



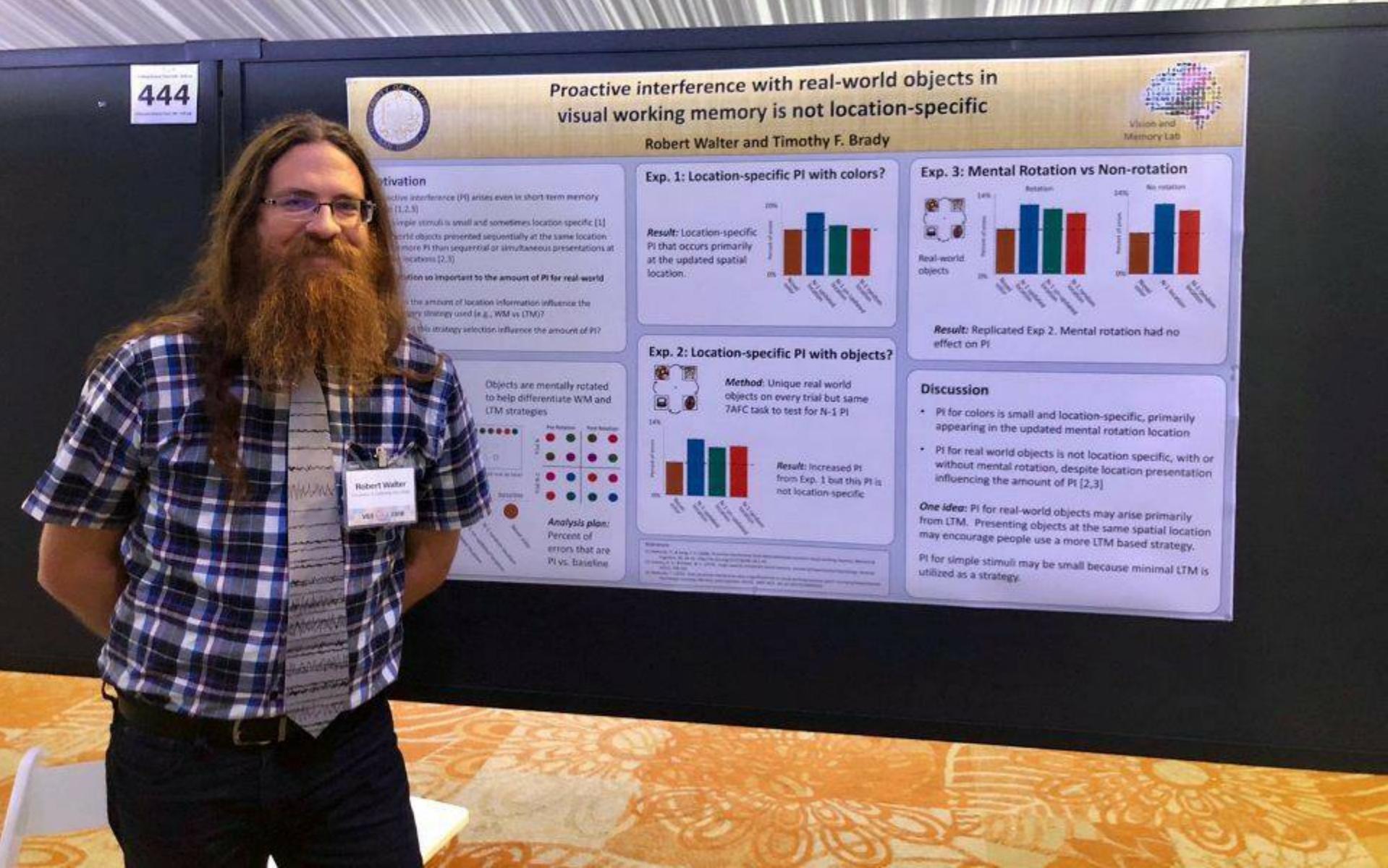
Honors Project - Differentiating the Components of Visual Short Term Memory with Proactive Interference

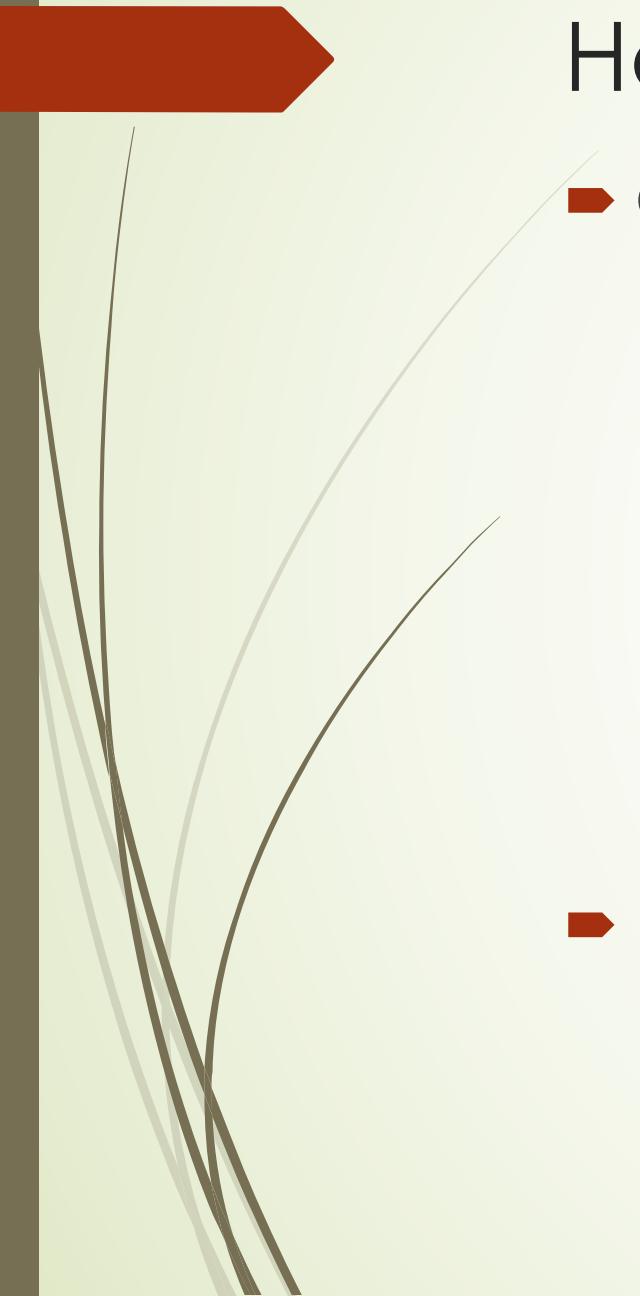
-Presented by:
Robert Walter



Why join the Honors program

- ▶ If you're not in a lab:
 - ▶ Excellent way to start doing research
 - ▶ Difficult learning curve, but a good way to "catch up" to be competitive for grad school or industry
- ▶ If you're already in a lab
 - ▶ Great way to take a more hands on approach to research (follow your interests!)
 - ▶ Why not? You're already doing science!
 - ▶ Can explore other labs/ fields
- ▶ Improve your science presentation skills
- ▶ May lead to publishable data!





Honor's program components

- ▶ Cogs 190A taken during the spring
 - ▶ Get up to speed on your lab's research
 - ▶ Learn appropriate skills
 - ▶ Read lots of literature
 - ▶ Help with lab duties
 - ▶ Develop a research proposal
- ▶ 190 B&C (like a 199+)
 - ▶ Develop and complete the research proposal
 - ▶ Analyze data and prepare thesis write up



Honor's program components

- ▶ 198 & 190D
 - ▶ Develop science presentation skills
 - ▶ Learn about other Honor's research projects
- ▶ Graduate Class
 - ▶ Excellent opportunity to learn about a specific topic in depth
 - ▶ Very small classes (usually 6-12 people)
 - ▶ Seminar style classes recommended
- ▶ Present research at the Honors Conference

My Path Through the Honors Program

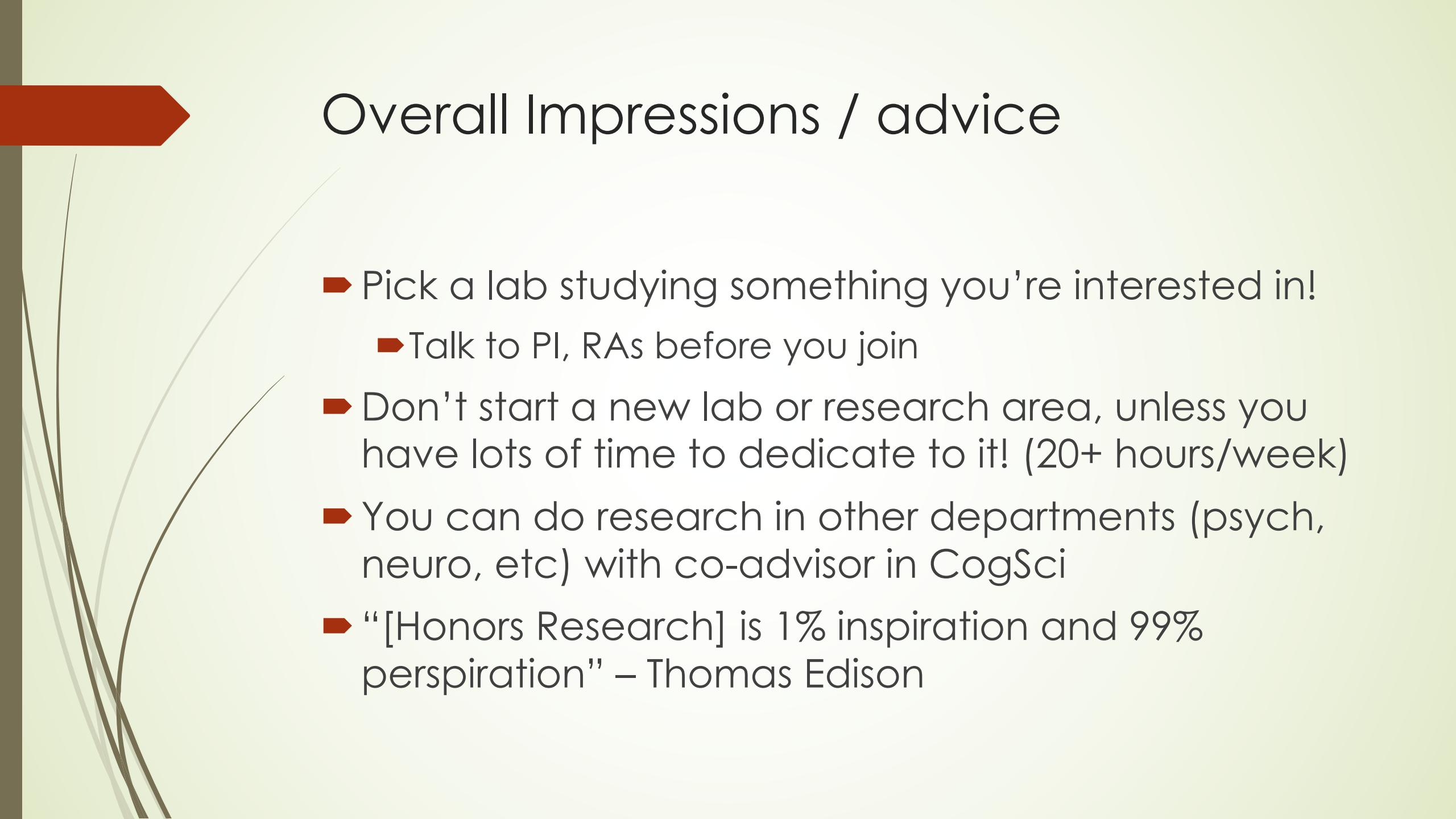
Started in Dr. Brady's Lab in Fall 2016

Inspired by last years Honor's Program Presentation

Joined Dr. Chiba's Lab for Honors Project

Switched to Dr. Brady's lab to complete my project, continuing my existing research.





Overall Impressions / advice

- ▶ Pick a lab studying something you're interested in!
 - ▶ Talk to PI, RAs before you join
- ▶ Don't start a new lab or research area, unless you have lots of time to dedicate to it! (20+ hours/week)
- ▶ You can do research in other departments (psych, neuro, etc) with co-advisor in CogSci
- ▶ “[Honors Research] is 1% inspiration and 99% perspiration” – Thomas Edison



Some of My Research!



Differentiating the Components of Visual
Short Term Memory with Proactive
Interference



Two Kinds of interference:
Retroactive & Proactive

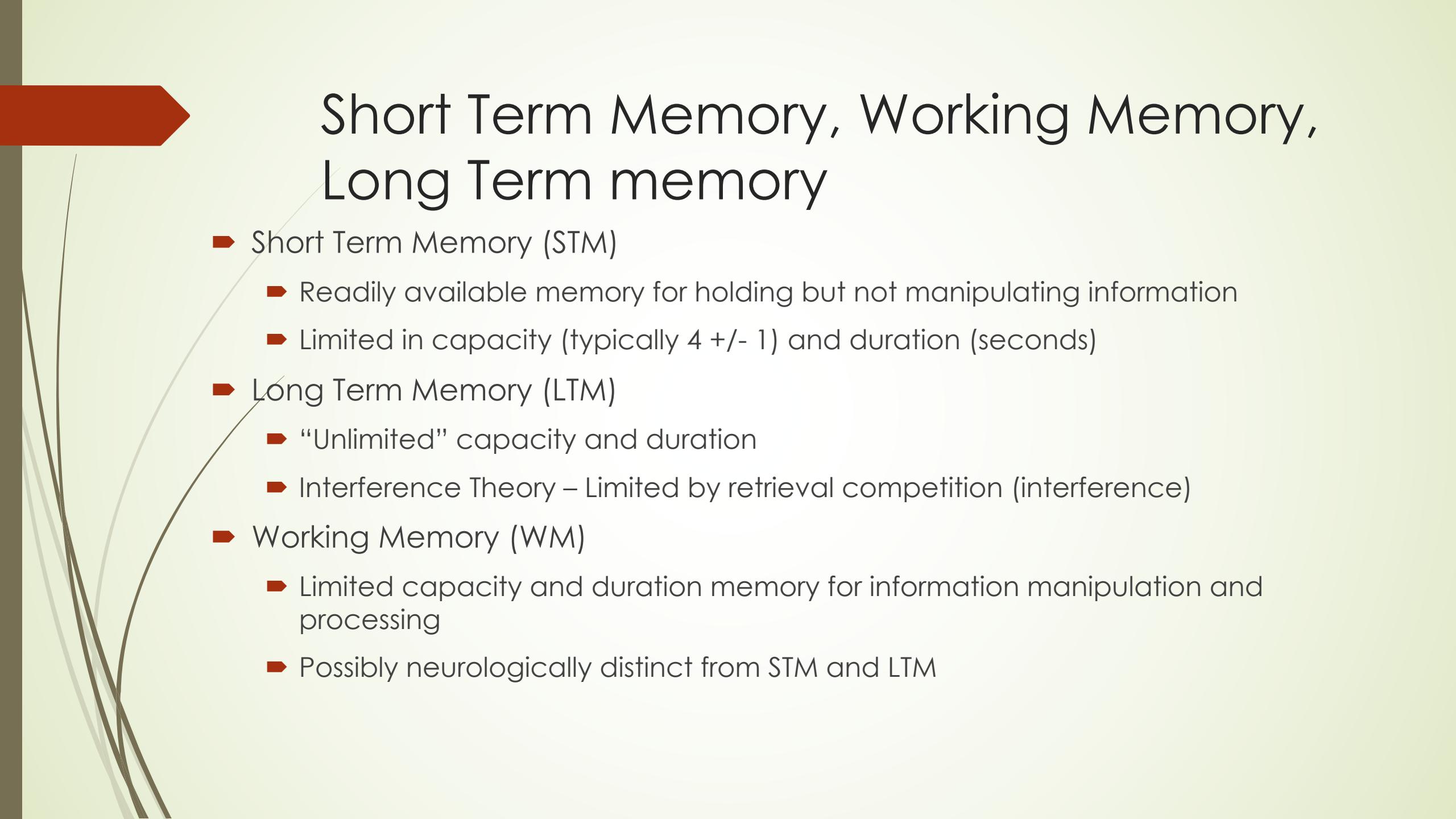


Everytime I learn something new,
It pushes the old stuff out of my brain.

Retroactive – Current memories interfere with past
memories

Proactive – Past memories interfere with current ones





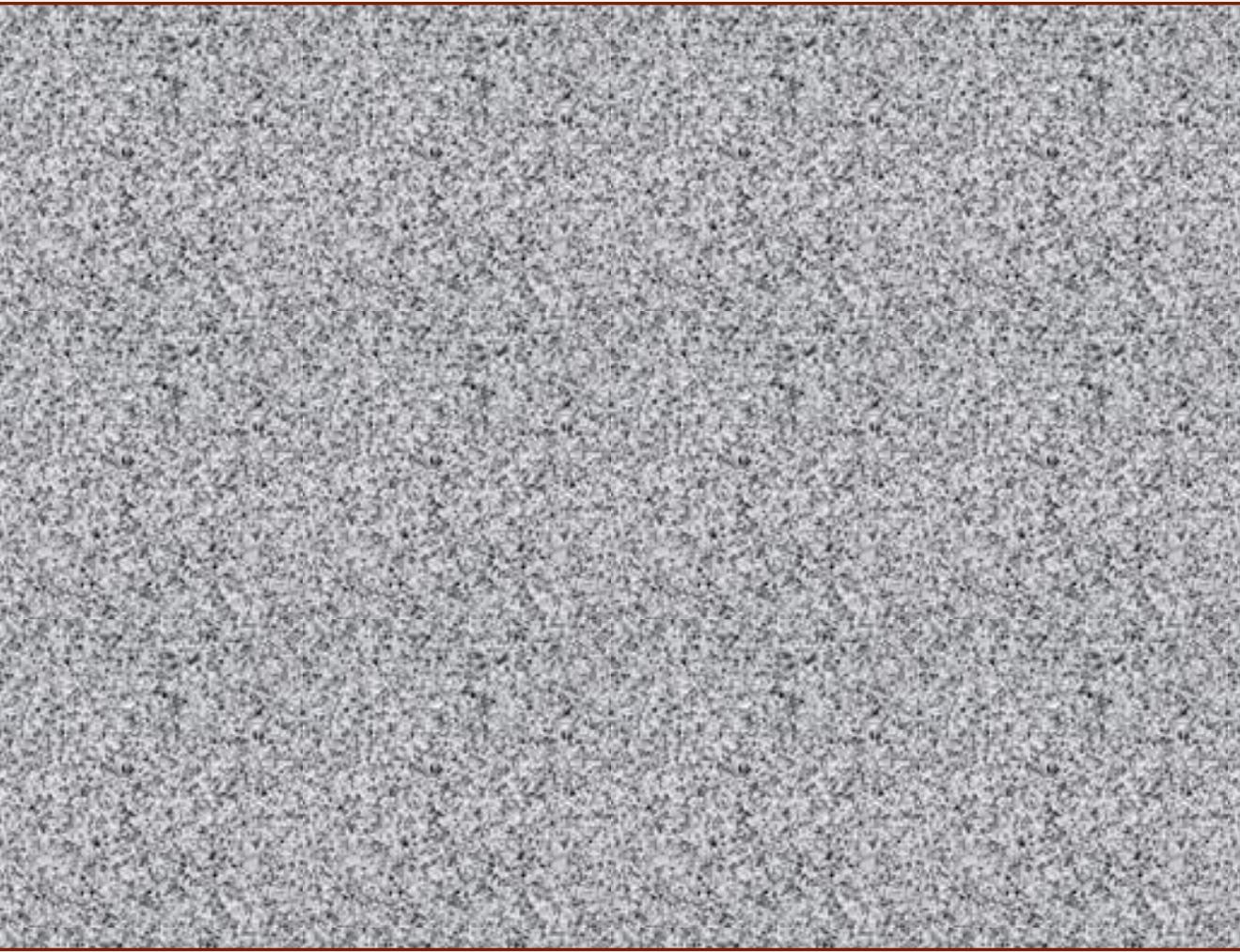
Short Term Memory, Working Memory, Long Term memory

- ▶ Short Term Memory (STM)
 - ▶ Readily available memory for holding but not manipulating information
 - ▶ Limited in capacity (typically $4 +/ - 1$) and duration (seconds)
- ▶ Long Term Memory (LTM)
 - ▶ “Unlimited” capacity and duration
 - ▶ Interference Theory – Limited by retrieval competition (interference)
- ▶ Working Memory (WM)
 - ▶ Limited capacity and duration memory for information manipulation and processing
 - ▶ Possibly neurologically distinct from STM and LTM

Some background:

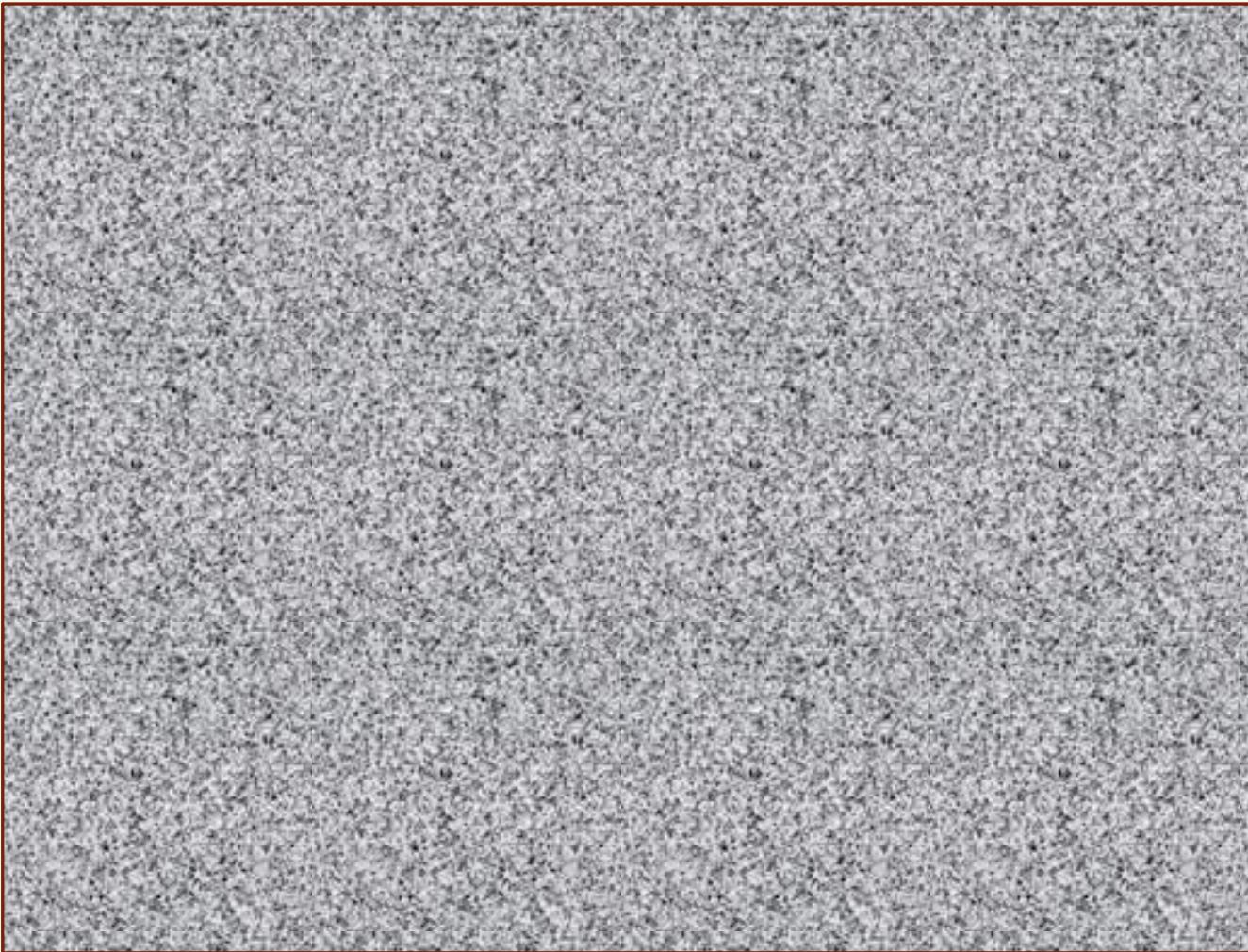
- ▶ Recent studies have found Proactive Interference (PI) in STM tasks (Makovski 2008, 2016 & Endress 2014)
 - ▶ Unexpected because interference was thought to be primarily in LTM
- ▶ Is there PI in working memory?
- ▶ Do people use different strategies in utilizing WM and LTM in different STM tasks?
- ▶ We will use PI to separate LTM and WM components of SSTM tasks
 - ▶ **But How????**

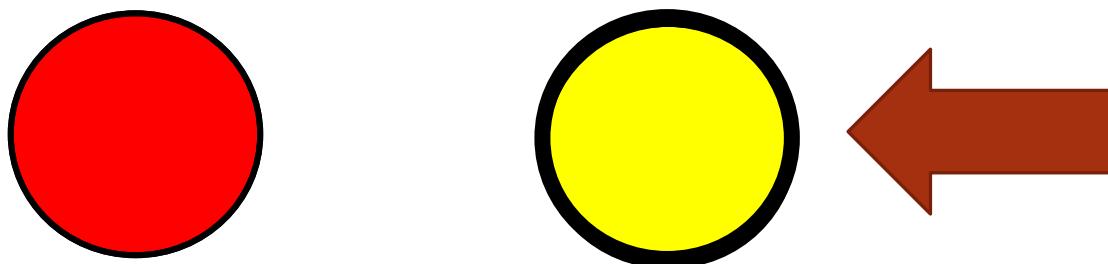
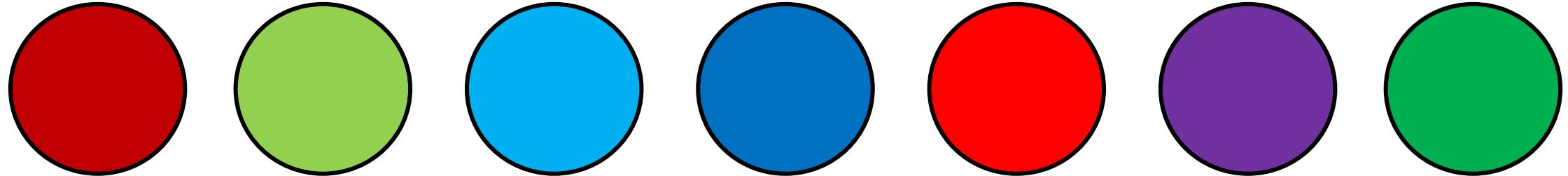
Change Detection Task



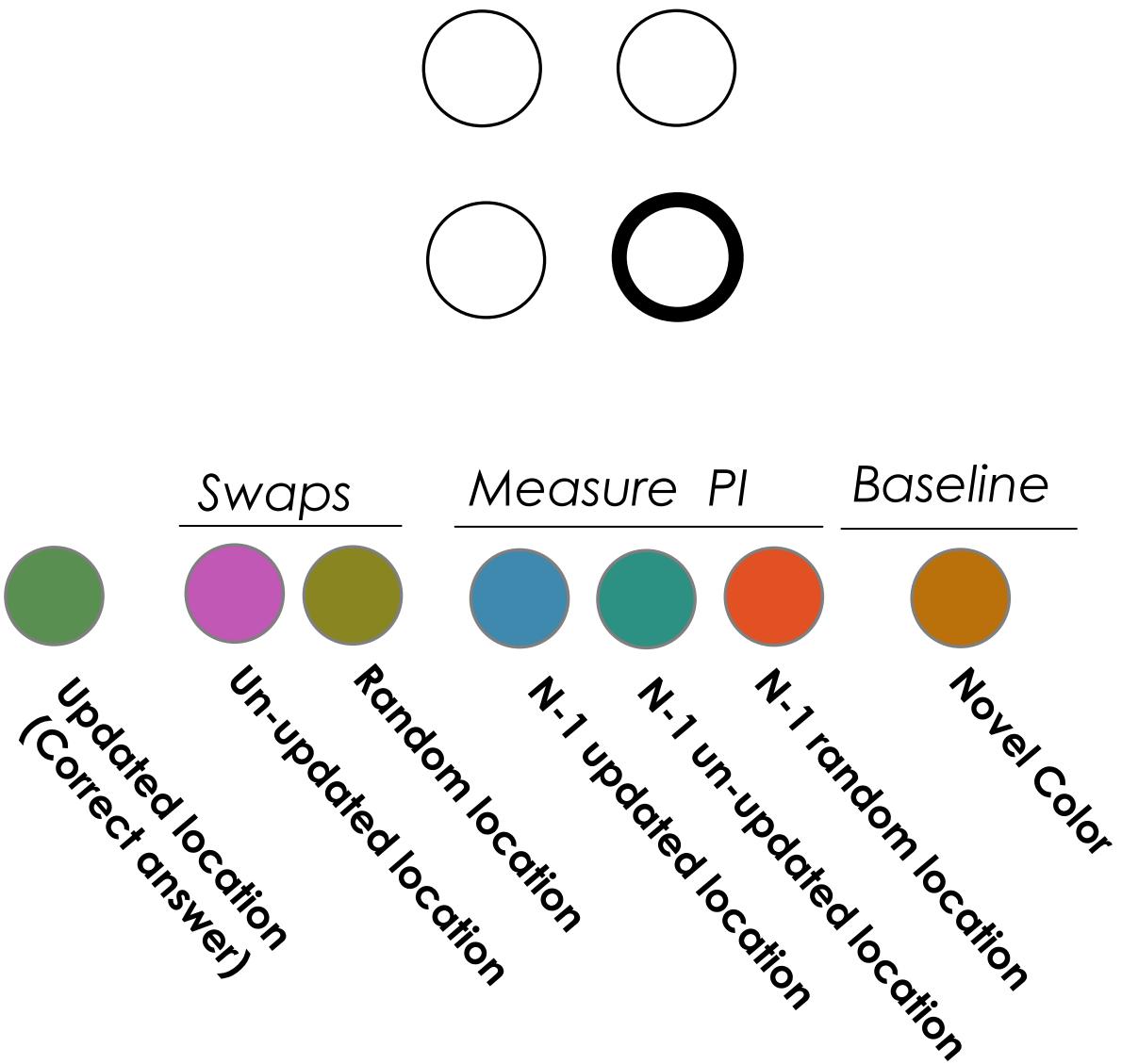


Alternative Forced Choice (AFC) Task



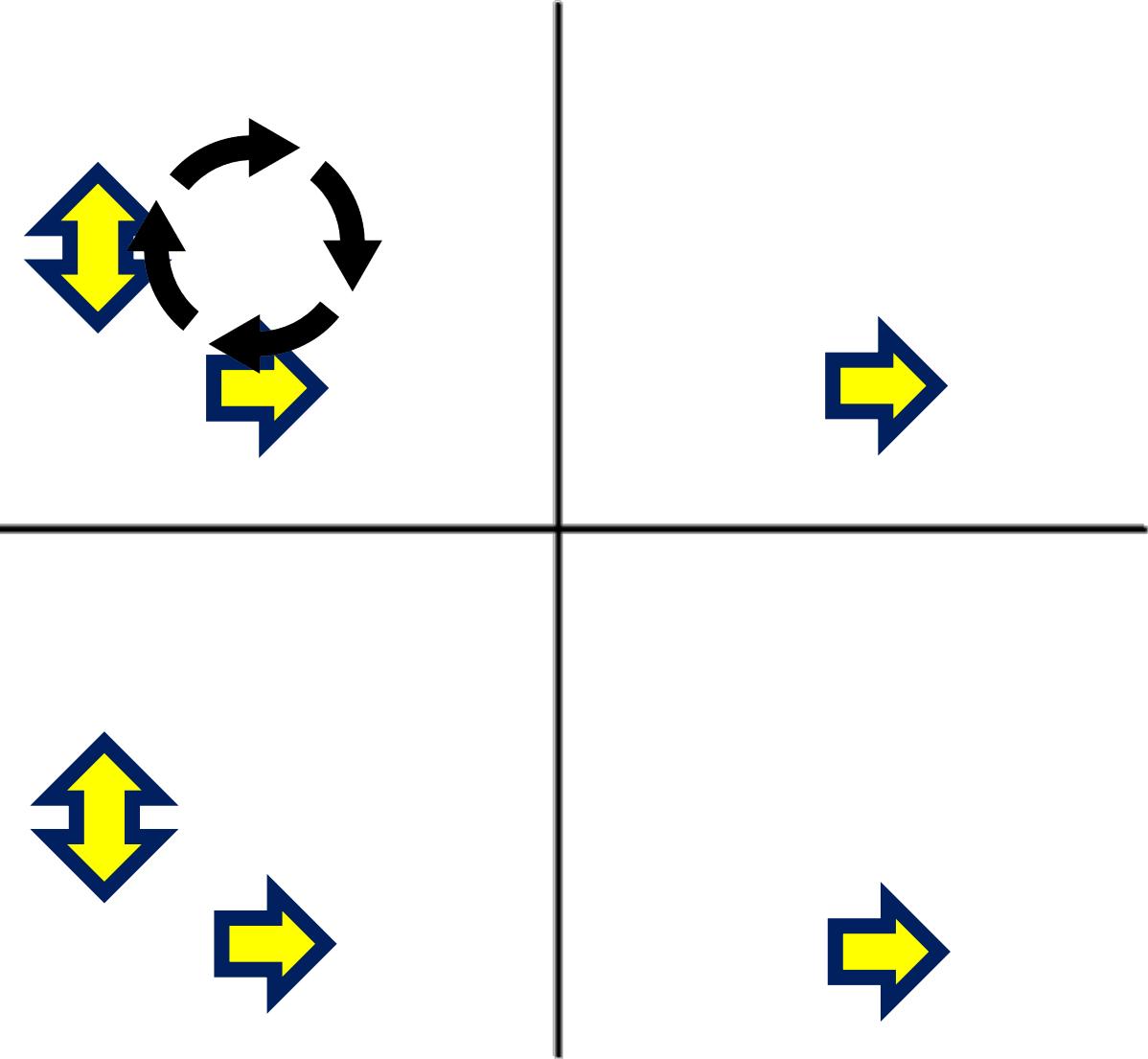


- What is here **after** the rotation?
- Updated object location should be held primarily in WM, not LTM



Current Trial (N)

Previous Trial (N - 1)

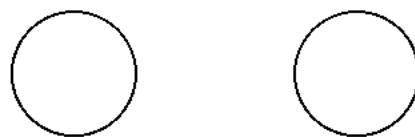


Data Analysis: Are PI measures higher than the Baseline (guess rate)

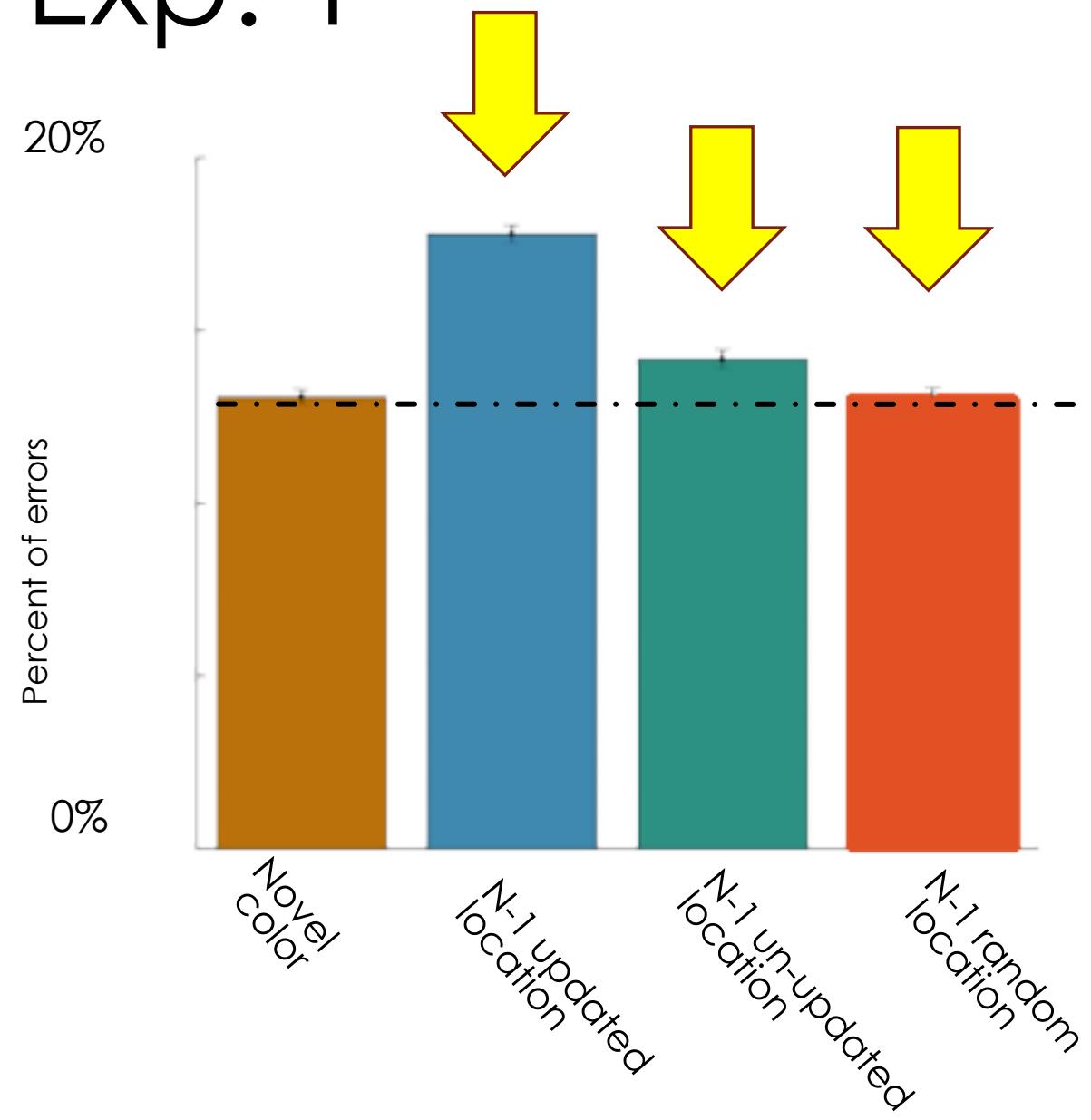
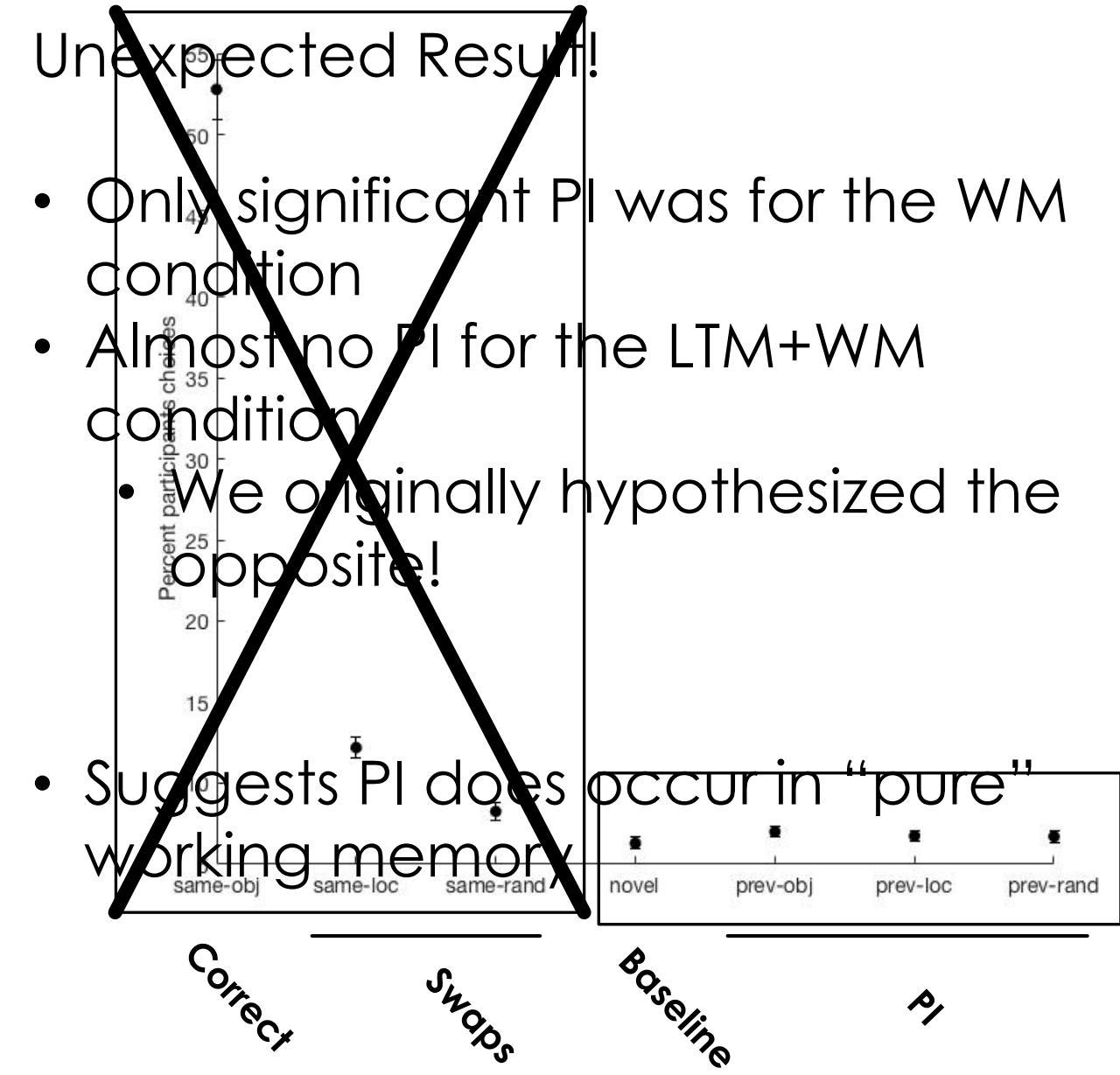
click mouse to start next trial

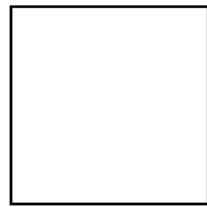
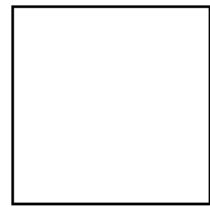


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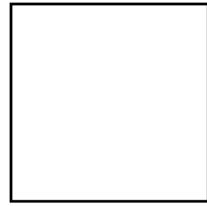
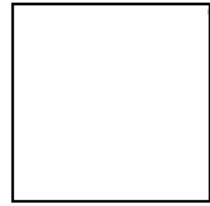


Results Exp. 1



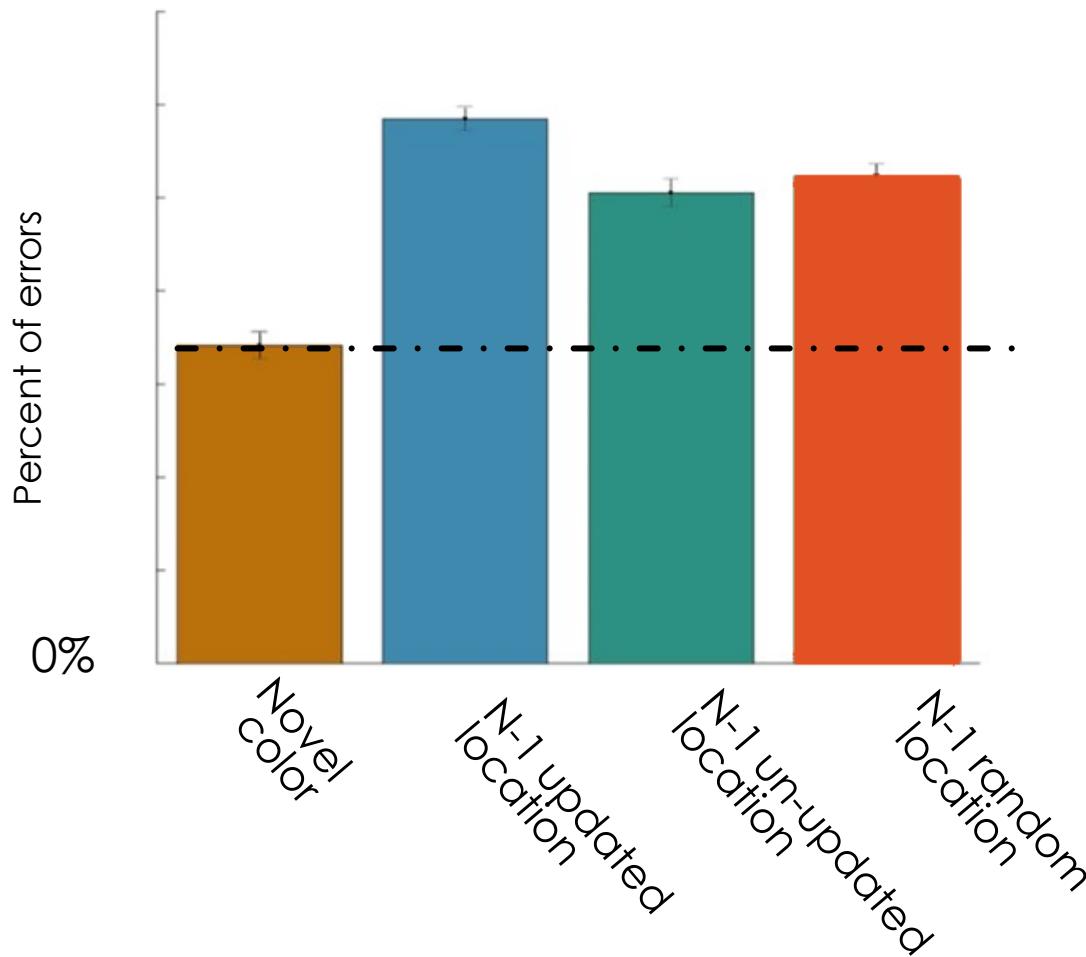


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Results Exp. 2

14%



People were more accurate with real world objects but...

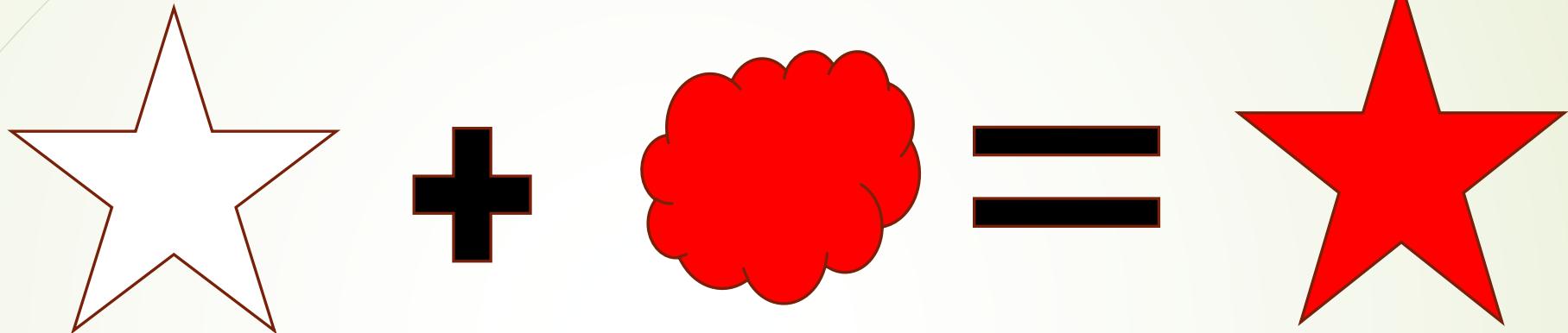
Mistakes proportionally had much more PI

PI was not location specific

Conclusions

- ▶ Location specific PI is present in working memory conditions (small, but it's there)
- ▶ Real world objects show more PI, which is not location specific
- ▶ Perhaps people use LTM to help in real world object memory tasks, but not with simple stimuli
 - ▶ Further investigation required

What about Object binding?



► The goals are:

- See if interference tends to affect individual characteristics or bound objects as a whole.
- See if interference is more tightly bound to one characteristic pairing over another (shape and color, location and shape, etc.)

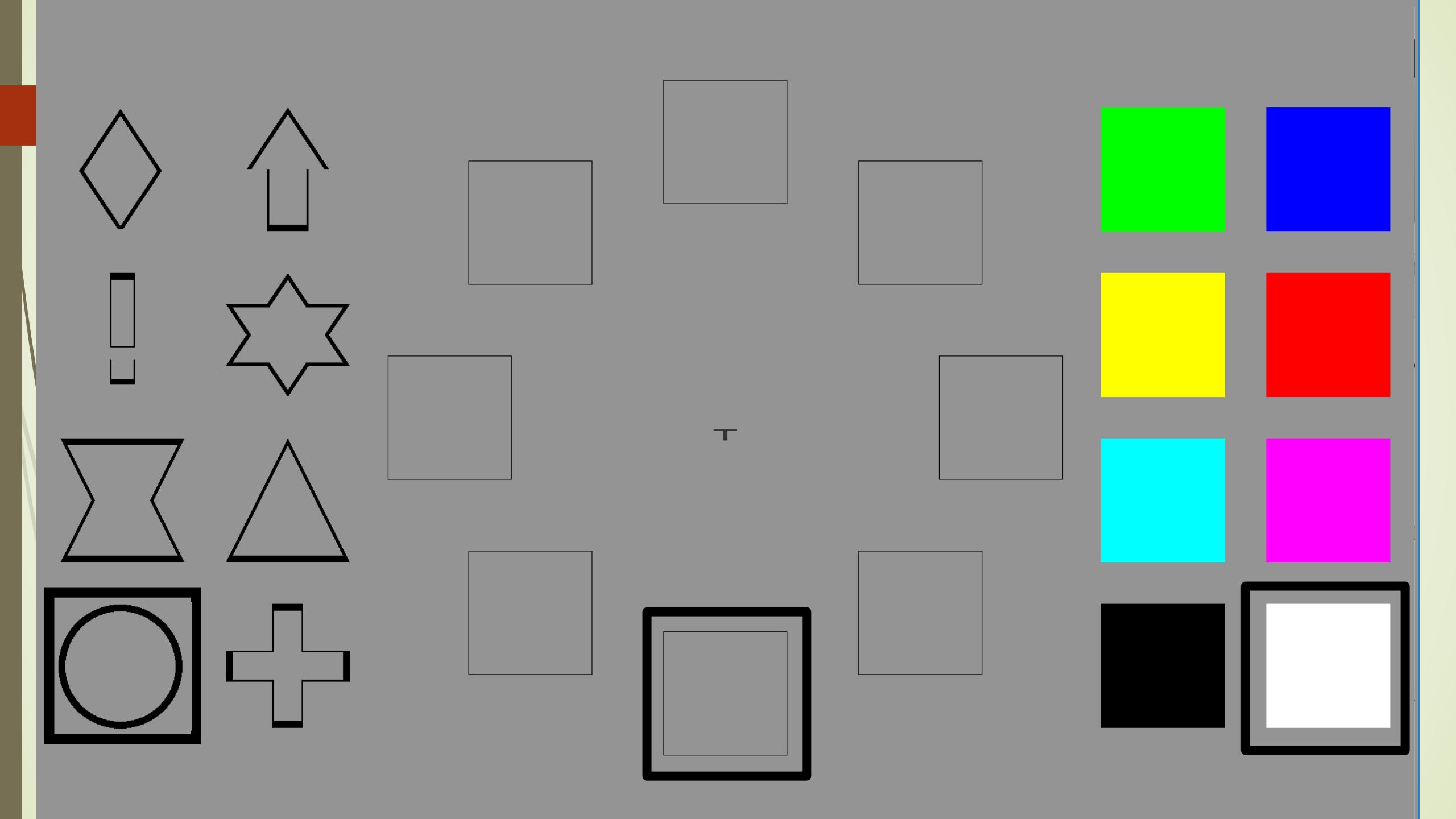


Figure 3

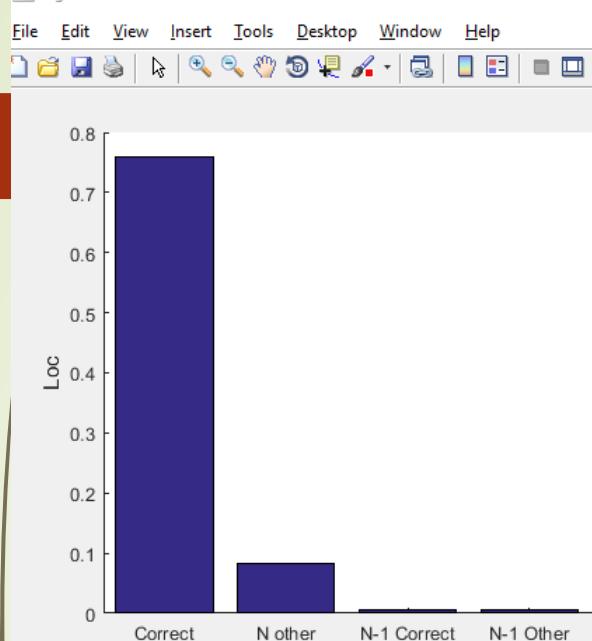


Figure 1

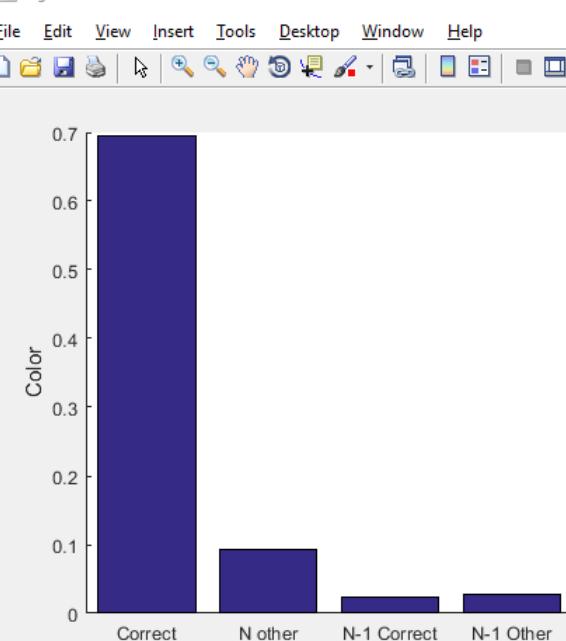


Figure 5

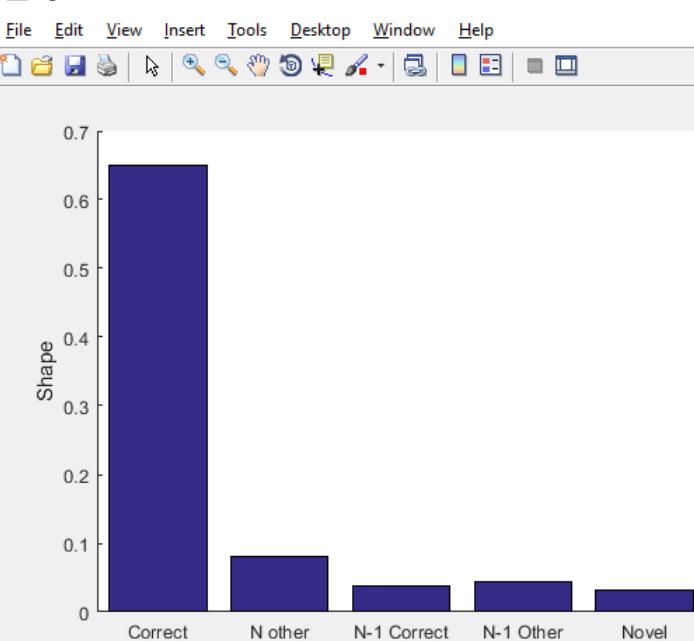


Figure 4

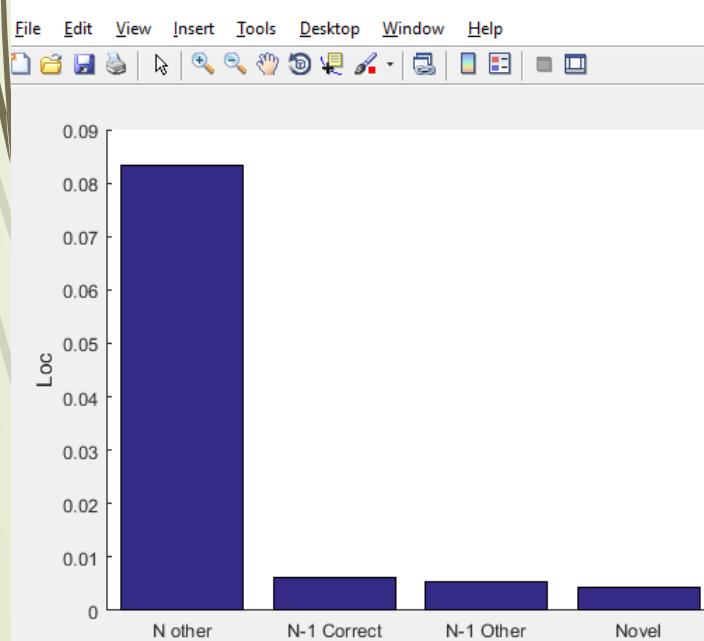


Figure 2

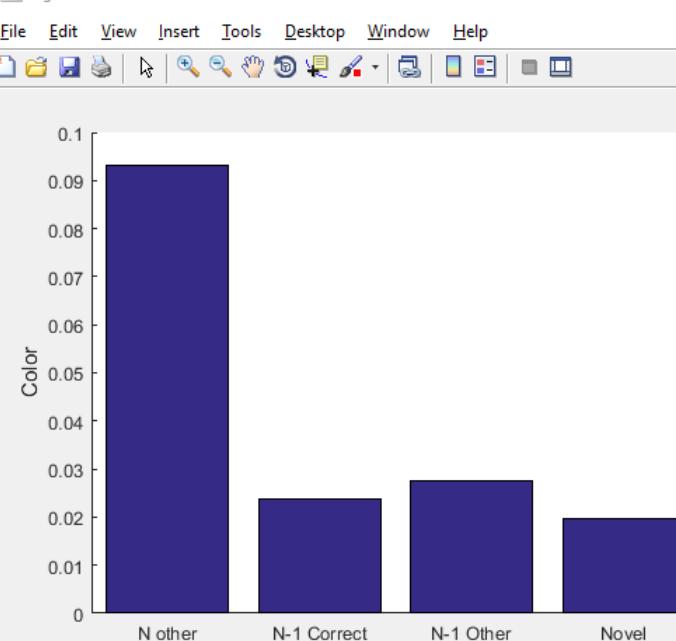
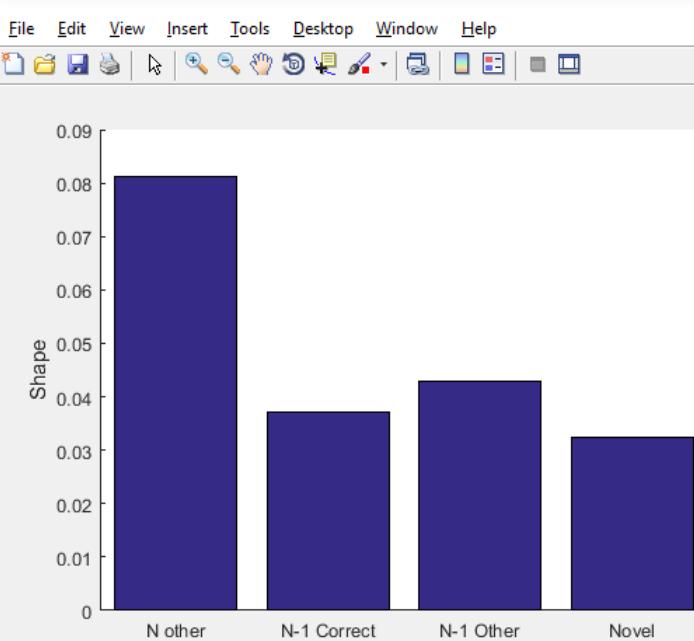
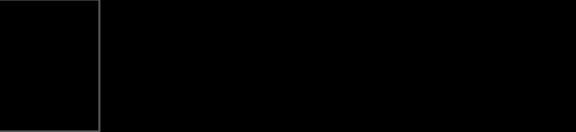
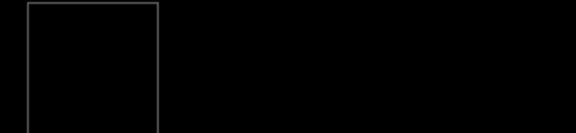
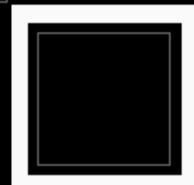


Figure 6





Acknowledgements

- ▶ Special thank you to the members of my labs, including PIs Dr. Timothy F. Brady and Dr. Andrea Chiba

**And you, my wonderful
Audience!!!!**





Redesigning the Hearing Aid User Experience

By Tamara Zubatiy

Advisors: Dr. Scott Klemmer,
Dr. Harinath Garudadri,
Krishna Vastare

Is this program for me?

- - 1. Independent
 - 2. FLEXIBLE
 - 3. Enjoy reading
 - 4. Will work closely with faculty

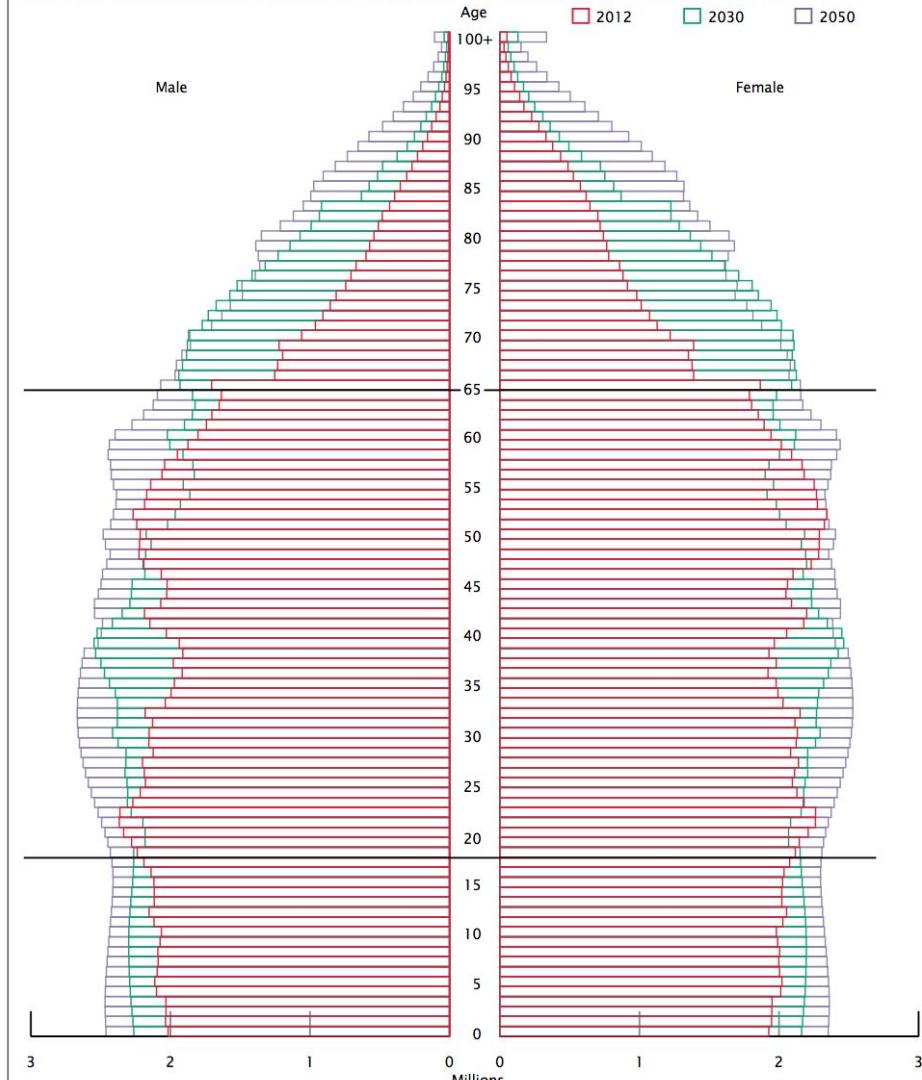
Have realistic expectations

- 1. Time commitment
 2. Higher caliber of work
 3. Public speaking

Hearing Loss is a Growing Problem

Figure 2.

Age and Sex Structure of the Population for the United States: 2012, 2030, and 2050



- Challenge: redesigning the hearing aid user experience for **hearing loss patients**
 1. What does hearing loss sound like?
 2. Settings don't work across environments
 3. Leads to depression, shame and withdrawal
 4. High rate of abandonment

Current Hearing Aid Tech. Lacks:

1. Ability to change settings remotely
2. Battery life for frequent changes
3. Effective noise cancellation
4. Mitigation of high cognitive load
5. Accessibility - too expensive



Unitron Moxi \$1799



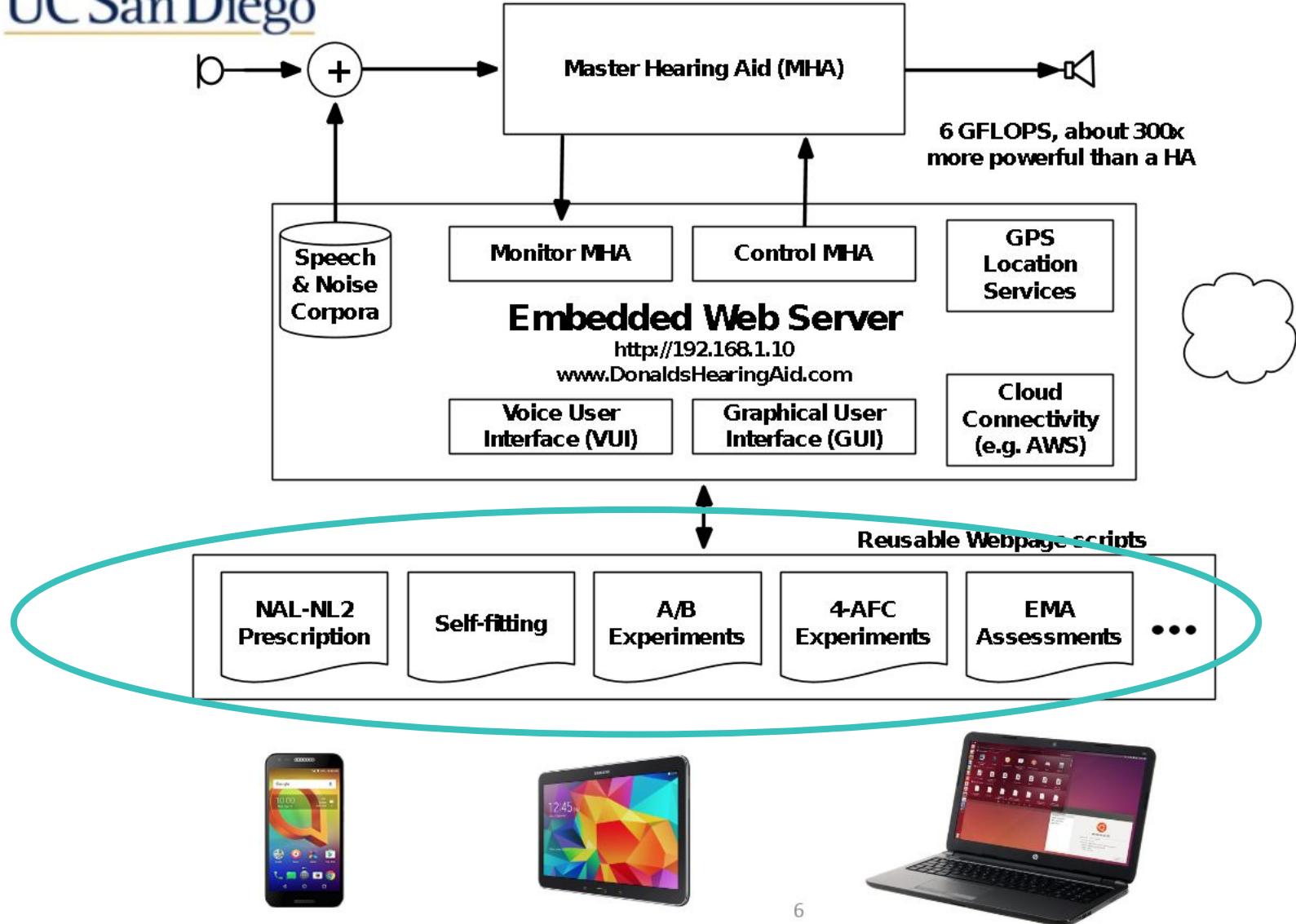
Widex Beyond \$1799



Oticon Opn \$3598

- Challenge: redesigning the hearing aid user experience for **audiologists**
 - 1. ~60 minute appointments w. high cognitive load
 - Play tones @ different levels y/n
 - Cut corners to save battery life
 - 2. Limited features in commercial hearing aids
 - 3. No testing done in noise

Our Platform



Our Platform Offers

1. Change settings remotely
2. 300X power = battery life
3. Better noise cancellation
4. Patient in the loop
 - a. A/B testing in different noise levels
 - b. Patient aids prescription from home
5. Adaptive settings



Powered by Snapdragon

Key Collaborators



Collaborators (2017)



SAN DIEGO STATE
UNIVERSITY



University of Colorado
Boulder



Northwestern
University



THE UNIVERSITY
OF IOWA

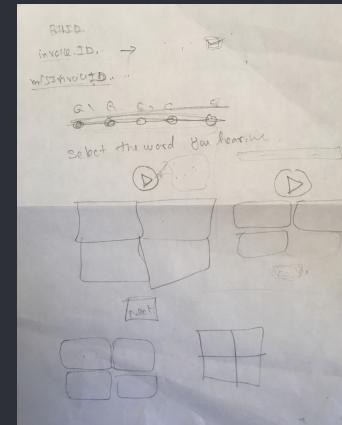
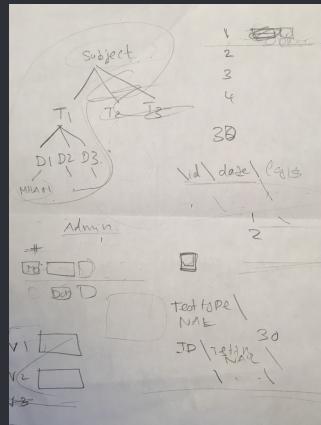


● Designing for Audiologists Process

1. Survey the target audience

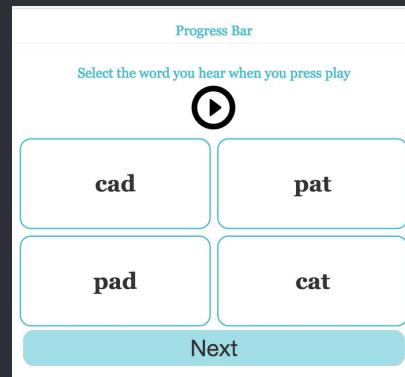


2. Ideation & Wireframing



Early sketches

3. Prototyping & Iteration



QUESTIONS RESPONSES

Is there anything about input format that we have forgotten to ask?
Long answer text

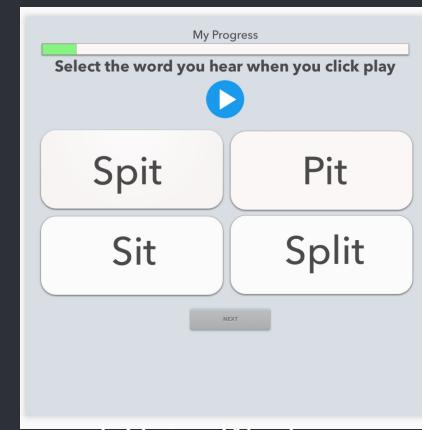
What other features would you like to be able to set on the MHA?
Long answer text

Please describe in detail how you manipulate the master hearing aid (MHA), i.e.: using the OSP Xcode or Android app?
Long answer text

Are there live tests (e.g. stimulus received by ear level microphones)? If yes, what changes do you want in the MHA parameters (e.g. amplification parameters)?
Long answer text

Is there anything about the MHA that we have forgotten to ask?
Long answer text

Google Form Survey



InVision Wireframe

For Audiologists

Master Hearing Aid Control

localhost:8080/nalnl2

Sergio

Client Data

Gender Choose...

Date of birth yyyyymmdd

Do you speak a tonal language?
Choose...

Hearing Aid History

Experience Choose...

Device Choose...

Choose...

Audiogram

250	500	1000	2000	4000	8000

Get Parameters

Parameters

Frequency	177	354	707	1414	2828	5657
Compression Ratio	0	0	0	0	0	0
G50	0	0	0	0	0	0
G65	0	0	0	0	0	0
G80	0	0	0	0	0	0

For Audiologists

MHA Control Sergio

localhost:8080/researcherpage

Control Via: G50/G80 CompRatio/G65

Researcher Page

Frequency	177	354	707	1414	2828	5657
Compression Ratio	0	0	0	0	0	0
G50	0	0	0	0	0	0
G65	0	0	0	0	0	0
G80	0	0	0	0	0	0
Knee Low	55	55	55	55	55	55
Knee High	100	100	0	0	0	0
Attack	0	0	0	0	0	0
Release	0	0	0	0	0	0

Reset **Transmit**

For Hearing Loss Patients

Question 1

Which of the options below is different from the sample sound?



A

B

No Difference

Next

Conclusions

- Our system enables **real time changes** to settings of a hearing aid (ha)
- Works with **cheaper over the counter h.a.**
- Changes can be made **remotely**
- H.L. patients can respond to **A/B style comparisons** for effective diagnosis
- H.L. patients could do a test on their **smart-phones!**

Future Work

- User testing with our collaborators
- Implementing a wearable pendant system
- Demonstrate low barrier to entry- a high schooler could edit an app
- Use machine learning to model the individual experience for truly adaptive settings

Thank you so much for listening!

Special thanks to: Dr.Scott Klemmer, Dr. Harinath Garudadri, Dr. Ganz Chockalingam, Kishna Vastare, Sergio Luna, and Simon Li for your guidance, patience and support!

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