Research Portfolio

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Agenda

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Everyday Spatial Experiences, Video Games, and Spatial Abilities

Slide 3
Quantitative, Spatial cognition study

Bay Area Rapid Transit

Slide 8
Qualitative, In depth Interviews (IDIs)

Communication in Virtual Team Environments

Slide 13
Observational, Qualitative

Children's Judgments of Contextual Racial Presentation

Slide 20
Social psychology experiment, Mixed methods

The Monty Hall Problem

Slide 25
Agent Based Modeling

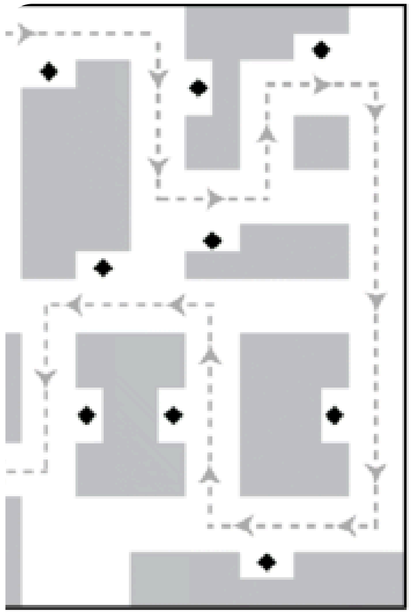
Everyday Spatial Experiences, Video Games, & Spatial Abilities

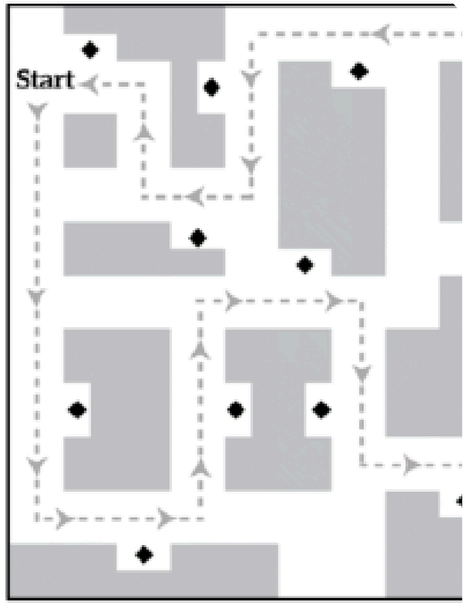
Investigating the impact of spatial experiences (e.g., hiking or computer programming) on spatial task performance

Agenda

Research Focus

- Studied how spatial experiences like hiking or programming affect navigation and mental rotation tasks.
- Explored the relationship between everyday activities and specific spatial competencies.
- Investigated the impact of different interfaces (desktop vs. VR) on task performance.
- Examined familiarity with controls in different environments.





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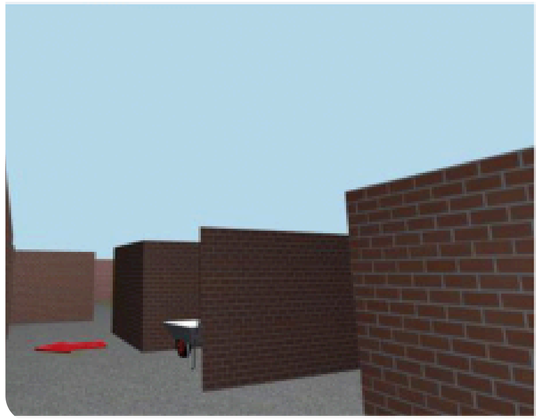

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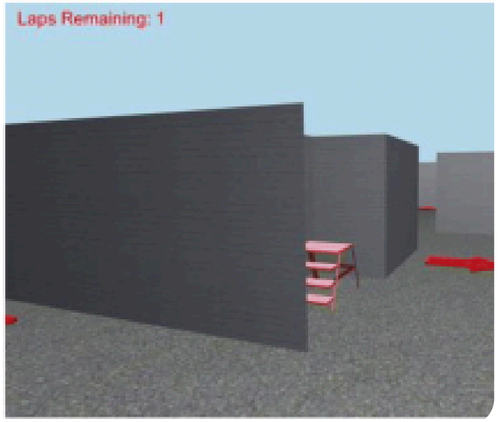


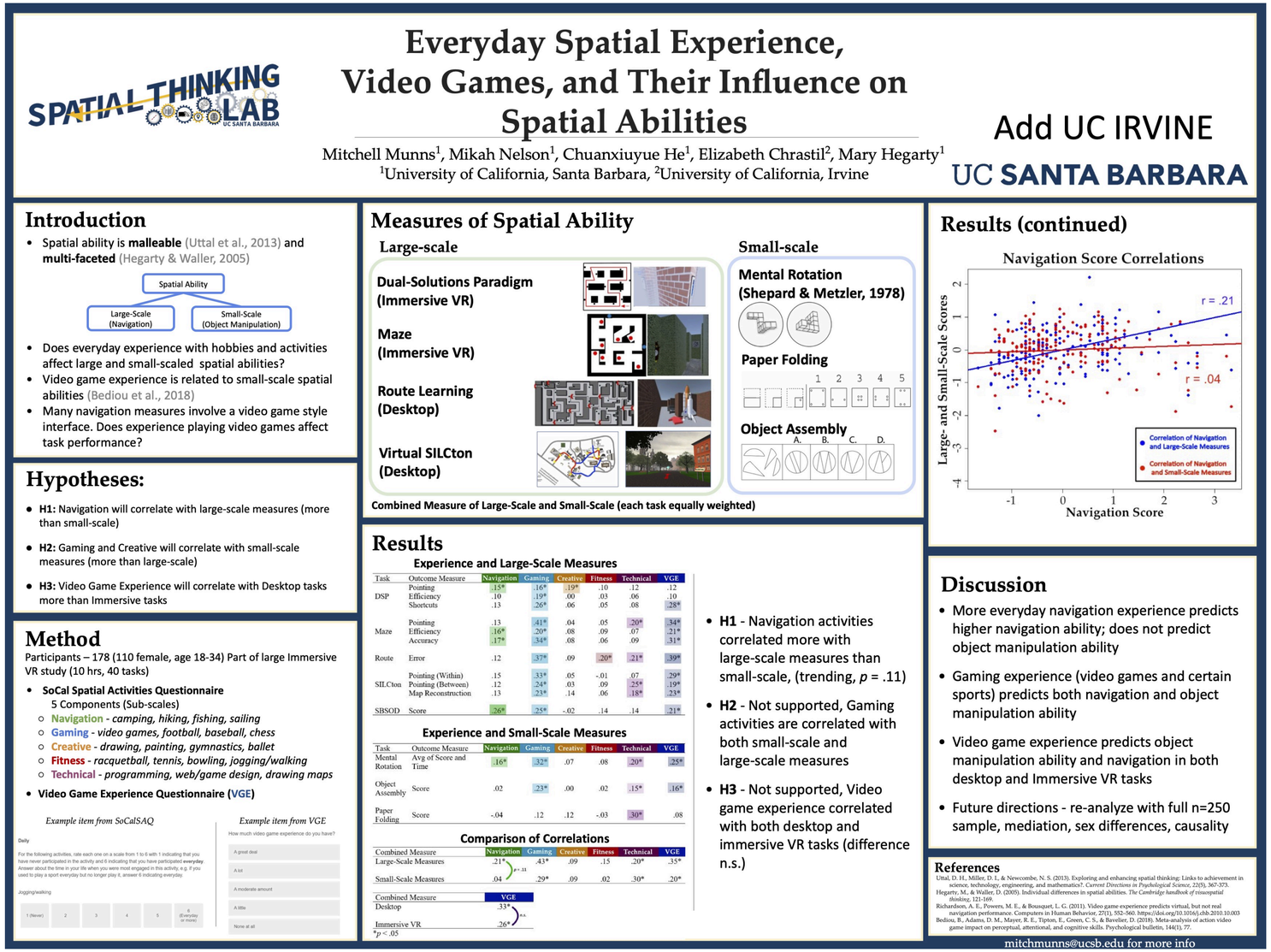
Skills and Tools

- User research, data visualization, and analyses.
- Tools: R, immersive VR, desktop VR, Psychopy, Python, Excel.
- Developed reproducible scripts for data analysis.
- Trained new research assistants and managed lab operations.

Poster Presentation for Psychonomics 2023

Key Findings

- Spatial abilities can be developed through training and everyday experiences.
- Different types of experiences may enhance specific spatial skills.
- Experience with playing video games might enhance both navigation and mental rotation abilities.



Challenges and Learnings

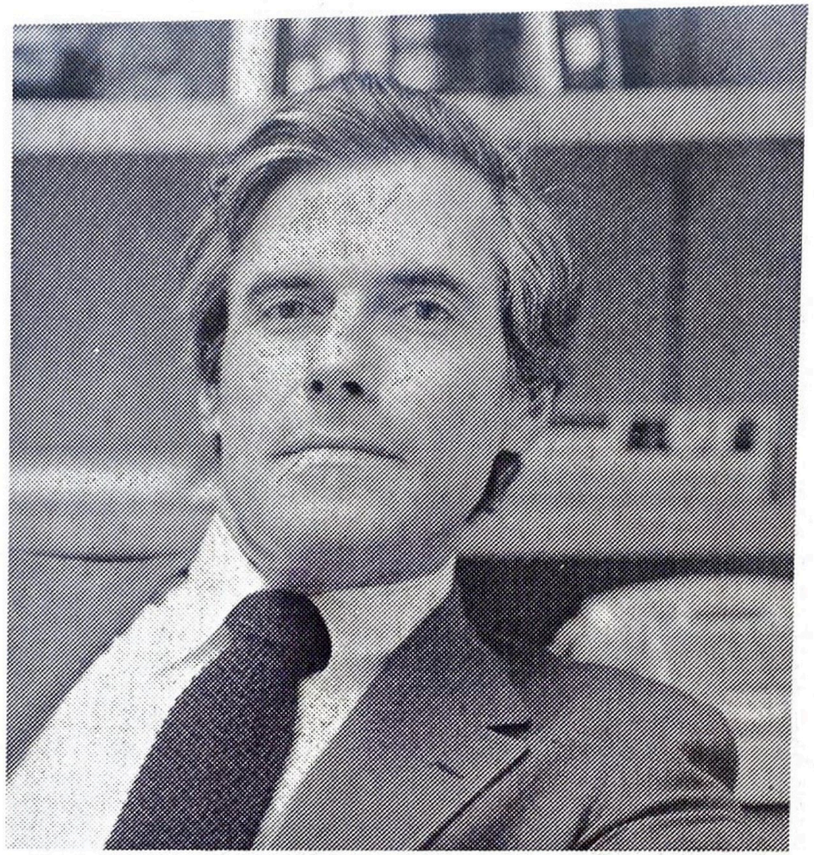
- Learned to be specific and concise in writing and communication.
- Developed reproducible and efficient code in R.
- Emphasized the importance of choosing the right research methods.
- Collaborated with team members to refine research approaches.

A Case of Convenience: Bay Area Rapid Transit

Understanding why people typically ride the Bay Area Rapid Transit system.

Agenda

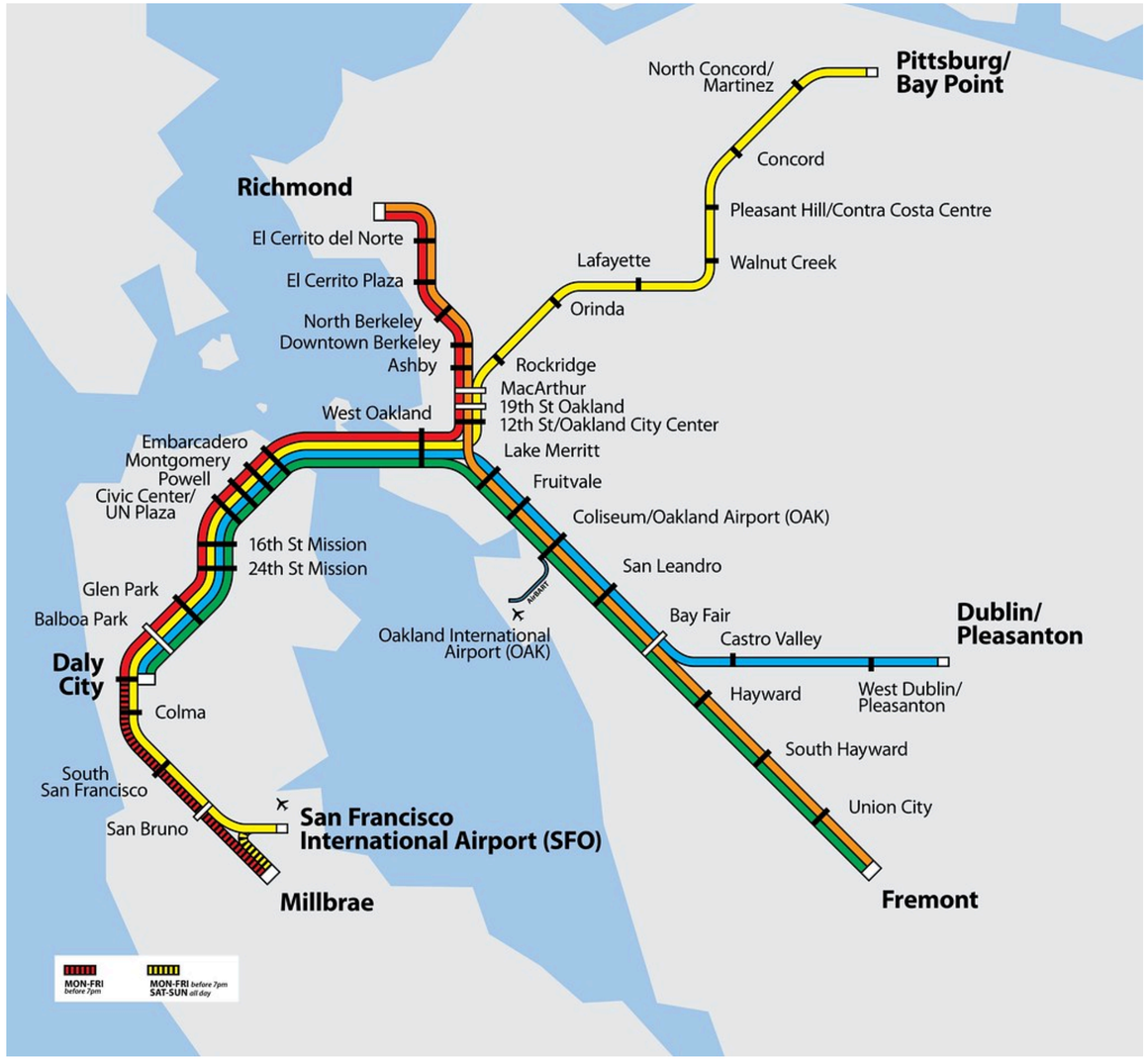
Ian Cheshire quit his job on BART.



He does it every day—around 5:30. Instead of carrying the day's problems onto the freeway with him and roaring home like a lion, Ian now sits back on BART, reads, relaxes or twiddles his thumbs and comes home like a pussycat.

Problem Statement

- The Bay Area Rapid Transit (BART) is a historic “heavy-rail public transit system” starting service in 1972.
- After the COVID-19 pandemic BART’s ridership fell drastically, covering only 25% of the costs related to maintenance and upkeep in 2023.
- With a change in the work/life balance, there exists a need to understand BART’s current and potential ridership and offer actionable improvements to the BART system.



Research and Groundwork

- Surveyed Bay Area residents* to understand attitudes towards BART.
- Emphasized a need to explore options for transit regionally, such as systems between the South Bay, Atherton, CalTrain and BART regarding the expansion of a connecting route.
- Found that users come from an array of socioeconmic backgrounds, with 31% of its riders making less than $50k a year.
- Emphasized the importance of social factors such as NIMBYism in wealthier residential areas.

*Participants for this study represented Bay Area residents from one of the nine counties comprising the “Bay Area”: Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, Sonoma, and San Francisco.

Key Findings

Confusion among riders about BART's identity as a transit system.

Riders often struggle to categorize BART—viewing it as a hybrid of a subway, metro, and commuter rail, and this changes their idea of what an optimal BART experience is.

Many riders perceive public transit, including BART, as an inherently social experience.

Commuters appreciate the opportunity to travel to or with others, whether for work, leisure, or social activities. Crowded trains can feel more welcoming, while emptiness can be unsettling.

Riders express a complex relationship with safety and cleanliness. Their perceived safety depends on frequency of use.

More frequent riders feel safer while less frequent riders associate BART with crime due to a word of mouth reputation.

Redesigned BART Clipper Card

Supplemental Design

- Developed a high-fidelity prototype for connecting BART riders focusing on regional identities.
- Focused on existing card system.

Communication in Virtual Team Enviornments

Understanding how players in virtual environments leverage technology and language to communicate about their environment.

Agenda

When we cooperate we assume a *communicative responsibility*, incorporating and accounting for other people's efforts to create a shared understanding of the situation (Aune et al., 2005; Youk & Park, 2023).

Research Focus

- Studied how teams in high-pressure virtual environments (First Person Shooters or MMORGs) chose to communicate about virtual environments and about rival teams.
- Explored the relationship between spatial language usage (axises such as up/down, left/right) on win rates.
- Investigated the impact of different communication (linguistic vs. in-game, such as “pings”) on game performance.
- Developed a spatial-linguistic codebook.

Timeline

Phase 1

Created a research plan,
variables to measure, subsequent analyses.
Created a codebook of spatial utterances
before viewing videos

- Twitch

Phase 2

Adjusted codebook while
collecting data for repeated patterns of language.
Collected 38 videos of unique gameplay for
instances of spatial language according to
established linguistic codebook.

Phase 3

Created a poster deliverable
and analyzed the data in R.
Collaborated with a mentor to
extrapolate possible solutions
for patterns in the data using R and Python

Poster Presentation from APS

Key Findings

Teams who use spatial language, use it in conjunction with other spatial phrases.

- Utterances of “left” are highly correlated with “right” and “back”
- Using a variety of spatial linguistic terms does **not** predict a win or loss for a team.

Expressing Collective Spatial Communication in Goal-Orientated Virtual Worlds

UC SANTA BARBARA
DEPARTMENT OF COMMUNICATION

Mikah Nelson, Kylie Woodman, Sungbin Youk, Musa Malik, Joseph Belinfante, Jenna Liedtky-Lundstedt, Chiamaka Utom, René Weber*

We present a preliminary codebook in which to investigate instances of spatial communication in a cooperative virtual space. Indeed, axial terms are used to describe spatial locations/objects (even virtually) but are not significant spatial cues for efficient teamwork. Effective teamwork may be best indicated by how often one references the layout of their environment.

Background

Prior research suggests playing First Person Shooter Games have had a marked effect on spatial cognition as well as sensory, visual attentional, fine motor control, and memory mechanisms [2].

People who engage in **Collective Spatial Cognition** (CSC; 3) also assume a **communicative responsibility** [1].

Apex Legends is a video game where three players engage in prosocial behavior by effectively communicating spatial information in order to reach a common goal.

Research Question
What leads to efficient spatial communication in teams within a goal-orientated virtual world, both linguistically and as afforded by technology?

Data

N = 38 unique competitive matches from Twitch

“Apex Legends” official search result → Videos → Views (High to Low; default) → data includes videos from both “All videos” and “Past Broadcasts”

- Videos were chosen first by popularity then by each unique streamer for variation; all English-speaking

Codebook created using linguistic spatial terms based on axial structure phrases, related to spatial memory [5]

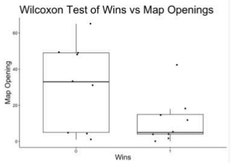
- Developmental spatial origins; children's production of spatial words is related to their spatial skills (e.g., Hermer-Vazquez et al., 2001)
- High interrater reliability (κ = .97)

Results:

Figure 1.

Example player view (top) and aerial map (left).

Figure 2.



0 = Loss, 1 = Win; $N = 18$, $p < .05$-$.08$

cont. Results:

Figure 3. Spearman’s Correlation Matrix

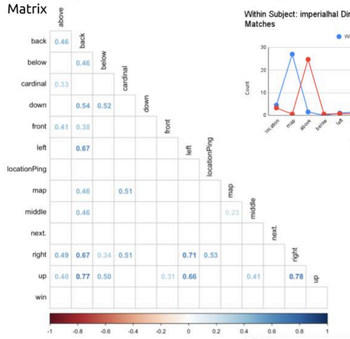


Figure 4. Within Subject Analysis

Table 1. Descriptive Statistics

Characteristic	Loss, N = 29[1]	Win, N = 9[1]
Team [1] vs Solo [0] Matches		
Mean (SD)	0.9 (0.3)	0.8 (0.4)
Ranking		
Mean (SD)	10.5 (4.7)	1.0 (0.0)
Missing	15	0
Number of Location Pings		
Mean (SD)	6.6 (7.4)	3.7 (2.8)
Number of Times Map is Opened per Match		
Mean (SD)	21.2 (23.3)	11.3 (13.0)
Above		
Mean (SD)	0.8 (1.1)	0.8 (1.1)
Below		
Mean (SD)	0.8 (1.3)	1.0 (1.2)
Left		
Mean (SD)	1.7 (2.0)	3.2 (3.6)
Right		
Mean (SD)	2.3 (3.1)	2.7 (3.0)
Next		
Mean (SD)	0.0 (0.0)	0.1 (0.3)
Front		
Mean (SD)	0.6 (1.1)	1.1 (1.3)
Middle		
Mean (SD)	0.2 (0.7)	0.3 (0.7)
Back		
Mean (SD)	3.8 (3.5)	4.4 (3.3)
Up		
Mean (SD)	2.8 (2.8)	4.1 (5.4)
Down		
Mean (SD)	1.2 (1.6)	1.0 (1.4)
Cardinal Directions		
Mean (SD)	1.4 (2.2)	1.1 (2.3)
Streamer Name		
	6 / 29 (21%)	1 / 9 (11%)
dezignful	1 / 29 (3.4%)	0 / 9 (0%)
diegosaurs	1 / 29 (3.4%)	1 / 9 (11%)
faide	2 / 29 (6.9%)	0 / 9 (0%)
hiswattson	6 / 29 (21%)	1 / 9 (11%)
iiTzTimmy	2 / 29 (6.9%)	0 / 9 (0%)
imperialhal	7 / 29 (24%)	2 / 9 (22%)
lululively	0 / 29 (0%)	1 / 9 (11%)
mande	0 / 29 (0%)	1 / 9 (11%)
rouge	2 / 29 (6.9%)	1 / 9 (11%)
snipedown	0 / 29 (0%)	1 / 9 (11%)
verhulst	1 / 29 (3.4%)	0 / 9 (0%)
zer0	1 / 29 (3.4%)	0 / 9 (0%)

[1] n / N (%)

Diversity of spatial linguistic terms does not predict win/loss rate (β = 4.4, SE = 5.6, z = 0.79, p = 0.43)

Discussion:

- Teams who do use spatial language use them significantly in relation to each other (e.g., left/right, up/back)
- Suggests less time viewing the map is related to efficient teamwork in a virtual environment (Apex Legends)
  - Individual differences suggesting opposite relationship for opening map vs win/loss rate

Future Directions:

- Larger sample size!
- Are there linguistic terms or technological affordances that are better predictors of effective teamwork?
- Do different individuals exhibit different spatial communication tactics?
- Do we use axial terms to talk spaces similarly in non-virtual environments? (e.g. emergency response transmissions)

REFERENCES
[1] Aune et al. (2005)
[2] Bediou et al. (2018)
[3] Curtin & Montello (2023)
[4] Hu & Liden (2015)
[5] Munnich et al. (2001)

ACKNOWLEDGEMENTS
Thank you so much to the entire MNL team, Dr. Weber, and research assistant Nara Kim for helping with data collection and coding!

Communicative responsibility doesn’t hold for independent play styles.

Players assume the team is unified.
That is, that they’re able to keep track of what one player’s left, right, or back is. One player saying “Go left” is assumed to have no ambiguity about which direction that is.

Challenges and Learnings

- Learned to brainstorm: I had to think critically about communication patterns which emerge when people are under pressure.
- Learned the importance of scientific communication and visual design for a specific audience.
- Emphasized the importance of storytelling, and showing people the “so what?” of research.

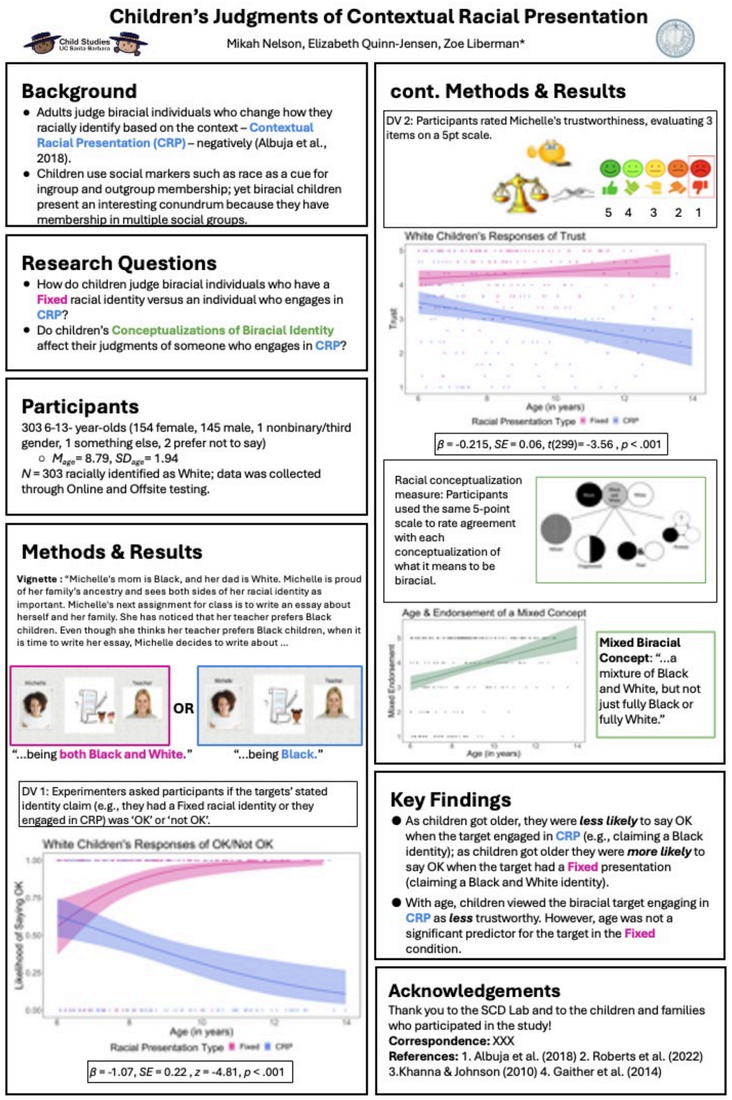
Children’s Judgments of Contextual Racial Presentation

Investigating how children view biracial individuals who flexibly present their identity based on context.

Agenda

Research Focus

- Adults judge biracial individuals who change how they racially identity based on context, known as Contextual Racial Presentation (CRP) **negatively.**
- Children use social markers such as race as a cue for ingroup (like me) and outgroup (not like me) for deciding who they associate with.
- Biracial people present an interesting conundrum because they have membership in multiple social groups.

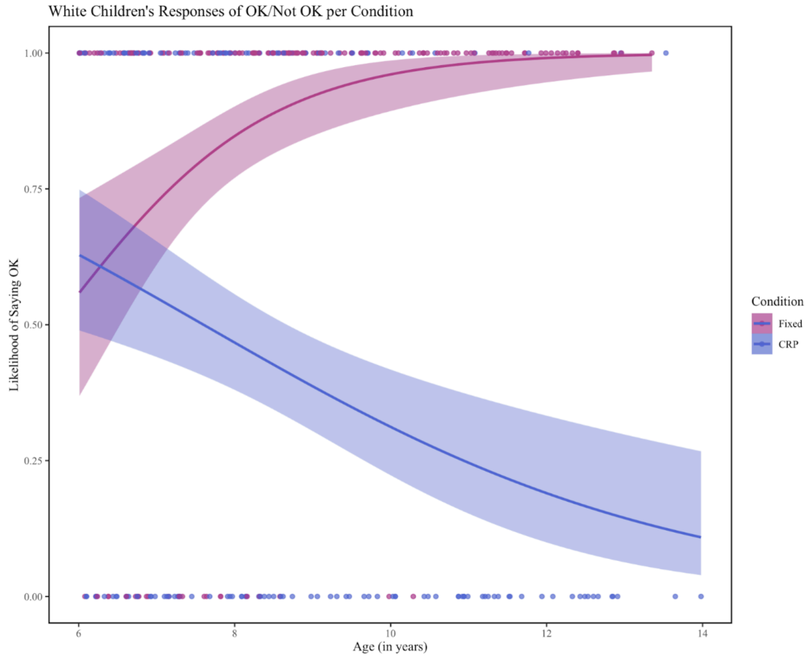


Methodology

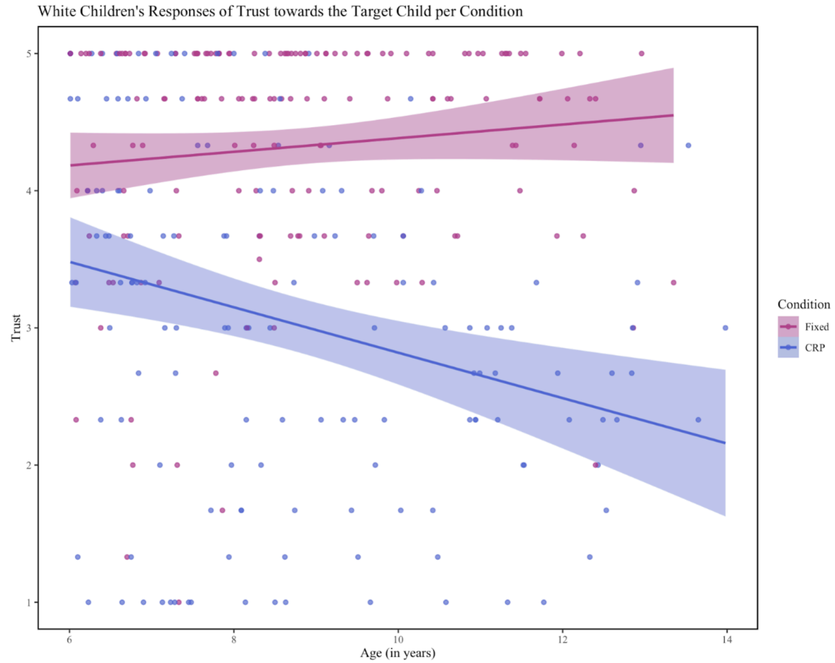
- Participants: 303 6-13- year-olds collected from Online and Offsite testing at a local zoo.
- Method: 2 × 2 between-subjects design, became 2 condition design (main character either **maintains** their biracial identity or **switches** to a monoracial identity.
- Conducted logistic and linear regressions, Chi-squared test, Welch's two-sample t-test to run pre-registered analyses and explore the data.

Two Condition Design

White children's responses of OK/Not OK based on presentation condition



White children's responses of trust towards target per Condition and by Age (6-9- & 10-13-)



OK/Not OK

- As children got older they were **less likely** to say it was OK when the character in the story claimed only a **monoracial** identity (claiming a Black identity).
- As children got older they were **more likely** to say it was OK when the character in the story claimed a **biracial** identity (claiming a Black and White).

Trust

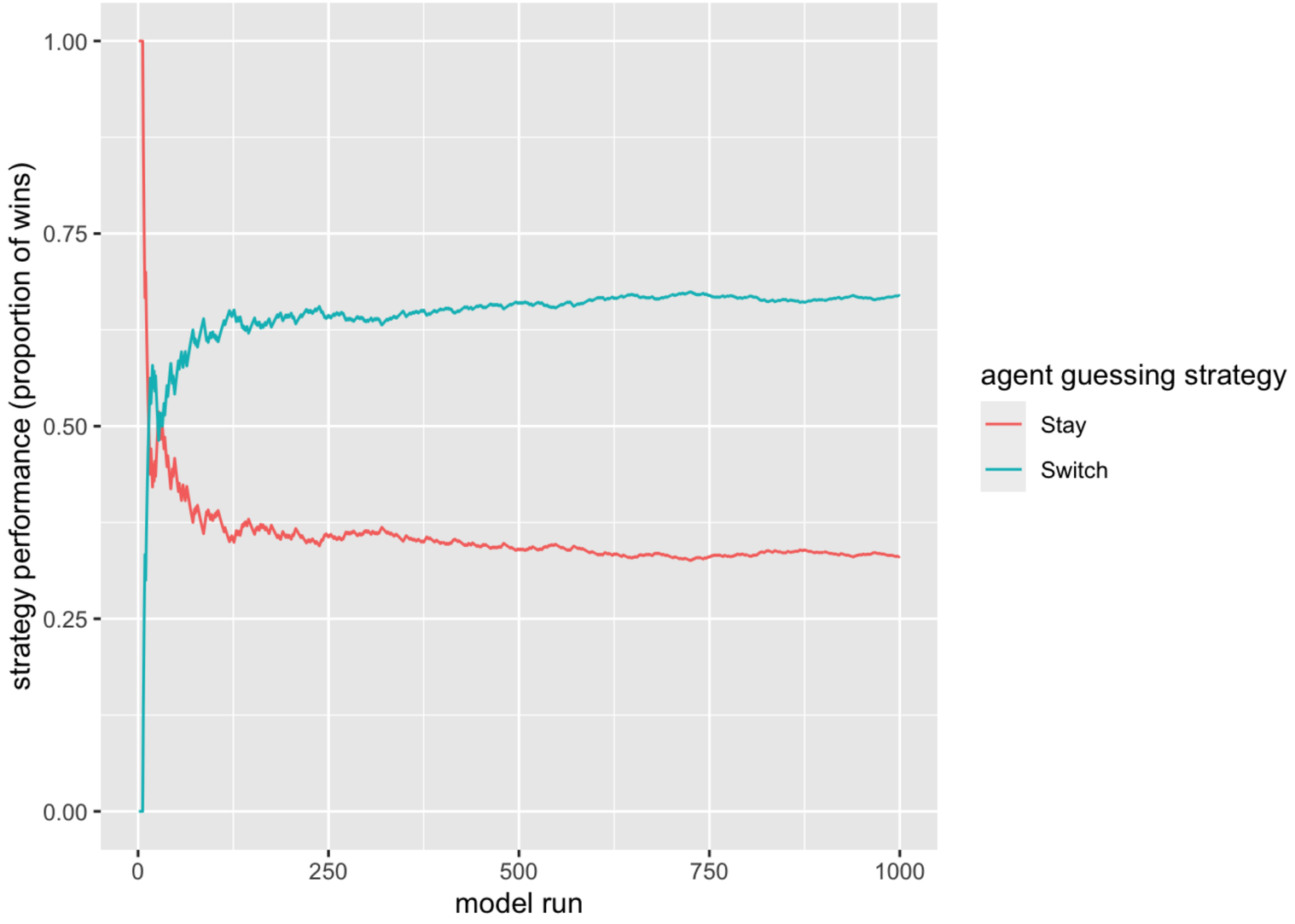
- With age, children viewed the character in the story who claimed the monoracial idenitty as less trustworthy.
- Age was not a significant predictor of trust in the character when children saw them claim a biracial identity.

Takeaway

Children exhibit judgments of CRP that grow increasingly adult-like in their cognition and perceptions of biracial individuals who present different racial presentations.

Agent Based Modeling

The Monty Hall Problem



Created a life cycle in R to compare strategies within the Monty Hall Problem.

Questions?

Email me at **mikah@berkeley.edu** !

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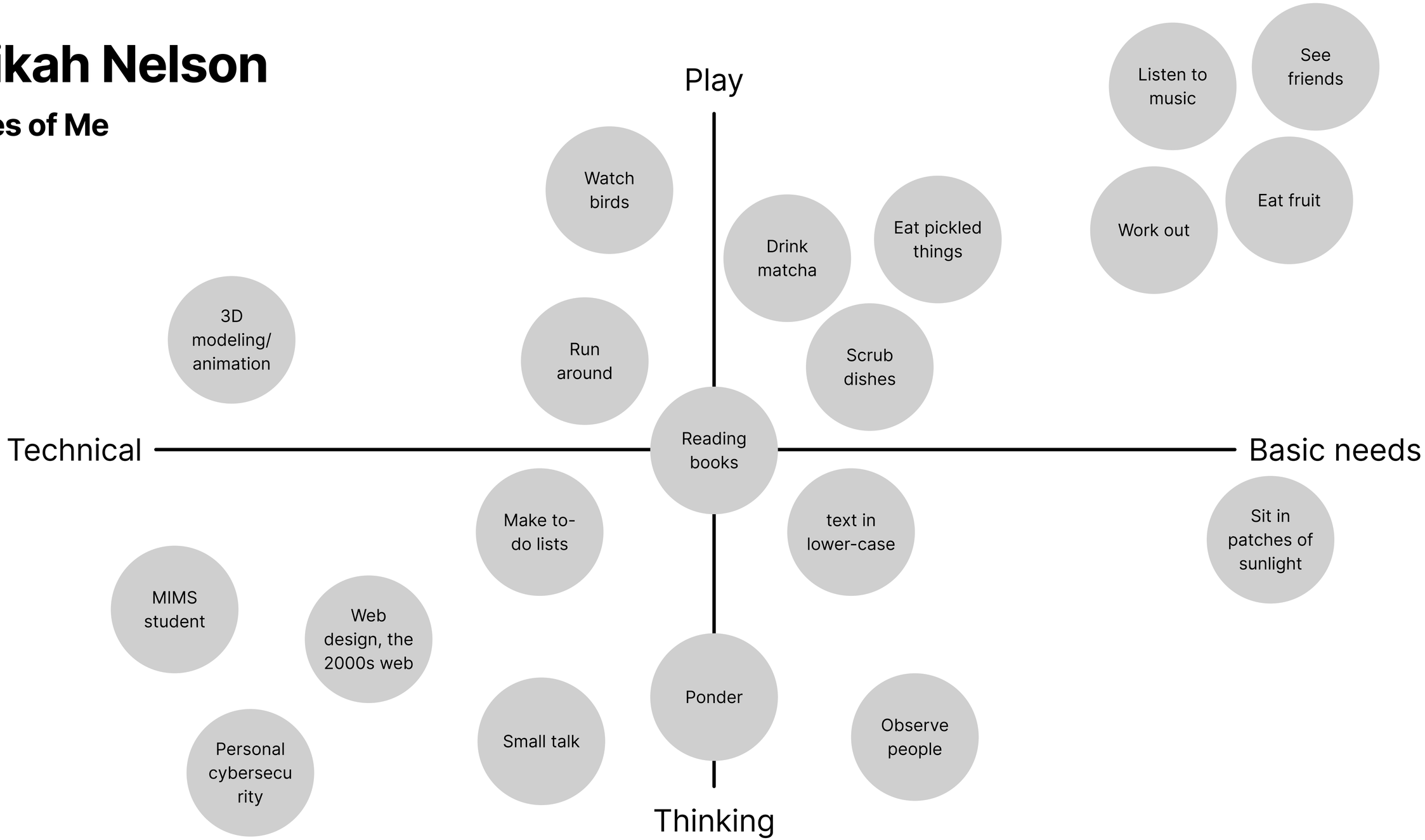
Mikah Nelson

Axes of Me



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