

Social support and stress in virtual reality

Garrett S. Byron MS, Clayton J. Hilmert PhD
North Dakota State University

Significance

Trier social stress test (TSST)

- The TSST is a standardized protocol for eliciting psychophysiological stress in the laboratory. Participants are asked to give an impromptu speech and complete an oral math task while in front of a non-positive audience of confederates.

TSST & Virtual Reality (VR)

- The TSST has recently been adapted to VR presentation and our lab has shown this to be an effective way to study stress in the lab (Byron et al., 2023).

TSST & Social Support

- A number of in-person studies have found that a socially supportive audience can affect responses to the TSST (Frisch, Häusser, van Dick, & Mojzisch, 2014). However, it is not clear if social support from a VR audience would have similar effects.

This study examined the effects of a supportive immersive pre recorded 3D 360-degree virtual audience of 2 and 200 persons. Audiences were instructed to act supportively or non-supportively throughout the TSST.

Methods

Participants

- Participants were undergraduates with an average age of 18.8 (SD=1.0) years. The sample (N=113) was 50% females (n=56) and 50% males (n=56). The ethnic and racial breakdown of the sample was representative of the surrounding population with 82% White/Caucasian, 7% Black/African American, 5% Asian, and 4% American Indian/Alaska Native or other. Six percent (n=7) reported being of Hispanic ethnicity.

Procedure

- Participants completed a standardized psychophysiological challenge task, the Virtual Trier Social Stress Task (V-TSST).

V-TSST

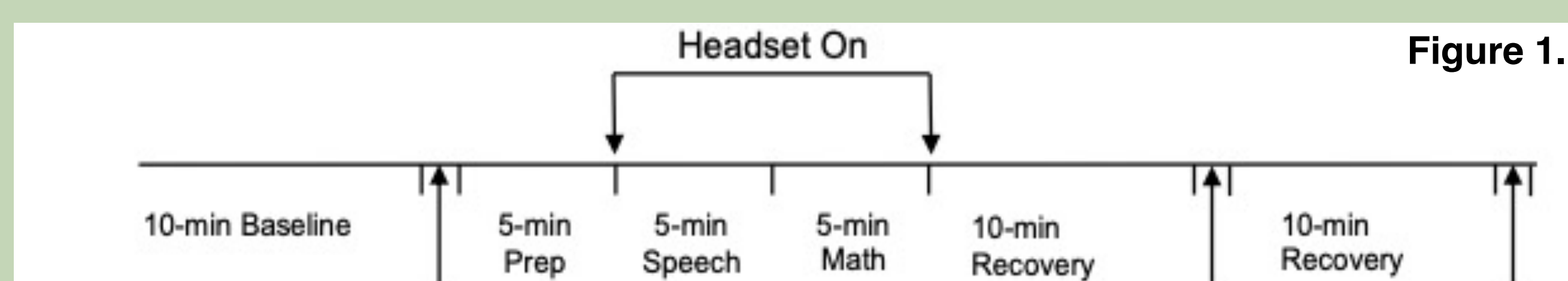
- This is a new adaptation of the traditional TSST (Kirschbaum et al., 1993) designed by our lab (Byron et al., 2023). Participants performed 5-minute speech and math tasks while viewing an immersive, 2-person or 200-person audience recording on an Oculus headset. See Figure 1 for Timeline.

Support Manipulation

- In the *non-support condition* the audience was inattentive and unresponsive, with two individuals getting up to leave midway through the tasks. In the *support condition* the audience was attentive and smiling and nodding throughout the task performances.

Measures

- The Positive Affect and Negative Affect Scale (PANAS) indicated participant **Negative Affect (NA)** and **Positive Affect (PA)** responses to the stress tasks.
- The Stress and Arousal Checklist (SACL) indicated participant self-reported **Stress** and **Arousal** during the tasks.
- Cardiovascular reactivity** was calculated by subtracting average baseline measures of heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) from average TSST performance measures.

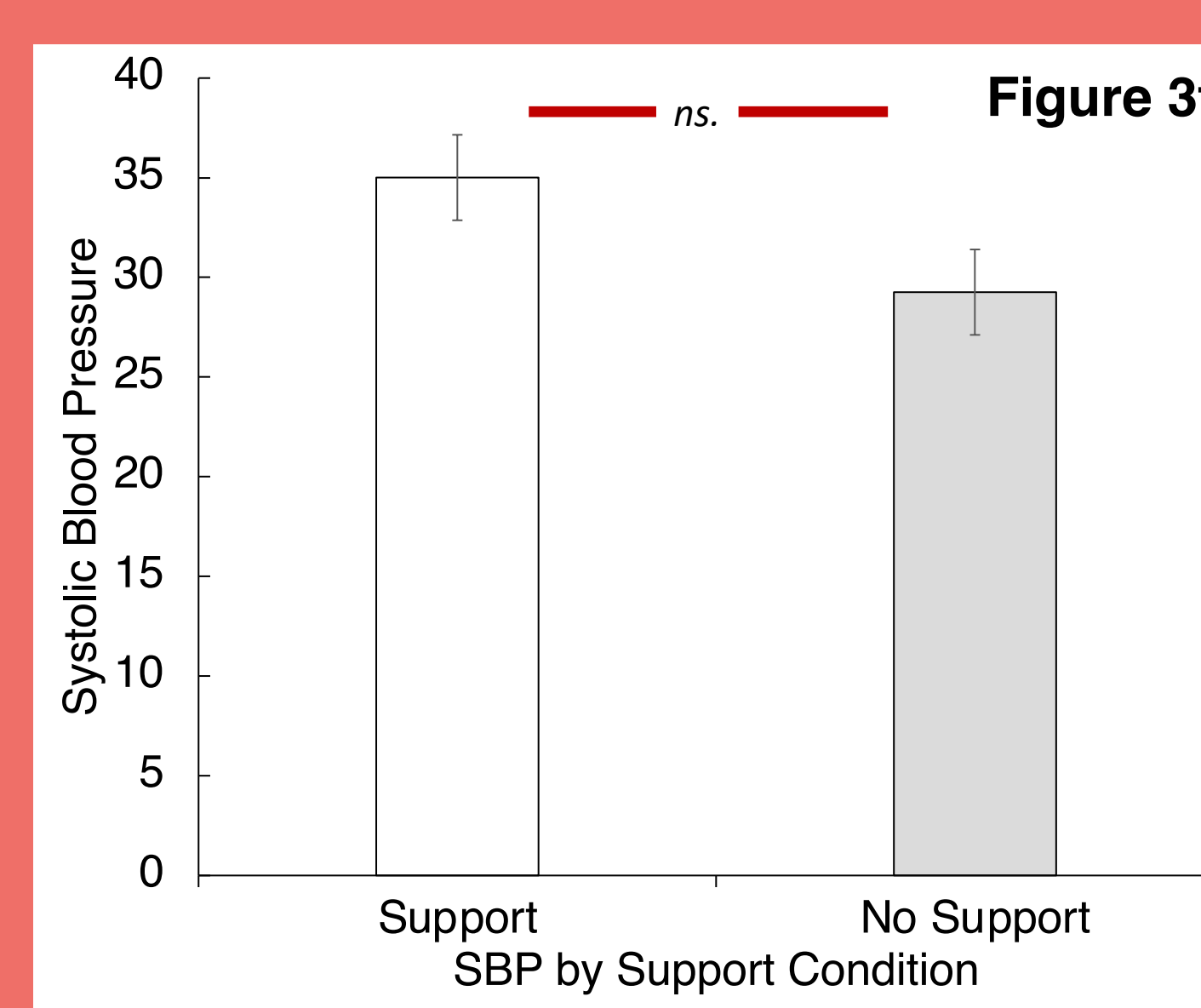
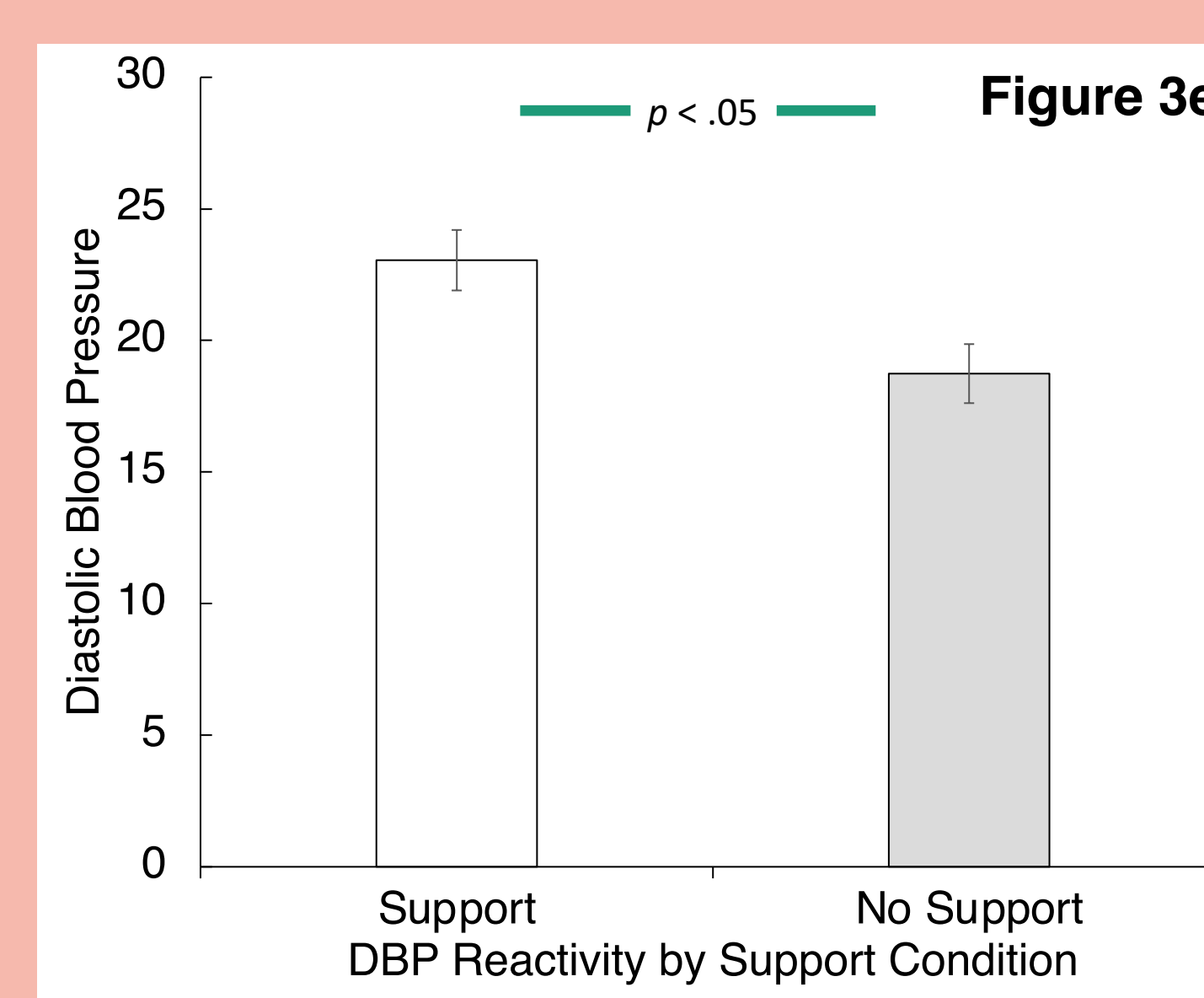
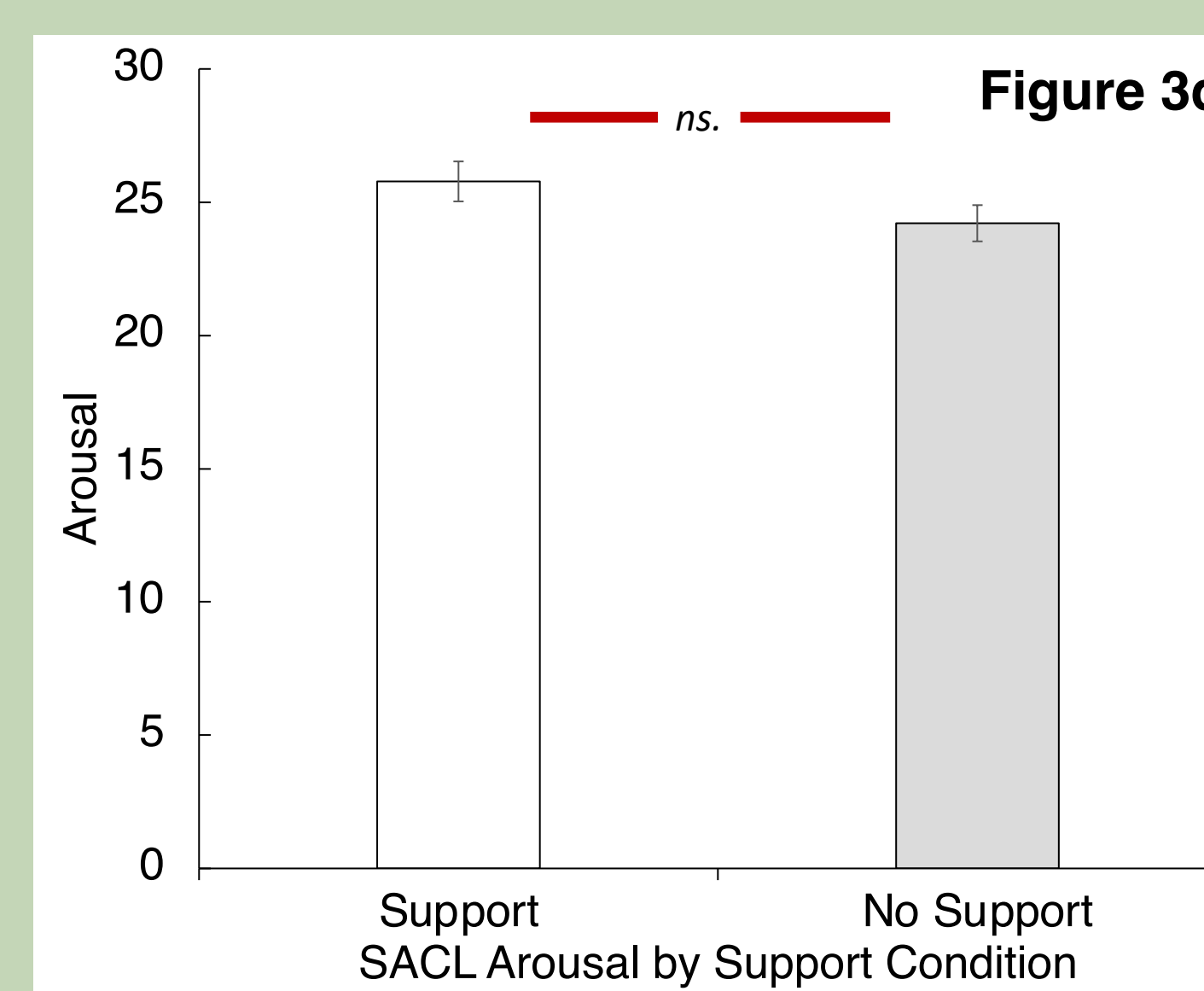
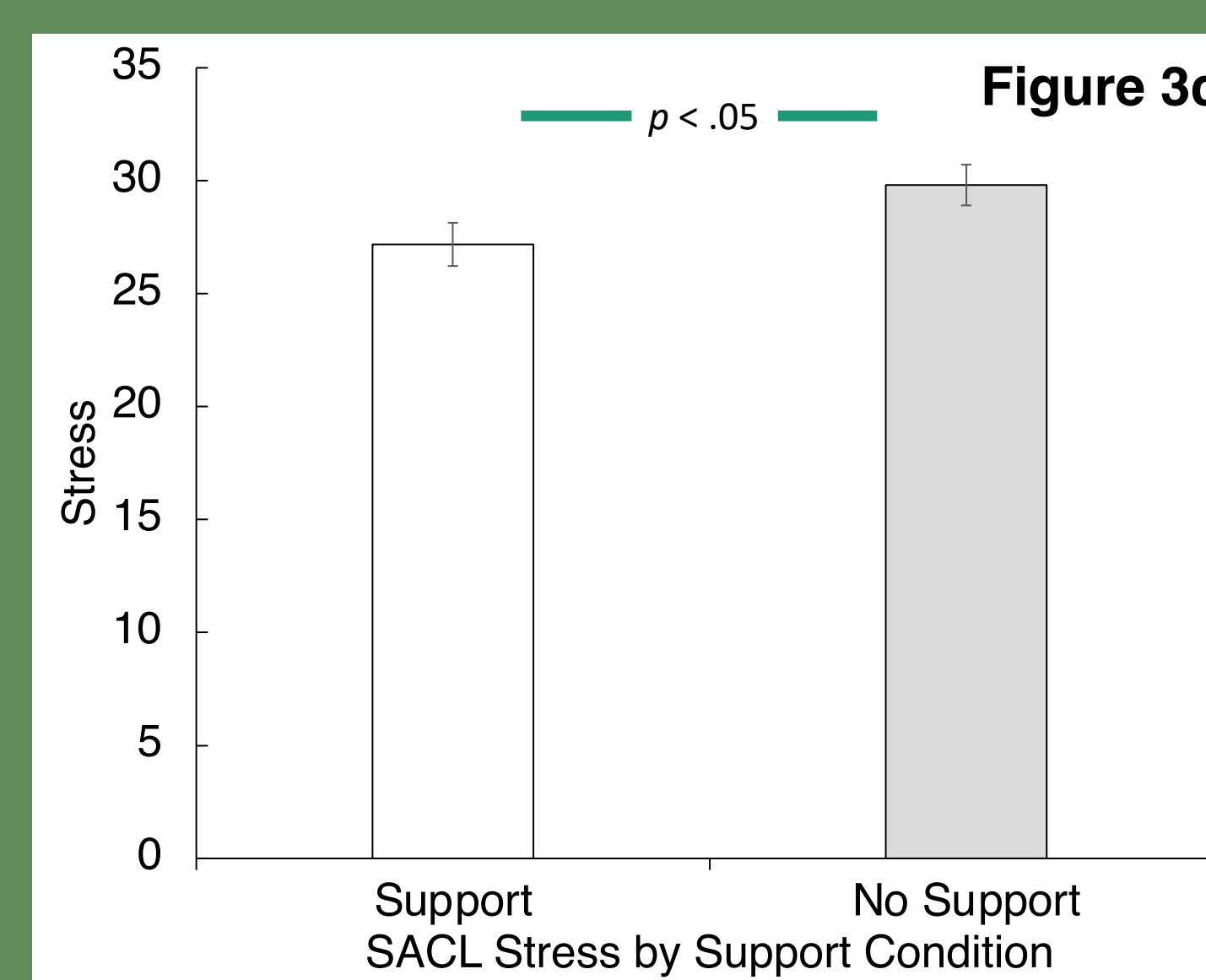
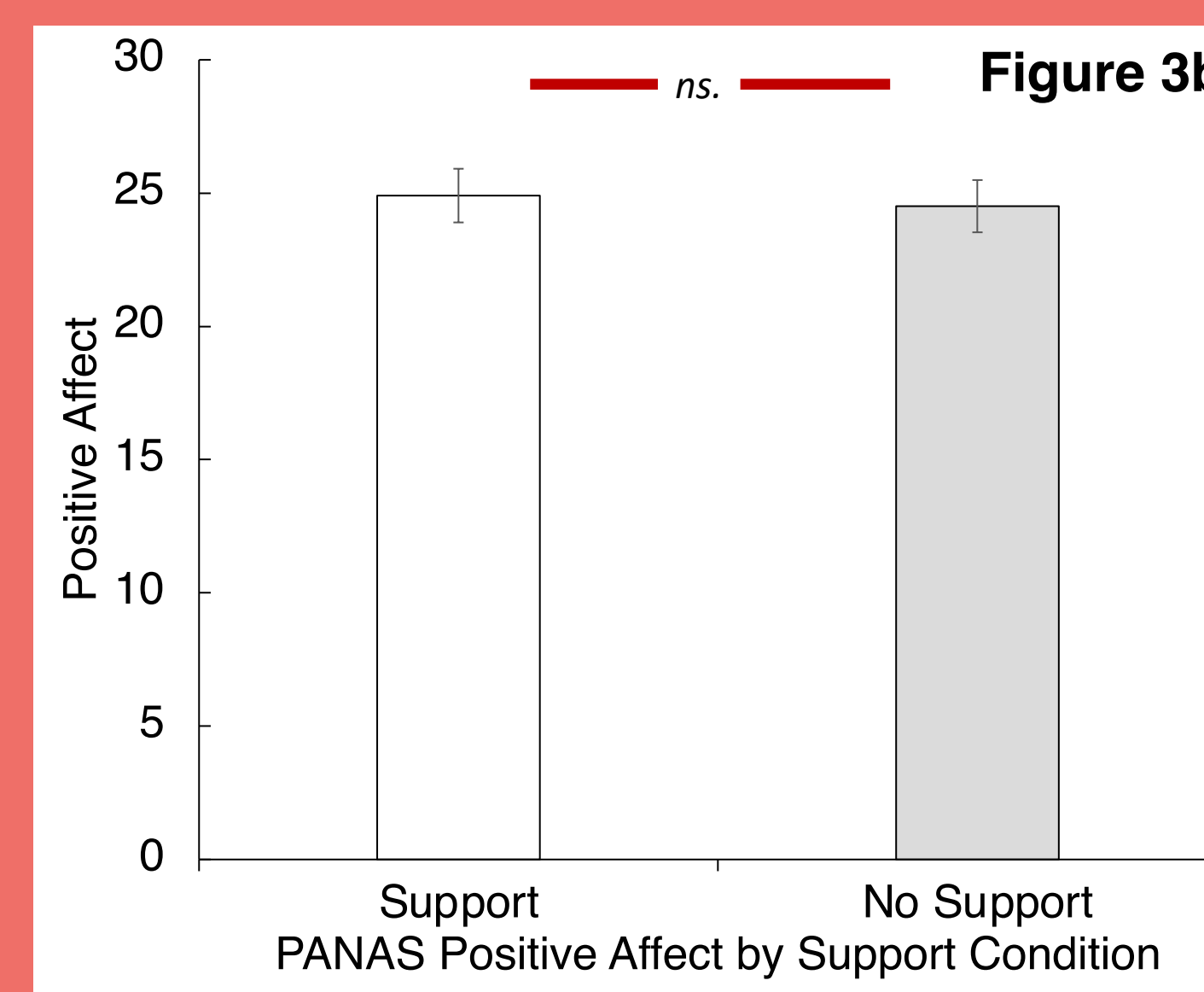
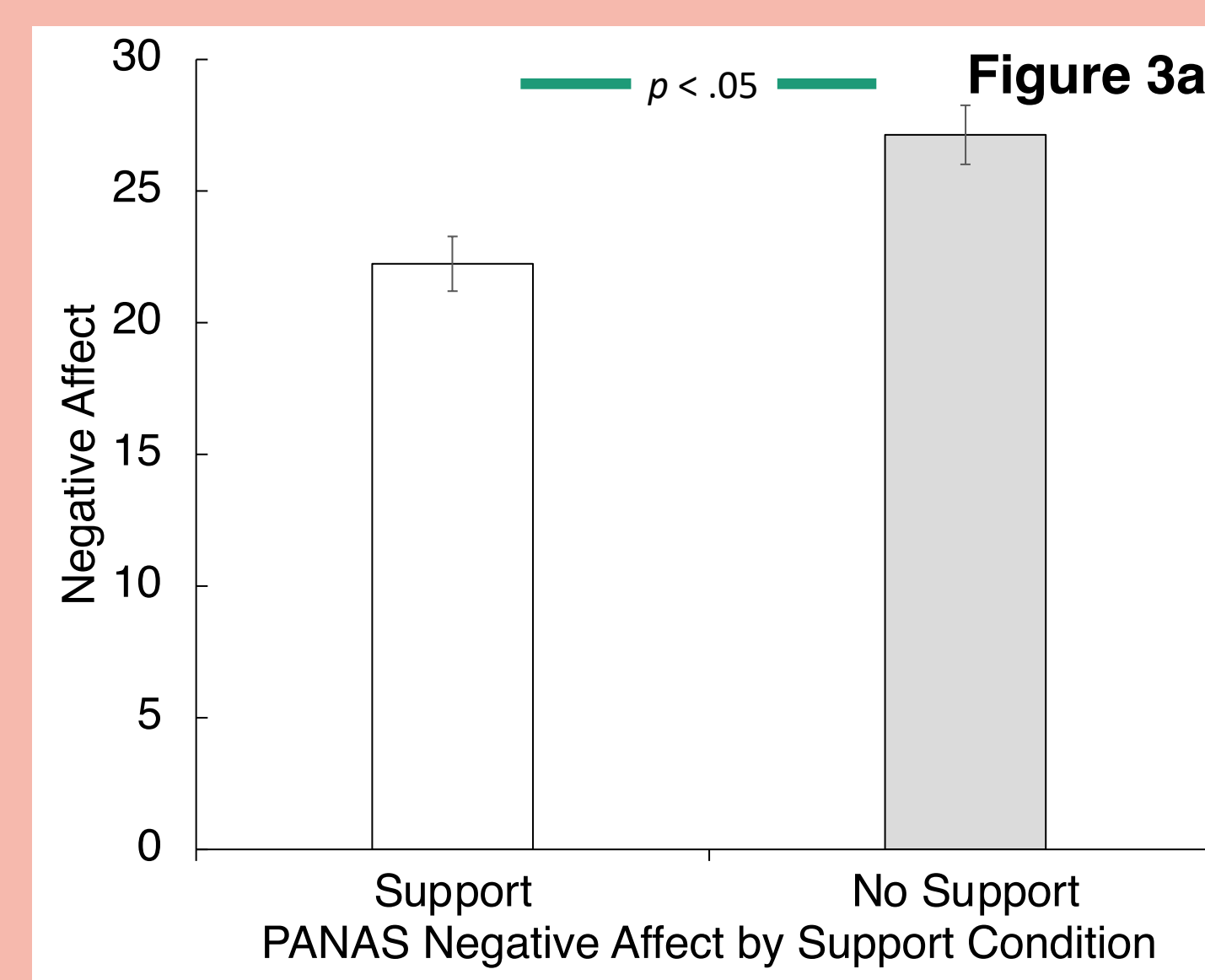


Tables & Figures

Figure 2. Immersive Virtual Reality Audience Stimulus:



A 3D, 360* pre-recorded 200-person confederate audience (right), viewed using an Oculus head mounted display (left) with accompanying audio.



Results

Analyses:

- 113 participants with complete data were included.
- Univariate ANOVA's were used to examine psychological responses or cardiovascular reactivity by support condition.

Primary Analyses:

- Results indicated that self-reported negative affect, stress, and DBP reactivity differed by support condition but that positive affect, arousal, and SBP reactivity did not. (See figure 2).

The Social Support audience condition elicited:

- less Negative Affect** $F(1,112) = 10.24, p < .002, \eta^2 = .085$
- less Stress** $F(1,112) = 4.1, p < .05, \eta^2 = .035$
- Greater DBP Reactivity** $F(1,112) = 7.19, p = .008, \eta^2 = .06$

Positive affect, arousal, and HR reactivity did not significantly differ by condition p 's $> .05$. However, SBP reactivity by support condition approached significance ($F(1,112) = 3.6, p = .06, \eta^2 = .03$).

Discussion

Social support reduces negative psychological responses

- Our results suggest that social support from a virtual audience is effective at reducing the negative psychological impact of the TSST. Even though the audience was pre-recorded and presented virtually the positive behavior of a supportive audience reduced negative affect significantly.

Social support did not affect positive psychological responses

- Interestingly, support did not affect positive affect or arousal. This lack of effect on positive emotions is consistent with past research showing a similar pattern of reduced negative emotions rather than an increase in positive ones.

Conclusion:

- Overall, the results of this study suggest that social support from a pre-recorded VR audience was effective in reducing psychological perceptions of stress and negative affect while eliciting a pattern of increased SBP and DBP compared to a non-supportive audience.

Virtual reality can be used to study social support and perhaps develop interventions utilizing its effects.

References:

- Byron, G., Strahm, A., Bagne, A., & Hilmert, C. (2023). Using virtual reality to study the impact of audience size on cortisol responses to the Trier Social Stress Test. *International Journal of Virtual Reality*, 23(1), 1-16. doi:10.20870/ijvr.2023.23.1.7146
- Frisch, J. U., Häusser, J. A., van Dick, R., & Mojzisch, A. (2014). Making support work: The interplay between social support and social identity. *Journal of Experimental Social Psychology*, 55, 154-161.
- Kirschbaum, C., Pirke, K.-M., & Hellhammer, D. H. (1993). The "Trier Social Stress Test": A tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, 28(1-2), 76-81.



Contact information: Correspondence can be made to Garrett S. Byron at garrett.byron@ndsu.edu