

# Spatio-temporal dynamics of noun and verb naming in early bilinguals

Shuang Geng<sup>1</sup>, Lucia Amoruso<sup>1,2</sup>, Nicola Molinaro<sup>1,2</sup>, Manuel Carreiras<sup>1,2,3</sup>

<sup>1</sup> BCBL, Basque Center on Cognition, Brain and Language, 2 Ikerbasque, Basque Foundation for Science, 3 University of the Basque Country UPV/EHU



BASQUE CENTER  
ON COGNITION, BRAIN  
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## INTRODUCTION

• Despite decades of research, the question of how conceptual knowledge is represented and retrieved from memory remains controversial.

• Previous evidence about how nouns and verbs are represented in the brain is mixed, with some studies reporting overlapping functional neural networks and others a differential engagement of ventral and dorsal pathways, respectively [1-2].

• Furthermore, within this context, little is known about how conceptual knowledge is represented and accessed in bilingual speakers [3].

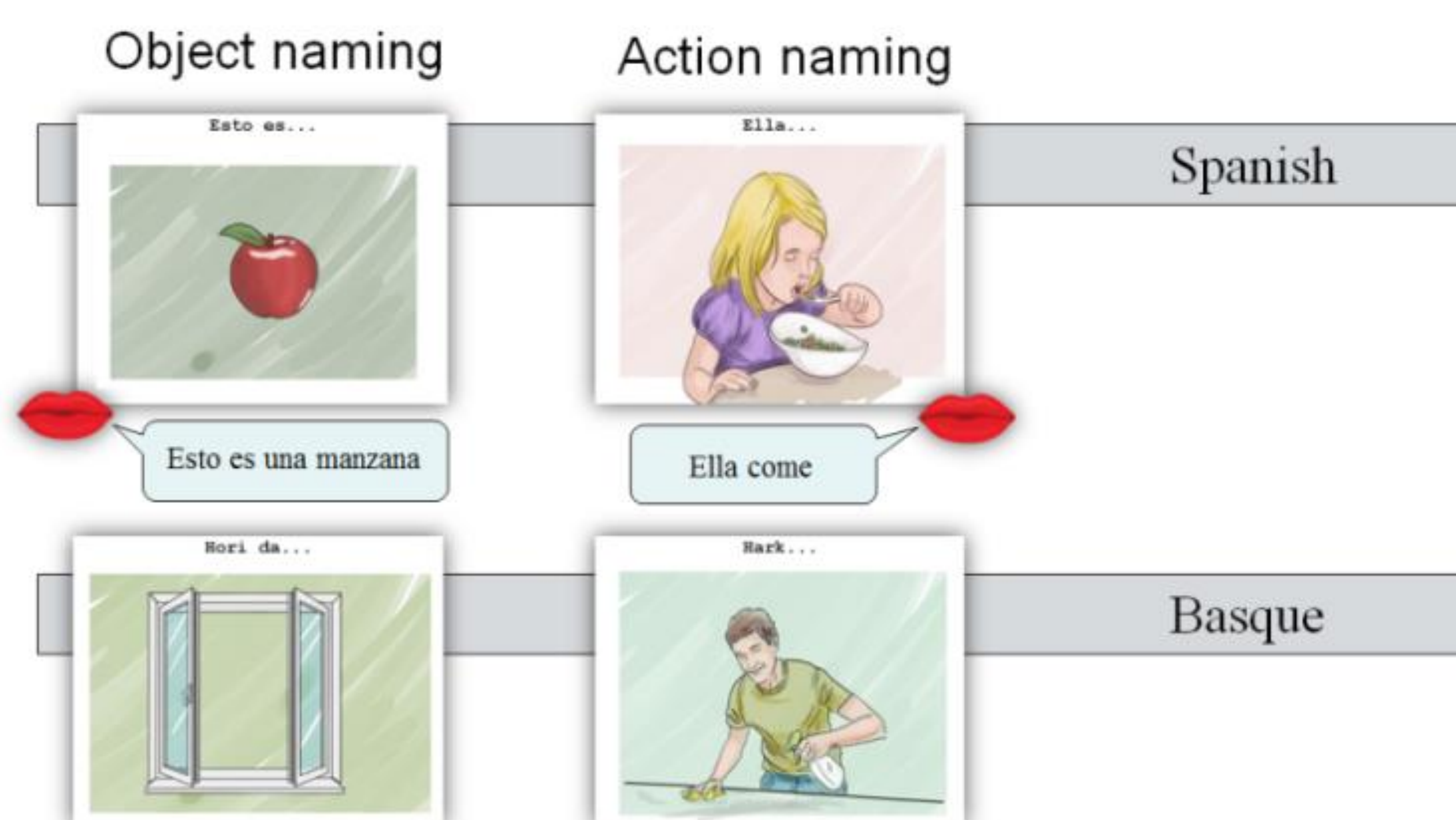
• Here, we aimed to address how oscillatory dynamics mediate the lexico-semantic retrieval of nouns and verbs and whether this process differed or not across languages.

## METHODS

• **MEG** data were acquired with a 306-channel ELEKTA Neuromag system.

• **20 Basque-Spanish balanced bilinguals** (4 male, M = 24.75; SD = 3.82)

• **Picture-naming task:** Pictures were matched for familiarity, frequency, and length. Noun and verb production were asked in the context of a brief sentence that had to agree in number-gender and subject-verb, respectively.



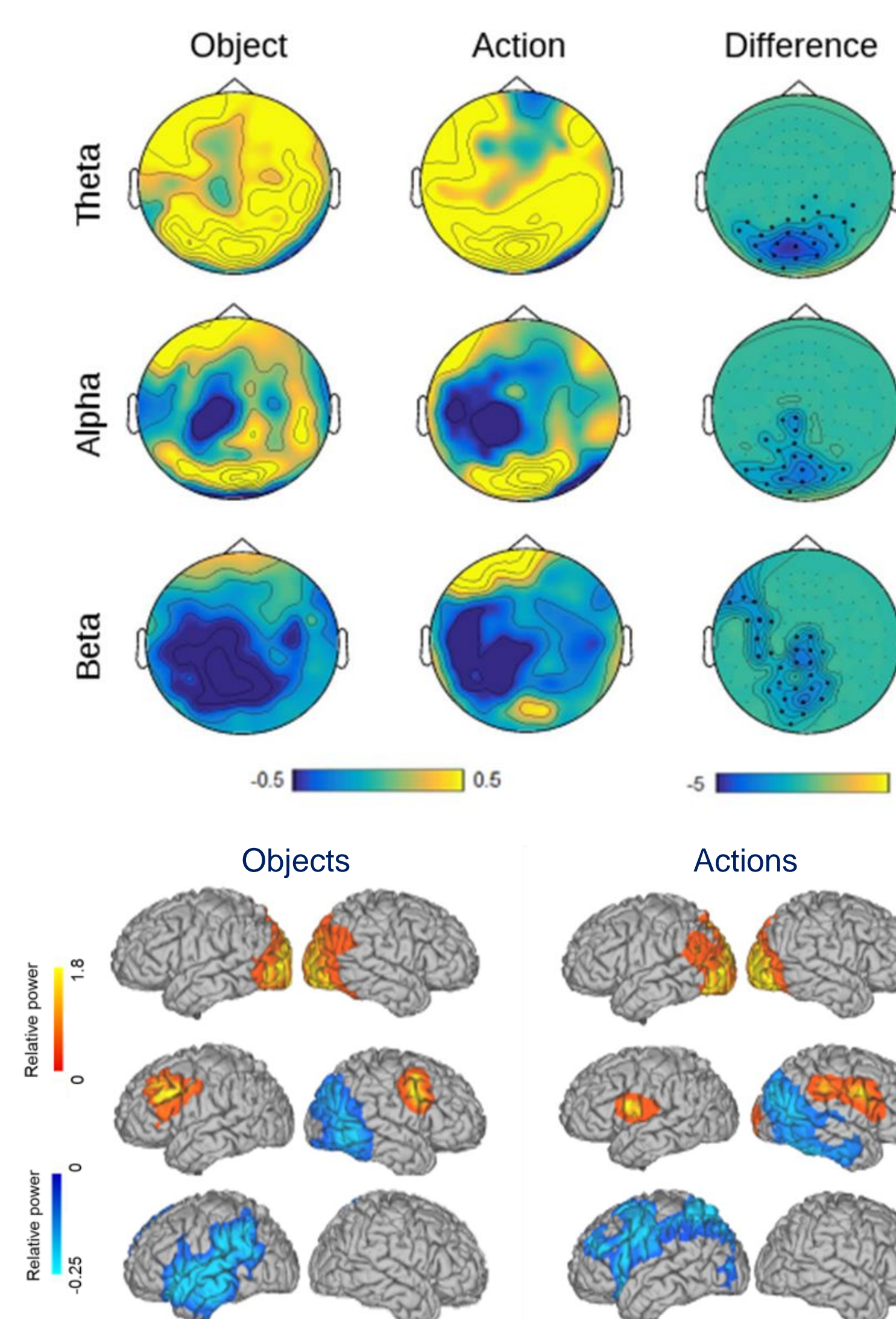
- Data were pre-processed and analyzed using FieldTrip.
- TFR analysis on -0.5 1sec cleaned segments.
- Cluster-based permutation test.
- Source reconstruction of significant sensor effects using Beamforming.

## REFERENCES

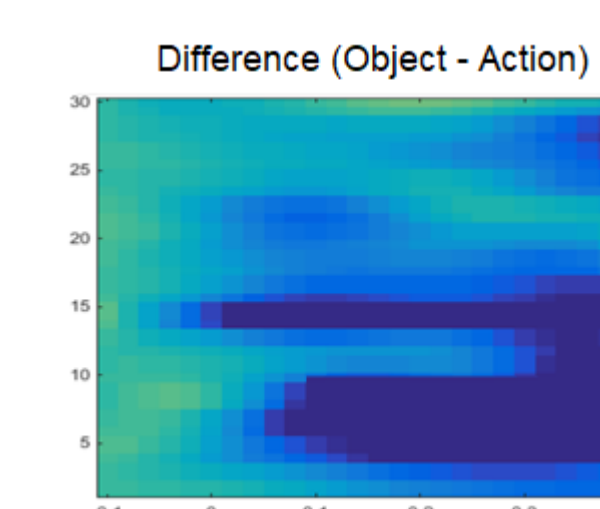
- [1] Vigliocco, G., Vinson, D. P., Druks, J., Barber, H., & Cappa, S. F. (2011). Nouns and verbs in the brain: a review of behavioural, electrophysiological, neuropsychological and imaging studies. *Neuroscience & Biobehavioral Reviews*, 35(3), 407-426.
- [2] Lubrano, V., Filleron, T., Démonet, J. F., & Roux, F. E. (2014). Anatomical correlates for category-specific naming of objects and actions: A brain stimulation mapping study. *Human brain mapping*, 35(2), 429-443.
- [3] Pang, E. W., & MacDonald, M. J. (2012). An MEG study of the spatiotemporal dynamics of bilingual verb generation. *Brain research*, 1467, 56-66.

## RESULTS

### (1) Objects < Actions in Spanish



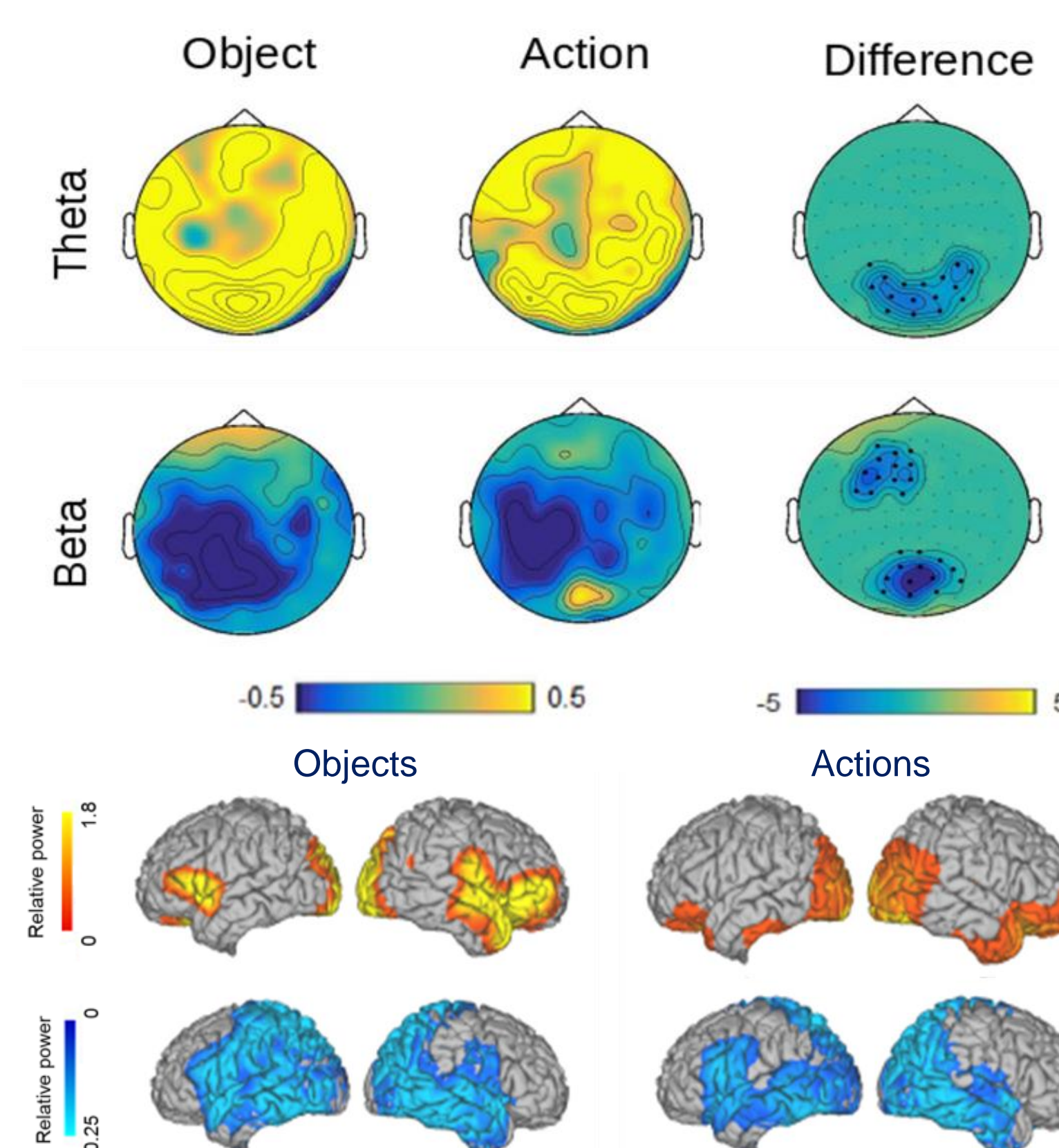
**200-400ms:** Power decreases for objects as compared to actions in the theta (4-8Hz), alpha (8-12Hz) and beta (13-28Hz) bands.



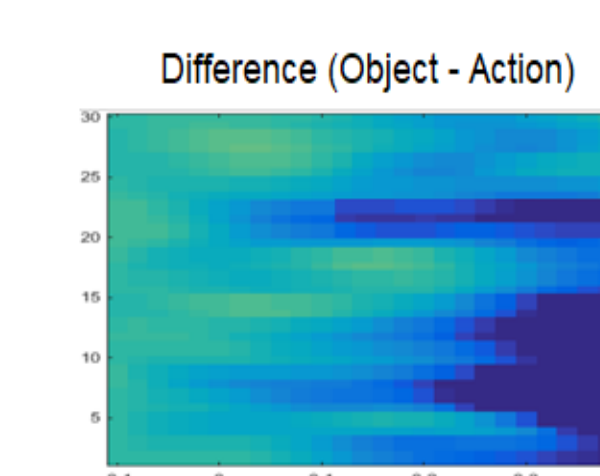
#### Source localization:

- similar theta power increases in bilateral occipital regions for both categories.
- similar alpha power increases and decreases in frontal and occipito-temporal regions, respectively for both categories.
- left-lateralized beta power decreases in inferior parietal, anterior temporal and inferior frontal regions for nouns and in fronto-parietal regions for verbs.

### (2) Objects < Actions in Basque



**200-400ms:** Power decreases for objects as compared to actions in the theta (4-8Hz), and beta (13-28Hz) bands.



#### Source localization:

- similar theta power increases in bilateral frontal, temporal and occipital regions for both categories.
- Broad bilateral beta power decreases in parietal, temporal and occipital regions for both categories.

### (3) Spanish = Basque (all clusters > 0.05)

## CONCLUSIONS

• Our results are consistent with previous studies suggesting the recruitment of partially different networks during noun and verb processing, at least when underscoring semantic aspects [1-2].

• Moreover, our data also reveal the oscillatory dynamics subserving semantic category processing, with objects showing less power as compared to actions.

• Finally, our findings support the existence of common brain networks and similar oscillatory dynamics across languages during noun and verb processing in early bilinguals.

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[s.gheng@bcbl.eu](mailto:s.gheng@bcbl.eu)