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Center for Brain Biology & Behavior

Dennis L. Molfese

University of Nebraska-Lincoln, dmolfese2@unl.edu

Victoria J. Molfese

University of Nebraska - Lincoln, vmolfese2@unl.edu

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Center for Brain Biology & Behavior

Dennis L. Molfese, Ph.D.

Mildred Francis Thompson Professor

Director: Center for Brain, Biology & Behavior (CB3)

Director: Big Ten/Ivy League/CIC Traumatic Brain Injury Research

Editor-In-Chief: *Developmental Neuropsychology*

Victoria J. Molfese, Ph.D.

Chancellor Professor

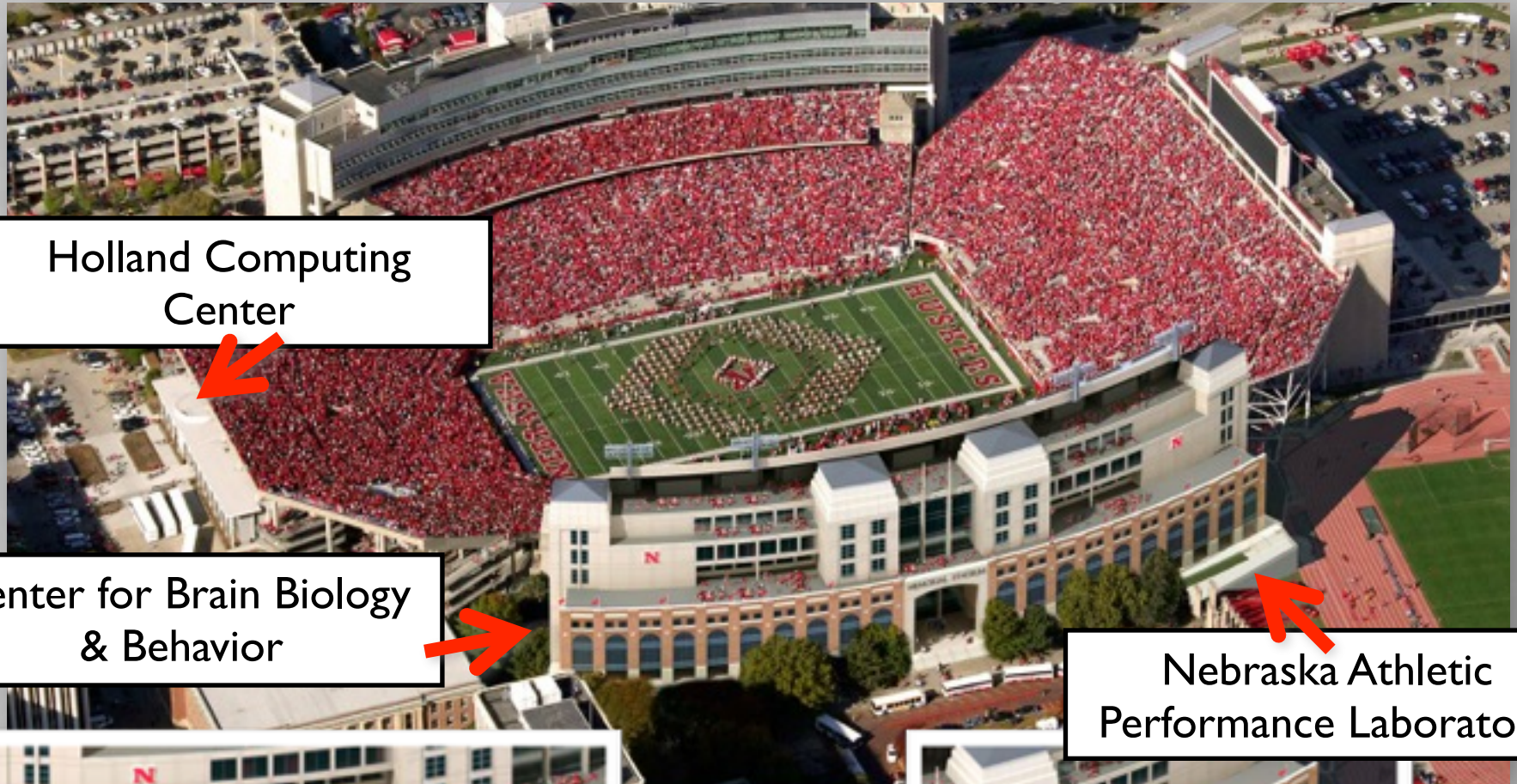
Director: Early Development & Learning Laboratory

Department of Child Youth & Family Studies

University of Nebraska–Lincoln
Office of Research and Economic Development



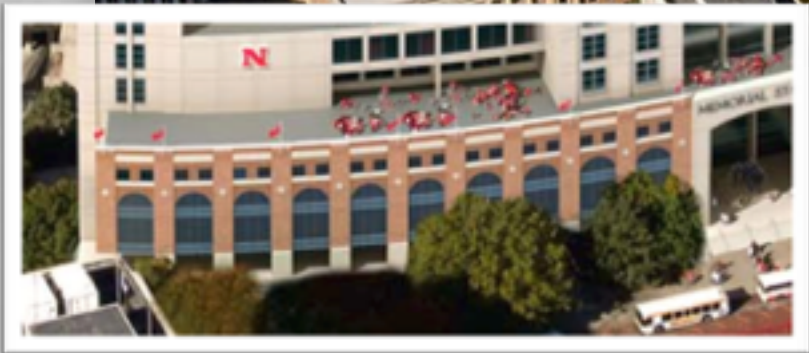
UNL Athletics Complex



Holland Computing Center

Center for Brain Biology & Behavior

Nebraska Athletic Performance Laboratory

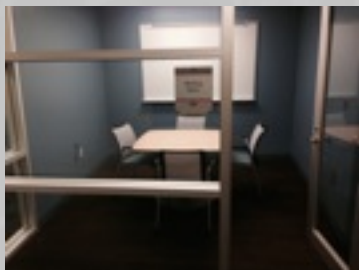
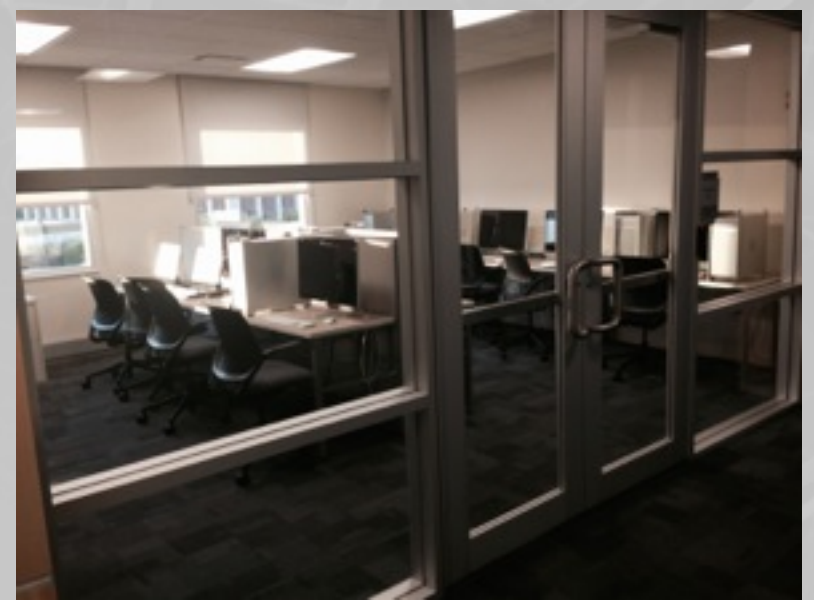


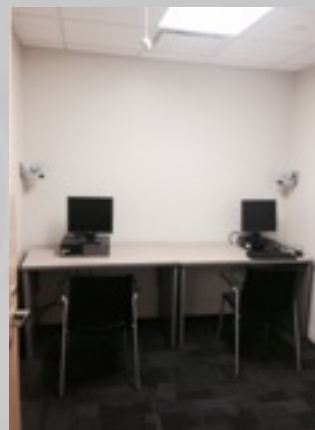
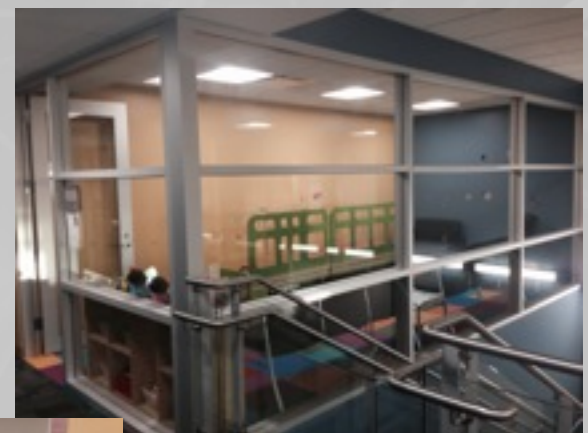
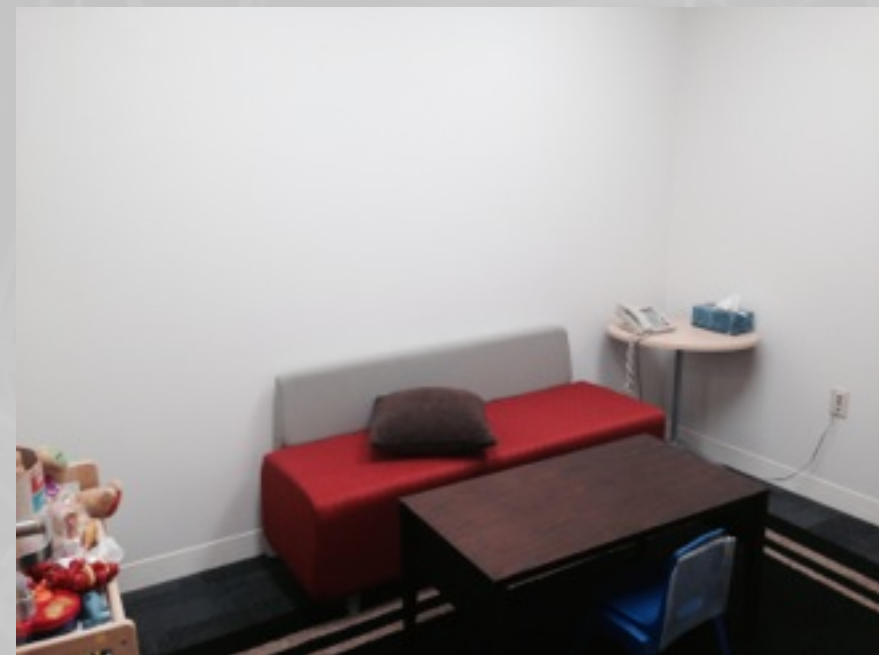
Center for Brain Biology & Behavior CB3

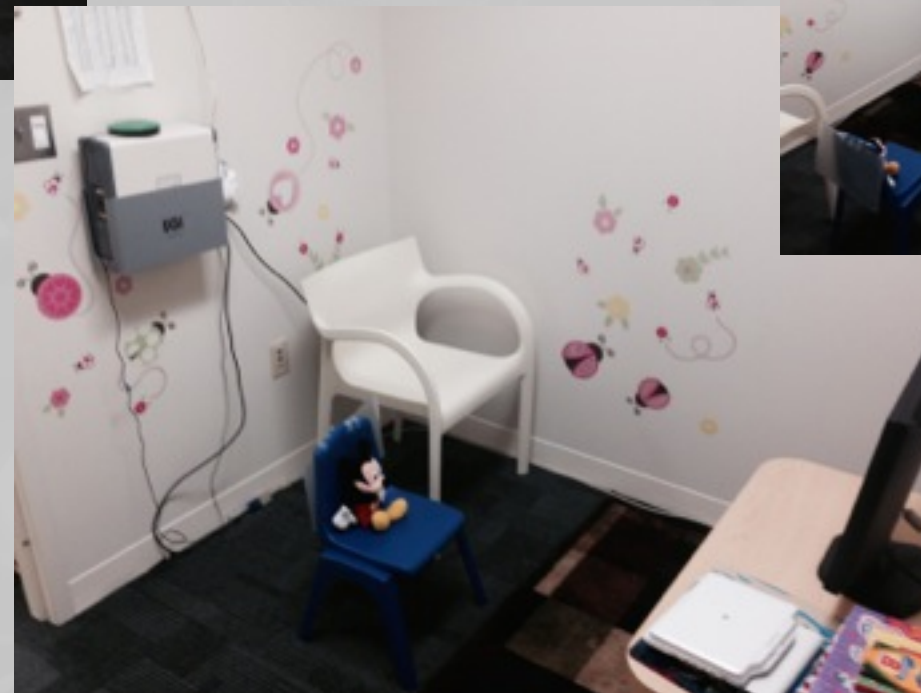
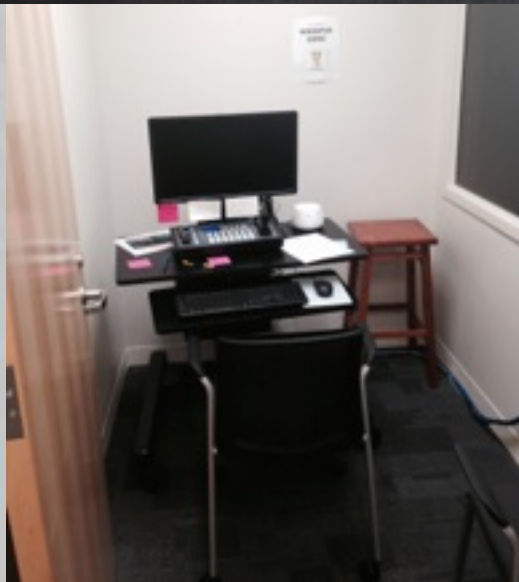
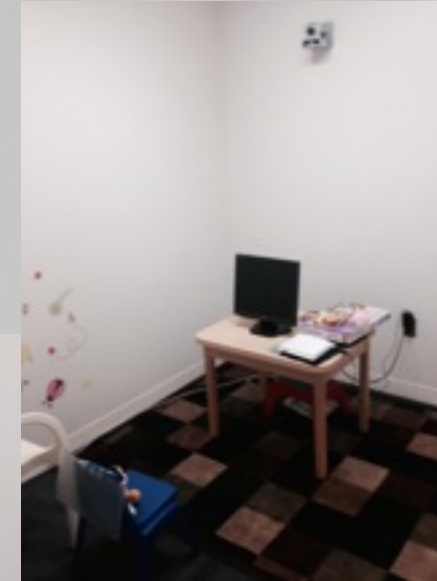
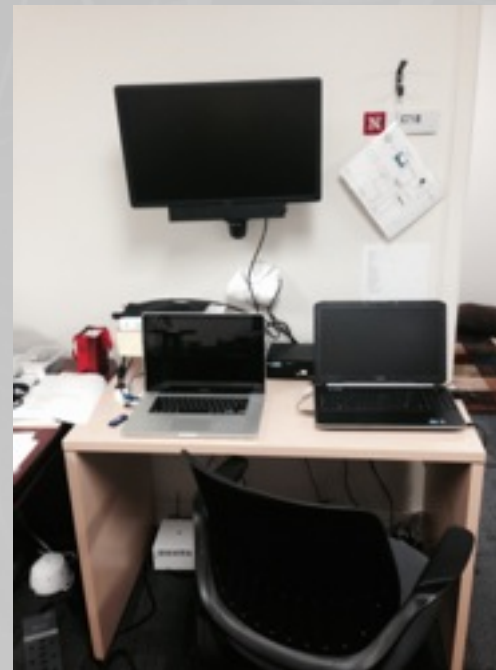
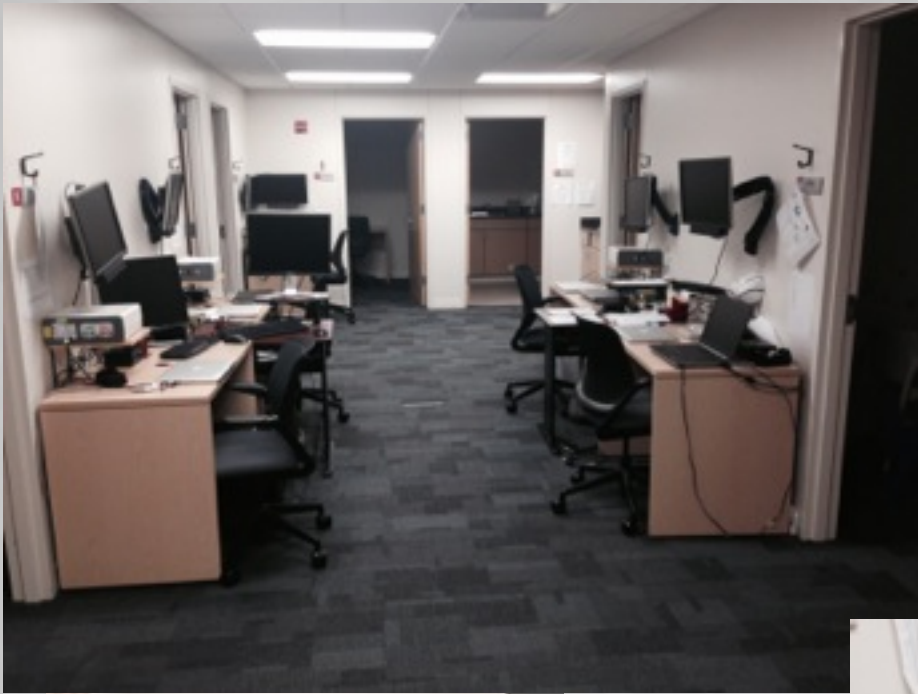
Research Areas

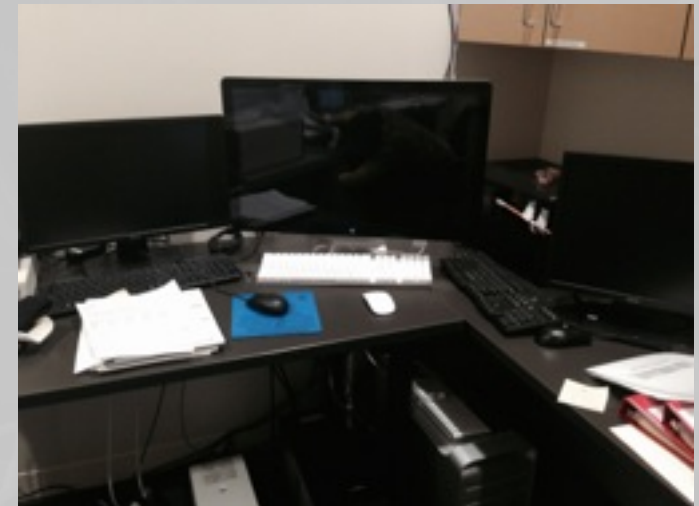
Human & Animal Models of TBI
Neural Modeling
Cognitive & Social Neuroscience
Endocrine System
Attention, Perception & Memory
Vestibular/Balance, Biomechanics
Genetics
Cognition, Language & Performance
Lifespan Development
Therapeutic Interventions











CB3 Unique Tools & Training

fMRI/DTI/MRI + ERP + Eye Tracking

12 High-Density EEG/ERP Labs

21 Behavior Science Labs

Endocrine Lab

Genetics Lab

3 Vestibular/Balance Labs

3 Eye Tracking Labs

2 Super Computing Labs

100 gbps Link - Big10/NIH/FITBIR Informatics System

MEG (UNMC)

Big10-Ivy League Concussion Questionnaire

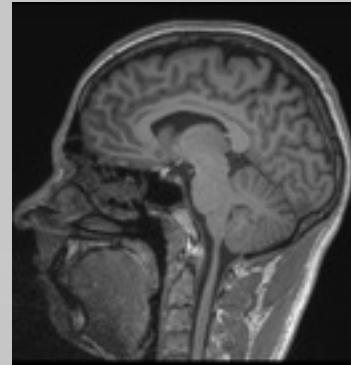


Magnetic Resonance Imaging (MRI, fMRI, DTI, SPECT) + 256-high density electrodes + eye tracker + Photogrammetry

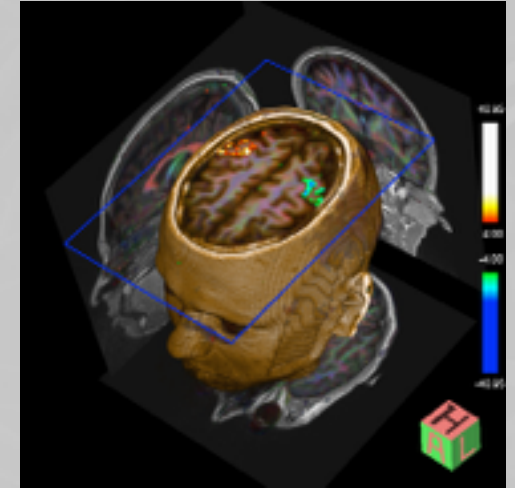
Siemens 3 Tesla 70 cm bore



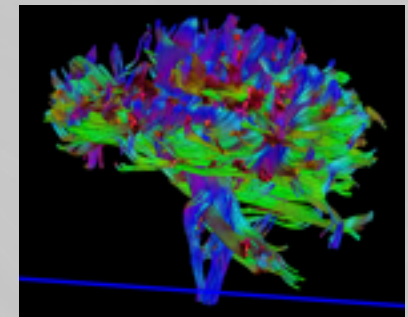
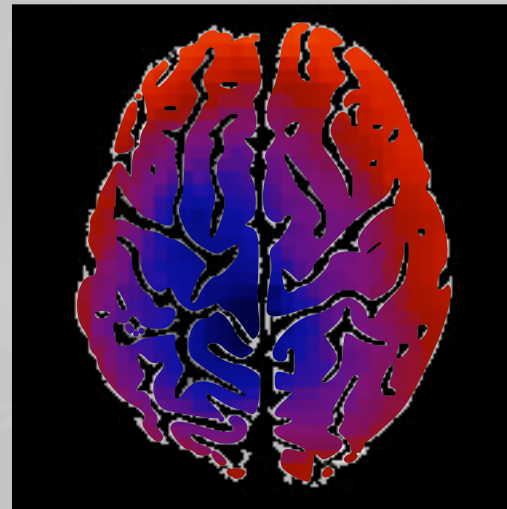
Structure



Function



HD ERP



DTI



Child Testing



Endocrine Laboratory

Douglas Granger, ASU Judy Burnfield, NAPL Dennis Molfese, CB3



Genetics Laboratory

Identifying Genetic Risks & Factors that Mitigate Traumatic Brain Injury

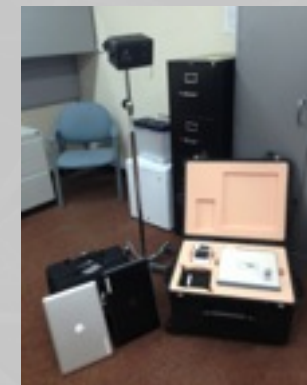
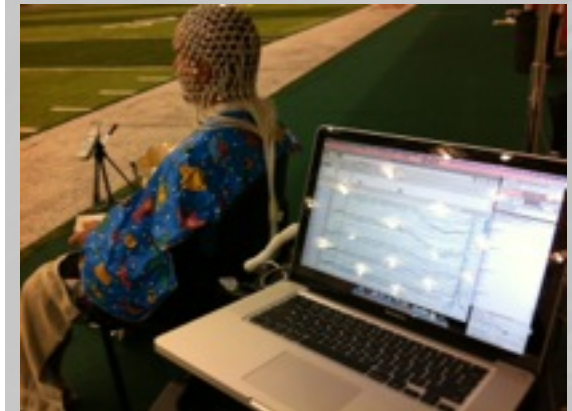
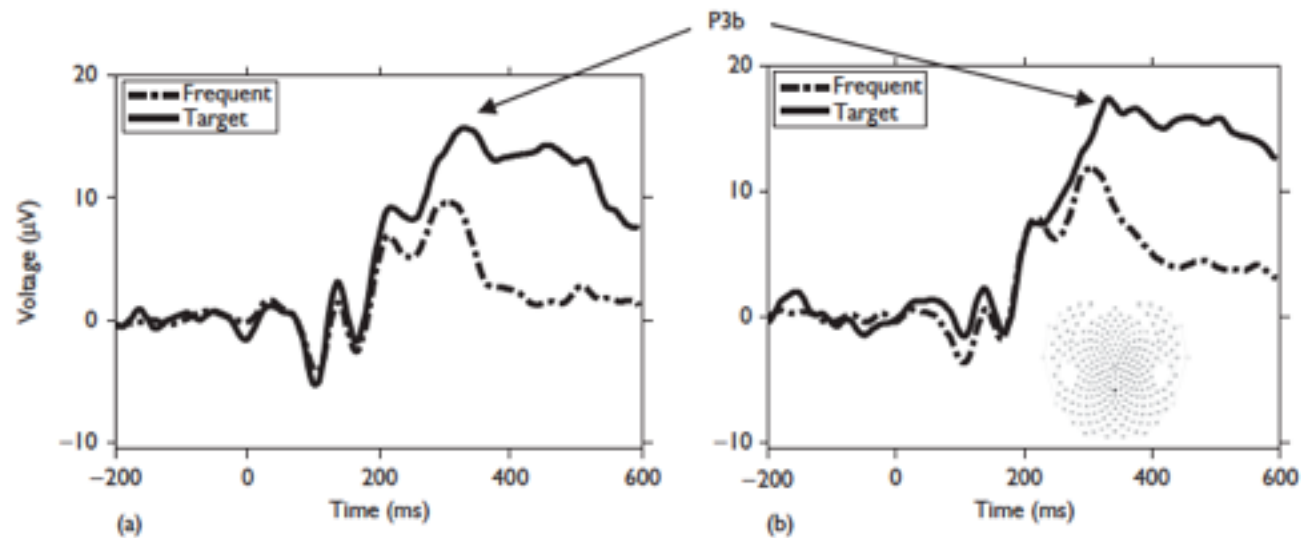
- **Few studies** use pre vs post TBI testing to investigate genetic risk for impairment (Weaver, et al., 2012)
- **Candidate genes:**
 - APOE
 - Tau
 - Neurotransmitter system genes
 - Glutamate
 - GABA
 - Dopamine
 - Serotonin



Feasibility of Using HD ERPs On/In the Field

Resting State

After Strenuous Exercise



Traumatic brain injury 1

Feasibility of using event-related potentials as a sideline measure of neurocognitive dysfunction during sporting events

Srinivas Kota, Kathleen M. Kelsey, Joseph B. Rigoni and Dennis L. Molfese

This study recorded brain event-related potentials (ERPs) during an attention task under two conditions: (a) immediately after strenuous exercise and (b) immediately after an extended rest period. The goal was to examine the effect of different physiological states on the electrophysiological data. As expected, a larger P3b ERP component was observed in response to attended

of a sporting event. *NeuroReport* 00:000-000 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins.

NeuroReport 2013, 00:000-000

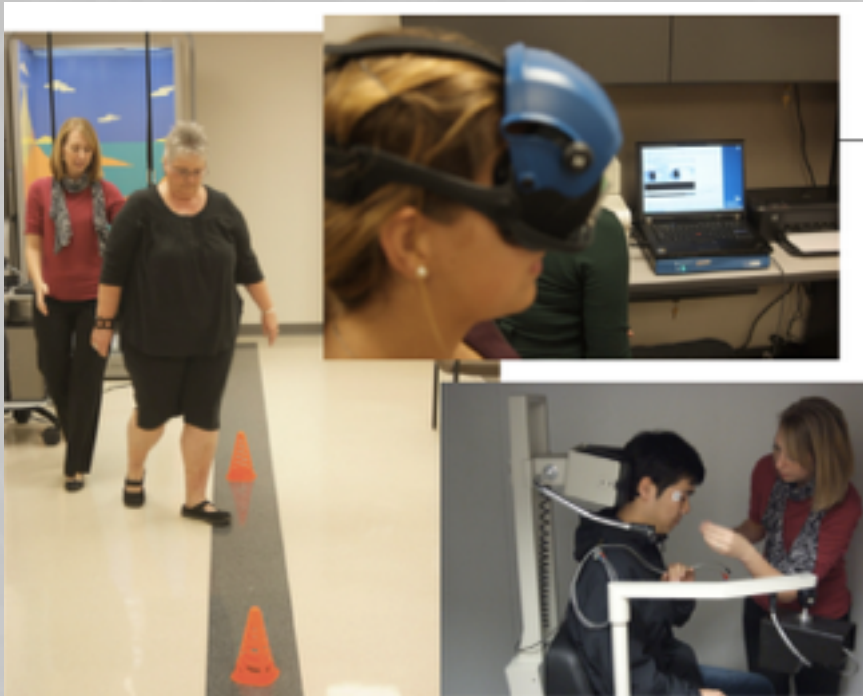
Keywords: concussion, event-related potentials, oddball, P3b, sport

Developmental Neuroscience Laboratory, Department of Psychology, University of Nebraska-Lincoln, Lincoln, Nebraska, USA

omic Development



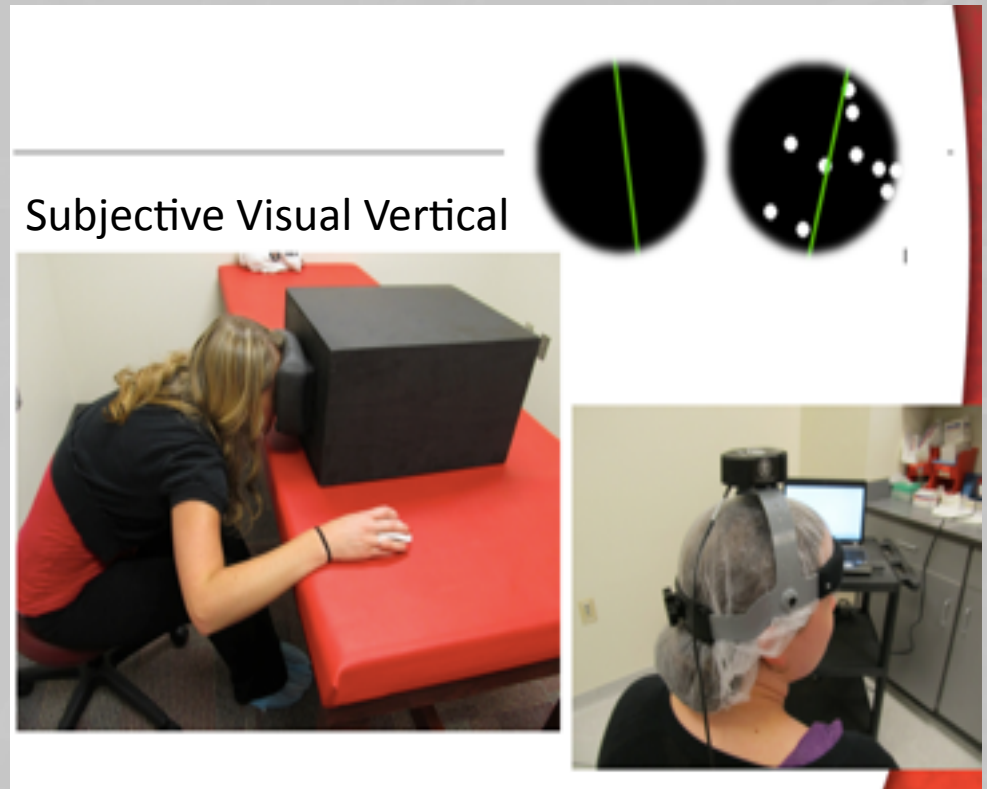
Vestibular/Balance Lab



Gait Testing

Rotational Chair

Videonystagmography
(VNG)

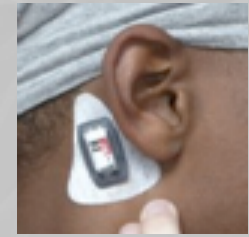


Subjective Visual Vertical

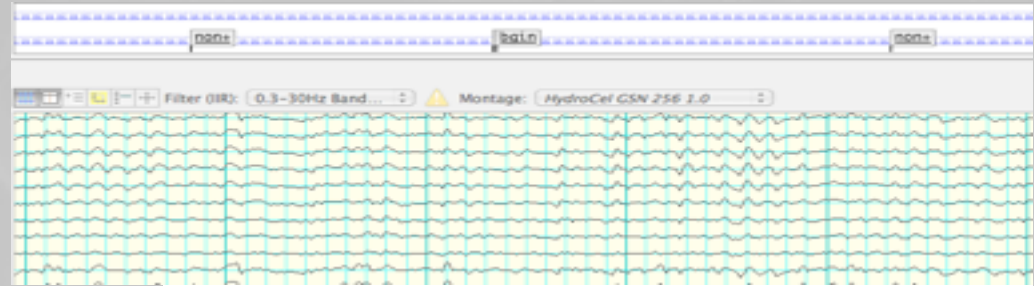
Vestibulo-Ocular Reflex (VOR)

Dr. Julie Honaker

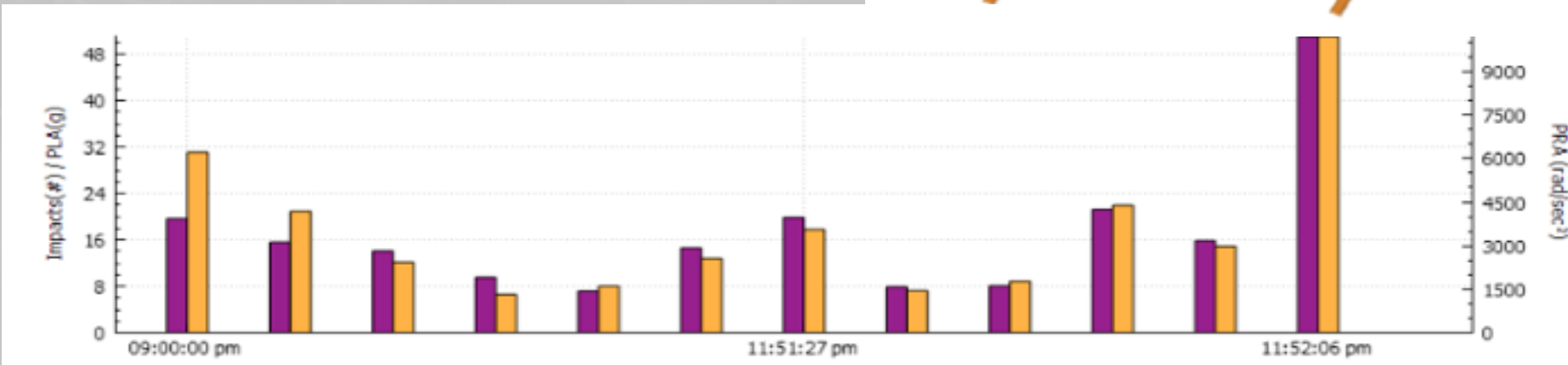
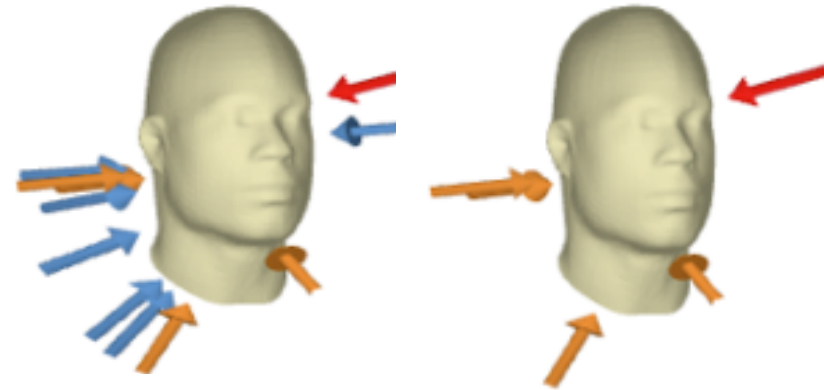
X2 Patch Accelerometer Investigation



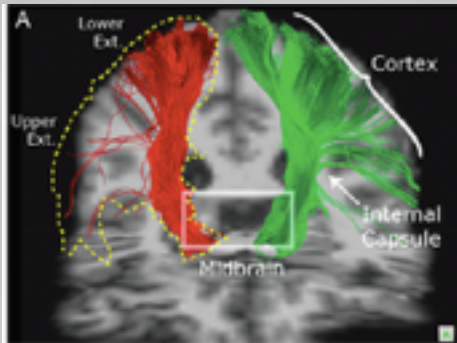
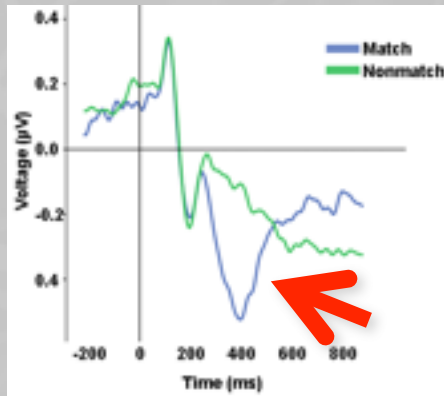
- G-force
- Number
- Location (6 vectors)
- Frequency (e.g., days, months, seasons, teams)
- Time-link to game film
- Correlate with ERPs



1/25/2014		42	12	+10
Day	WEEK			today's max.
MONTH	SEASON	Xposure	# of Impacts	+3
				today's avg.

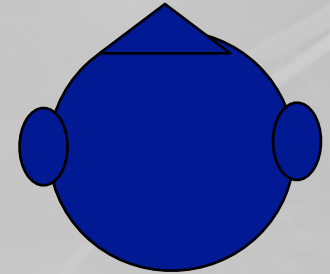


Two-Back Memory Task



4-5-2-5.....

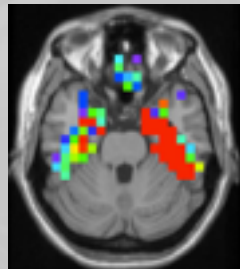
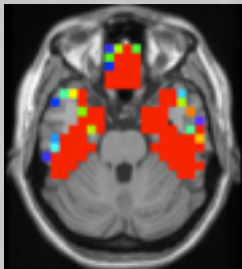
Numbers
Match



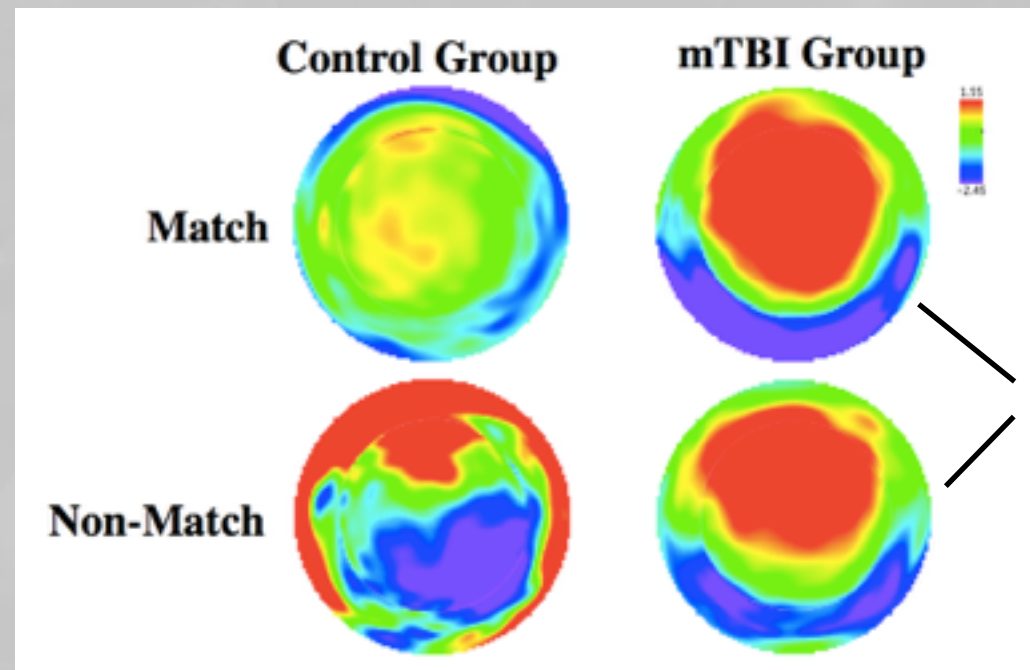
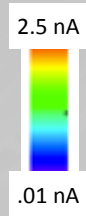
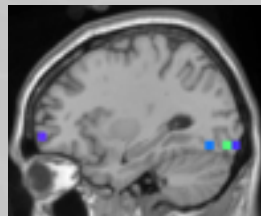
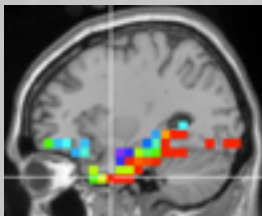
No history of
persistent
headache (n=16)

History of
persistent
headache (n=19)

Match



Mismatch



Same

Molfese et al., under review

200 - 400 ms



Intervention For TBI

20-40% With TBI Experience Vision-Disorders

Normal Visual World

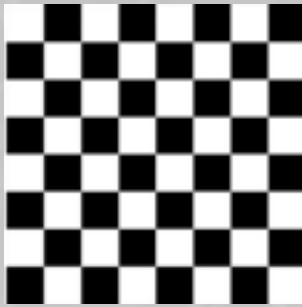
World Distorted by TBI



Post-Trauma Vision Syndrome (PTVS)
Visual Midline Shift Syndrome (VMSS)

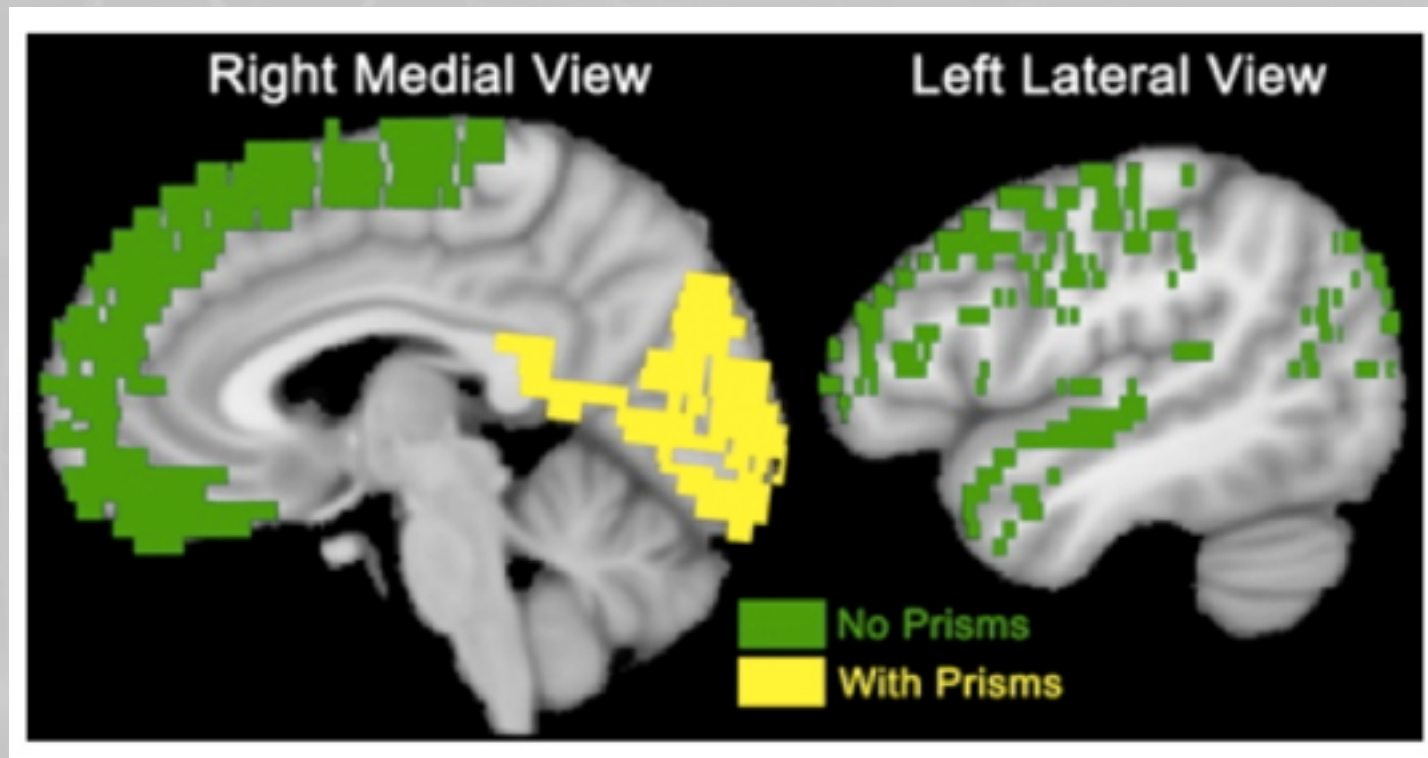
Intervention For TBI

Stimulus



Without Prisms: Large areas of cortex recruited but fail to resolve discrepant AUDITORY & VISUAL input

With Prisms: Eliminates disagreement between Visual & Auditory inputs, restricting processing to visual cortex



Prisms:

Eliminate conflict between Visual & Auditory inputs

Reduce number of cortical regions needed to resolve
discrepant AUDITORY & VISUAL input,
returning visual processing to visual cortex



Current Major Initiatives:

CTE: All former UNL Athletes

Normative data, Longitudinal/Cross-sectional, Biomarkers for Risk & Recovery, Longterm outcomes, Intervention success.

NCAA-DoD: All Athletes across all sports

Establish universal baseline measures to detect concussion and monitor recovery.

Longitudinal Concussion Study: Football, Soccer

First year college players across years of play. Neuropsychology, symptoms, brain imaging.

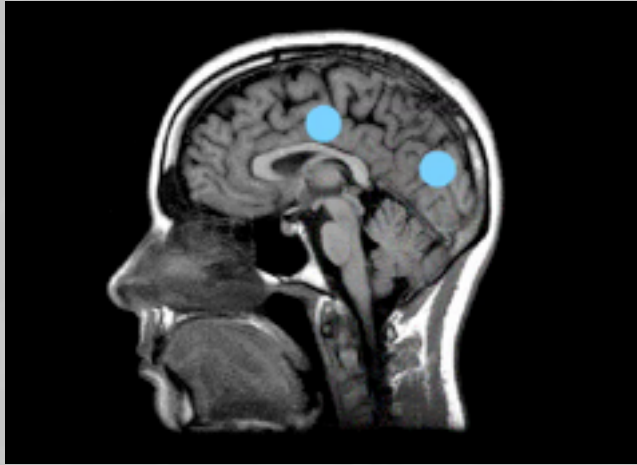
TBI: Behavior, neurocognition, endocrine, genetics & brain imaging.



Model for Head Injury

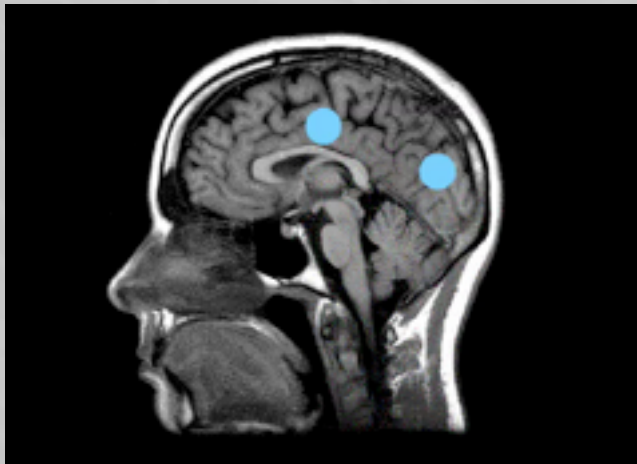


Normal

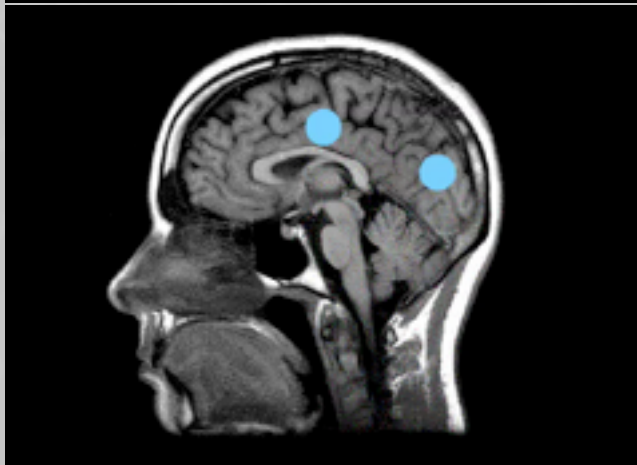


MODEL

First Presentation
of Stimuli

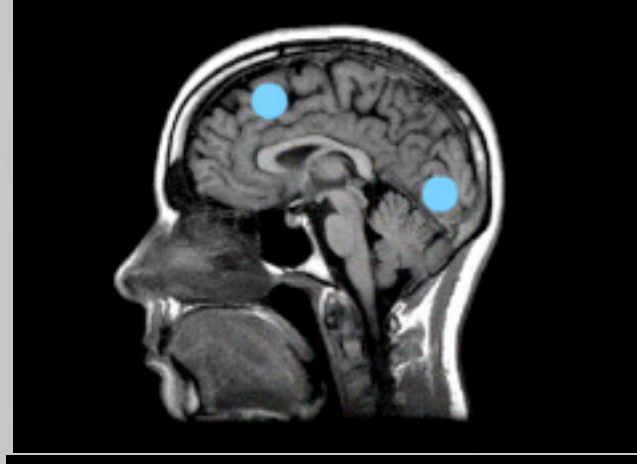
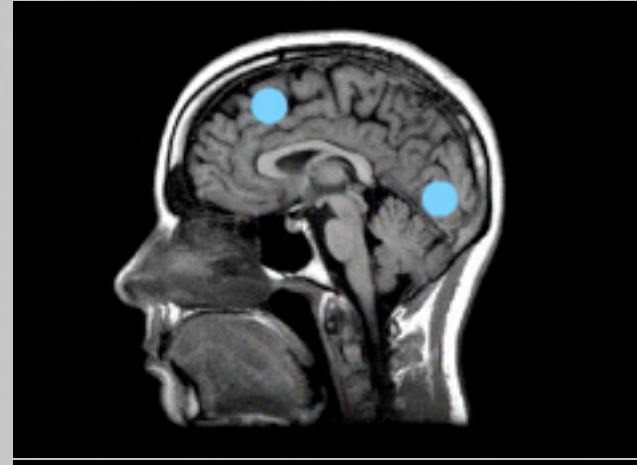


Second Presentation
of stimuli



Repeated
presentation
of stimuli

TBI





QUESTIONS ?

Dennis L. Molfese, Ph.D

dlmolfese@mac.com



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