

Quantifying Stress and Cognitive Responses during Auditory Stressors Exposure

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INTRODUCTION

- Stress affects cognitive function, health, and focus by increasing cognitive load. [1]
- Auditory stressors (e.g., occupational noise) reduce concentration and increase mental effort. [2]
- Stress in cognitive tasks is traditionally measured via self-reported methods. [3]
- Emerging tools like Galvanic Skin Response (GSR) and salivary cortisol enable non-invasive, continuous stress assessment. [3]
- Yerkes-Dodson law: Moderate stress improves cognition; extreme stress impairs it.
- Hypothesis: Auditory stress increases GSR and subjective stress; cognitive performance peaks at mild stress and declines under high stress. [4]

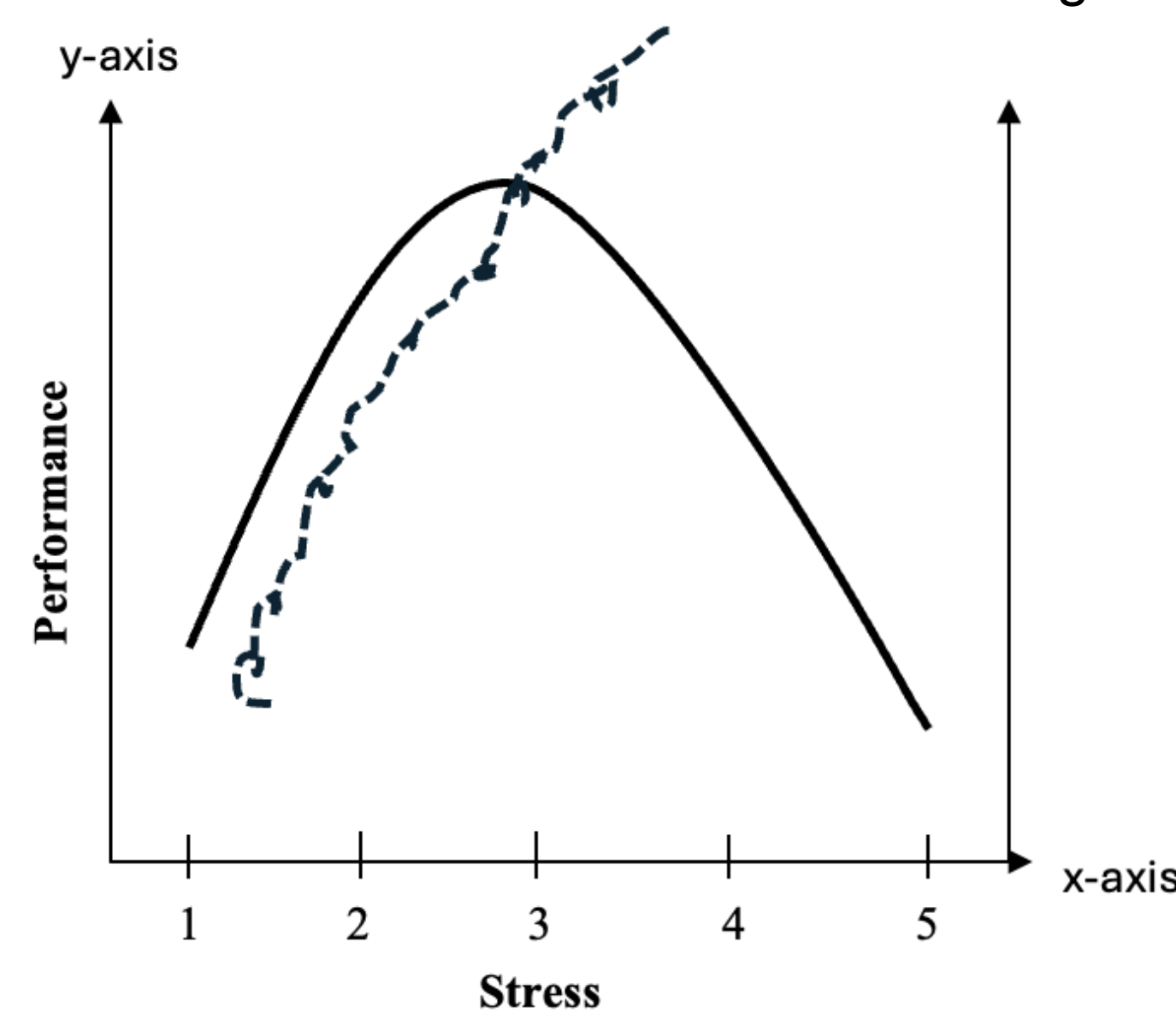


Fig 1. Hypothesized impact of auditory stress on physiological response & cognitive performance

METHODS

- Ten healthy adults (18-60 years) participated.
- Shimmer3 GSR+ device recorded physiological data via iMotions software.
- Baseline cognitive tasks (Stroop, Hopkins Verbal Learning Test (HVL)) were completed pre-sound exposure.
- Participants experienced graded soundscapes (calm to disruptive) for 20-90 secs.
- Cognitive tasks were repeated post-exposure to each soundscape.
- GSR data and timestamps were collected continuously for analysis.
- Skin conductance levels and responses were analyzed in MS Excel to correlate stress (GSR) with cognitive performance (Stroop, HVL).

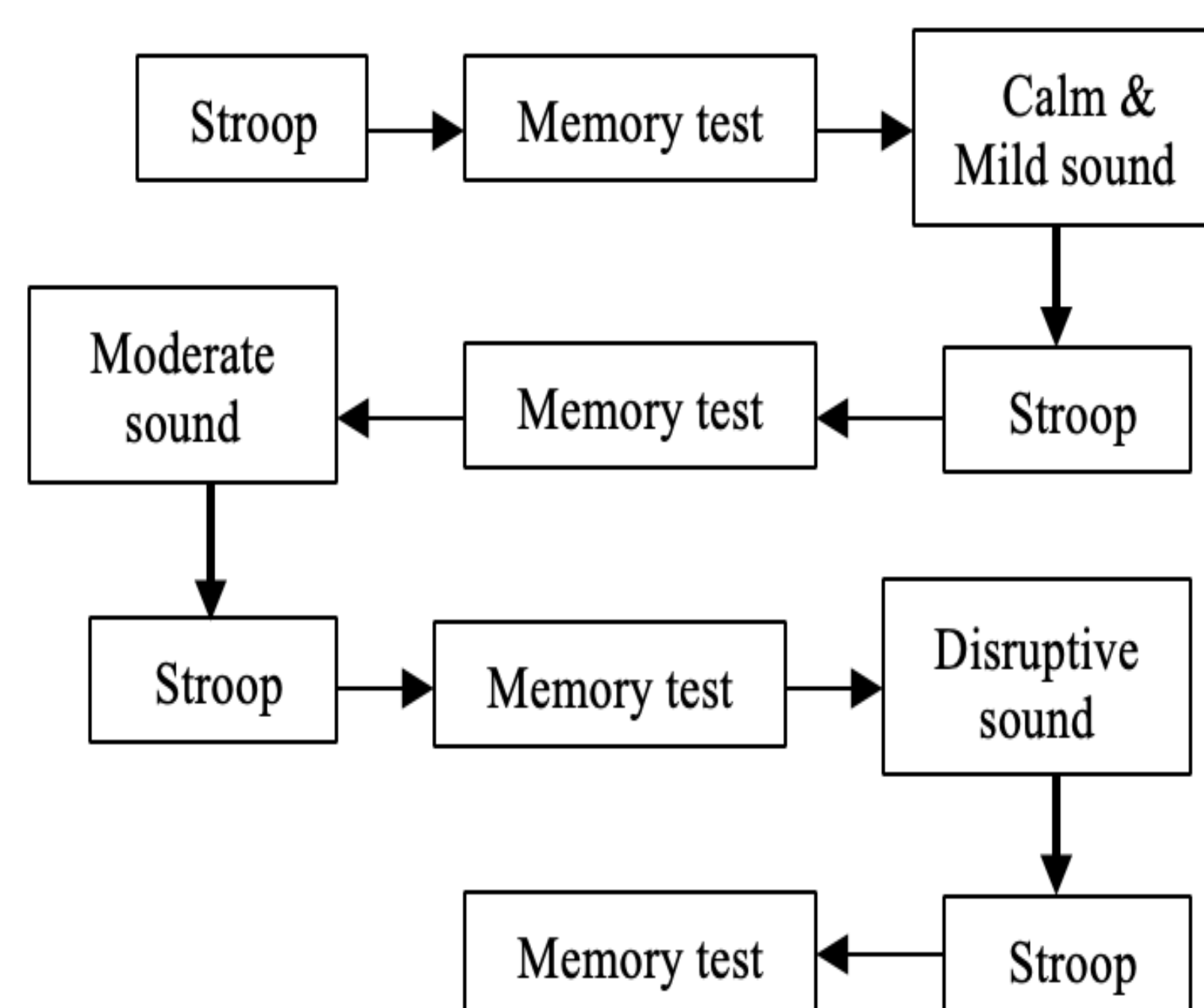


Fig 2. Visual timeline of the experiment

RESULTS

- Stroop completion times improved consistently, from baseline to Disruptive stress (20.94 s), indicating enhanced focus under stress. (Fig 3)
- HVLT scores showed an inverted U-shaped trend, peaking at baseline (21.8) and declining under Moderate stress (19.7). (Fig 4)
- Memory performance rebounded under Disruptive stress (21.6), suggesting task prioritization or adaptation.
- GSR levels increased from Calm (2223 μ S) to Moderate (2234 μ S), with Disruptive (2233 μ S) maintaining high levels, supporting stress escalation under auditory conditions. (Fig 5)
- A slight GSR decrease under Calm (2223 μ S) suggests relaxation in low-stress environments.
- Weak correlations were observed between GSR, Stroop time, and memory scores. Trends showed improved Stroop efficiency with stress and an inverted U-shape for memory performance.
- Relationships were not strong enough to draw definitive conclusions on stress and cognitive performance.

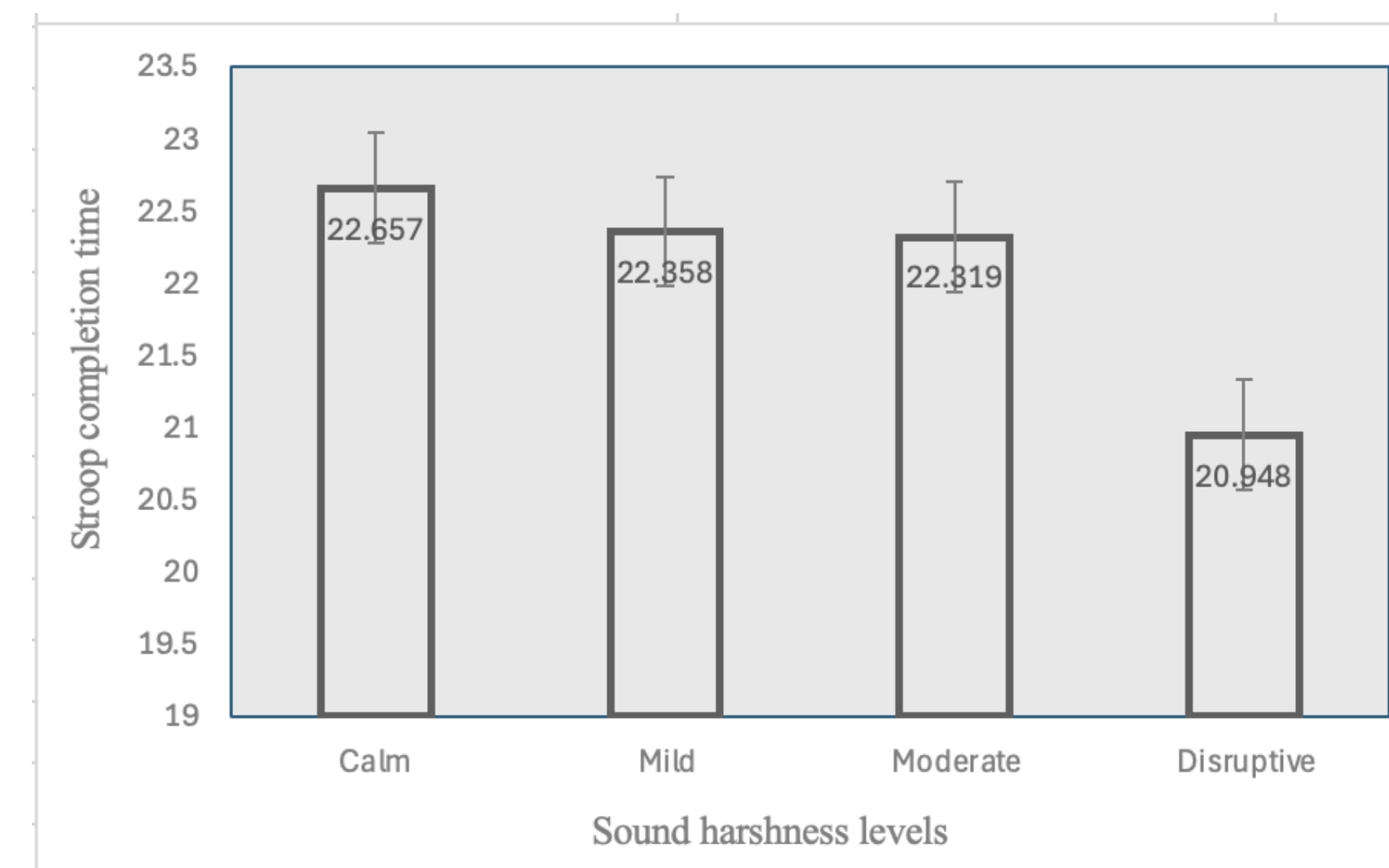


Fig 3. Stroop completion time vs. Sound harshness levels

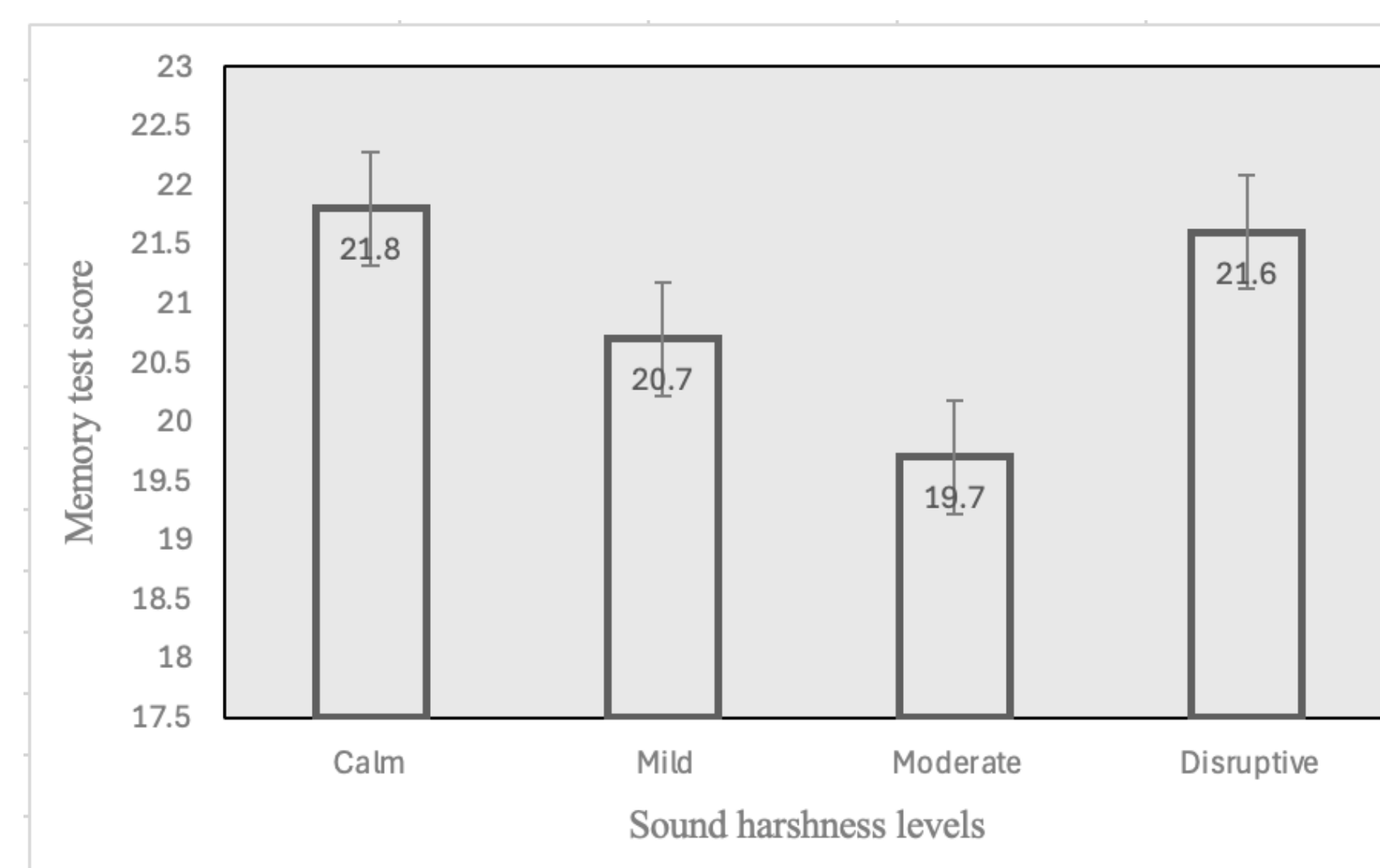


Fig 4. Memory test score vs. Sound harshness levels

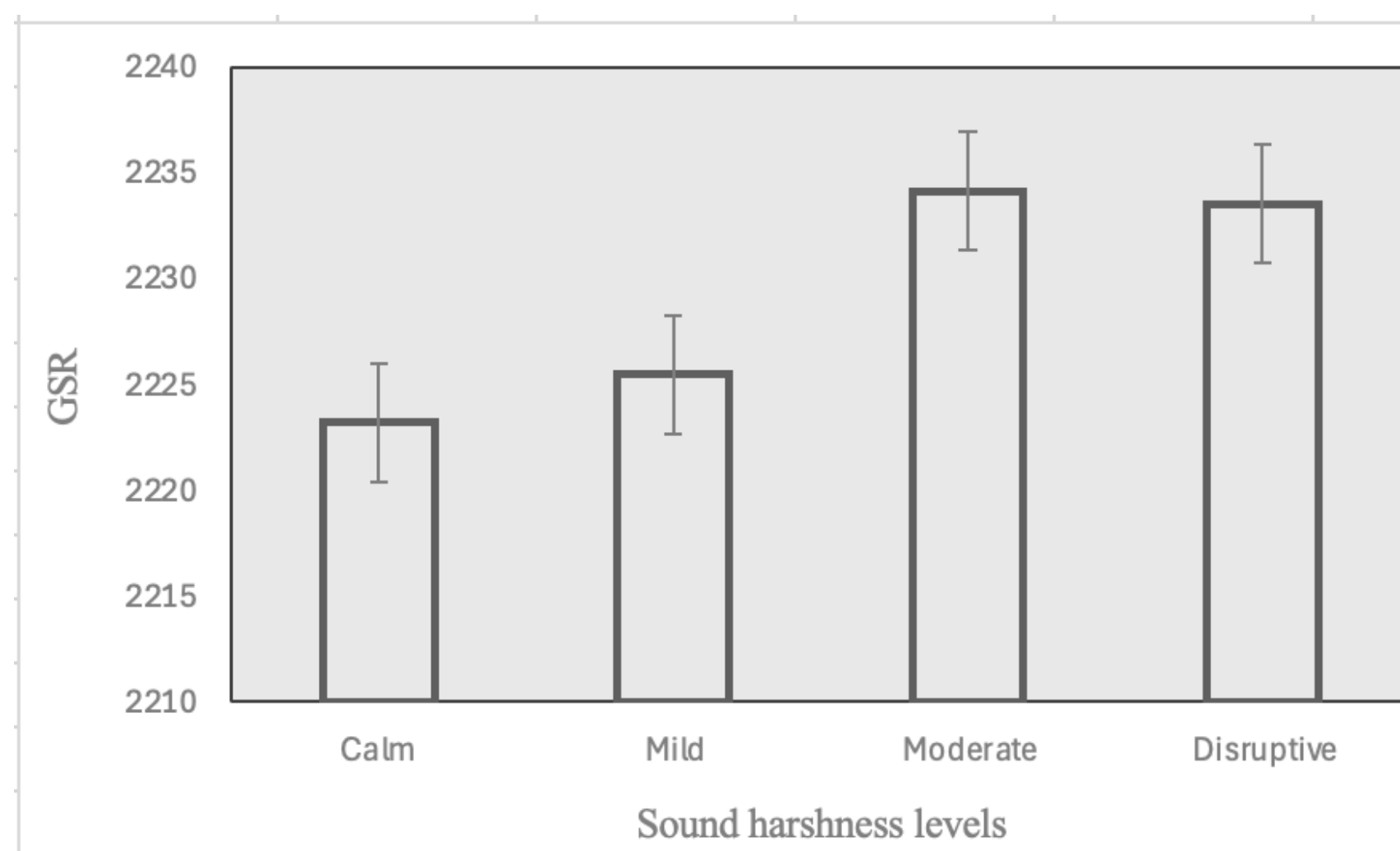


Fig 5. GSR vs. Sound harshness levels

SUMMARY

- Stress impacts cognitive performance and physiological responses.
- The study analyzed auditory stress using GSR, HVLT, and Stroop tests.
- GSR levels rose with stress, confirming it as a reliable marker.
- Memory performance peaked at Baseline and declined under moderate stress.
- Stroop efficiency improved with higher stress levels, showing adaptability.
- Results partially supported the hypothesized stress-performance relationship.
- Findings highlight task-specific stress effects and the need for further research.

CONCLUSIONS AND FUTURE DIRECTIONS

- GSR levels increased with auditory stress, confirming it as a reliable marker.
- Memory performance peaked at Baseline and declined under moderate stress.
- Stroop efficiency improved with stress, showing task-specific adaptability.
- Stress effects vary by task, highlighting the complexity of stress-cognition relationships.
- Investigate individual differences and task-specific adaptations to improve generalizability.
- Explore additional physiological markers and real-world stress management applications.

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