

# Sensory supplementation to enhance adaptation following G-transitions and traumatic brain injury

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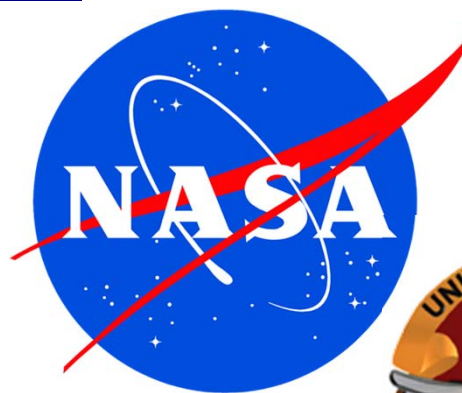
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<sup>3</sup> USAARL, Fort Rucker, AL



Towards Integrated Countermeasures  
August 28, 2013

# Sensory supplementation

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- Using natural senses (touch, sight, hearing) to display information intuitively from physical sensor
- Focus is on reinforcement of accurate sensory information rather than enhancing signals (stochastic resonance) or substitution (prosthesis)

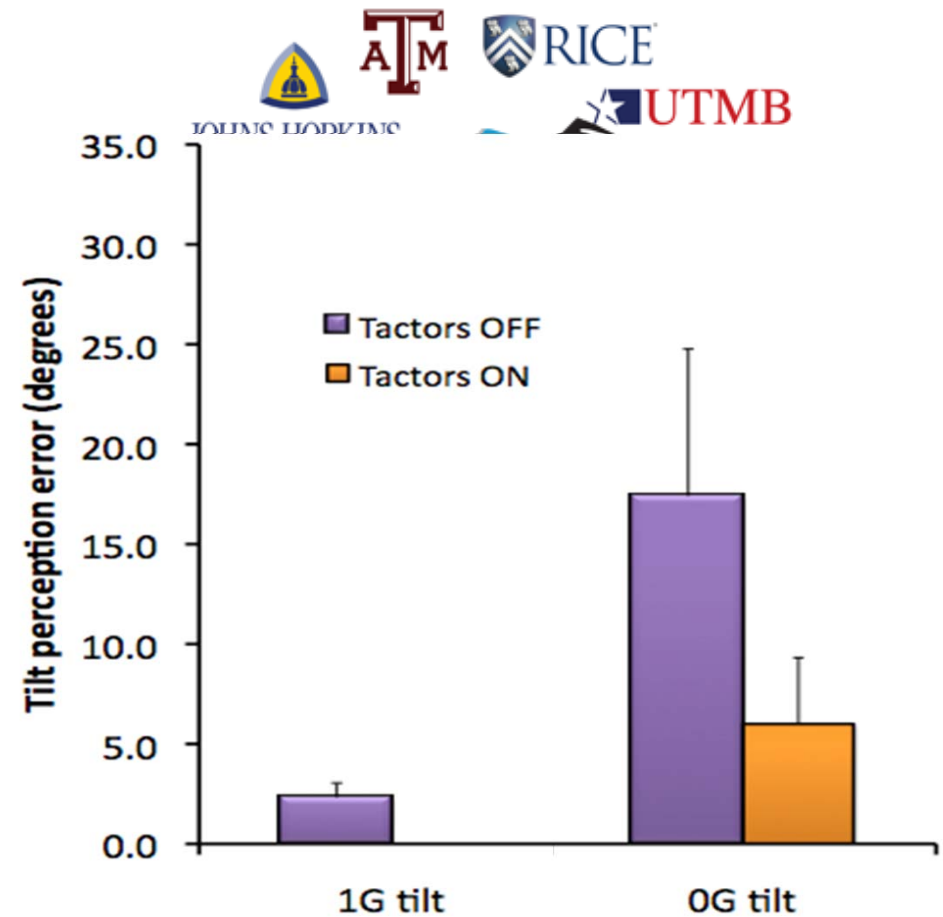


# Tactile Situation Awareness System

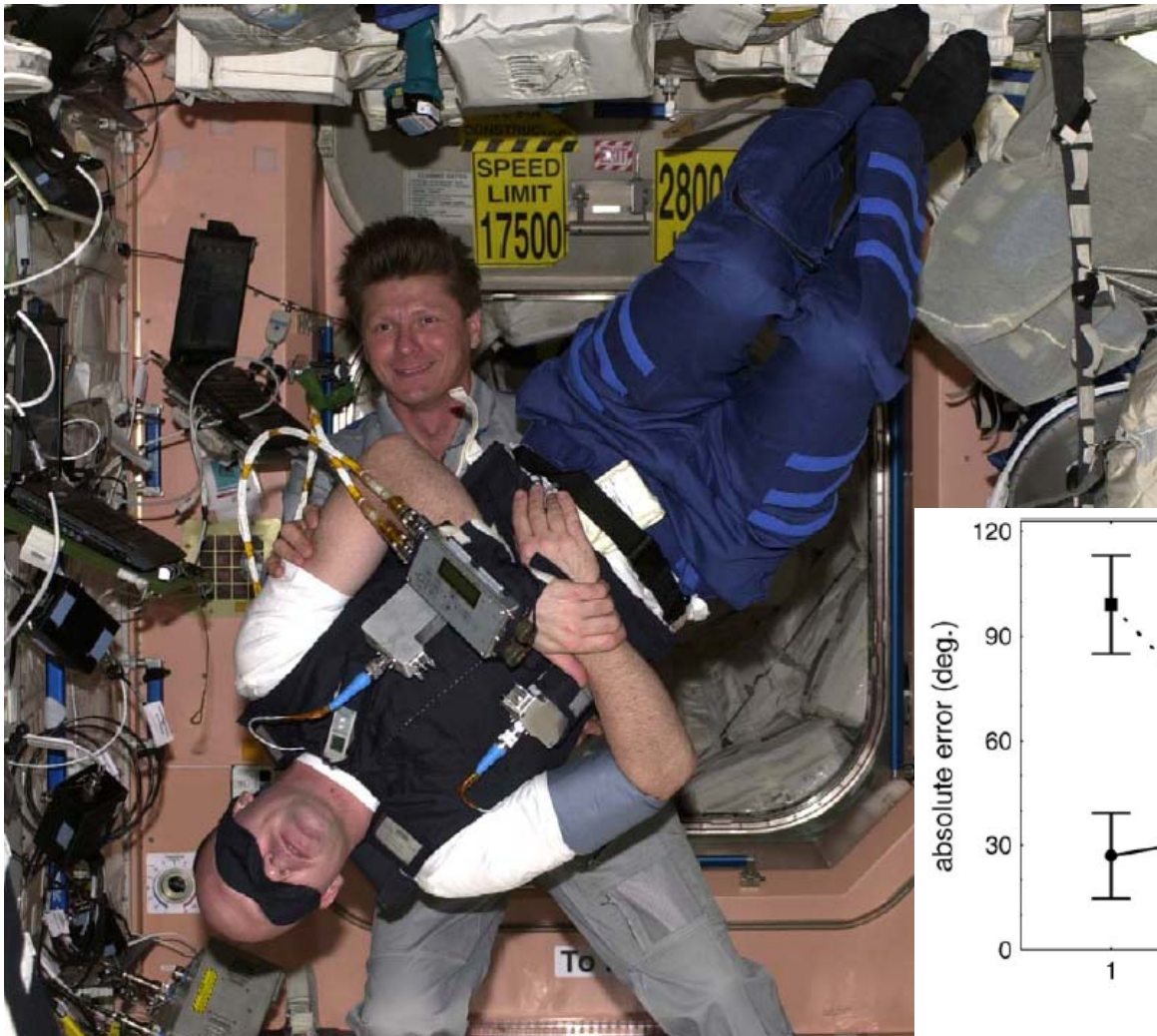
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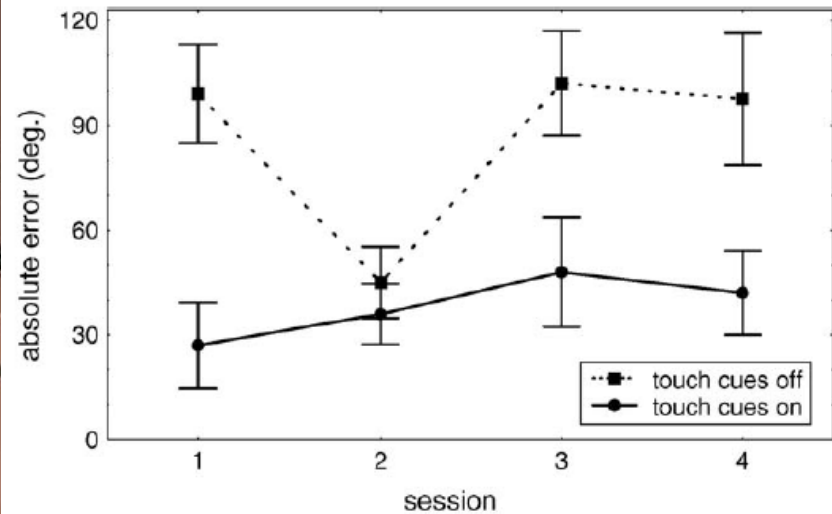
# Parabolic Vibrotactile Experiment



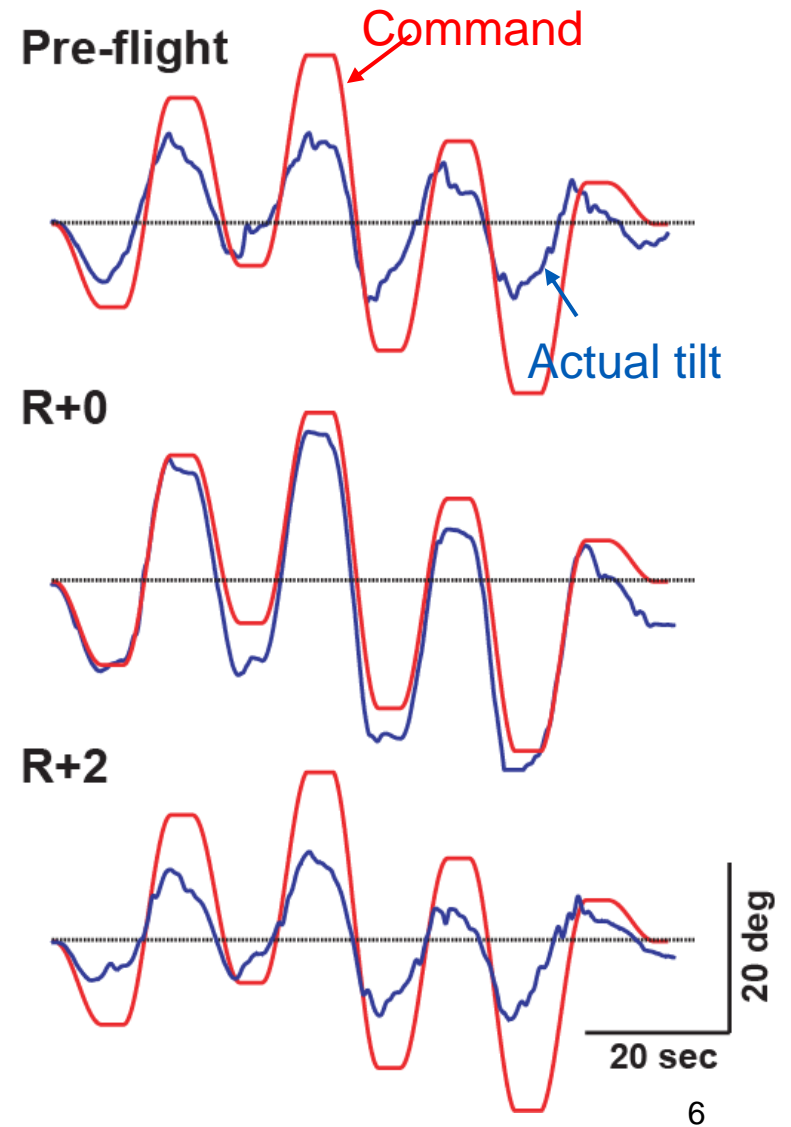
# ISS Vibrotactile Experiment



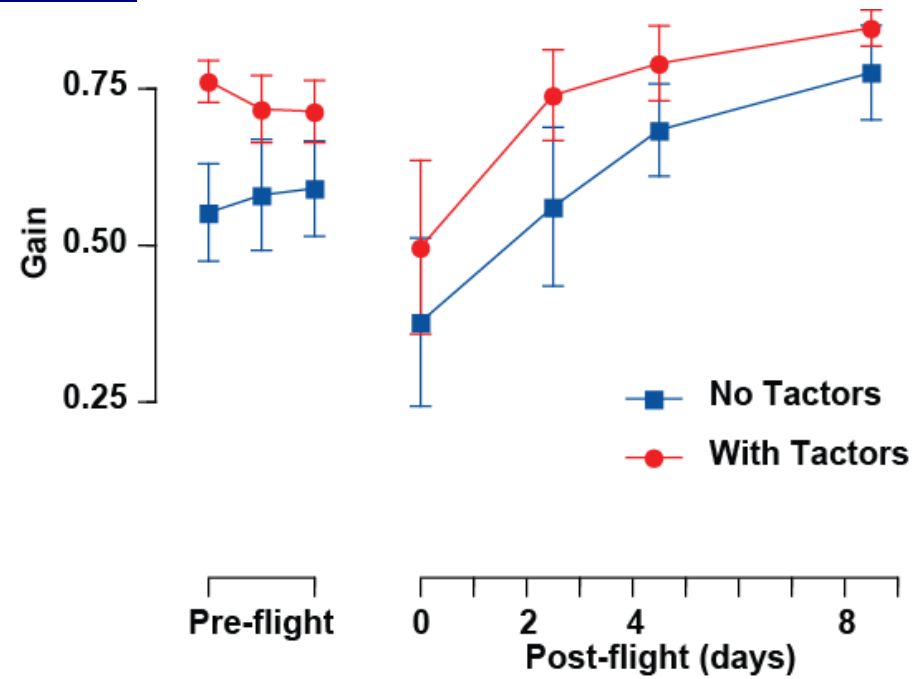
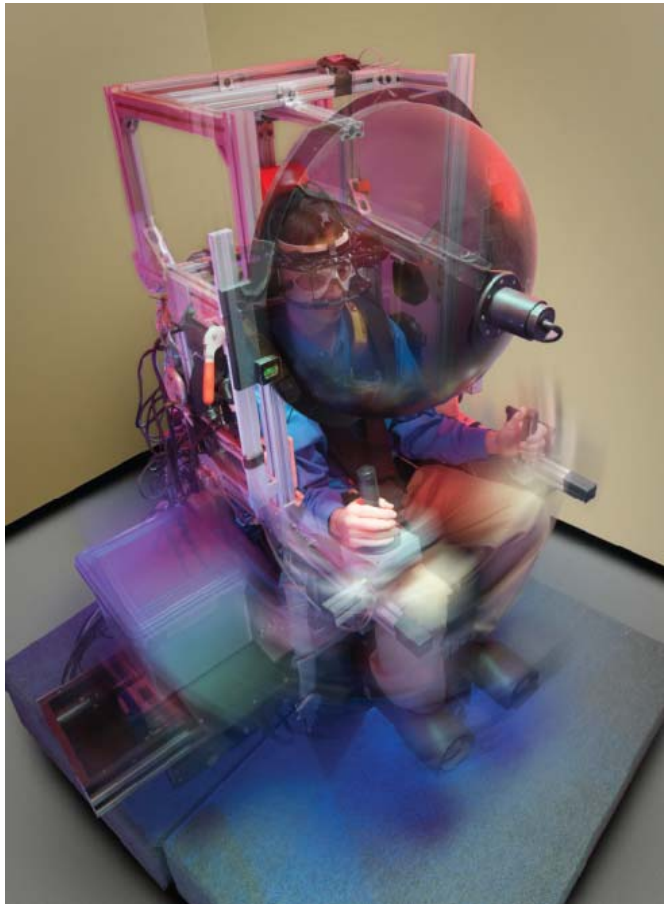
Days 2, 3, 6 & 7  
van Erp & van Veen  
(Neurosci Lett 2006)



# Shuttle ZAG experiment – Clément

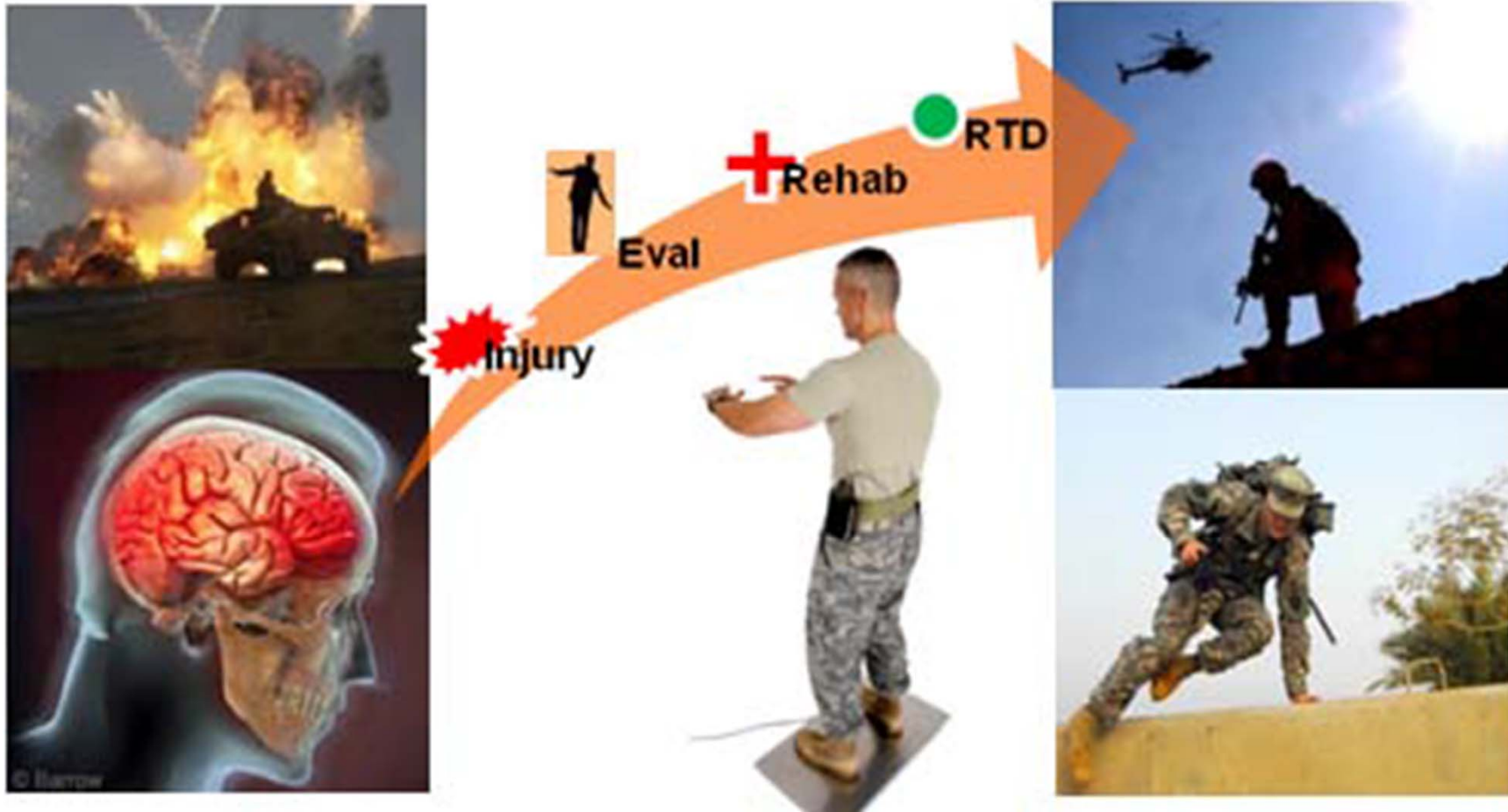


# Shuttle ZAG experiment – Clément



- Performance improved with tactors
- R+0 with tactors similar to preflight without

# Traumatic Brain Injury (TBI)





# Increased sway following TBI

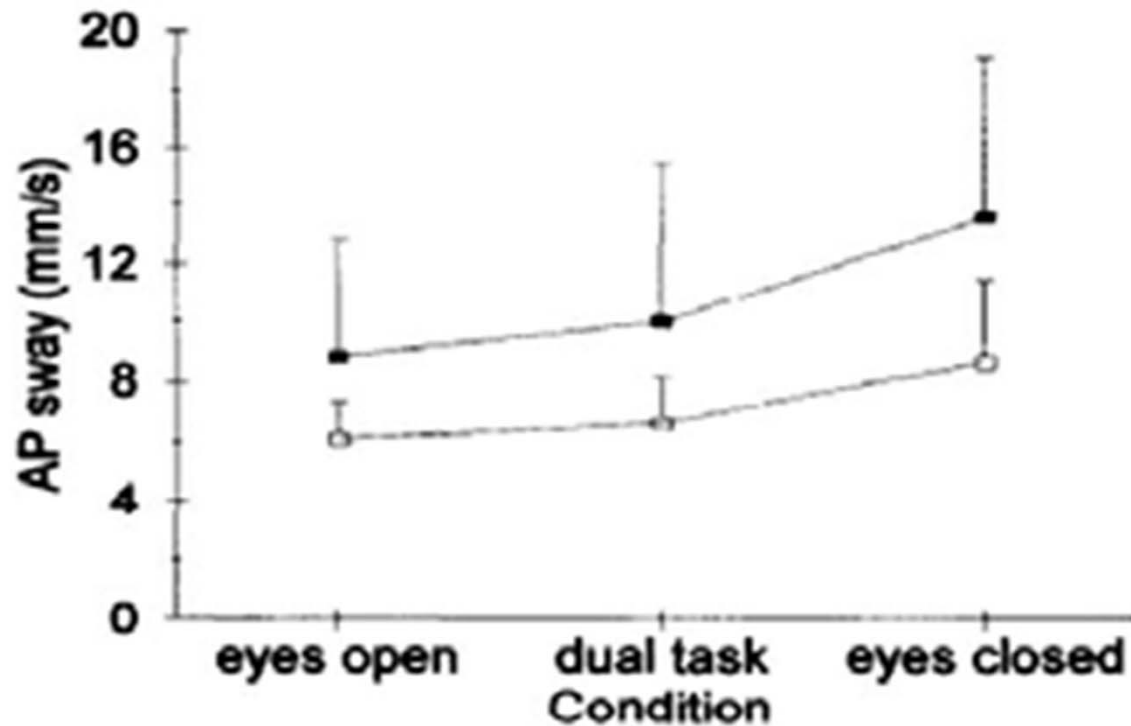
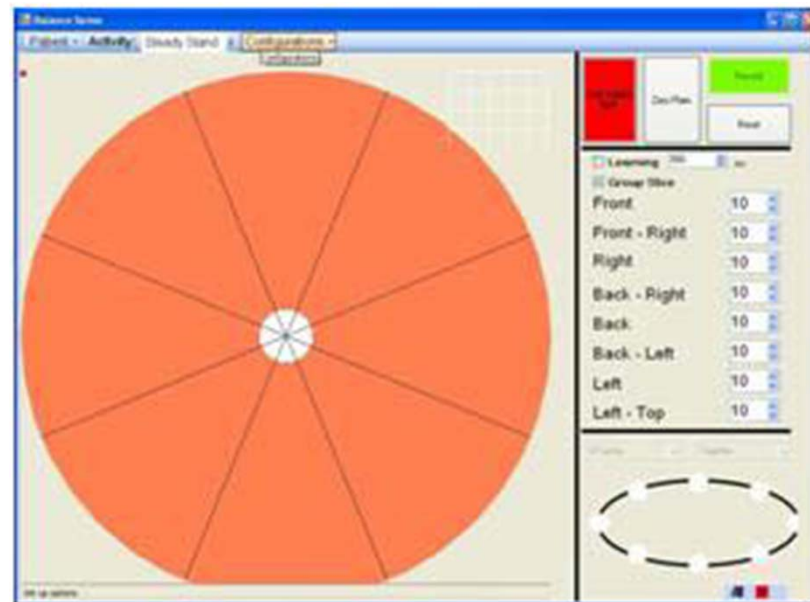
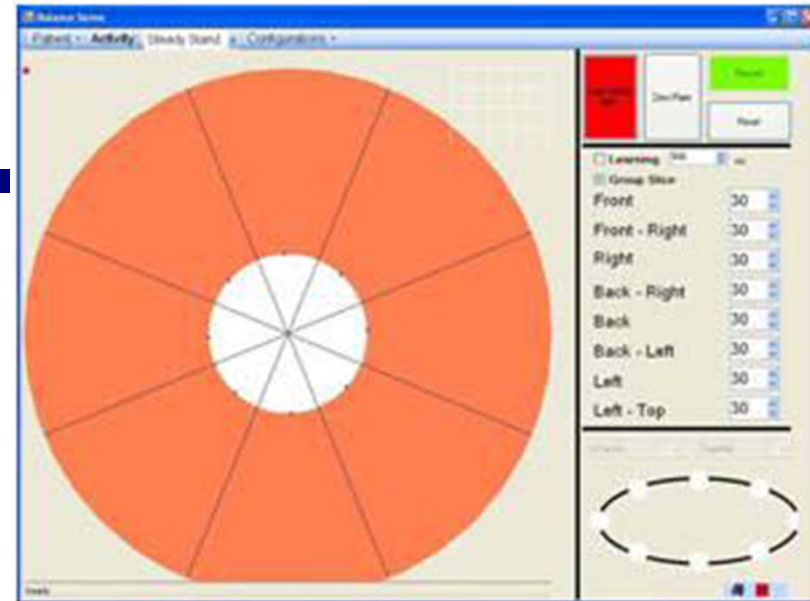
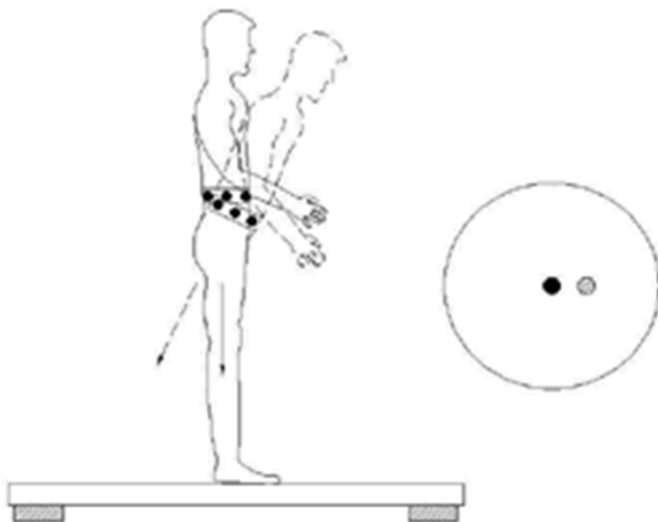


Fig 2. The group means and SDs of the RMS CP velocity in the antero-posterior (AP) direction are shown for both the TBI group (■) and the control group (□) in different conditions (N = 20).

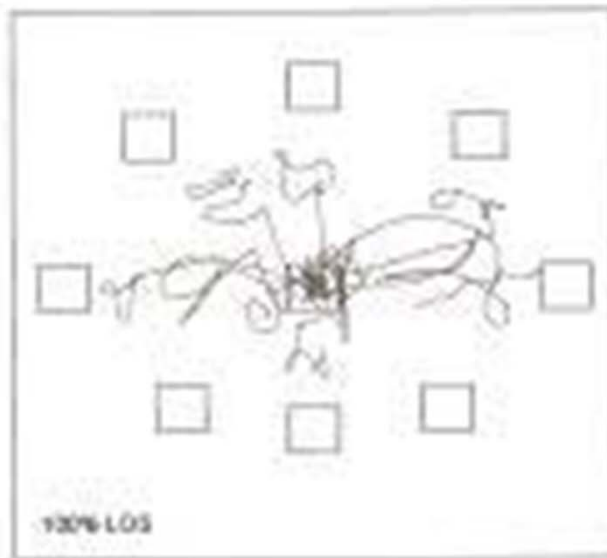
# Balance Sense belt



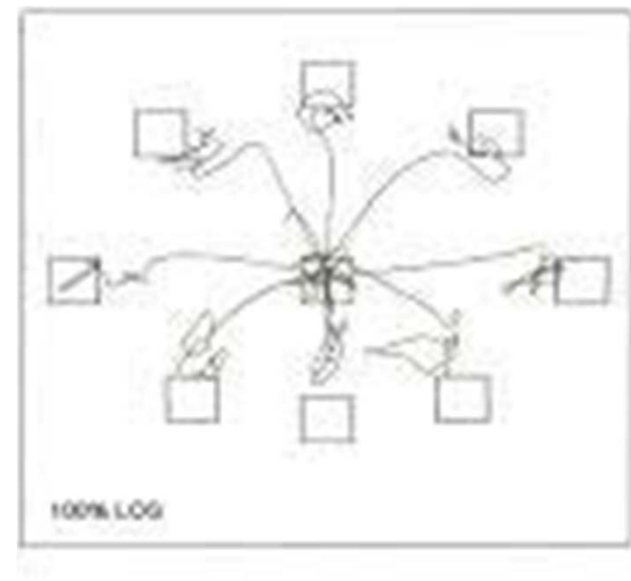
# Limits of stability test



Before rehab

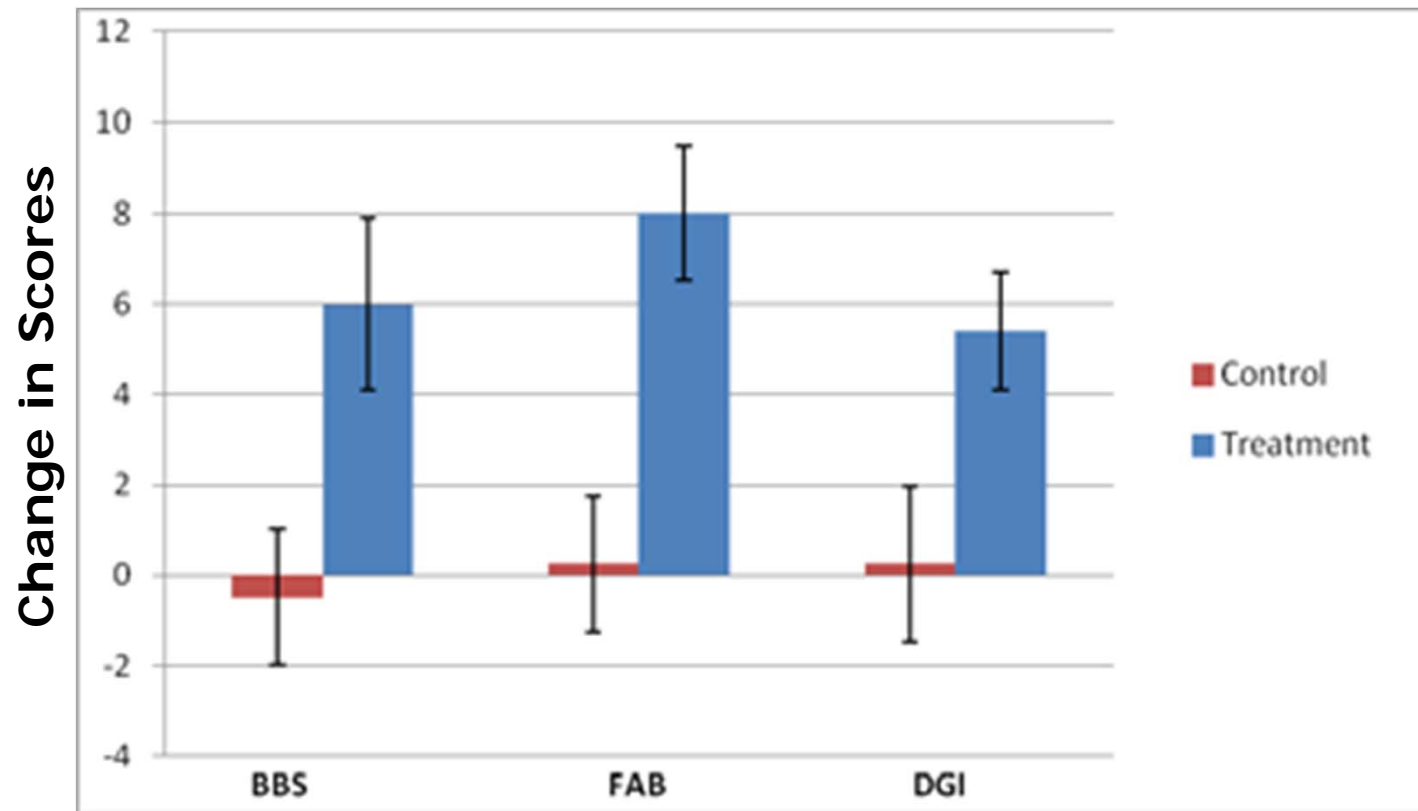


After tactile training



(from Akins, 2010)

# Tactile training in elderly patients



BBS = Berg Balance Scale

FAB = Functional Assessment Battery

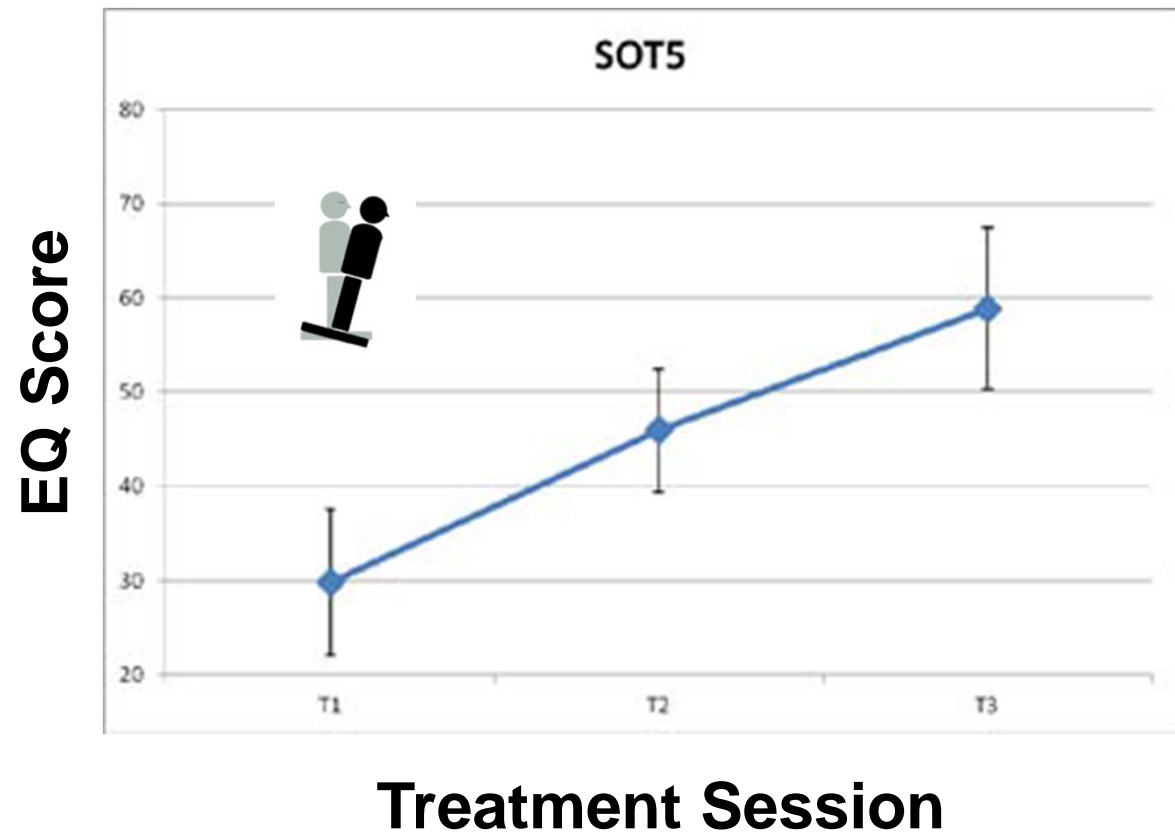
DGI = Dynamic Gait Index

(from Akins, 2010)

# Tactile training in TBI patients



Eyes closed, unstable support



(preliminary data from Rupert et al., 2013)

# Summary

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- Sensory supplementation can be incorporated as online feedback for improving spatial orientation awareness for manual control tasks (e.g. TSAS, Shuttle ZAG study)
- Preliminary data with vestibular patients and TBI military population is promising for rehabilitation training
- Recommend that sensory supplementation be incorporated as a training component in an integrated countermeasure approach