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Presenter Information

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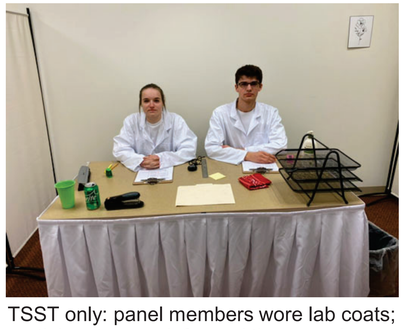
Introduction

Most studies examining the effects of stress on learning and memory utilize stressors that are extrinsic to the learning task. For instance, investigators may expose participants to a social evaluative stressor, such as the Trier Social Stress Test (TSST), and then examine its impact on participant memory for a list of words, images, or a film[1]. However, the findings from such studies have limited translational value, as they do not involve an assessment of what participants remember about the stress experience itself. Because life frequently requires individuals to recall stressful events (e.g., crimes, traumatic events), it is important to understand what aspects of these events an individual is able to accurately recall. In the present study, we used a modified version of the TSST paradigm, originally developed by Wolf and colleagues[2], to test participants' memory for a laboratory-controlled stress event. We aimed to replicate previous work with the paradigm[2-5] and extend on it by quantifying false memories and intrusive memories in stressed participants.

Method

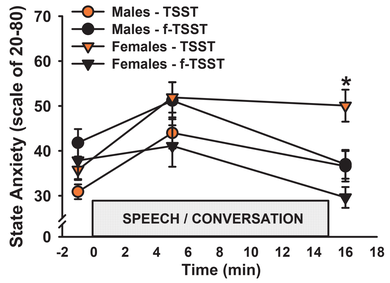
- 46 undergraduate participants [19 males, 27 females (17 naturally cycling); M_{age} = 19.20 years, *SD* = 0.93]
- Day 1: TSST or f-TSST
  - Glucose loading: 30 g glucose in 200 mL water; followed by 100 mL water rinse
  - Salivary cortisol: SalivaBio Oral Swabs[6] placed under the tongue for 1.5 minutes, samples stored at -20°C until assayed
    - Collected before and after the speech/conversation
  - 22 items within view of participants during speech/conversation
    - Objects manipulated by panel members during speech/conversation deemed "central objects," all other items deemed "peripheral objects"
  - TSST: participants instructed to deliver 10-min speech assuming the role of a job applicant
  - f-TSST: participants instructed to have a conversation about their aspirations, hobbies, favorite book/movie, etc.
- Day 2: Memory assessments
  - Free recall and recognition assessments testing object memory
  - Intrusive memory questionnaire
- Days 4, 6, and 8
  - Online intrusive memory questionnaire administered via Qualtrics

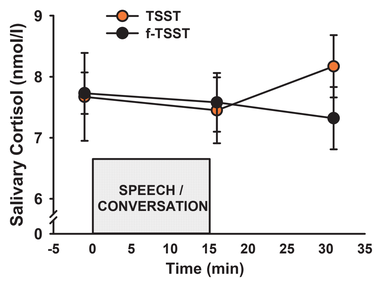


TSST only: panel members wore lab coats; participants were informed the speech would be recorded by a camera located to the left of the table

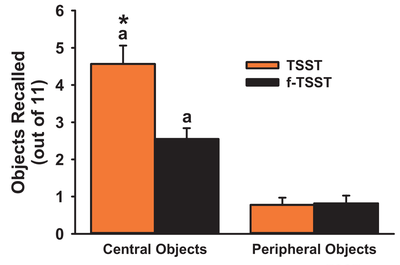
Participants were instructed to stand on the white X to deliver their speech/have a conversation with the panel members

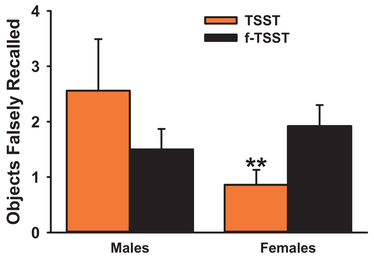
Results (all data are means ± SEM)

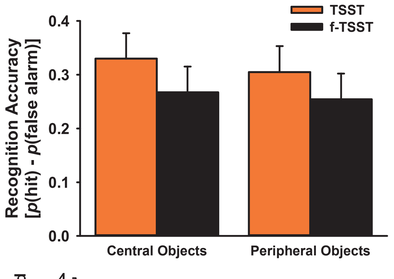


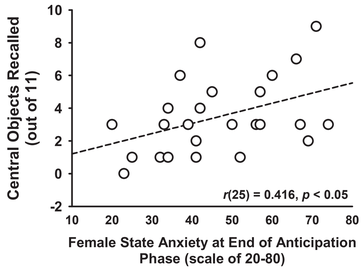


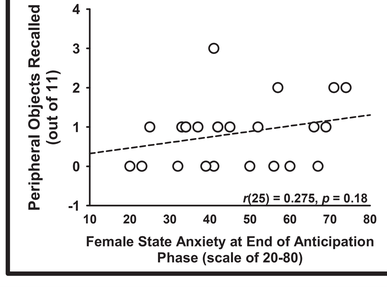
The TSST led to greater reports of state anxiety in females, but not males, as supported by a significant Condition x Sex interaction, $F_{1,41}$ = 6.75, $p < 0.05$. No significant effects were observed for salivary cortisol levels. * $p < 0.05$ relative to all other groups.



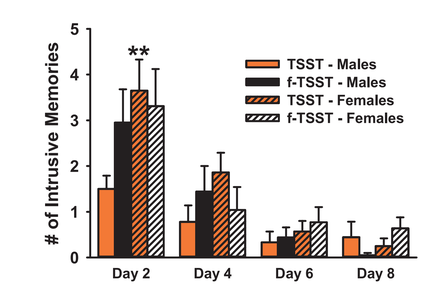


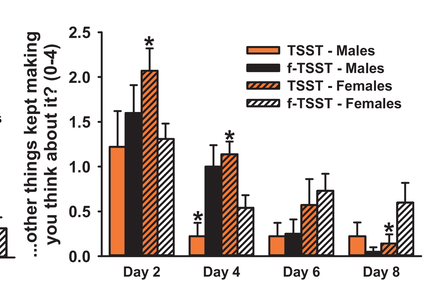


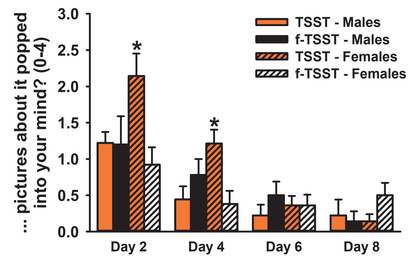


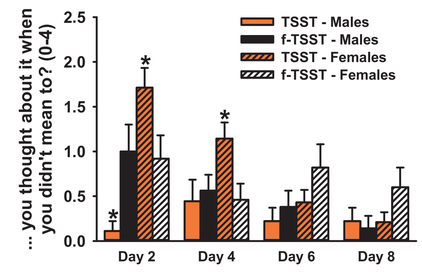


Both the TSST and f-TSST groups recalled more central objects than peripheral objects, $F_{1,41}$ = 90.89, $p < 0.001$. However, the TSST group recalled more central objects than the f-TSST group, $F_{1,41}$ = 6.04, $p < 0.05$. Males exposed to the TSST falsely recalled more objected than females exposed to the TSST. No significant effects were observed for recognition accuracy. Interestingly, state anxiety levels at the end of the anticipation phase in females was positively correlated with recall of central, but not peripheral, objects. * $p < 0.05$ relative to f-TSST; ** $p < 0.05$ relative to males TSST; a = $p < 0.001$ relative to peripheral objects.

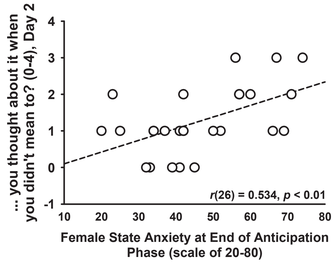


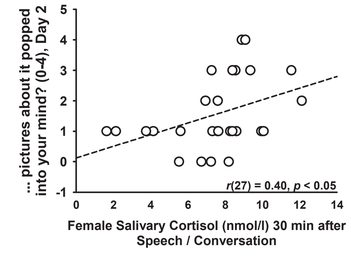






On Day 2, females exposed to the TSST reported more intrusive memories than males exposed to the TSST, $F_{1.98,73.14}$ = 4.16, $p < 0.05$. On Days 2 and 4, females exposed to the TSST were more likely to indicate that other things in their environment made them think about the speech task, $F_{2.28,81.93}$ = 6.78, $p < 0.01$, that pictures of the speech task popped into their mind, $F_{1.87,67.18}$ = 5.08, $p < 0.05$, and that they thought about the speech task when they did not mean to, $F_{2.27,81.85}$ = 11.36, $p < 0.001$, than females exposed to the f-TSST. * $p < 0.05$ relative to f-TSST; ** $p < 0.05$ relative to males TSST.





State anxiety levels at the end of the anticipation phase in females was positively correlated with several measures of intrusive memories. This figure depicts the positive relationship between anxiety levels and an indication of females thinking about the speech or conversation when they did not mean to. Salivary cortisol levels following the speech or conversation were positively associated with intrusive imagery in females.

Conclusions

Participants exposed to the TSST recalled more central, but not peripheral, objects than participants exposed to the f-TSST. No significant differences were observed for recognition memory. TSST exposure increased false recall in males, while tending to reduce it in females. However, females exposed to the TSST demonstrated the greatest evidence of memory intrusions regarding the stress experience, which was associated with their subjective (state anxiety) and objective (salivary cortisol) responses to the stressor. These findings are consistent with previous studies reporting that stress enhances participant memory for the central details of an experience. They also extend on previous work by suggesting sex-dependent effects for both false and intrusive memories that develop after stress exposure. This work indicates that the modified TSST paradigm is a useful way to study memory accuracy related to a stressful experience, as well as intrusive memories that ensue.

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