



BIOMARKER-ENHANCED VR-BASED PLATFORM FOR ASSESSING MOTION SICKNESS SUSCEPTIBILITY

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Motion sickness in flight - is it a big deal?

Airline passengers: ~1%

Astronauts: >60% in first 2-3 days weightless (Heer & Paloski 2006)

Student pilots: 39% (RAF, 1974) – 50% (Taiwan AF, 2000).

Counter-measures: - pharmacological (H1 and ACh M1 antagonists);
- MS desensitization programs (legthy & expensive).

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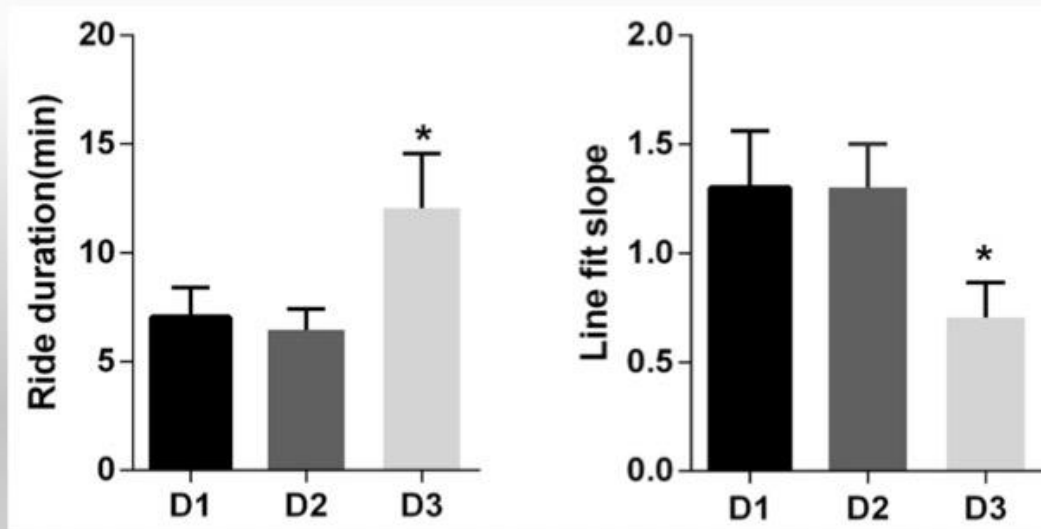
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- MS desensitization programs (lengthy & expensive).



RAAF AvMed, Adelaide, Australia

Cybersickness: what it is, and can we make use of it?

- ❖ Cybersickness is a subtype of motion sickness (MS) provoked by exposure to VR (i.e. it is predominantly visually-induced MS).
- ❖ Similar to motion-induced MS, repetitive exposure to VR provocations results in desensitization:

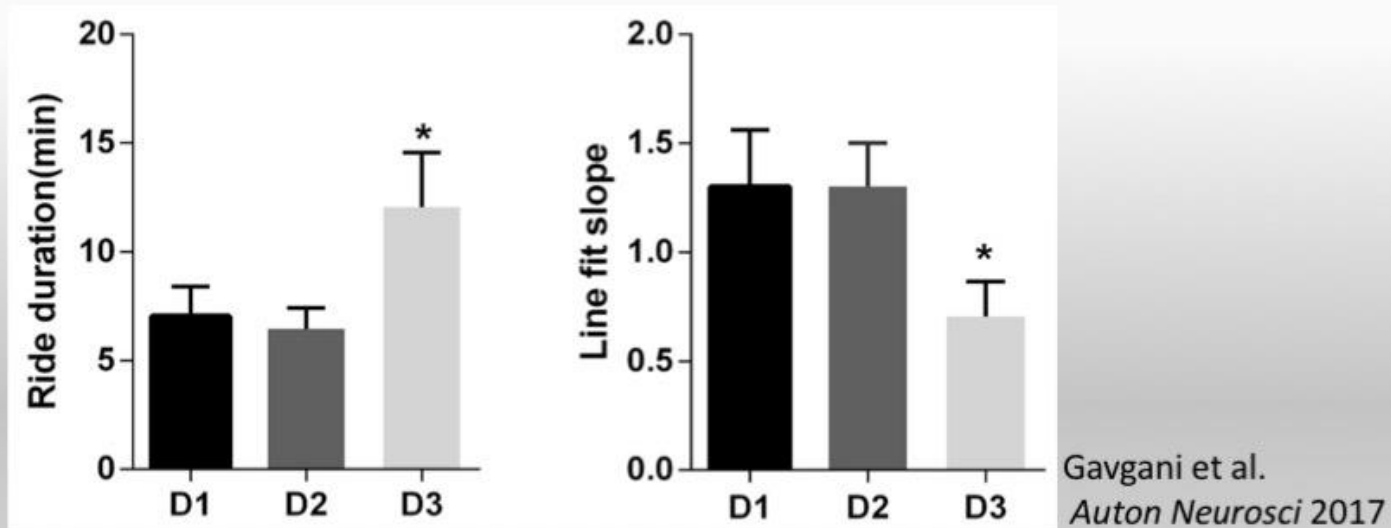


Gavani et al.
Auton Neurosci 2017

- ❖ It is currently not known which brain structures are responsible for desensitization of responses to provocative stimuli.

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- ❖ It is currently not known which brain structures are responsible for desensitization of responses to provocative stimuli.
- ❖ Hypothesis: Cross-desensitization?
- ❖ Step 1: Clarify relationship between CS and MS;
- ❖ Step 2: Test whether repetitive exposure to VR provocations reduces sensitivity to provocative motion.

Study protocol: MS provocation

On different days (a week apart) 30 young healthy volunteers were subjected to:

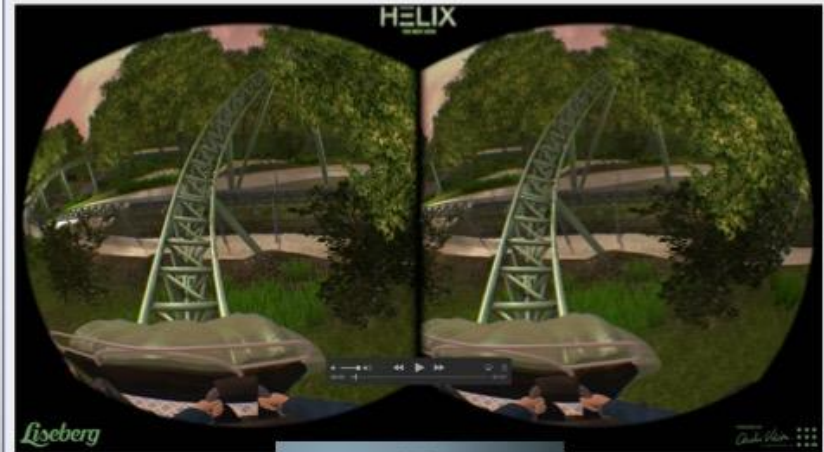
either (A) Coriolis cross-coupling



(purely vestibular provocation)

or

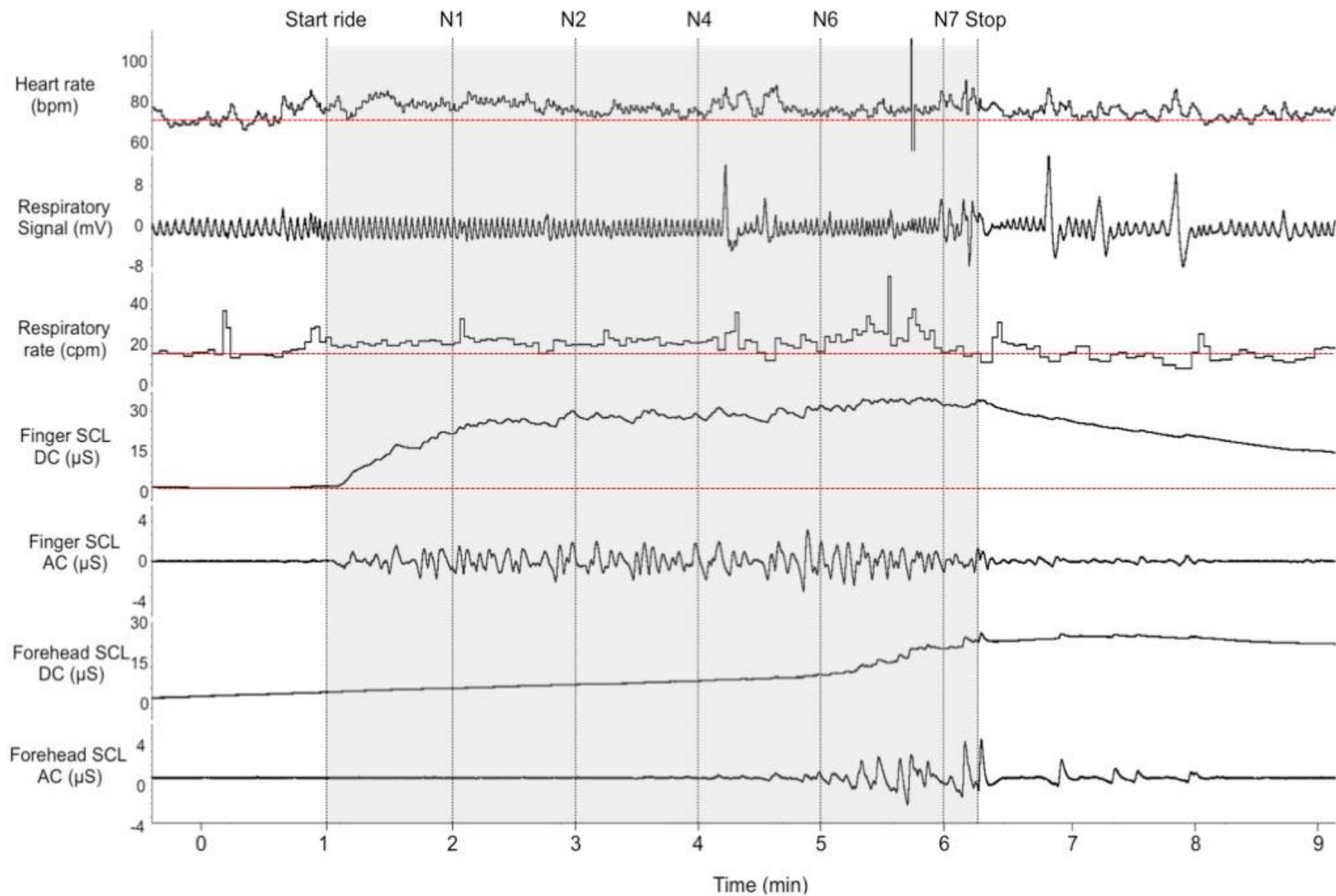
(B) virtual ride on a roller coaster



(purely visual provocation)

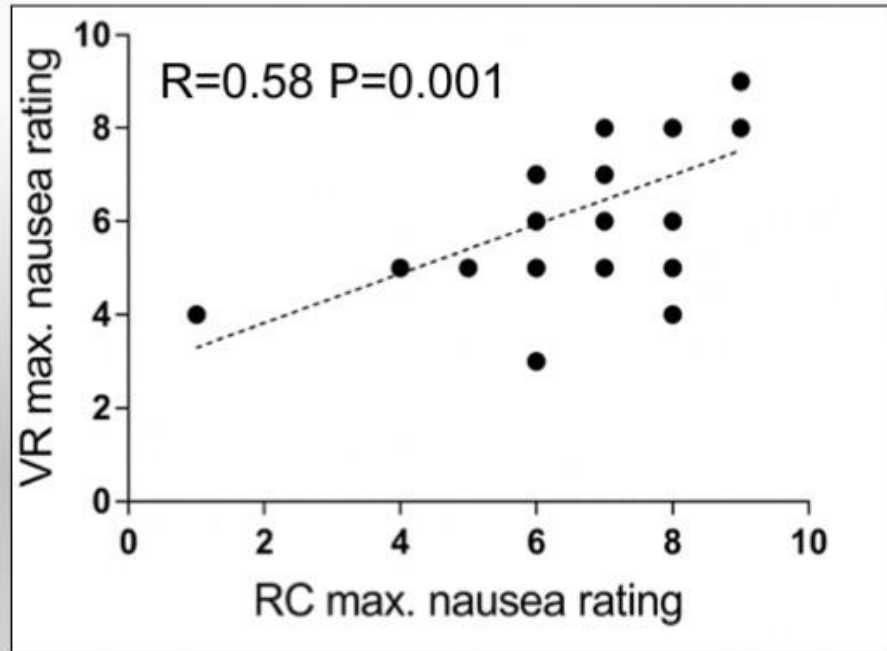
Assessed: - nausea rating (every min);
- MSAQ (post-test);
- forehead sweating (SCL).

Why we measured forehead sweating?

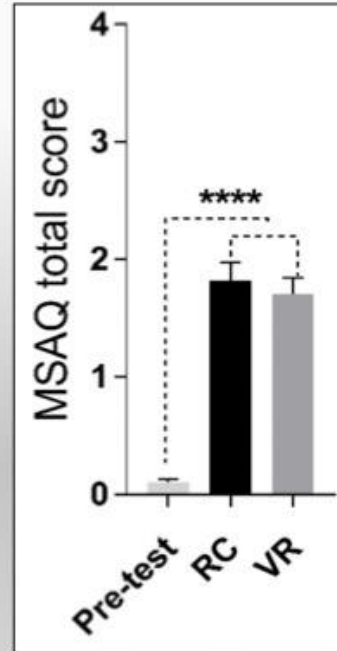


Similarities of symptoms in VR and RC conditions:

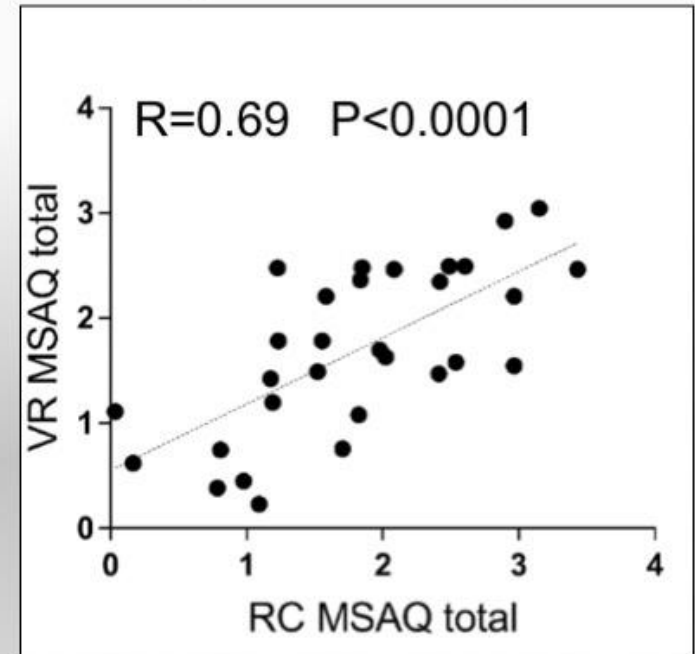
A. Correlation of max nausea ratings (VR vs rotating chair)



B. MSAQ total scores



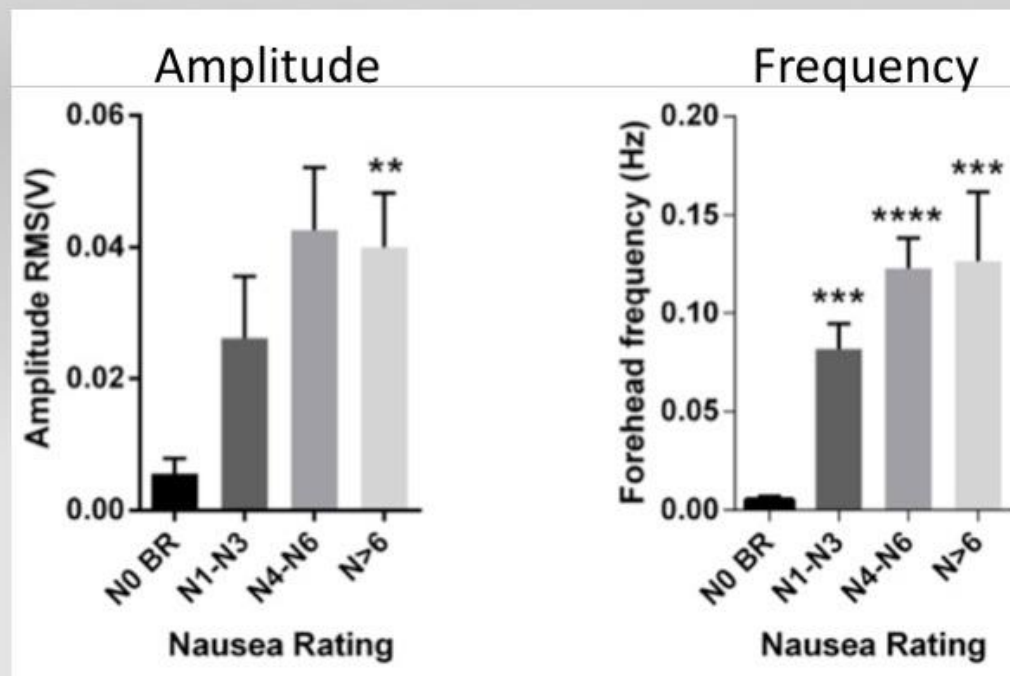
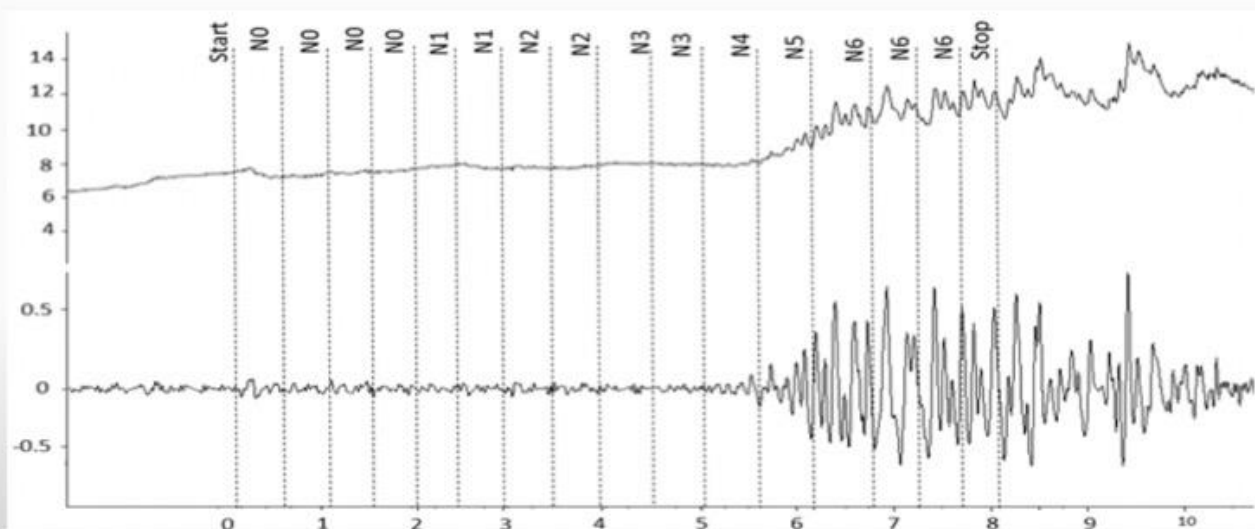
C. Correlation of total MSAQ scores (VR vs rotating chair)



There were equally high and significant positive correlations between 4 MSAQ symptom clusters and between 14 of 16 individual symptoms:

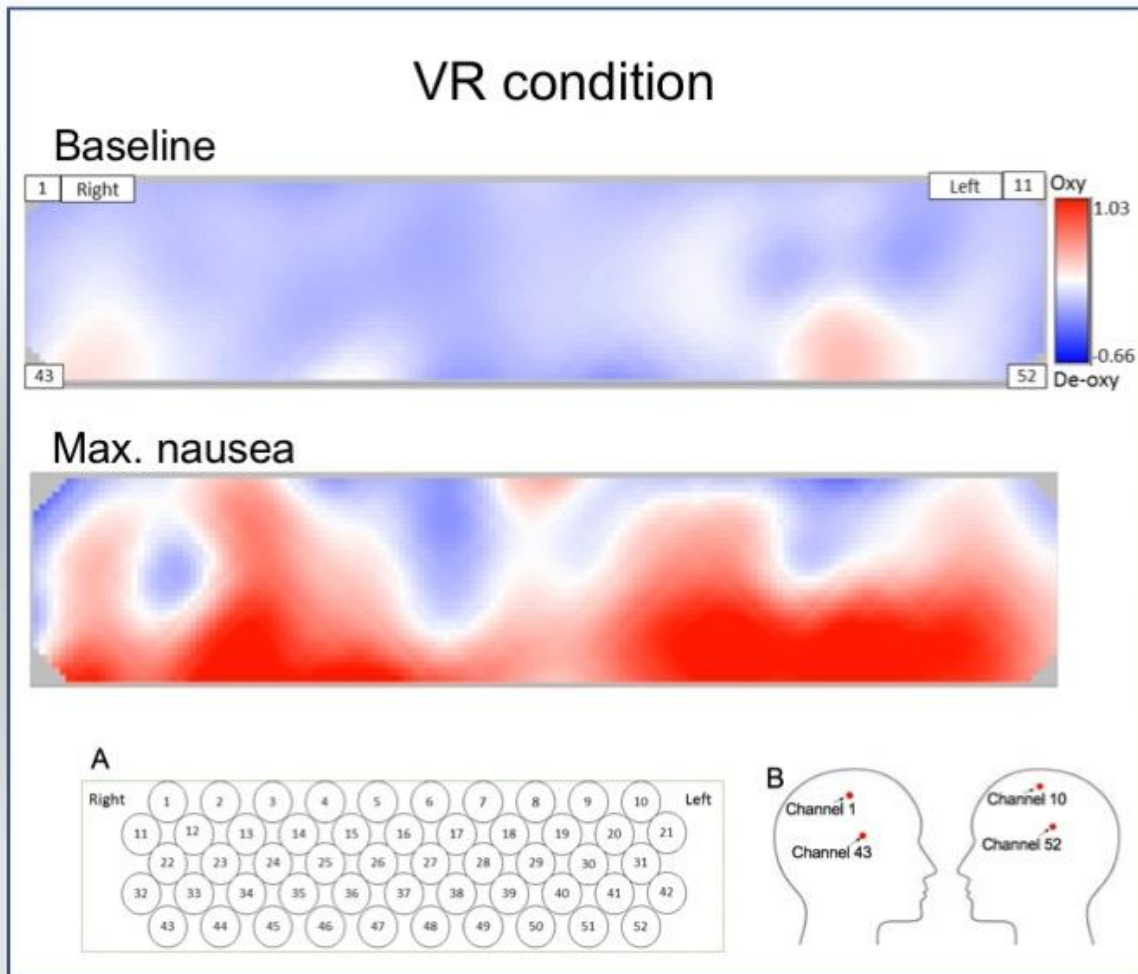
GI	$R=0.59$	$P=0.000$
Central	$R=0.69$	$P<0.0001$
Peripheral	$R=0.67$	$P<0.0001$
Sopite	$R=0.54$	$P=0.001$

Similarity in forehead sweating responses in VR and RC:



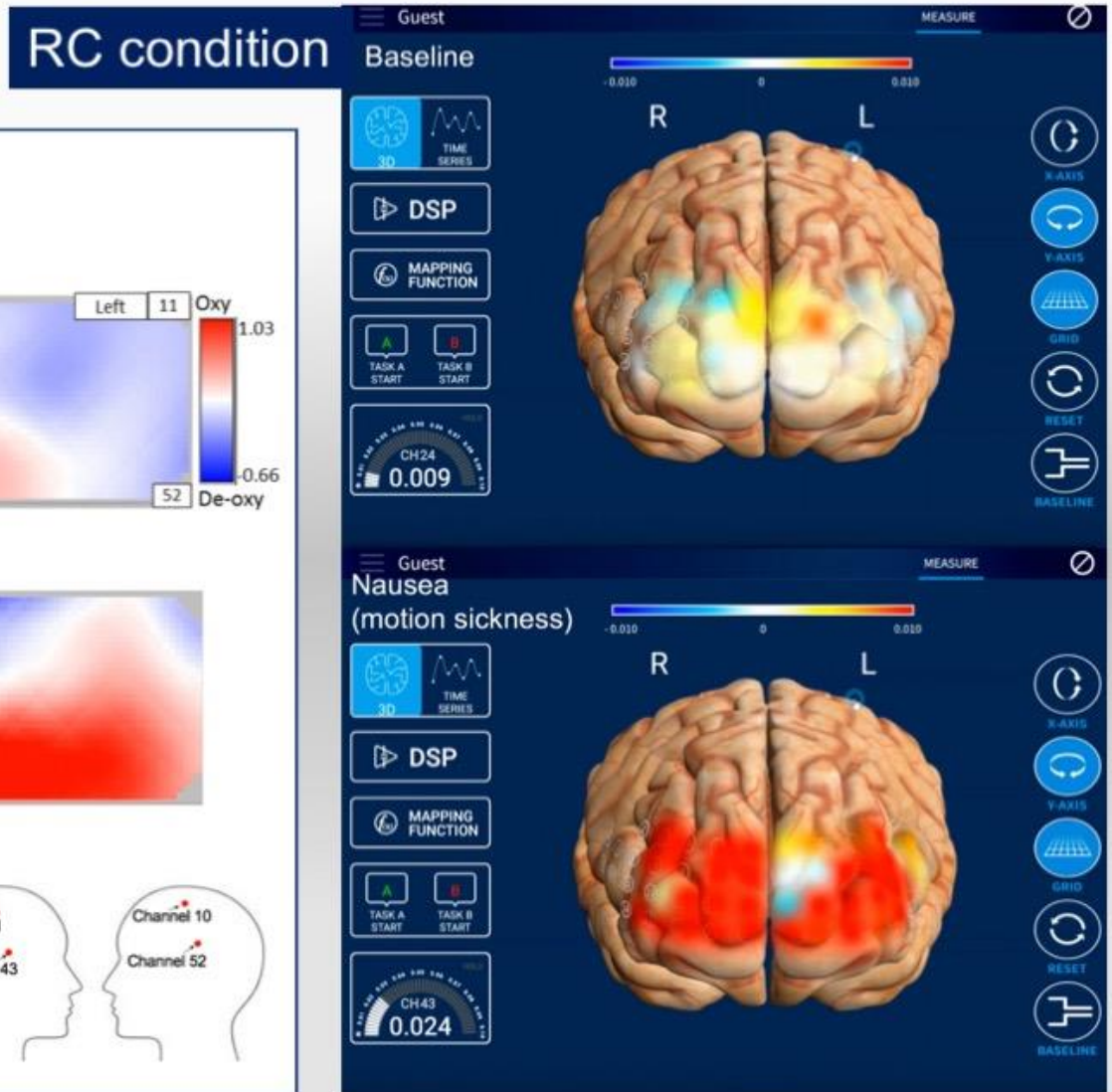
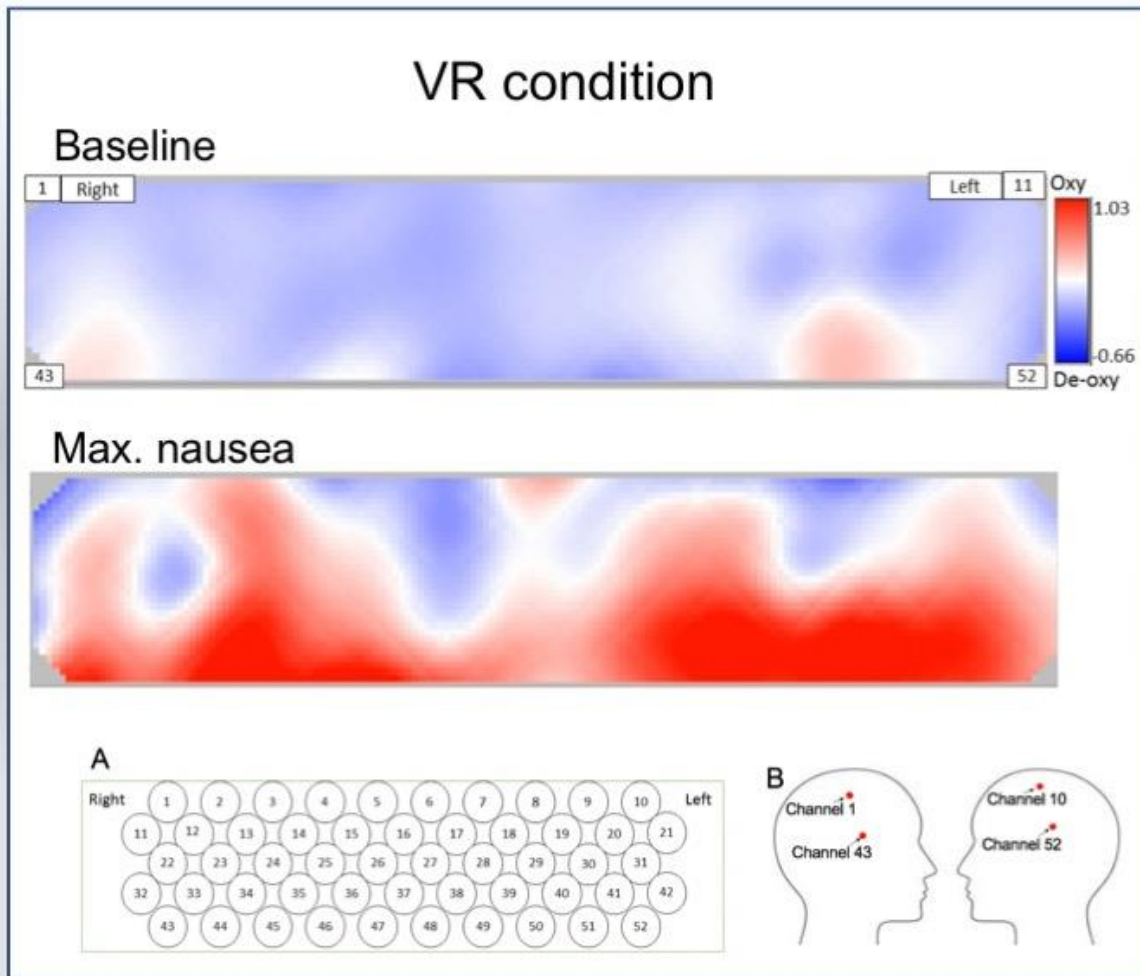
Similarities in changes of brain hemodynamics in VR and RC conditions (NIRS imaging):

NIRS = 'Near-Infrared Spectroscopy'. Basic principle is similar to pulse oximetry (Hb/HbO₂ detection).



Hitachi ETG-4000

Similarities in changes of brain hemodynamics in VR and RC conditions (NIRS imaging):



Conclusions for Step 1 (Clarify relationship between cybersickness and “classical” MS):

Symptoms and physiological changes occurring during cybersickness and "classical" motion sickness are quite similar, at least during advanced stages of these malaises.

Gavgani et al. A comparative study of cybersickness during exposure to virtual reality and "classic" motion sickness: are they different? *J Appl Physiol* 2018 October 4.

Step 2: Test whether repetitive exposure to VR provocations reduces sensitivity to provocative motion.

N=1 (but it is positive!)

For the details of the protocol, contact
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