

Final Presentation

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INTRODUCTION

TITLE

Investigating the Impact of Spatial Cues on Task Performance and Prospective Memory Under Simulated Memory Impairment in VR

RESEARCH QUESTION

How does simulated memory impairment affect the timing, sequencing, and prioritization of tasks in a complex VR environment, and to what extent can spatial memory cues mitigate these effects?

HYPOTHESIS

“Participants experiencing simulated memory impairment in VR will result in increased completion time and decreased task accuracy, but spatial memory cues will significantly improve their ability to navigate, prioritize, and complete tasks in the correct sequence”

PREVIOUS WORK

- ***“Are Visual Cues Helpful” Cogne et al. (2018)***
 - Explored how different visual cues might help Alzheimer patients
 - Spatial memory cues **CAN** effectively compensate for some cognitive problems
- ***“MyShoes” Adefila et al. (2016)***
 - Created memory loss simulation to help people understand the living experience of having memory loss
 - Objects switching places with another & forgetfulness of one’s location
- ***“A Walk Through Dementia” Alzheimer Research UK (2016)***
 - Visual distortions, objects disappearing/appearing

EXPERIMENT DESIGN

TASKS

1. Finding Books -> Placing it on a Shelf
2. Finding Game Consoles -> Placing it on Charging Dock
3. Finding Medication -> Placing it on Bedside Table

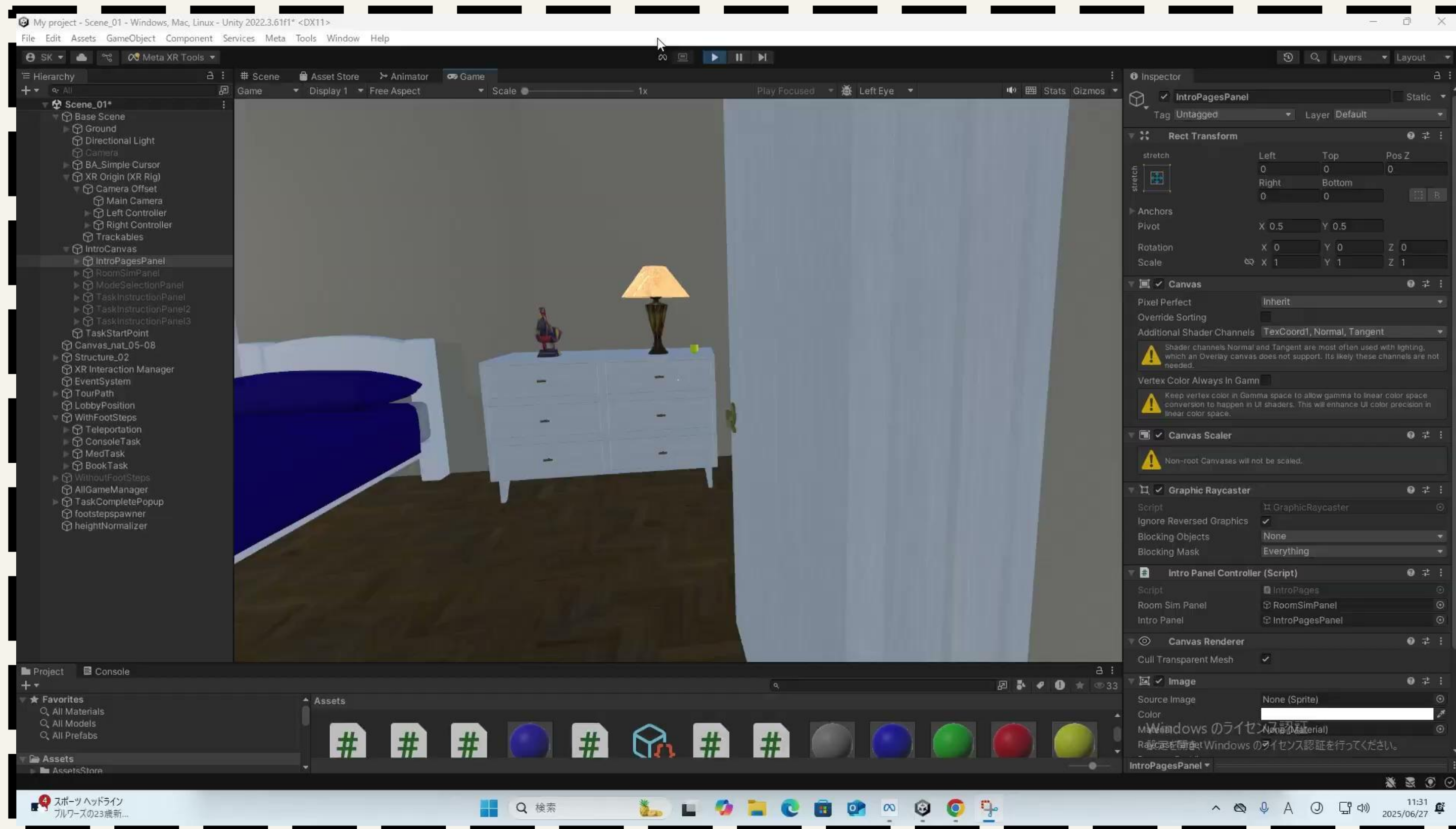
SIMULATION

1. Object Disappearing
2. Object Switching Positions
3. User Teleportation
4. Spatial Cue: Trailing Footsteps

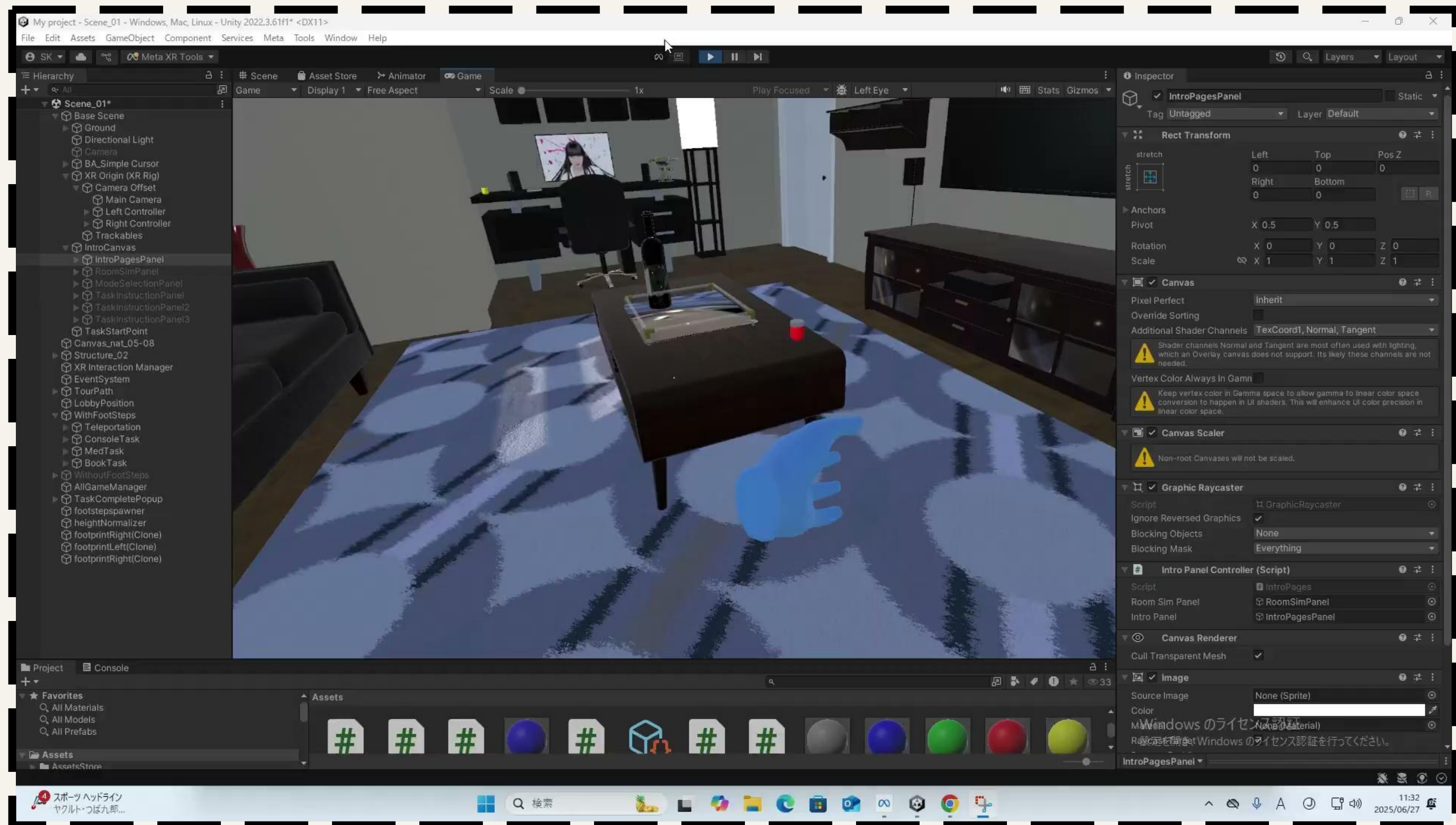
SETUP

- Initial tour of environment to familiarize participants
- Inform participants about tasks (and order) with 2 min break before starting
- Compare task performance **with vs. without** footsteps

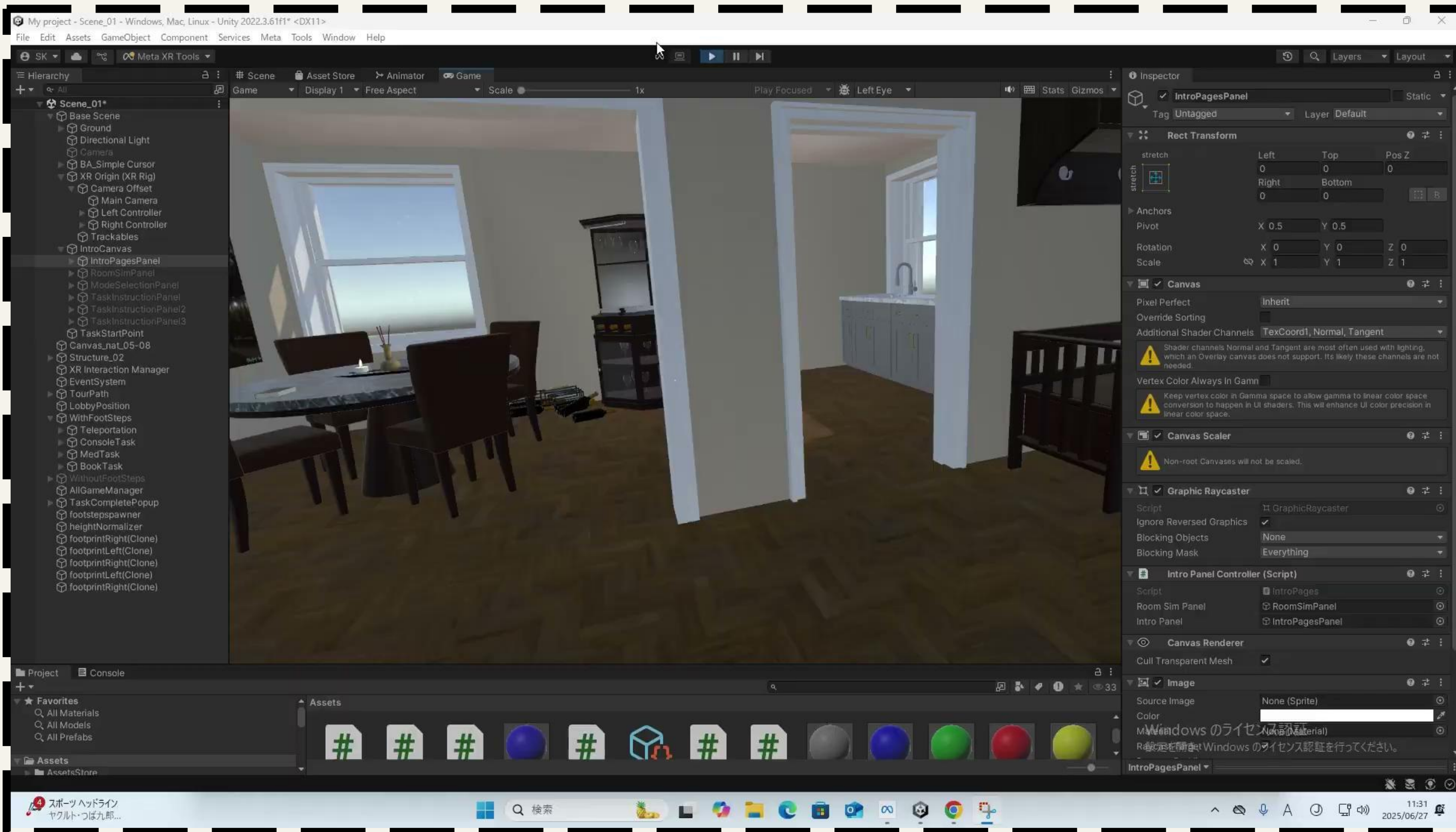
EXPERIMENT DESIGN



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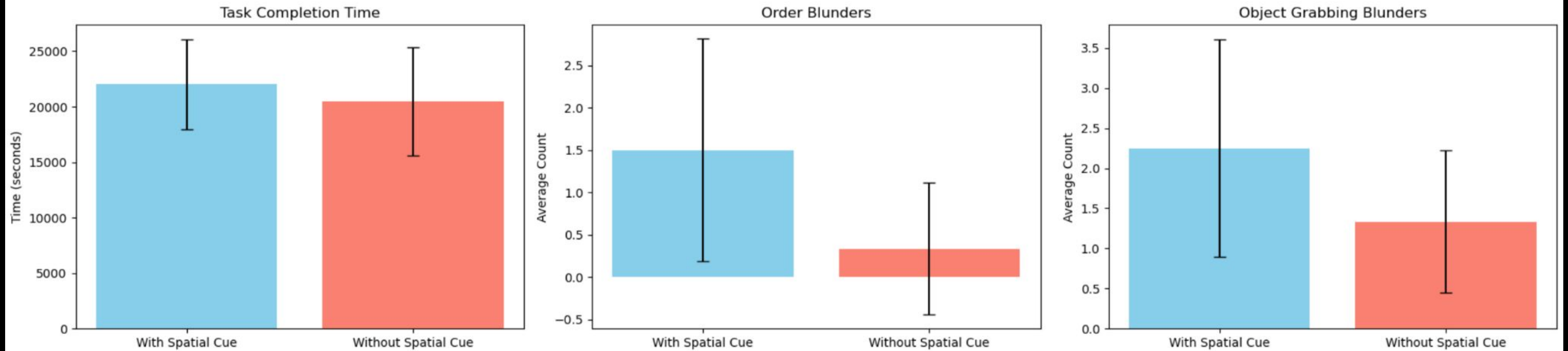


RESULTS

C	D	E	F	G	H	I
With Foosteps			Without Footsteps			CONSENT
Total Time	Order Blunder	Object Blunder	Total Time	Order Blunder	Object Blunder	
4:32.35	2	4	4:28.65	0	2	
6:05.25	1	4	8:26.28	2	3	
7:42.56	0	1	3:45.98	0	0	
5:58.07	3	2	6:38.69	0	1	
6:40.79	1	2	05:00.89	0	1	
4:37.36	0	3	05:03.16	0	1	
6:08.23	1	3	5:43.22	2	1	
5:21.82	1	3	4:55.39	0	2	
6:29.86	3	0	6:02.15	0	0	
5:23.51	4	0	4:39.81	0	2	
8:21.29	2	2	7:44.31	0	2	
5:59.65	0	3	5:44.43	0	1	

RESULTS

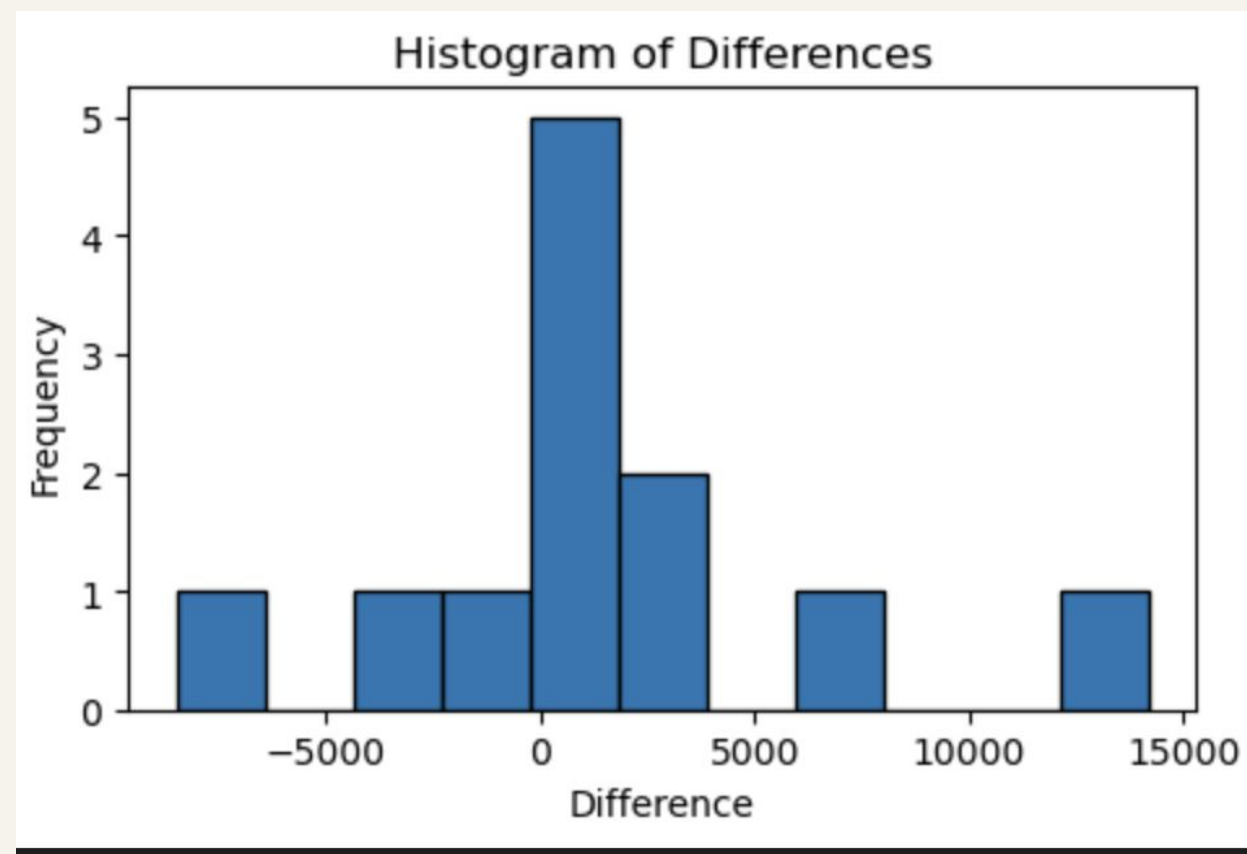
Performance Overview: With vs. Without Spatial Cues



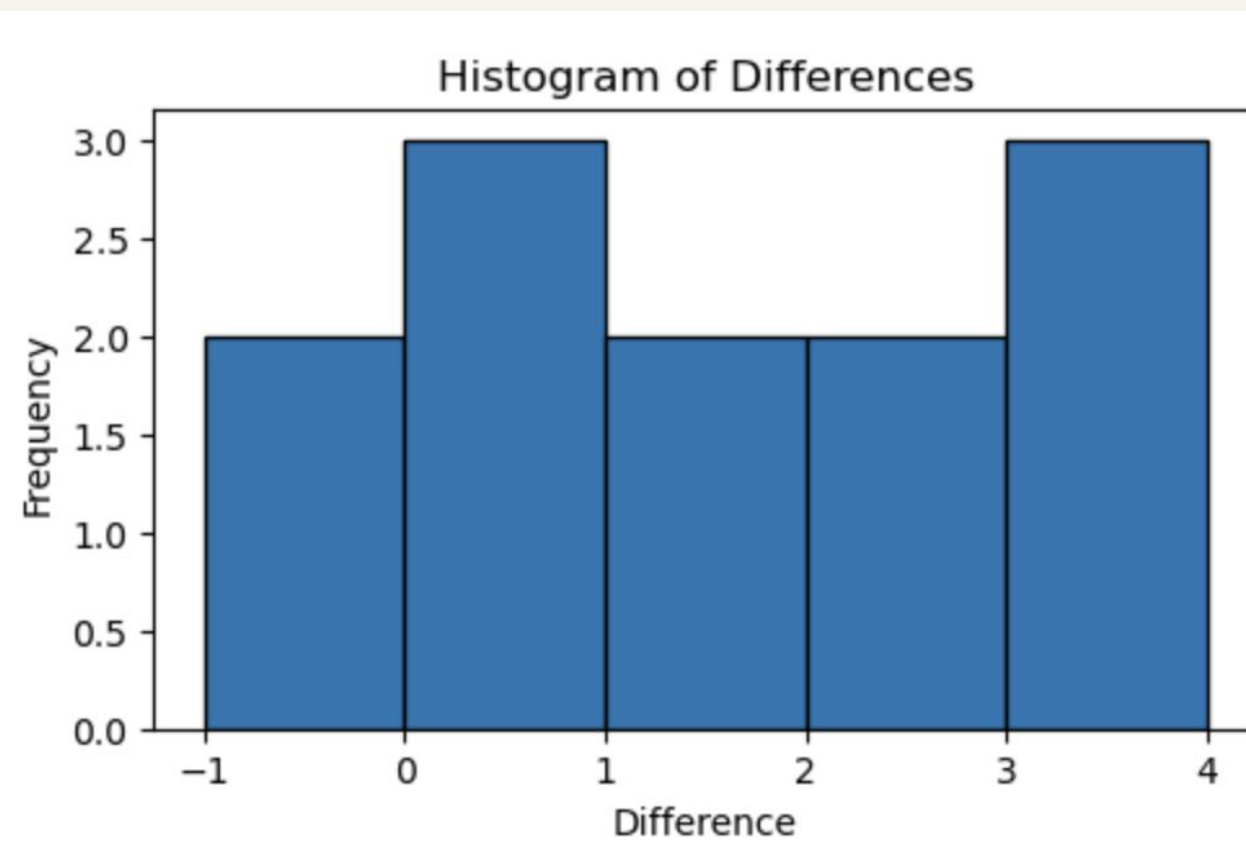
RESULTS

Normality Check

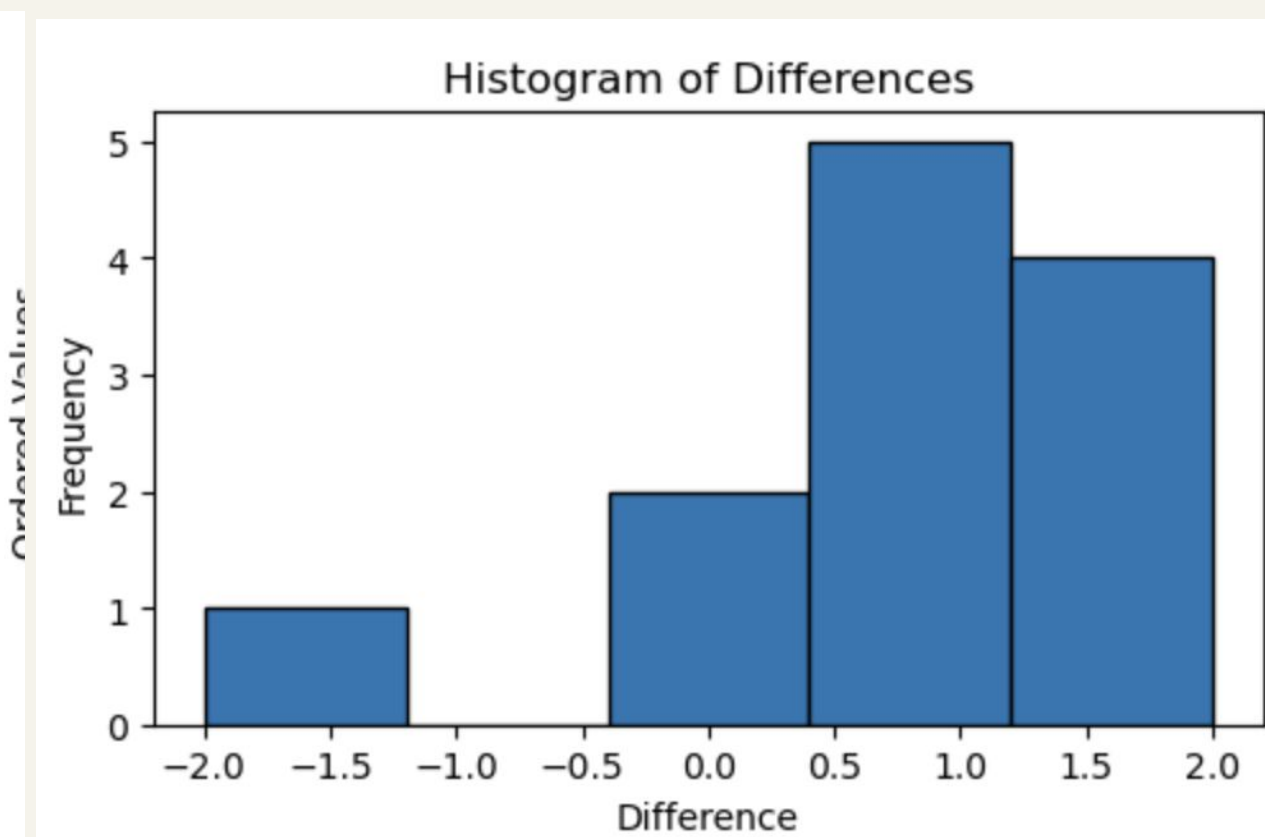
Time Difference



Order Difference



Object Difference

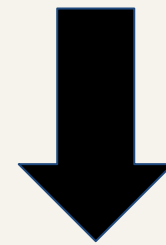


Shapiro-Wilk Test: $W=0.8891$, $p\text{-value}=0.1149$

RESULTS

Significance Test: Wilcoxon Test

TASK COMPLETION TIME (t-pair test)	ORDER BLUNDER	OBJECT BLUNDER
P-value = 0.2334	P-value: 0.0430	P-value: 0.0410



1. Task completion **not statistically significant**
2. Order and object blunder **statistically significant**

RESULTS

Degree of Significance Test: Rank-Biserial Test

TASK COMPLETION TIME	ORDER BLUNDER	OBJECT BLUNDER
RBC = 0.410256	RBC: 0.777778	RBC: 0.709091

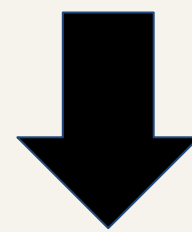
+1: all values in one group are higher than the other
-1: all values in one group are lower than the other
0: complete overlap → no effect



Fairly large effects of differences
between with spatial cue vs. without

RESULTS VERDICT

1. difference in time completion minimal (in terms of mean)
 - a. wilcoxon and rank-biserial showed its not significant
2. Difference in errors that occurred are very significant (in terms of mean)
 - a. wilcoxon and rank-biserial proved it is



Spatial cues caused more blunders consistently across all users

LIMITATIONS & FUTURE WORK

1. **Small sample size** – Results may not generalize to a larger population
1. **Short task duration** – Limited time may not reflect real-world memory challenges
2. **Learning effect** – Participants may improve with repeated exposure

BIGGEST LIMITATION

VR SIMULATION CAUSED NAUSEA ACROSS ALL PARTICIPANTS

References

- Cogné, Mélanie, et al. “Are visual cues helpful for virtual spatial navigation and spatial memory in patients with mild cognitive impairment or alzheimer’s disease?” *Neuropsychology*, vol. 32, no. 4, May 2018, pp. 385–400, <https://doi.org/10.1037/neu0000435>.
- Adefila, Arinola, et al. “MyShoes – the future of experiential dementia training?” *The Journal of Mental Health Training, Education and Practice*, vol. 11, no. 2, 9 May 2016, pp. 91–101, <https://doi.org/10.1108/jmhtep-10-2015-0048>.
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- Alzheimer Research UK (<https://www.alzheimersresearchuk.org/>)