

Representation of hand shape in the human resting-state activity



Yara El Rassi¹, Giacomo Handjaras¹, Andrea Leo¹, Paolo Papale^{1,2}, Maurizio Corbetta³, Emiliano Ricciardi¹, Viviana Betti⁴

¹Molecular Mind Laboratory, IMT School for Advanced Studies Lucca, Italy, ²Department of Vision & Cognition, Netherlands Institute for Neuroscience (KNAW), Amsterdam, The Netherlands, ³Department of Neurology, University of Padua, Italy, ⁴Department of Psychology, Sapienza, Italy



BACKGROUND

At rest, regions of similar functionality show spontaneous slow-frequency fluctuations that are temporally correlated.

Recent studies, mainly in the visual areas, suggest that these functional topographies at rest retain striking similarities with the patterns elicited by specific tasks (Kim, 2019).

A number of synergies with low-dimensionality of hand movements are invariant across subjects with a fixed cortical representational structure (Belic&faisal,2015).

AIMS

Aim: Map the representation of the natural hand in resting state: understand what is coded in resting state

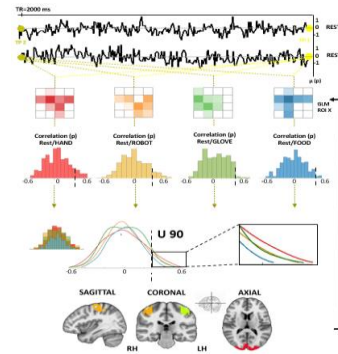
H: Spontaneous activity will represent natural human hands more strongly than controls:

- in the first resting state, before any presentation of hands
- in the fronto- parietal hand area, but not in the early visual areas

METHODS



U90 ANALYSIS



ACKNOWLEDGMENTS

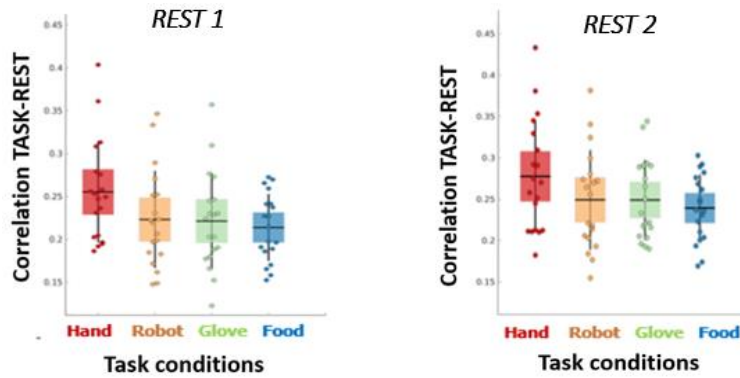
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REFERENCES

Belic, J.J. et al. (2015). Decoding of human hand actions to handle missing limbs in neuroprosthetics. *Frontiers in neuroscience* 9, 27
Kim, D. et al. (2019). Spontaneously emerging patterns in human visual cortex and their functional connectivity are linked to the patterns evoked by visual stimuli. *bioRxiv* 518712

RESULTS

LEFT SOMATOMOTOR AREA

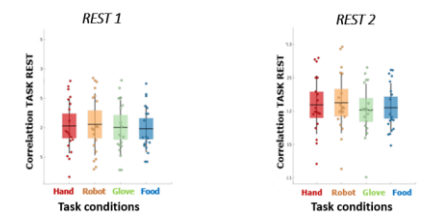


In the left somatomotor area, a two-way ANOVA shows a significant main effect of visual categories ($F(3,54)=3.469$, $p=.022$, $\eta^2=.162$), no effect of rest over time ($F(1,18)=.346$, $p=.564$, $\eta^2=.019$), and no interaction between rest time and categories ($F(3,54)=.380$, $p=.767$, $\eta^2=.021$).

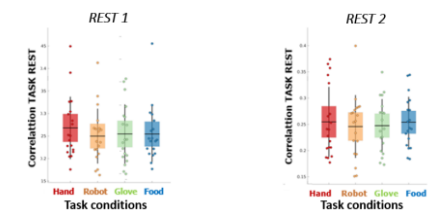
A posthoc analysis shows a significant linear trend in Rest1 ($F(1,18)=9.055$, $p=.008$, $\eta^2=.335$)

A searchlight analysis shows the task-rest association critically depends on the postcentral gyrus activity.

RIGHT SOMATOMOTOR AREA



EARLY VISUAL AREAS



In the right somatomotor area and early visual areas, the two-way ANOVA showed no significant main effect of conditions, no significant main effect of rest over time, and no significant interaction between rest, time, and condition.

CONCLUSIONS

Multi-voxel activity of natural hand stimuli in the left sensorimotor area was most represented in resting-state activity compared to the robot hand, glove, and food. This effect was not found in the right sensorimotor area or early visual areas.

No differences were found between the pre and post task resting state activities.

Spontaneous activity, despite its apparently noisy structure, reliably encodes the natural human hand.

This is the first experiment to describe the representation of hands in resting-state activity in fronto-parietal somatomotor areas by looking at the relationship between evoked and spontaneous activity.

This study may suggest that the human hand represents a *prior* for the effective motor interaction with the external environment.

yara.elrassi@imtlucca.it