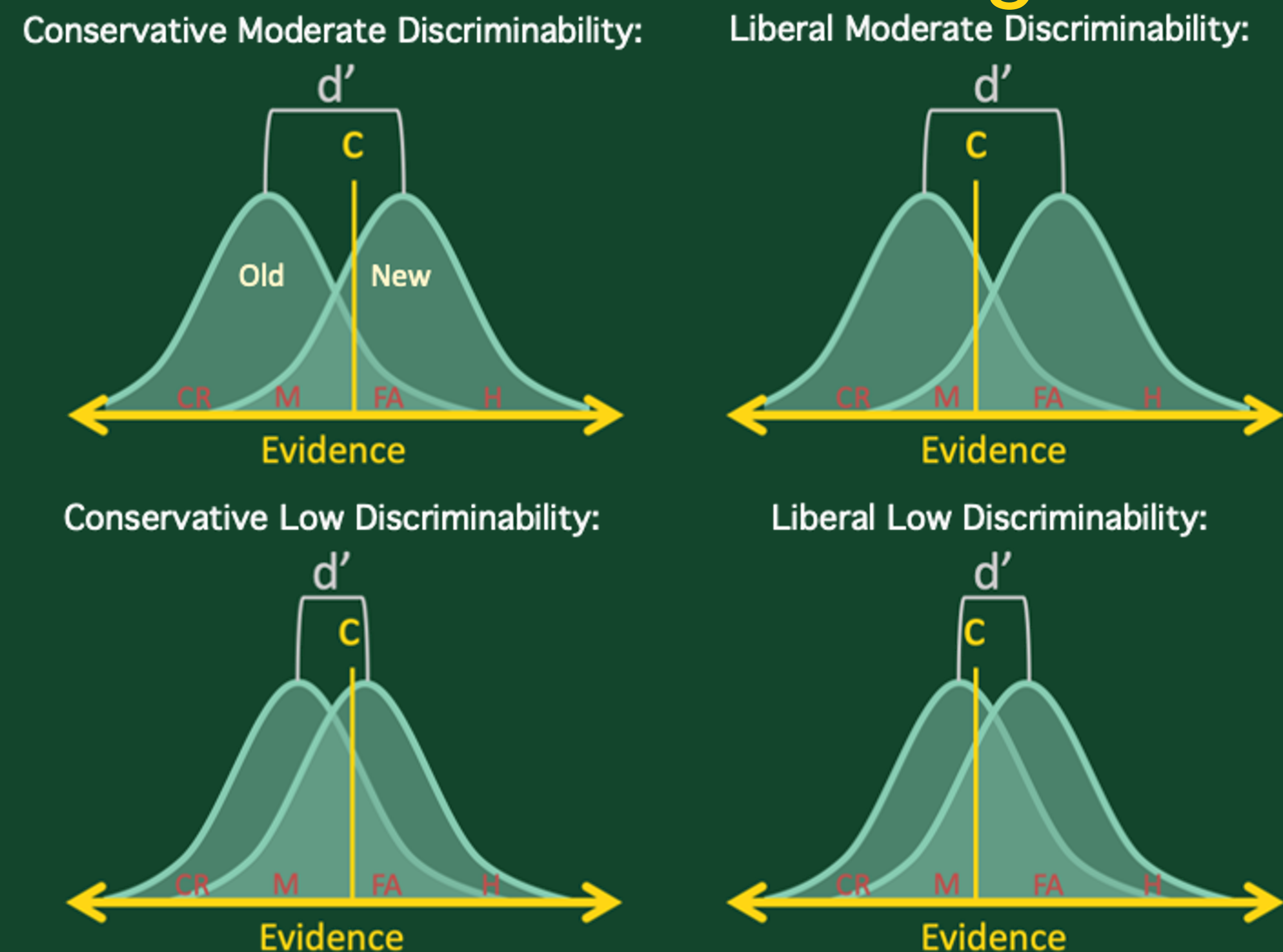


Shifting Expectations: Criterion shift association of EEG, in a recognition memory security patrol paradigm. Christina Boardman, Evan Layher, and Michael B. Miller



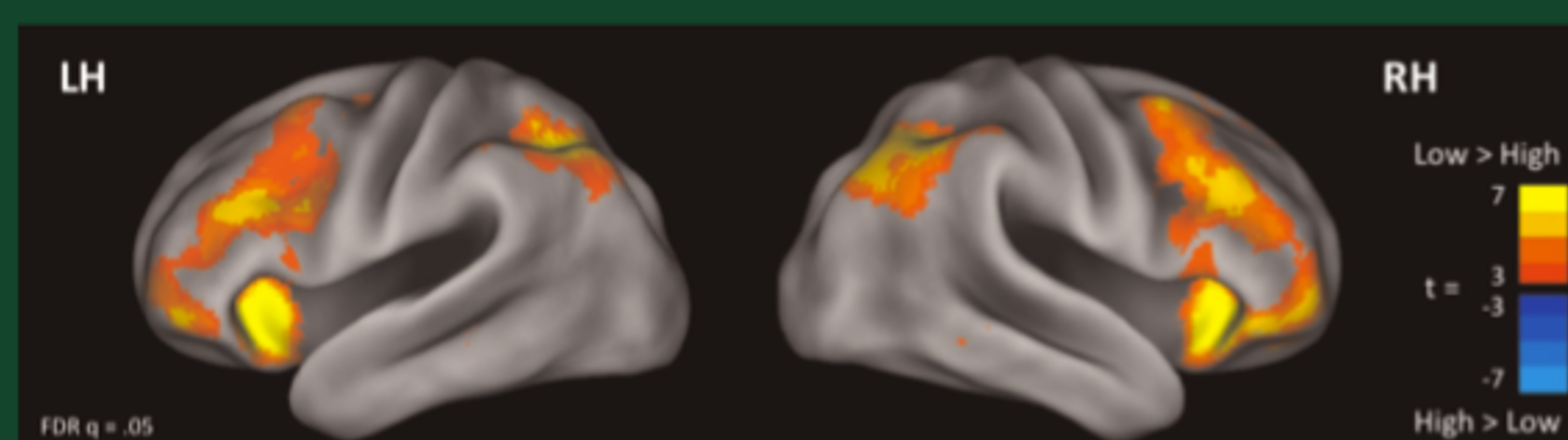
Criterion Shifting



In a memory task, distinguishing between targets (old) and non-targets (new), a conservative criterion (c) with moderate discriminability (d') (upper right) has fewer hits (H) and more misses (M) than a liberal criterion with moderate discriminability (upper left). However, a conservative criterion also has fewer false alarms (FA) and more correct rejections (CR). This effect is enhanced in between a conservative criterion with low discriminability (lower right) and a liberal criterion with low discriminability (lower left).

Criterion Shifts in fMRI

Conservative $H > CR > Liberal H > CR$



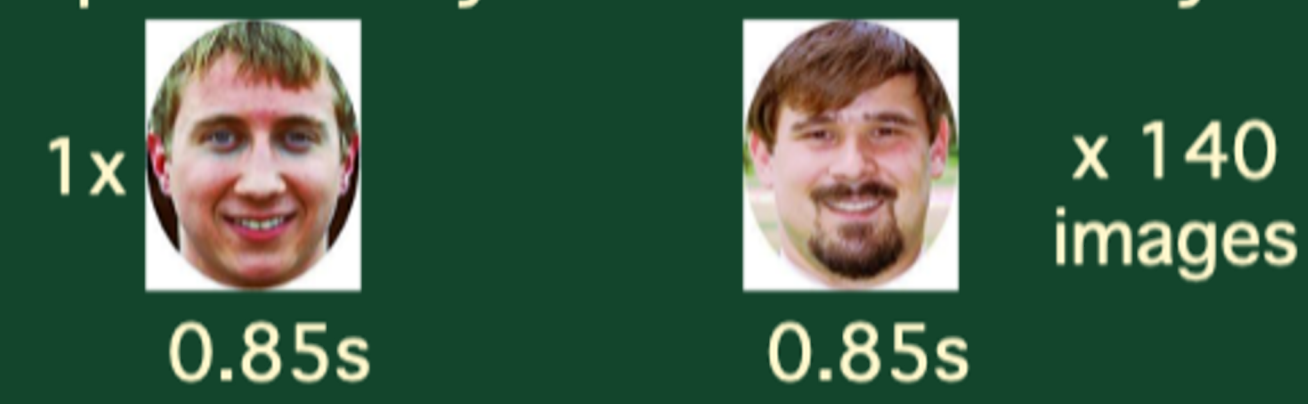
Functional magnetic imaging contrast from Aminoff et al. (2015), indicates that most of the frontal and parietal activity, associated with successful identification of a previously seen item (the successful retrieval effect) is explained by conservative criterion placement. Additionally, the regression analysis showed a strong positive correlation between $H > CR$ and individual criterion placement in most of the ROIs.

Current Study

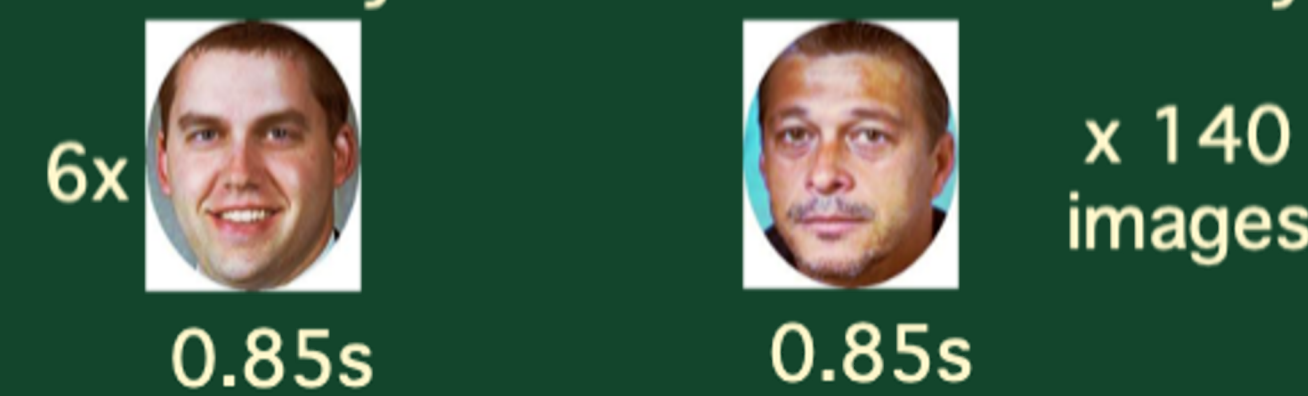
Appropriate criterion placement is particularly important for suspect identification in a security setting, such as a police or military patrol. In these scenarios, false alarms can lead to innocent people getting hurt or even killed. Here we expand on Aminoff et al., using EEG in a security patrol paradigm. We predicted that maintaining a conservative versus liberal criterion would be associated with a large positive event-related potential (ERP) peak around 300ms after stimulus onset (P3).

EEG Participants & Task

“Suspect” Study Low Discriminability:



“Suspect” Study Moderate Discriminability:



We identified 31 participants who sufficiently shifted their criterion (low $c > 0.4$) and identified suspects ($d' > 0.75$) in a screening task. Participants were asked to memorize images, which appeared for 0.85s. Images appear 6 times in the moderate sensitivity condition. Test blocks have 60 images (30 studied and novel images). Participants were asked to use a liberal criterion for two blocks and a conservative criterion for two blocks. Participants are told that the criterion is necessary, because of the location of the patrol (‘city’ or ‘outskirts’).

“Suspect” ID Test Conservative: Avoid False Alarms



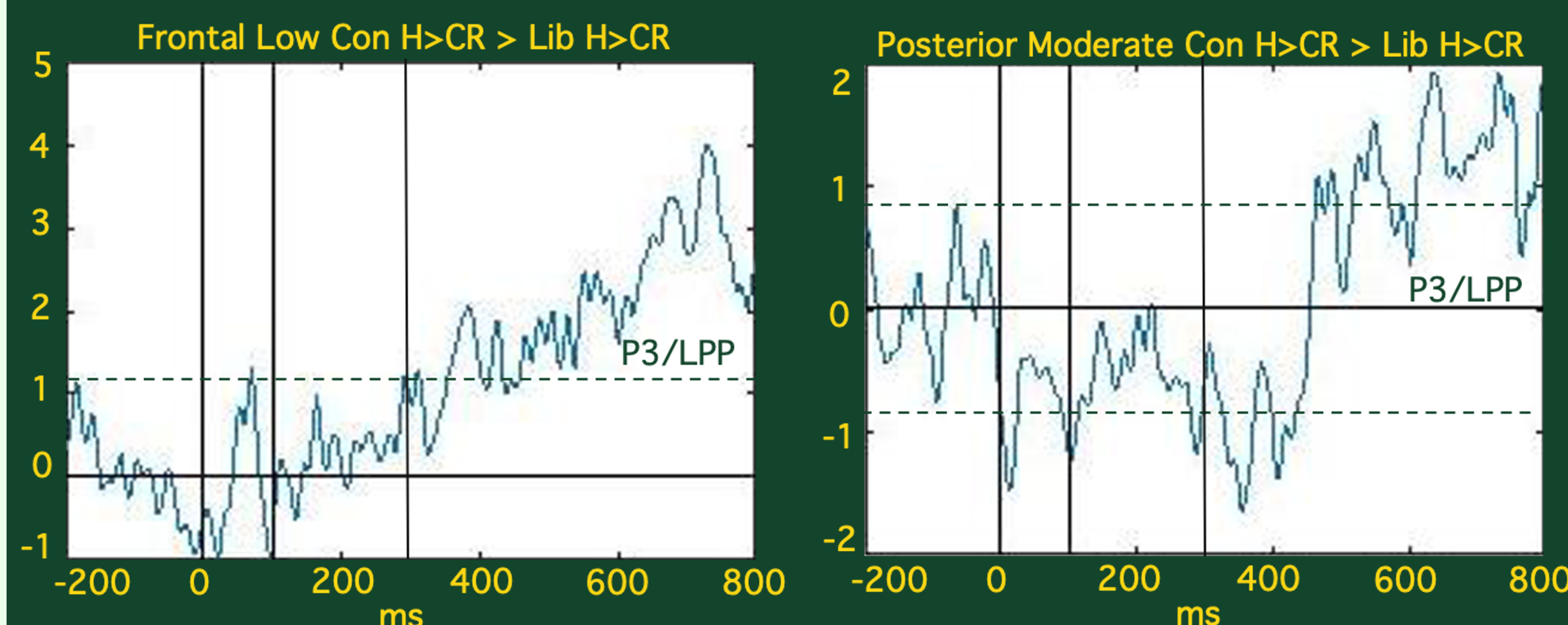
“Suspect” ID Test Liberal: Avoid Misses



Condition	Mean d'	Mean Conservative $c > Liberal c$
Moderate	0.72 (SD=0.37)	0.84 (SD=0.54)
Low	0.23 (SD=0.17)	0.81 (SD=0.60)

$$d' = (z(H \text{ rate}) - z(FA \text{ rate})), c = (-0.5 (z(H \text{ rate}) + z(FA \text{ rate})))$$

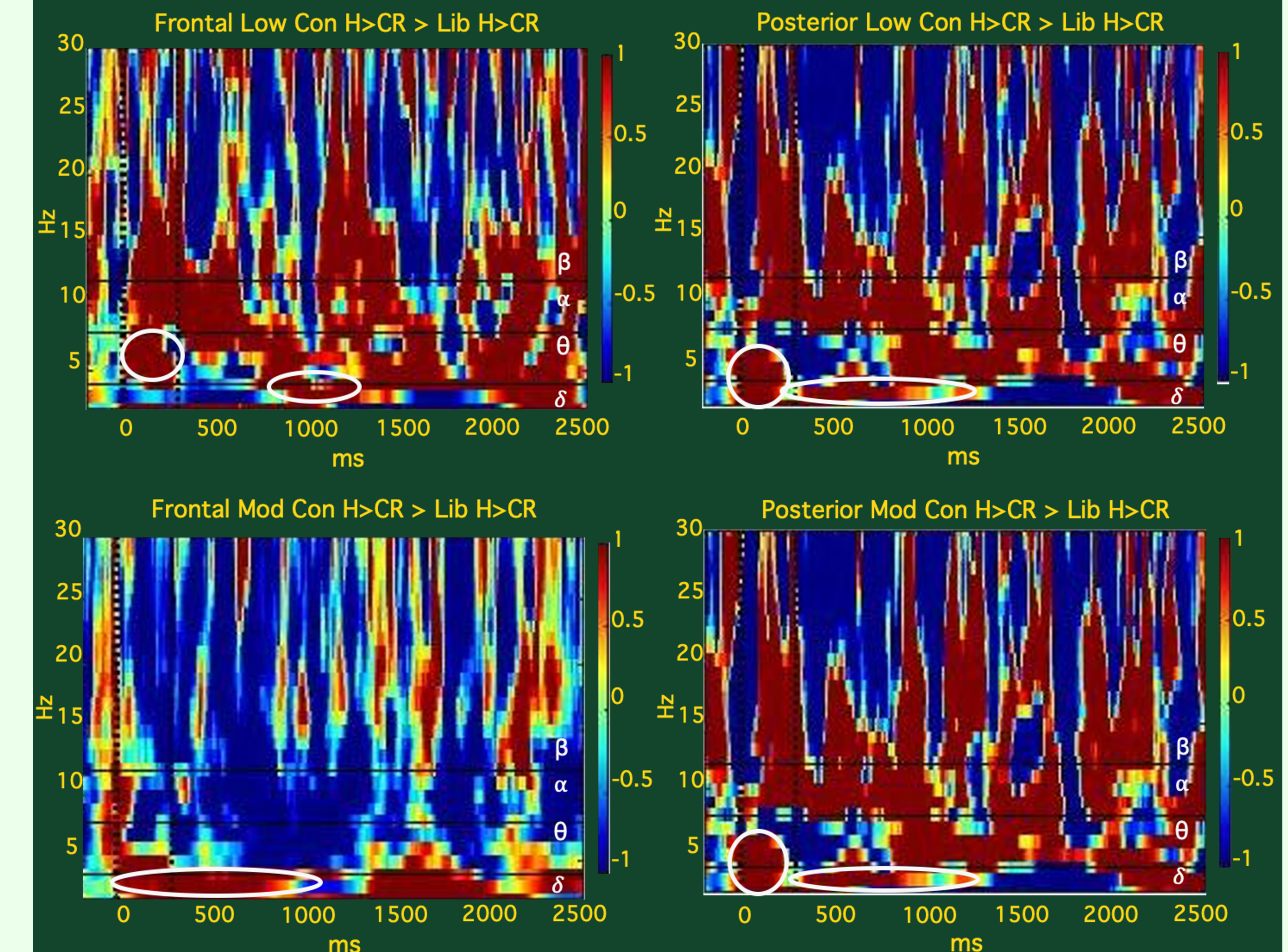
ERP Results



Channel	Mod P3	Mod LPP	Mod N179	Low P3	Low LPP	Low N170
AFz	0.24	0.47	1.32	9.82**	<u>10.54**</u>	1.44
Fz	1.03	2.47	0.31	7.18*	8.18**	0.82
Cz	0.61	5.76*	0.19	1.82	3.35	0.007
Pz	0.013	4.87*	0.093	0.23	2.03	0.19

F scores for one way ANOVA for conservative > liberal of average Event Related Potential (ERP) power over 300-600 ms(P3), 600-850ms(LPP), and 160-250ms(N170) post stimulus, for moderate (mod) and low discriminability * $p < 0.05$ ** $p < 0.01$ Underline: $r^2 = 0.2$.

ERSP Results



Averaged conservative > liberal event related spectral power (ERSP) for $\delta < 4$ Hz, θ 4-8 Hz, α 9-12 Hz, β 12-30 Hz. Horizontal lines at 4, 8, and 12 Hz from 0-2.5 ms post stimulus. Delta and theta are associated with P3. Early delta and theta power circled in white.

Conclusion & Future Directions

We observed significant P3 and LPP activity for conservative > liberal activity in both moderate and low conditions. We observed the largest effect size ($r^2 = 0.2$) for in the low anterior frontal LPP. Overall, effect sizes were modest. In a previous analysis we used different participants for the low and moderate discriminability and only found significant results for the moderate condition. The results of Aminoff et al. also indicates criterion shifting activity is mediated by individual differences. Therefore, our next step will be to compare activity between strong and weak shifters.

References

Aminoff, EM, Freeman S, Clewett D, Tipper C, Frithsen A, Johnson A, Grafton ST, Miller MB (2015) Maintaining a cautious state of mind during a recognition test: A large-scale fMRI study. *Neuropsychologia* 67:132-147.

Acknowledgements

Barry Giesbrecht and the UCSB Attention lab, especially Tom Bullock and Diya Das. Analysis advice from: Michael Spezio and Tyler Santander. Research assistants: Amanda Atanasolo, Matejas Mackin, Hana Simon, Luke Hamilton, Saleem Omary, Thien Truong, Tanya Bhatia, Mark Wang, Omeed Soltanalipour, and Nohemi Reyes Meraz.

Contact

Christina Boardman
UCSB, Visiting Scholar
Christina.Boardman@psych.ucsb.edu

This research was sponsored by the Army Research Laboratory and was accomplished under the Cooperative Agreement Number W911NF-10-2-0022. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Army Research Laboratory or the U.S. Government. The U.S. Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation herein.