

Sudoku and Emotional Memory Interference

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Introduction

- **Autobiographical Memories:** personal and intricate; memories that have been reflected on throughout life, so they become solidified (Conway & Pleydell-Pearce, 2000; Neil Macrae & Roseveare, 2002).
- **Vividness:** the detail, clarity, and intensity of an autobiographical memory (Tooming & Miyazono, 2020).
- **Emotionality:** how unpleasant a negative autobiographical memory is to recall (Van den Hout et al., 2011).
- **Dual Task Paradigms:** limit cognitive resources dedicated to recalling a memory by introducing a taxing additional task that requires these resources (Van den Hout & Engelhard, 2012).
- **Working Memory Theory:** holding a mental image or memory in mind demands cognitive resources (Andrade et al., 1997; Baddeley & Hitch, 1974). Dual-task paradigms reduce the vividness and emotionality of an autobiographical memory as the dual-task demands cognitive resources which reduces the amount available to recall the memory (Andrade et al., 1997).
- **Sudoku:** engages both medial and lateral functions of the prefrontal cortex. Performance correlated with the degree of working memory function (Ashlesh et al., 2020).
- **Post-Traumatic Stress Disorder (PTSD):** the recollection of autobiographical memories can inhibit daily functioning (Brewin et al., 2010). Individuals with PTSD report extremely lucid, intense memories of agonizing events (Beckers & Kindt, 2017).

Current Study: I aim to better reveal if a sudoku task measure reduces the cognitive resources available for a negative autobiographical memory and thus influences the emotionality and vividness of the mental image.

Hypothesis 1: The dual-task group (sudoku) is expected to rate a greater reduction in negative emotion toward the memory than the null post-task.

Hypothesis 2: The dual-task group (sudoku) is expected to experience a greater reduction in the vividness of the memory after task completion than the null.

Methods

Initial *a priori* power and sensitivity analysis was completed using G*Power. This study is aiming for a precise sample size to reach significant power with a moderate effect size ($\eta=0.35$, $\alpha=0.05$, $\beta=0.85$) (Mertens et al., 2021). There will be a minimum of 76 participants recruited through the University of South Florida's SONA system.

- Single-factor design with 2 dependent variables measured (vividness and emotionality)
- Condition (dual task vs. null) will be manipulated between subjects.
- Dependent variables will be measured pre-task and post-task; quantified as the difference between post-task and pre-task.

- Participants will rate the emotionality and vividness of their recollection from 0 (not at all) to 100 (extremely) using Visual Analogue Scales (VAS) (Engelhard et al., 2011).

Results and Discussion

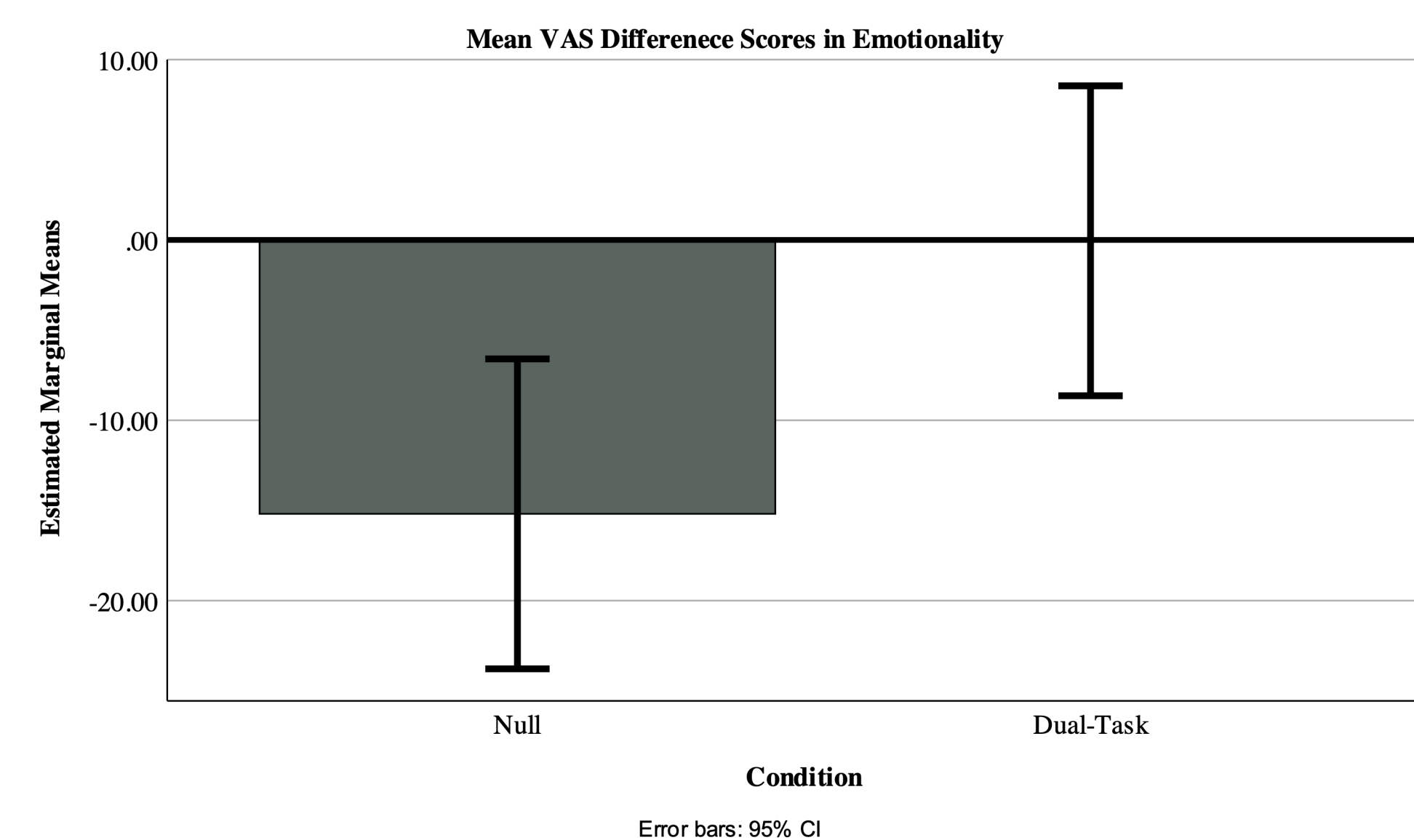


Figure 1. The Dual-Task group's Emotionality score was -0.05 showing no reduction. Group 1 did not show an average reduction and instead experienced an increase of 15.19.

	1	9	2	7	
	9		2	5	
2			3		
3			1	4	2
8					4
1		2	8		5
		9			7
1	3			9	
4	6	7	5		

Figure 3. Sudoku task example.

Hypothesis 1 was not supported. Results indicated the dual-task group did not rate a reduction post-task. However, the sudoku task measure showed a significant mean difference [$\Delta M = -15.14$, $F(1,40) = 6.34$, $p < .05$, $a = .05$, $\eta^2 = .14$, $\beta = .7$] with participants in the dual-task condition ($M = -.05$, $SD = 17.23$) reporting significantly greater emotionality ratings than in the null group ($M = -15.19$, $SD = 20.71$).

Hypothesis 2 was supported. Results indicated the sudoku task measure had a significant effect on vividness ratings [$\Delta M = -13.57$, $F(1,40) = 5.16$, $p < .05$, $a = .05$, $\eta^2 = .10$, $\beta = .53$] with participants in the dual-task condition ($M = 1.95$, $SD = 17.76$) reporting a greater reduction in vividness from pre- to post-task than those in the null group ($M = -11.62$, $SD = 21.84$).

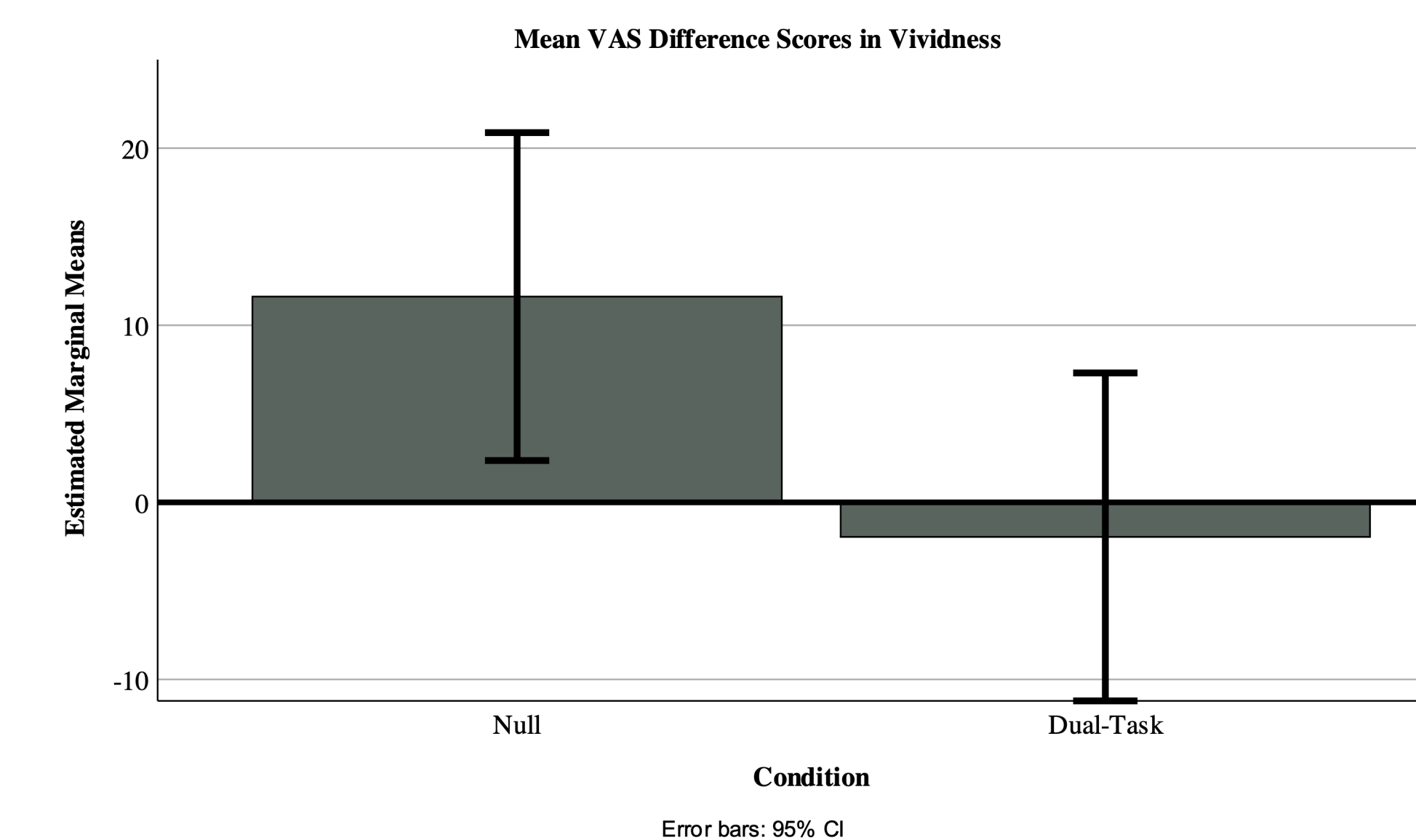


Figure 2. The Dual-task group's Vividness score saw an average reduction of 1.95, while Group 1 did not show an average reduction. Group 1 experienced a mean increase of 11.62.



Implications: Individuals suffering from PTSD are limited in immediate feedback options. If sudoku is shown to be an effective measure in utilizing cognitive resources and reducing the emotionality and vividness of negative autobiographical memories, sudoku tasks could be incorporated into the daily lives of clinical populations. This reduces the emotionality and vividness of the negative autobiographical memory immediately as opposed to most PTSD long-term treatment options that do not allow for immediate changes.

Limitations: This study did not include individuals diagnosed with PTSD. Also, participants were instructed to recall an academic, problem-solving memory instead of a personal memory and/or traumatic experience.

Future Directions: Future studies should expand to clinical populations and focus on non-academic memories.

Conclusions

Sudoku showed a significant impact on emotionality and vividness scores. We expect this significance to continue as we become more powered.

Sudoku was a functional task type in this Dual-Task paradigm. This said, the sudoku task effectively demanded cognitive resources and decreased the amount available for recalling the memory. This reflected a reduction in vividness ratings of the Dual-Task group after the sudoku portion was complete. A reduction was not reflected, though, for emotionality ratings.

This relationship was not seen in the null group. Post-task vividness and emotionality scores are significantly greater than those in the null group. This group was not reducing the cognitive resources available to recall the negative memory. There was a greater decrease in vividness scores than emotionality scores, consistent with previous literature (Mertens et al., 2021).

References

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