Cortico-muscular synchronization dependence on age, body side and visual feedback

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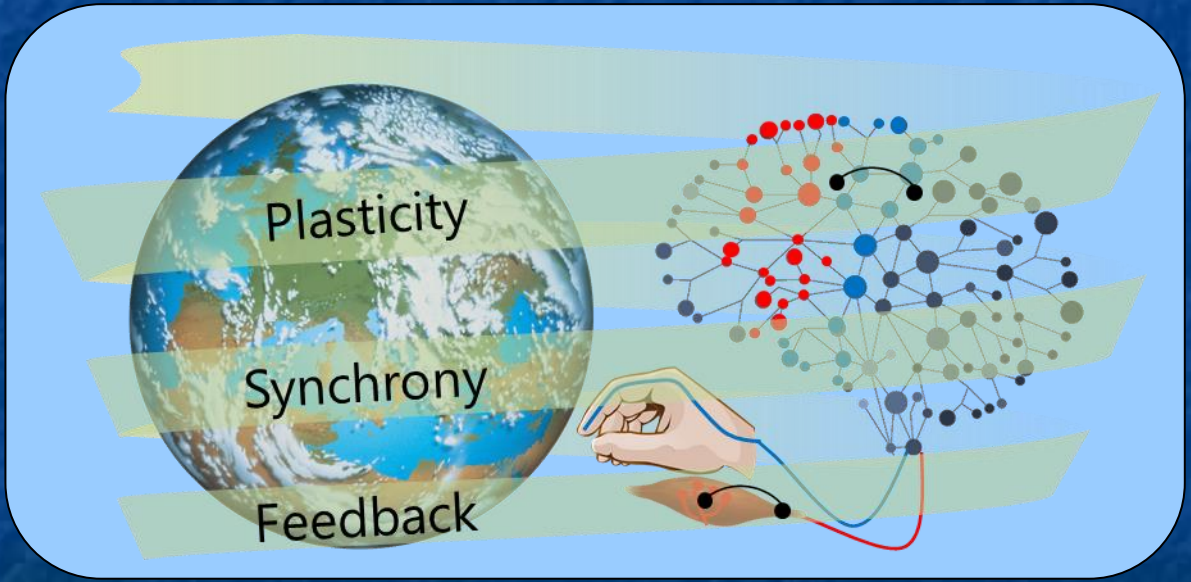
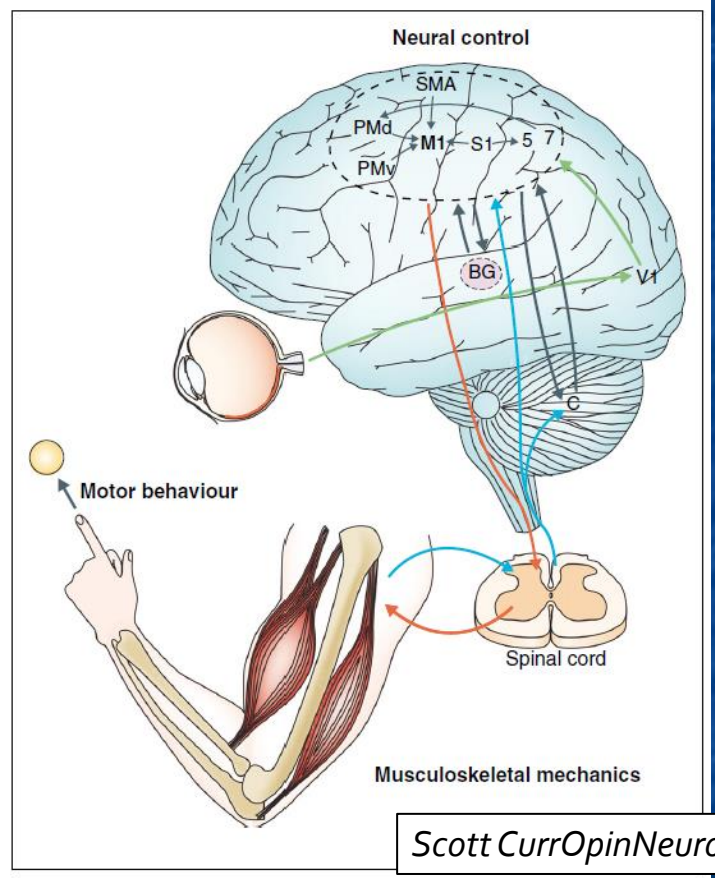
Our 'Body and Brain' system works governed by a triadic principle

Feedback, Synchrony, Plasticity

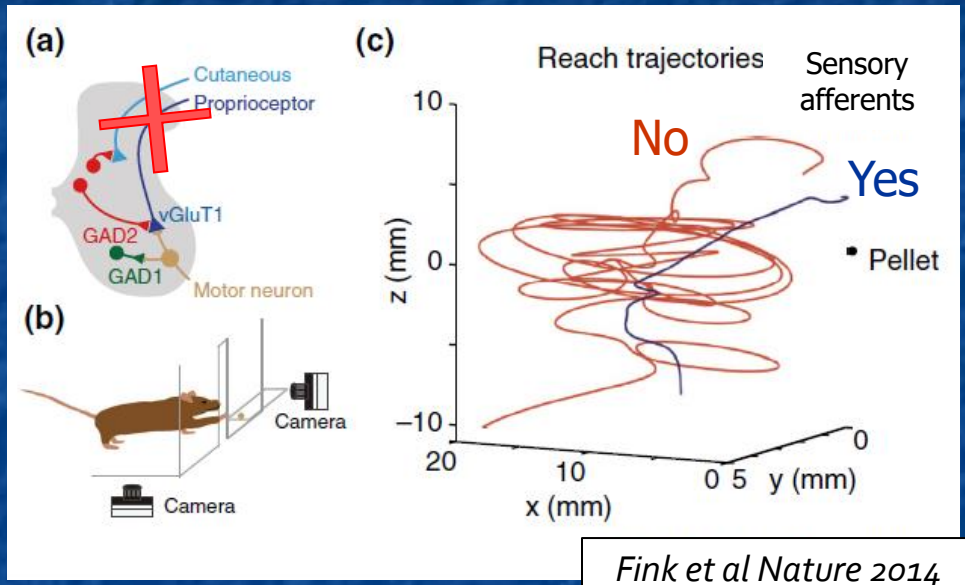


Feedback

Pharmacological block of primary afferent impairs voluntary movement control.



Scott CurrOpinNeurobiol 2017



Fink et al Nature 2014

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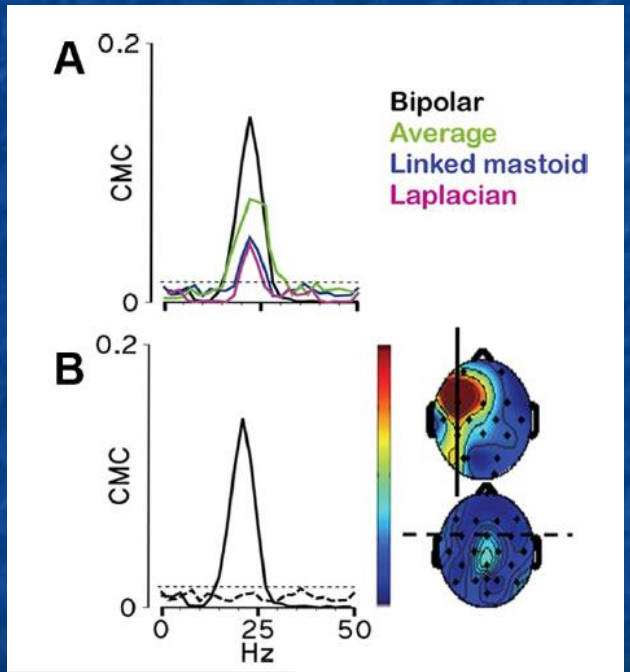
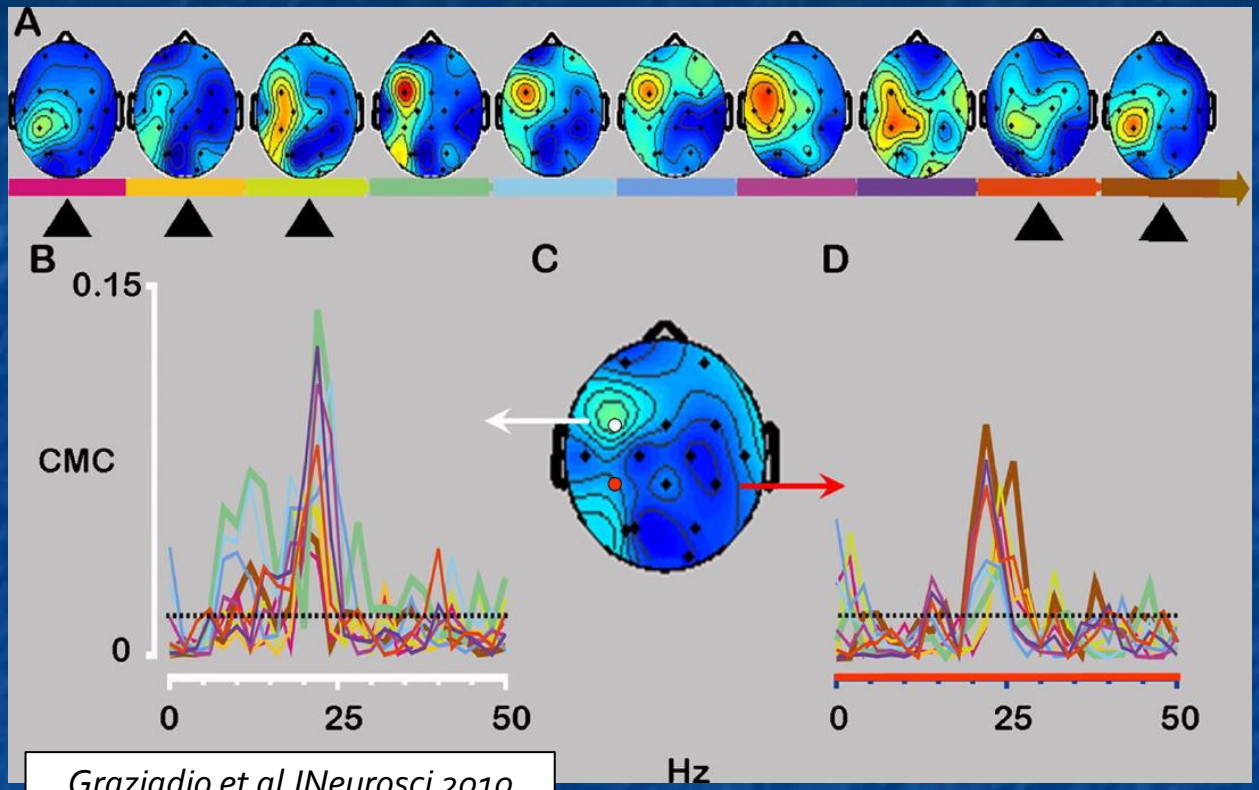
CM-Synchrony Sensory counterpart



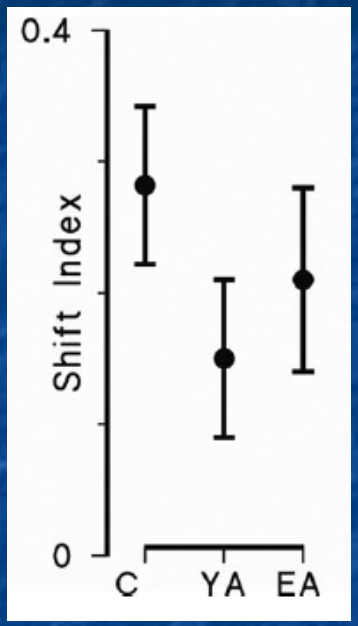
Graziadio et al JNeurosci 2010

CM-Synchrony networks fluctuate in time, with about 15-20% of parietal prevalence

CM-Synchrony
Sensory counterpart



Graziadio et al JNeurosci 2010



30% CST fibers from the primary sensory areas and parietal operculum

Seo and Jang, Am J Neuroradiol 2013
Lemon Annu Rev Neurosci 2008

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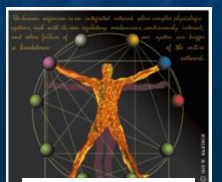
CM-Synchrony
Sensory counterpart

Somatosensory inflow
has a critical role in the
cortico-muscular control

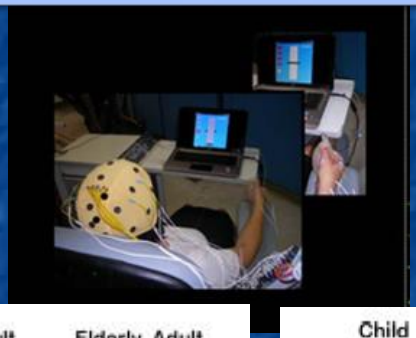
CM-Synchrony development

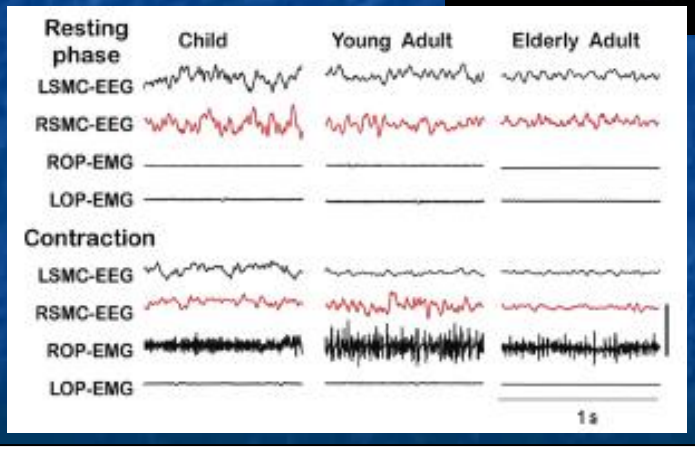


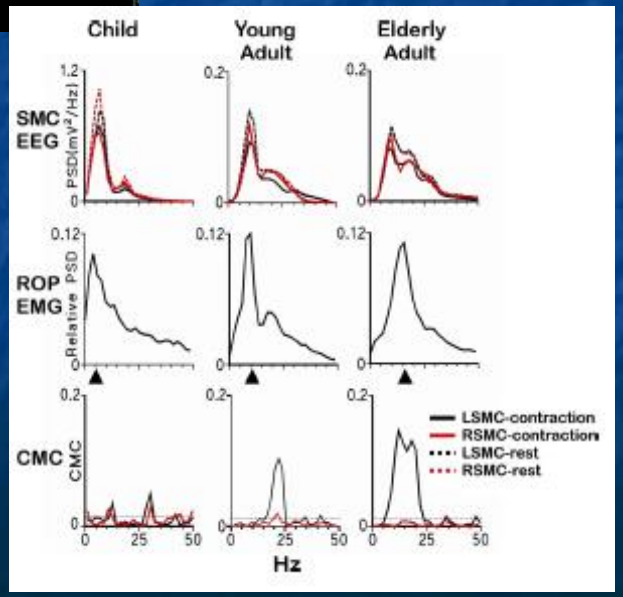
CM-Synchrony development

Synchrony between cortical and muscular activity:

corticospinal system activities tune along life

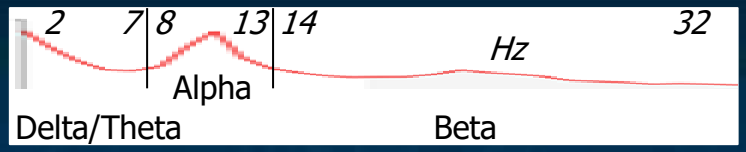


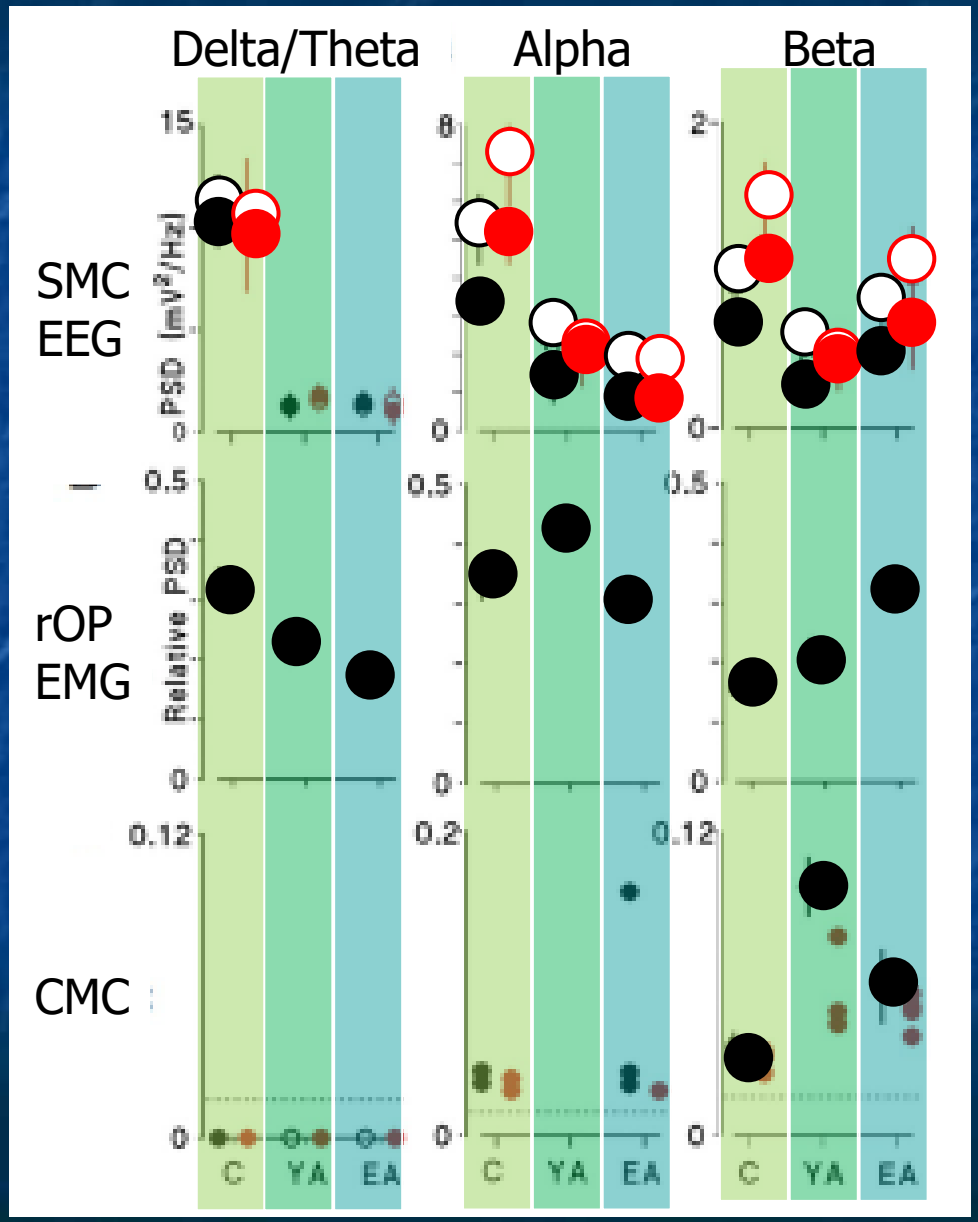




Graziadio et al JNeurosci 2010
(32 hv : 12 children, 10 young adult, 10 elderly adult)

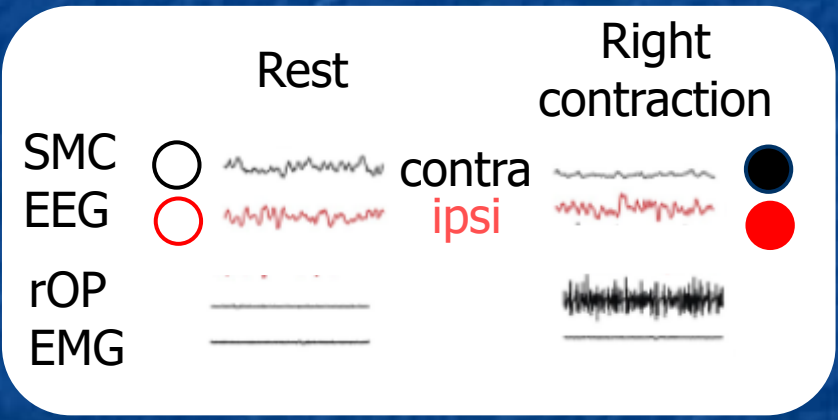
CM-Synchrony development





Synchrony between cortical and muscular activity:

corticospinal system activities tune along life

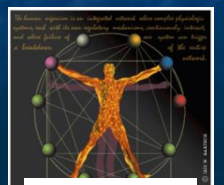


Graziadio et al JNeurosci 2010
(32 hv : 12 children, 10 young adult, 10 elderly adult)

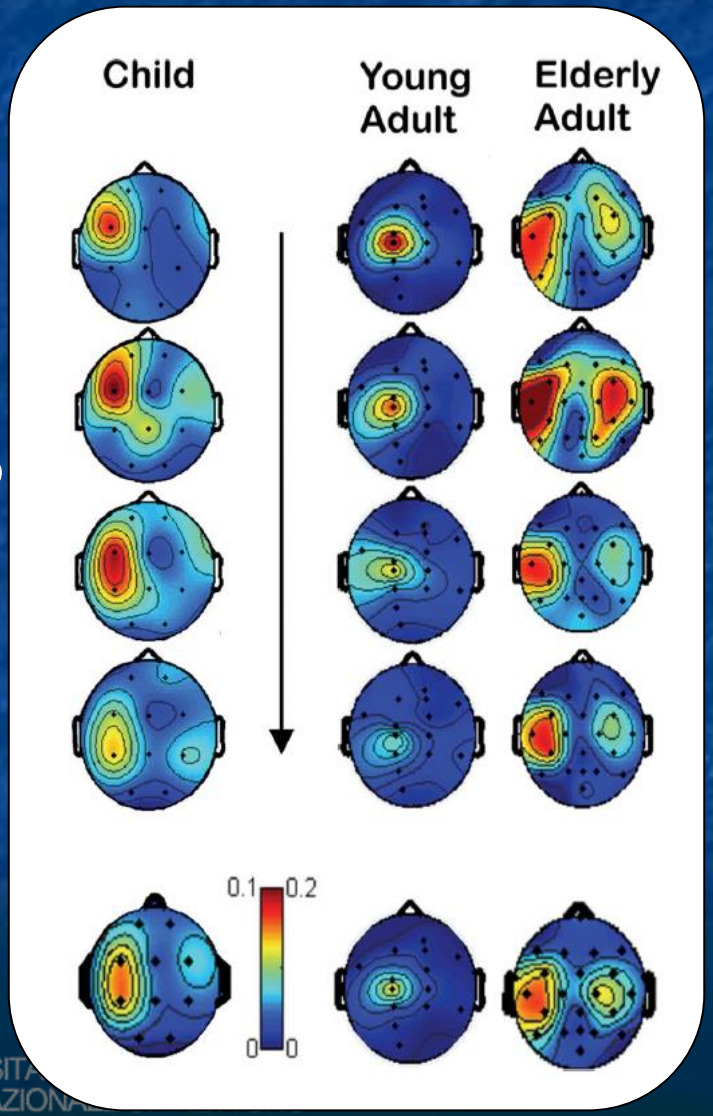
CM-Synchrony Development

With maturation,
neuronal communication
within the corticospinal system
increases

- the frequencies (f) of activity fluctuations
- f-specific reactivity (rest>movement)
- contra vs. ipsi lateral specific reactivity



CM-Synchrony networks modify along life



Graziadio et al JNeurosci 2010
(32 hv : 12 children, 10 young adult, 10 elderly adult)

CM-Synchrony Networks along lifespan

with maturation,
neuronal networks
controlling contralateral handgrip
increases

- Contra-lateral focal involvement
- Pre- vs. post-central involvement
- Stability during the execution

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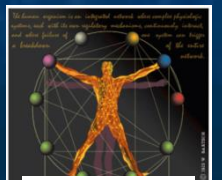
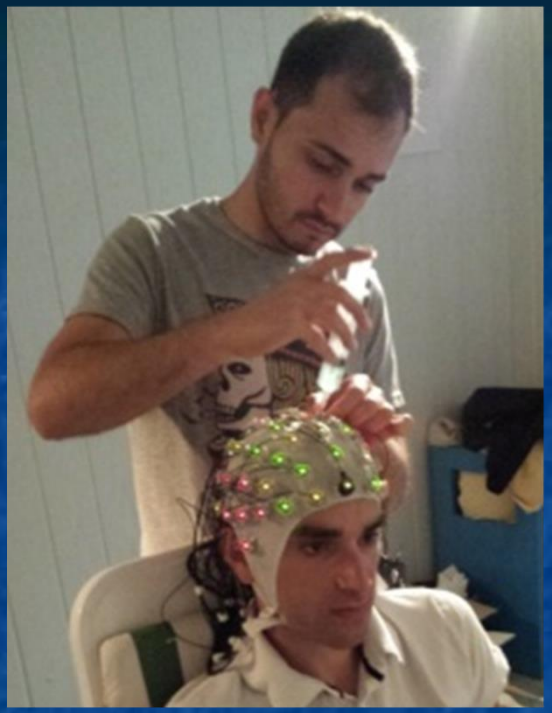
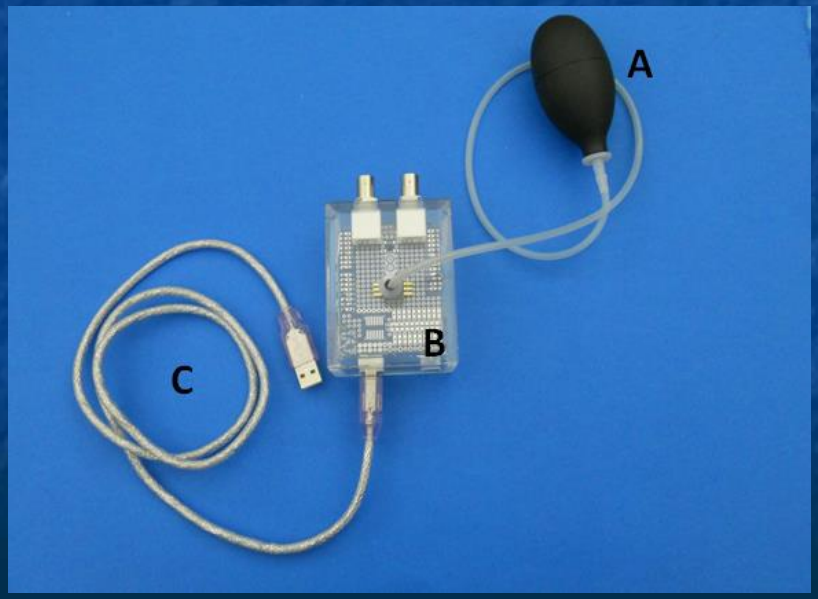
CM - Synchrony Visual feedback



CM - Synchrony Visual feedback



Padalino et al Brain Top 2021
Porcaro et al IntJNeuraSyst 2018
Tomasevic et al MSJ 2013
Pittaccio et al HBM 2011
Tecchio et al Neurosci 2008
Porcaro et al HBM 2008
Tecchio et al Neurosci 2006
Tecchio et al ExpBrainRes2006



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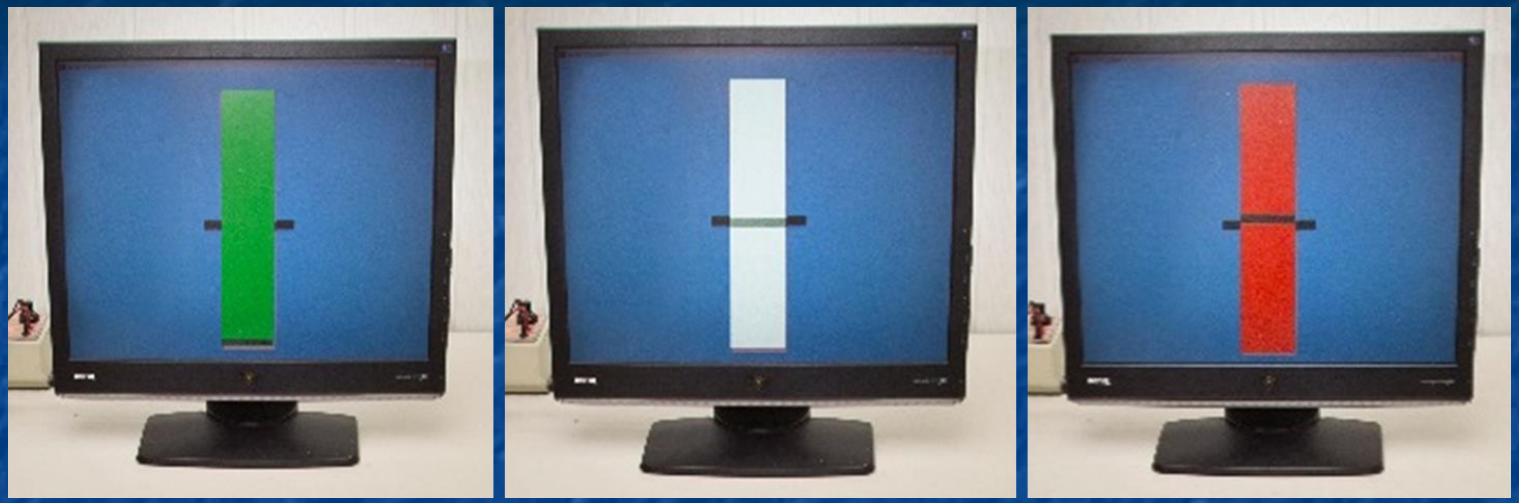
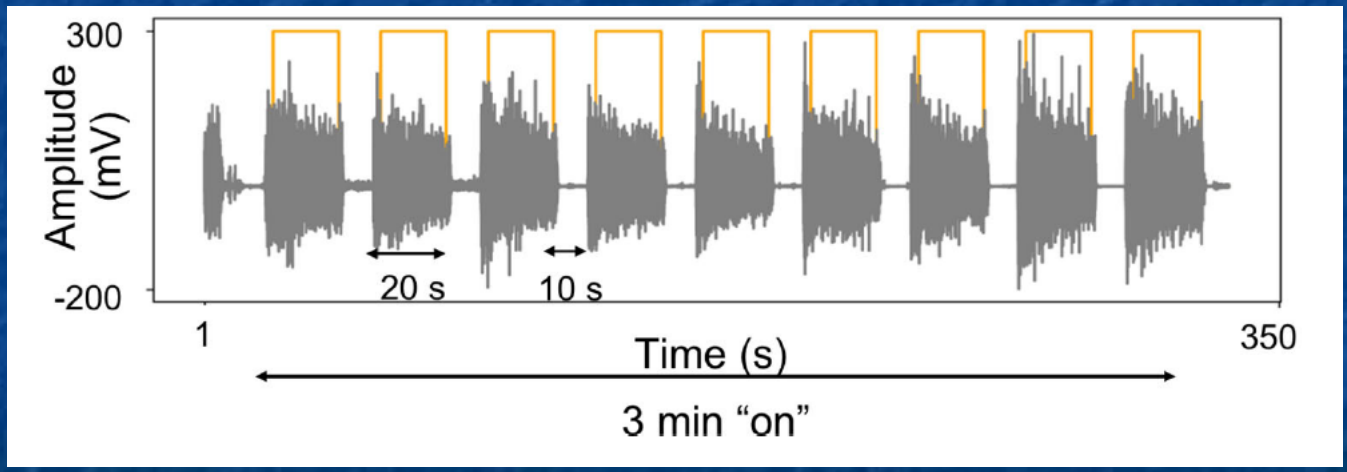
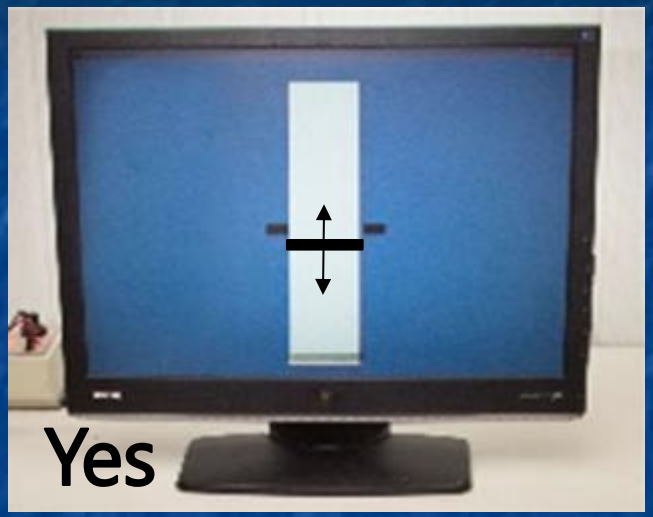
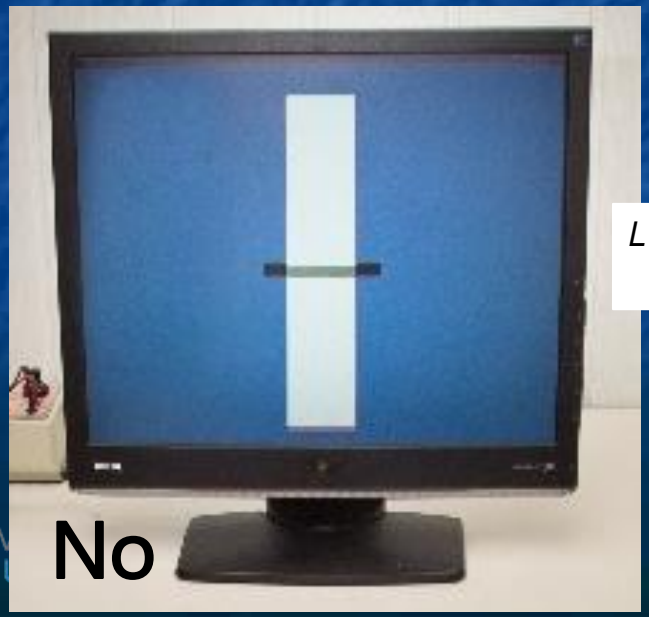




L'Abbate , Armonaite et al Neurosci 2022
18 young HV

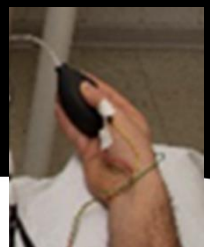
Visual feedback

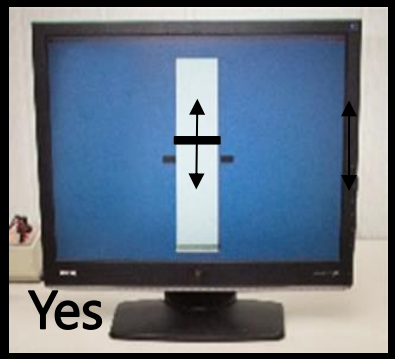




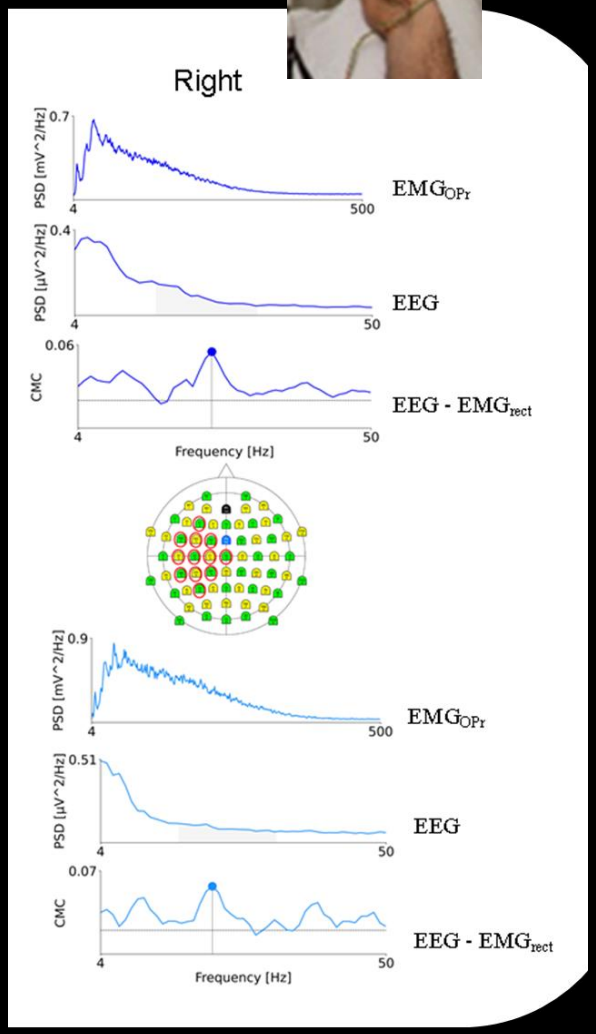
L'Abbate , Armonaite et al Neurosci 2022
18 young HV

handgrip





Visual feedback



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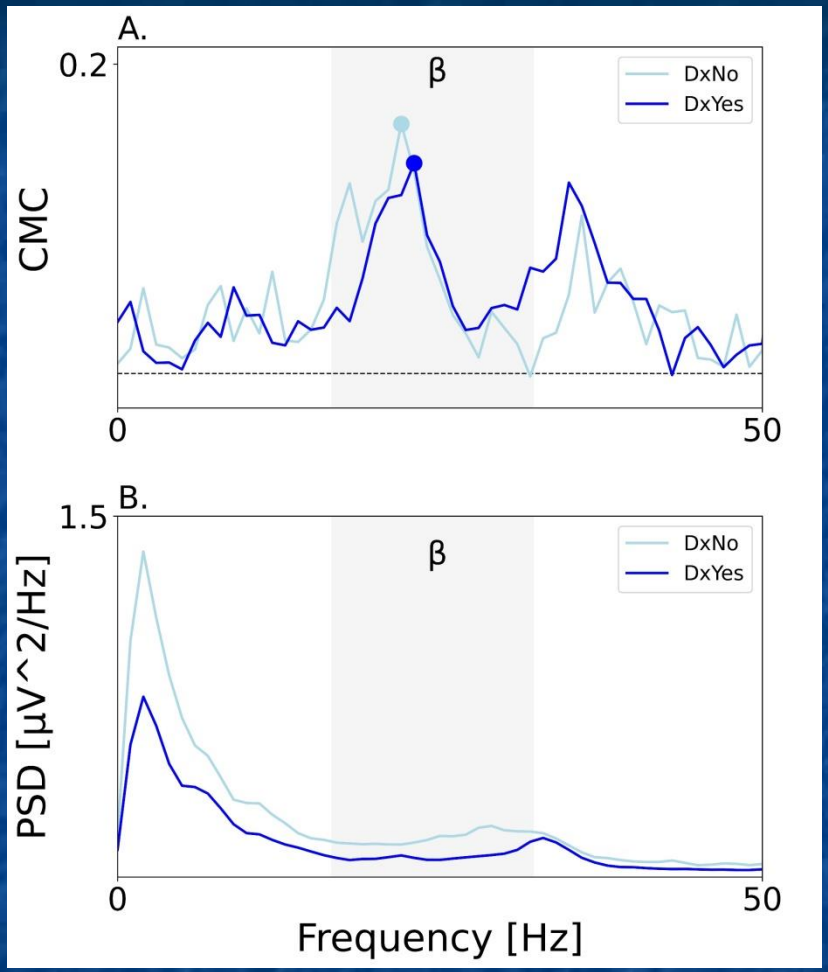
18 young HV

CM - Synchrony
Visual feedback



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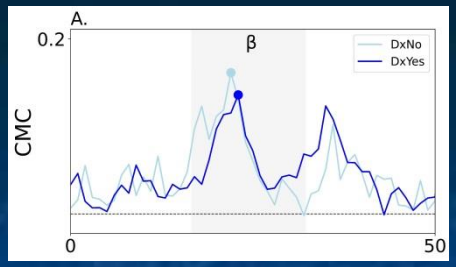
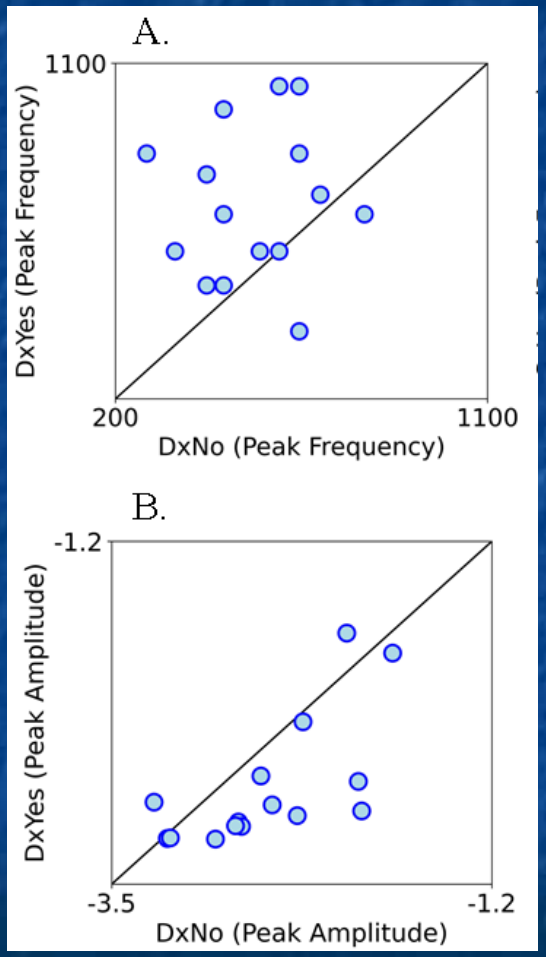
CM - Synchrony Visual feedback



CMC

frequency

amplitude



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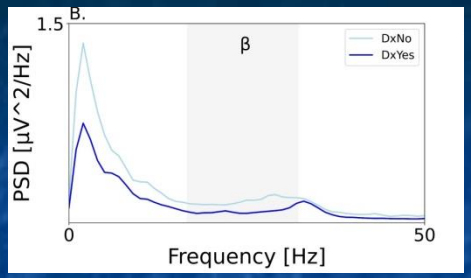
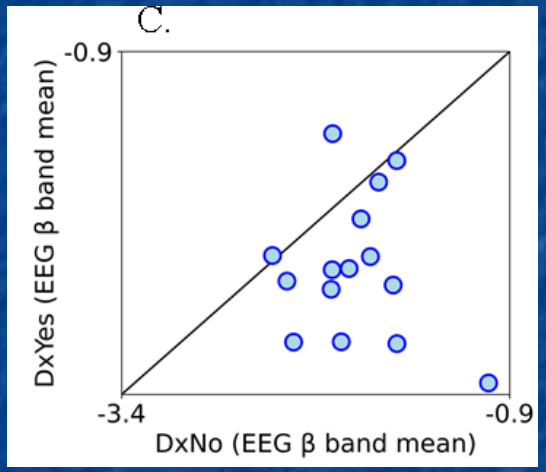
18 young HV

CM - Synchrony Visual feedback



Beta PSD



L'Abbate , Armonaite et al Neurosci 2022
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CM-Synchrony Visual feedback

With respect to a task typical of everyday repertoire, a weak handgrip

when providing an unusual visual information

- CMC peak frequency increased
- CMC peak amplitude reduced
- Cortical involvement increased

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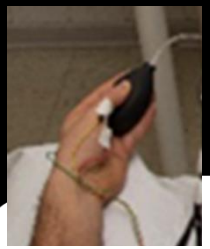
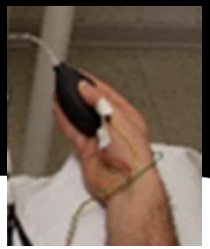
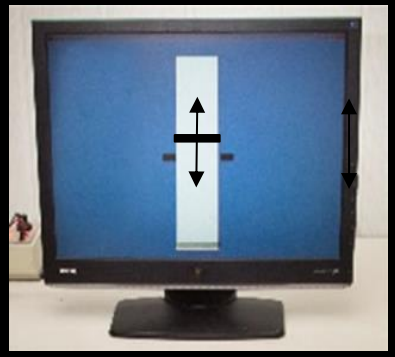
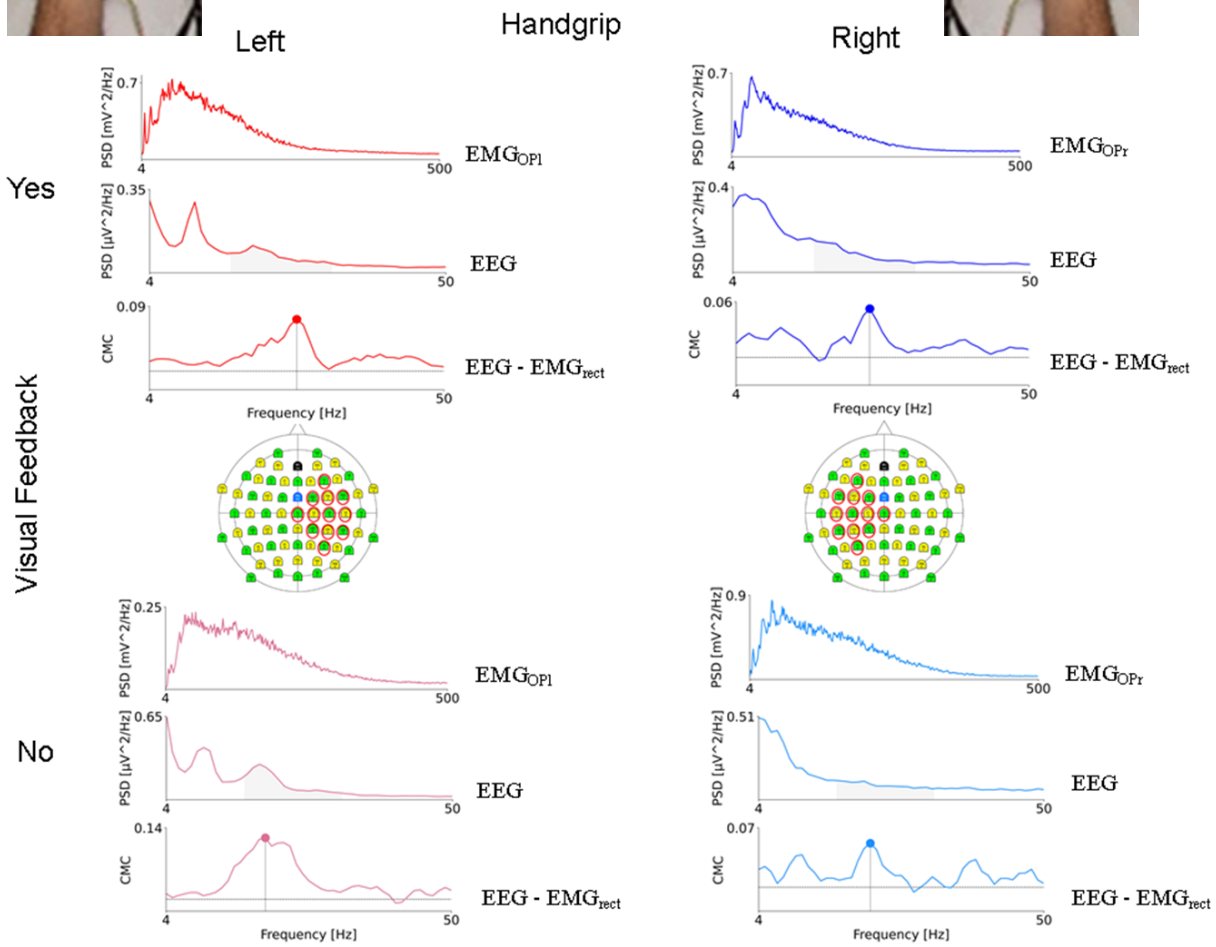
L'Abbate , Armonaite et al Neurosci 2022
18 young HV

CM-Synchrony
Hemibody dominance









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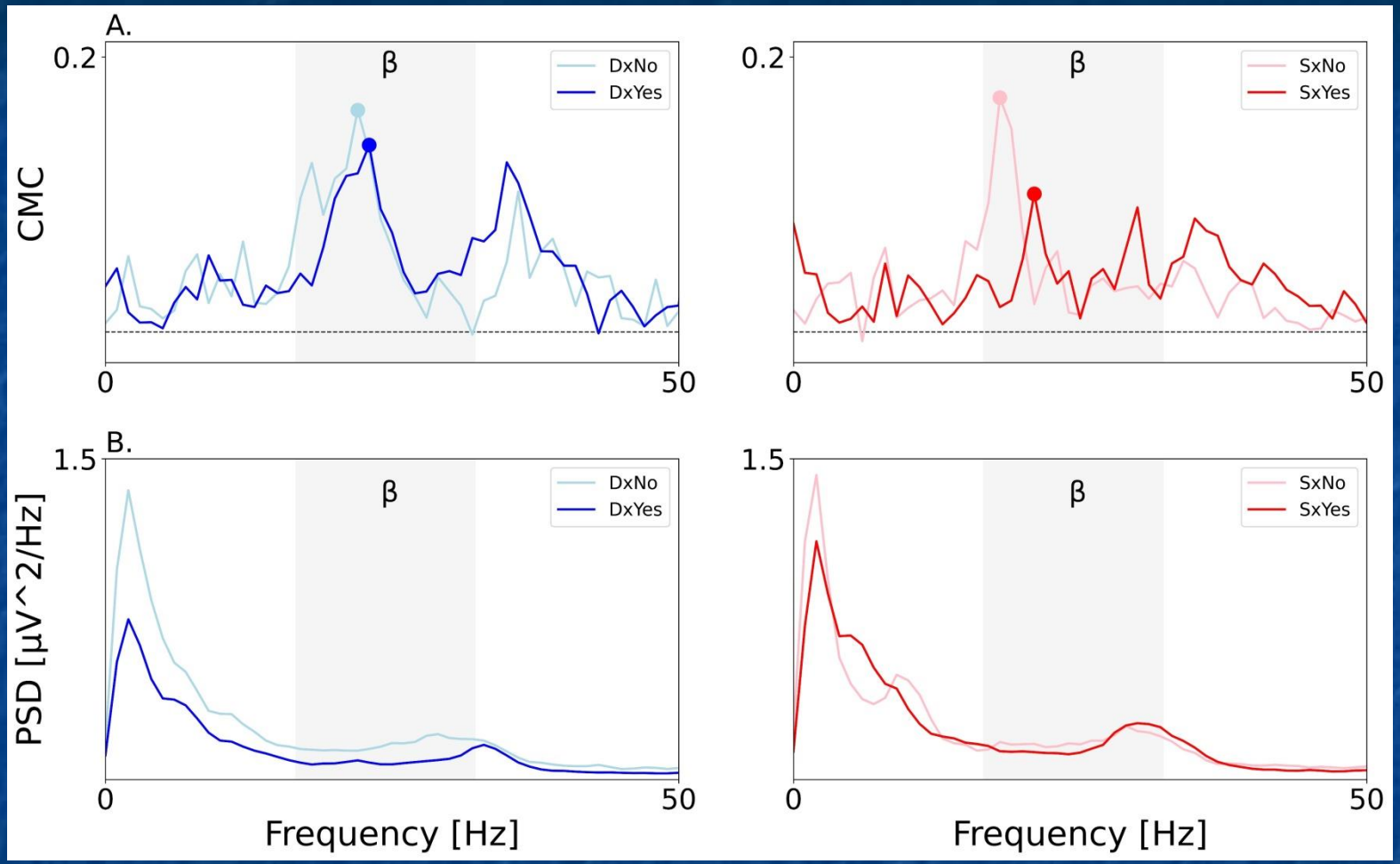
CM-Synchrony
Hemibody dominance



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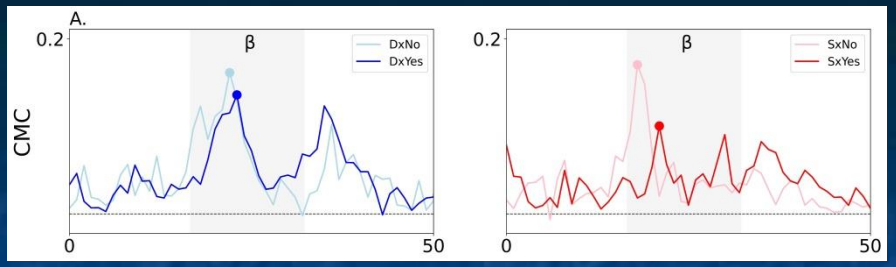
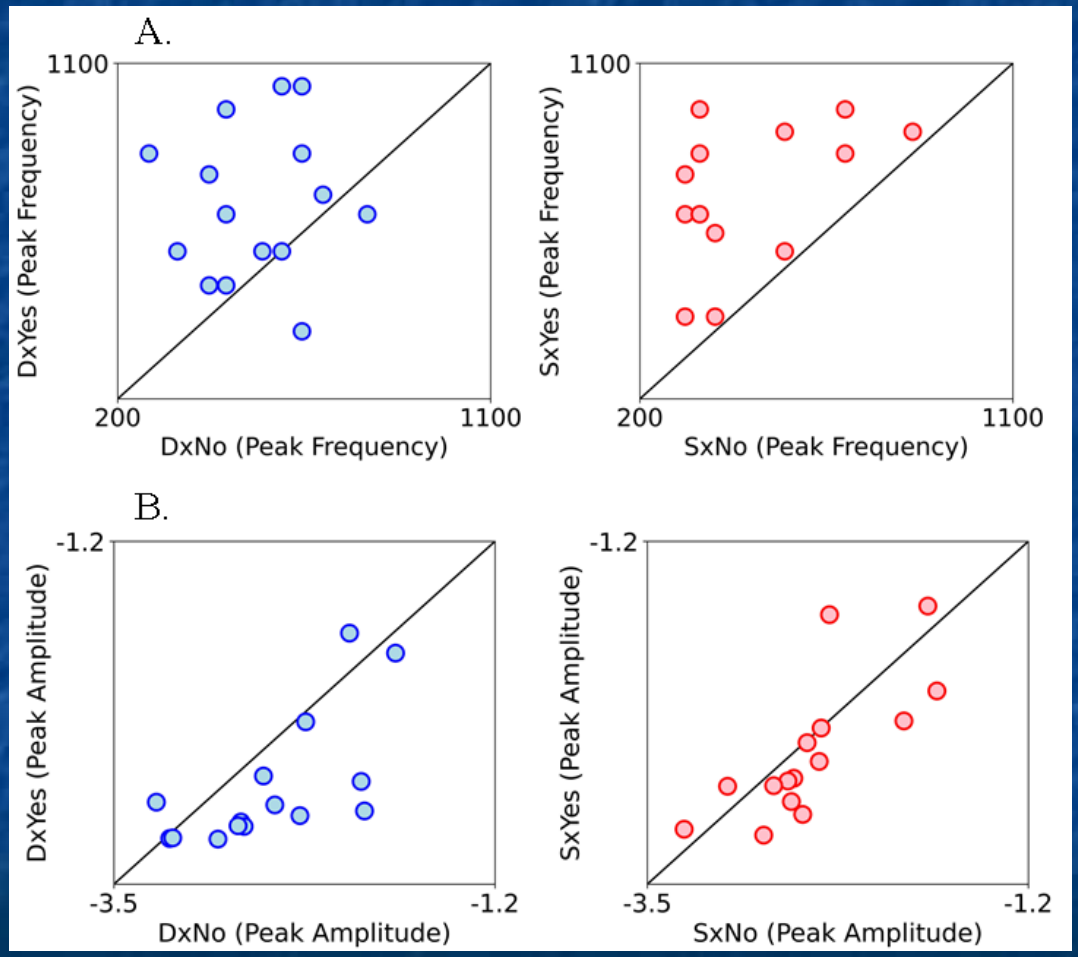
CM-Synchrony
Hemibody dominance



CMC

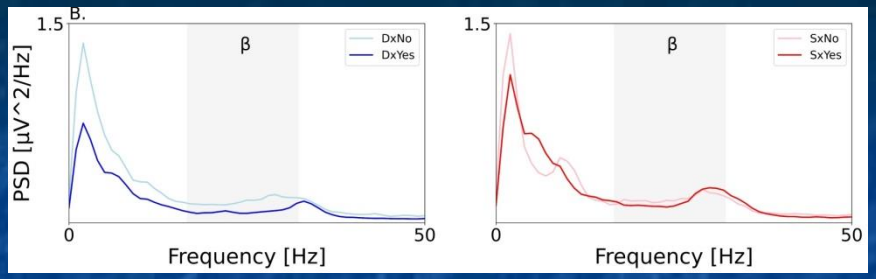
frequency

amplitude

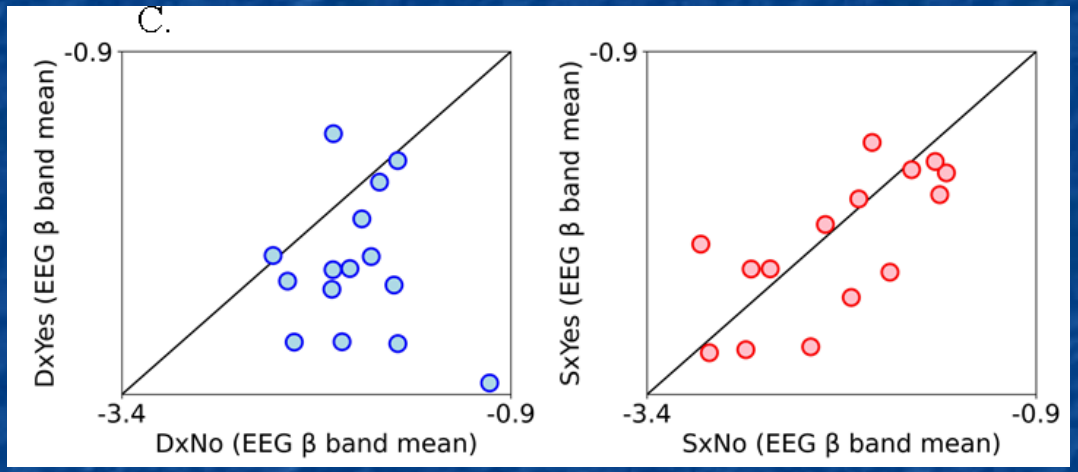


L'Abbate , Armonaite et al Neurosci 2022
18 young HV

CM-Synchrony
Hemibody dominance



Beta PSD



L'Abbate , Armonaite et al Neurosci 2022
18 young HV

CM-Synchrony Hemibody dominance

Execution with the dominant (right)
or non-dominant (left) hand
showed

no differences

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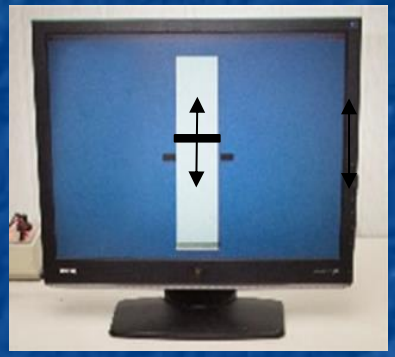
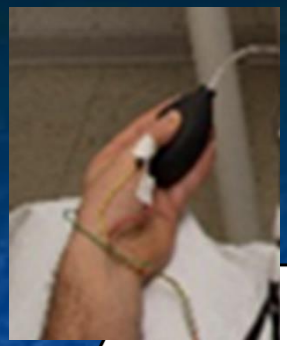
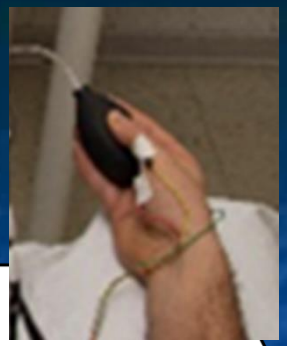
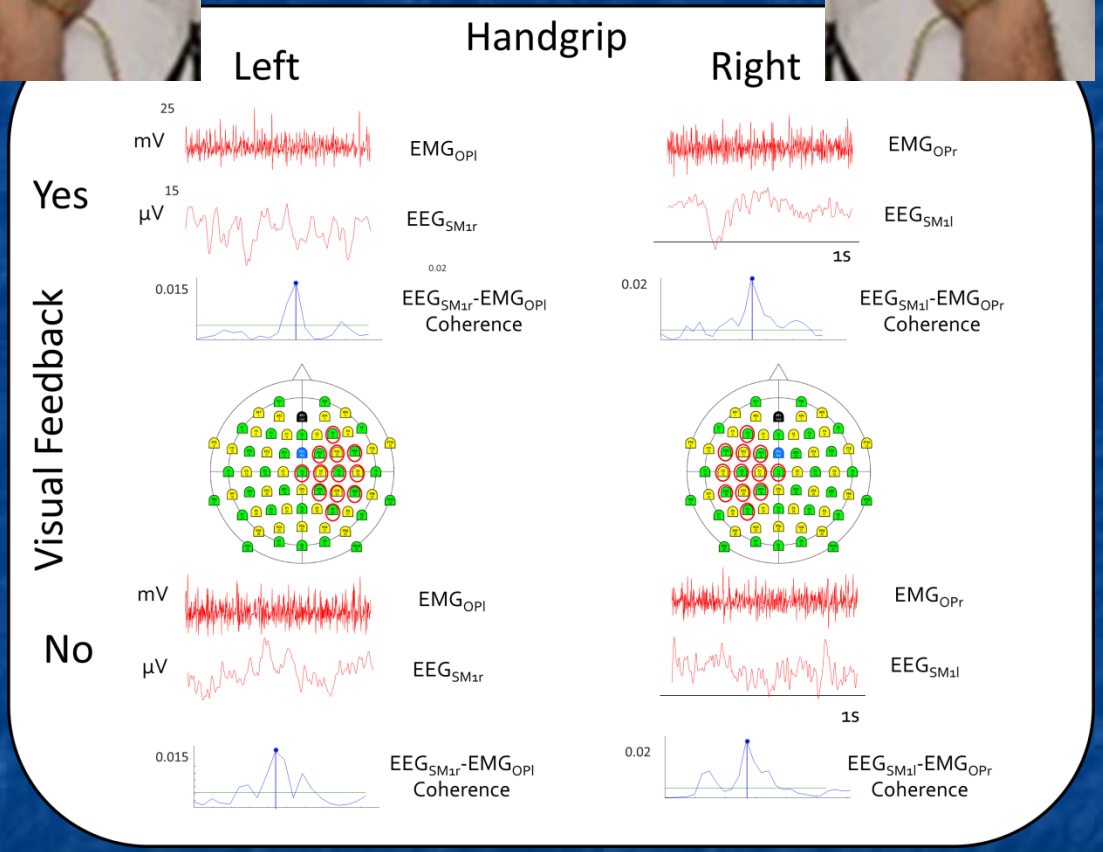
18 young HV







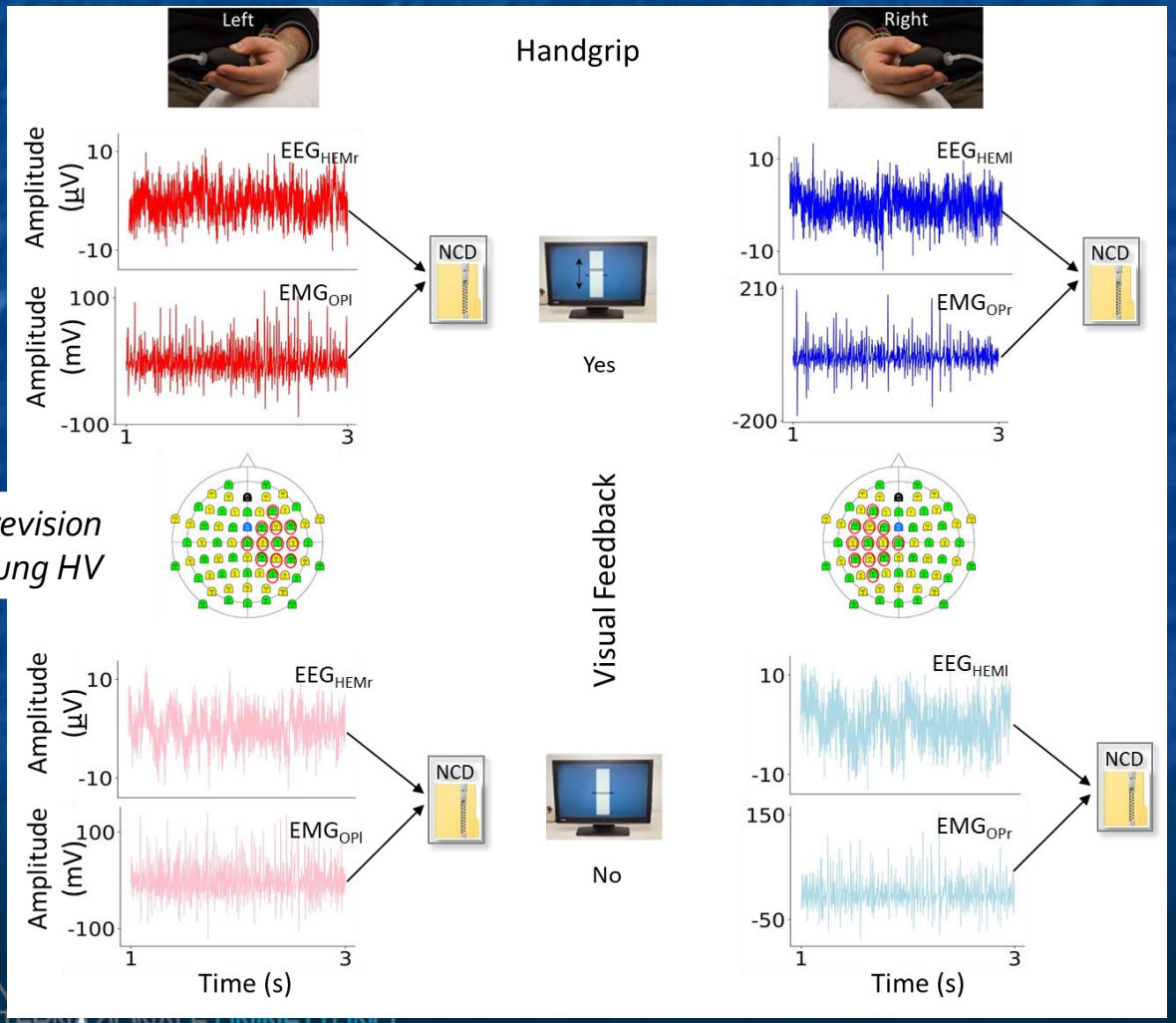


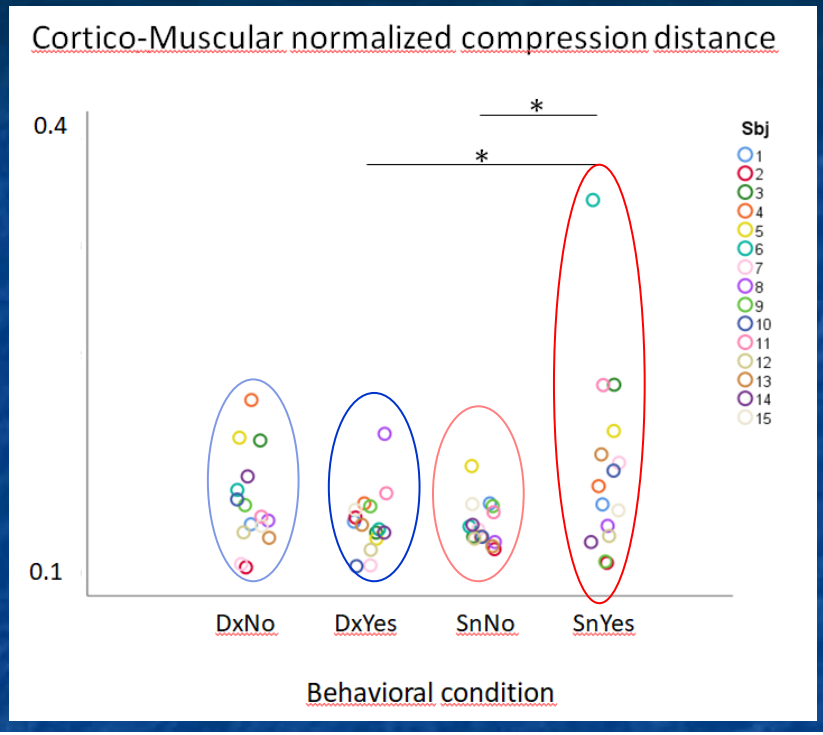
Pascarella, Gianni et al in revision
18 young HV

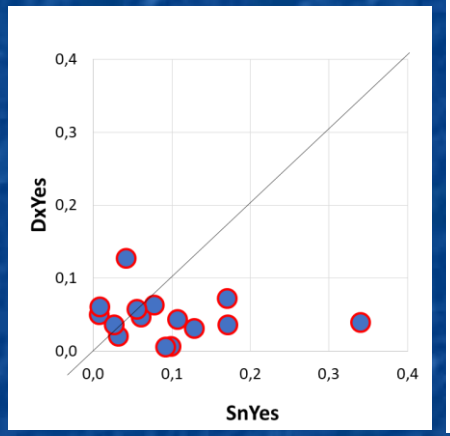
CM-Synchrony sensed by NCD instead of CMC

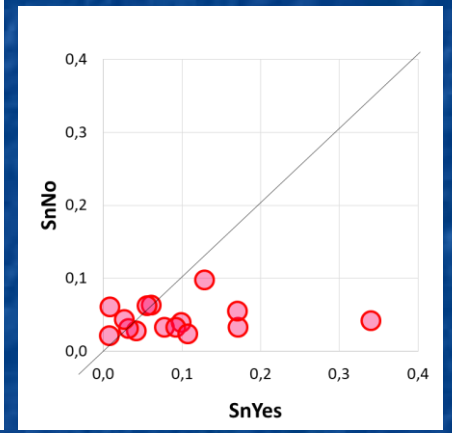
NCD
Normalized
Compression
Distance

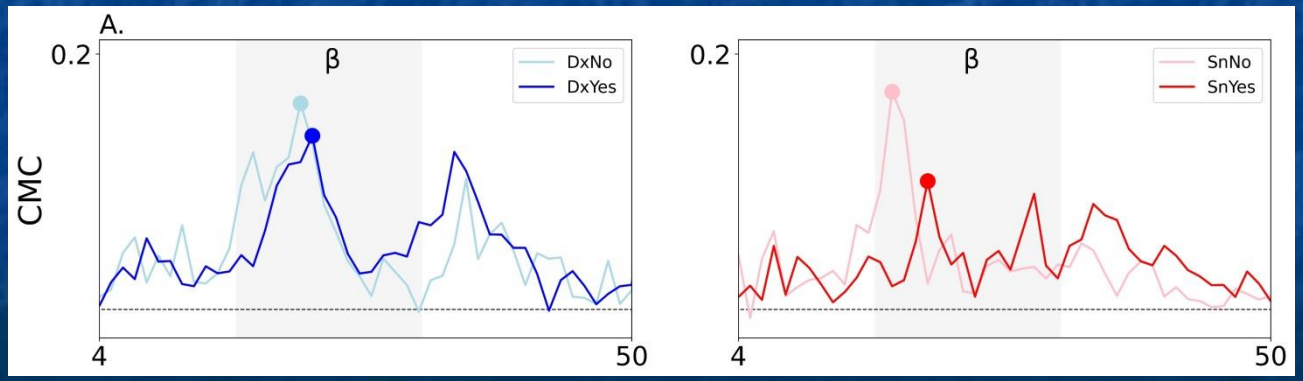
Pascarella, Gianni et al in revision
18 young HV











Pascarella, Gianni et al in revision
18 young HV

CM-Synchrony Hemibody dominance

Execution with the dominant (right)
or non-dominant (left) hand
showed that

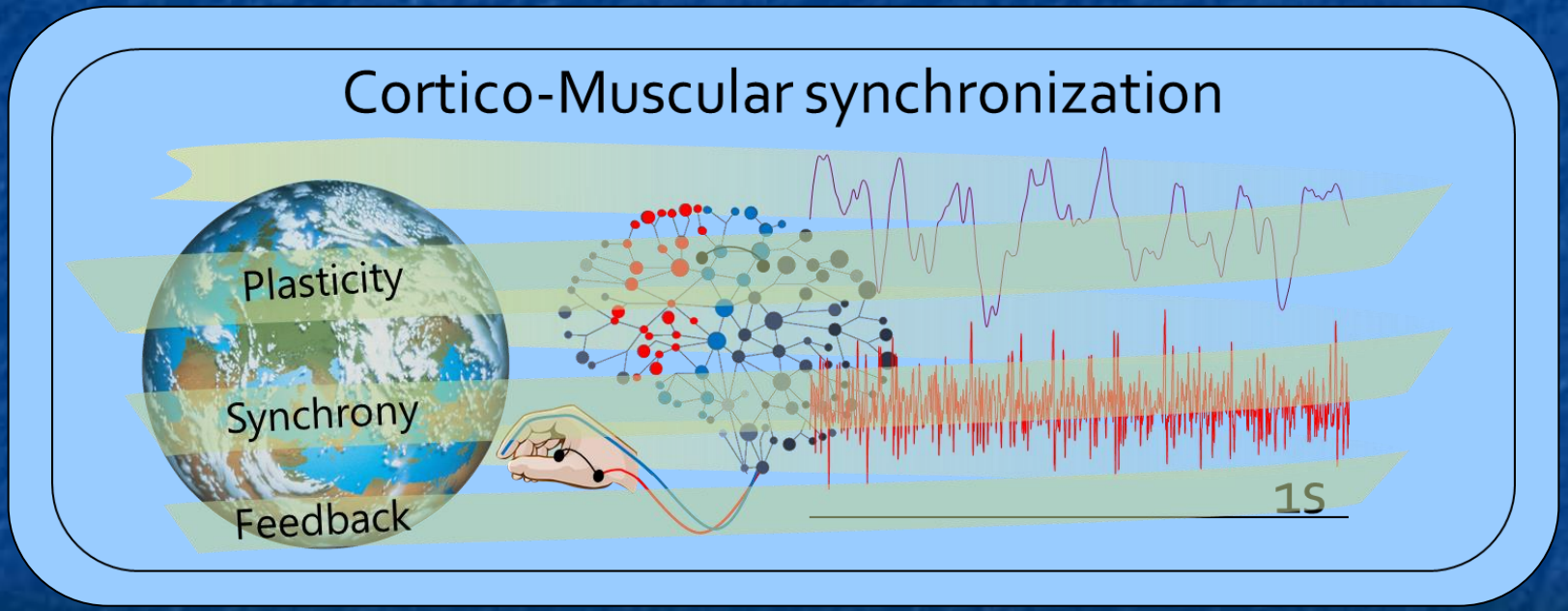
the non-dominant hand synchronizes worst than the dominant
when it needs to manage novelty, to learn a new task

Neuroscientists' new work is required to track CM - Synchrony by proper measures

Our 'Body and Brain' system works governed by a triadic principle

Feedback, Synchrony, Plasticity

will be better known through the knowledge of



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Triadic principle

Feedback, Synchrony, Plasticity

Electroceuticals

the ‘right’ signal to neuromodulate

37.000

Kevin Tracey

World Economic Forum 2018

Testimonial for Top10 Electroceuticals

478.000

Franca Tecchio

Per curare il cervello paliamogli in frattale

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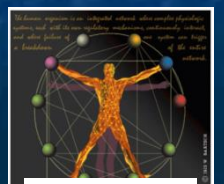

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Cortico-Muscular Network Intera

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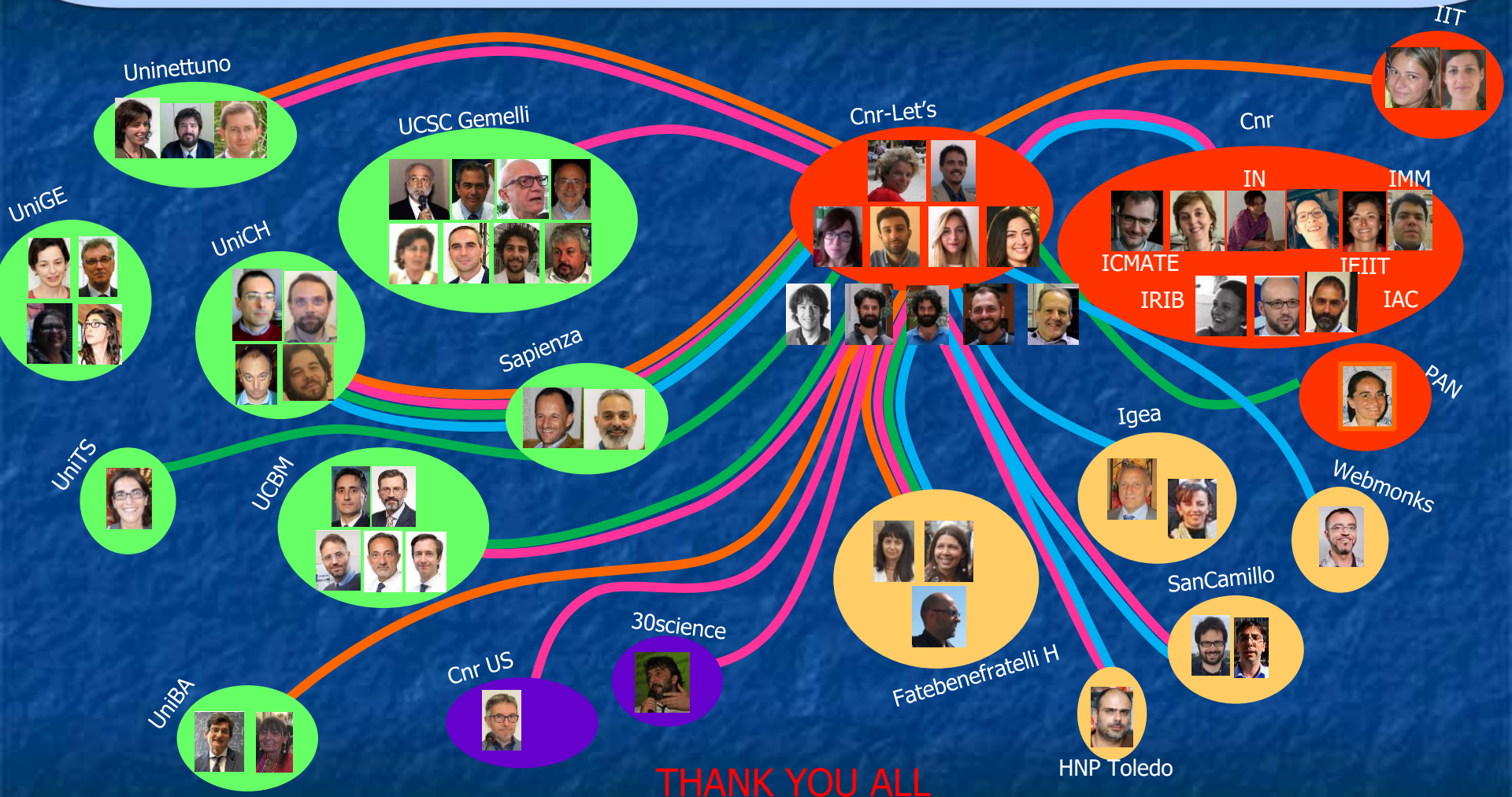

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