M1G Heart Rate Chest Transmitter.

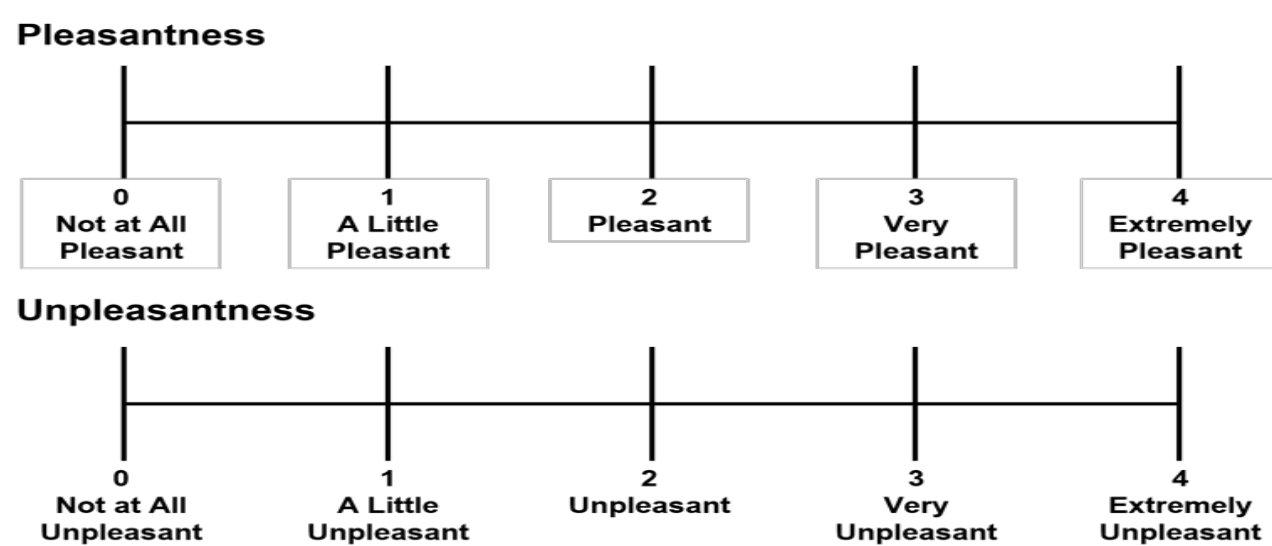
### Procedure

**Baseline Testing:** Baseline collection of olfactory functioning, heart rate, and PANAS, STAI, PSS, CEDS-R, and GAD-7. Participants will then be assigned to either a non-social or social stress condition.

**Non-Social Stress Condition:** Participants will be told to subtract the number 13 from 1,022 on a sheet of paper. Heart rate will be collected. After stress activity,, olfactory testing, PANAS, and STAI will be repeated.

**Social Stress Condition:** Participants will have ten minutes to the subtract number 13 from 1,022 aloud in front of a camera prop. If a mistake is made, the experimenter will abruptly stop the participant and request they start over. Heart rate will be collected throughout. After the stress activity, olfactory testing, PANAS, and STAI will be repeated.

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



## ANTICIPATED RESULTS

**1) Females in the social stress condition and males in the non-social stress condition will experience greater change in distress from Time 1 to Time 2 compared to males in the social stress condition and females in the non-social stress condition.**

*1a. Females in the social stress condition and males in the non-social stress condition will experience more negative affect and anxiety at Time 2 versus Time 1 compared to males in the social stress condition and females in the non-social stress condition.*

**2) Females in the social stress condition and males in the non-social stress condition will have greater change in olfactory functioning at Time 2 versus Time 1 compared to males in the social stress condition and females in the non-social stress condition.**

*2a. Females in the social stress condition and males in the non-social stress condition will have decreased odor detection sensitivity and odor identification, will rate odors as more unpleasant and intense at Time 2 versus Time 1 compared to males in the social stress condition and females in the non-social stress condition.*

**3) Sex differences in change in olfactory function following social and non- social stress will be mediated by the change in affect, such that higher levels of negative affect for females in the social stress group and males in the non-social stress group have a greater change in olfactory functioning, including odor detection sensitivity, odor identification, odor hedonics, and odor intensity, from Time 1 to Time 2. **Figure 2.****

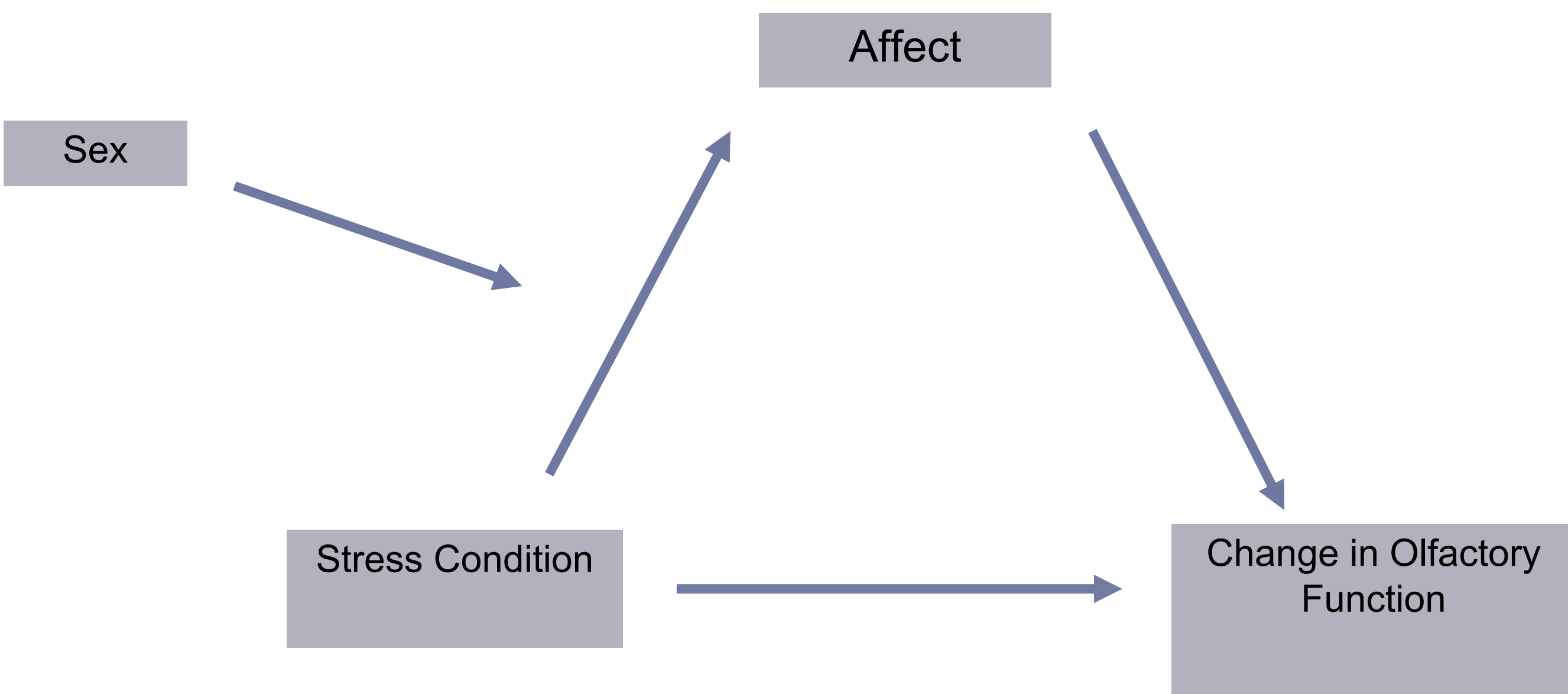


Figure 2. Mediation model of hypothesis 3

## SIGNIFICANCE

- Further the understanding the impact of social versus non-social stress on affective state and olfactory function and the important sex differences that may arise.
- Advance prevention and treatment of common disorders such as anxiety, depression, and other socially impairing disorders.