



**QUEEN'S  
UNIVERSITY  
BELFAST**

## EEG study of the cortical representation and classification of the emotional connotations in words

Gu, Y., Poesio, M., & Murphy, B. (2014). *EEG study of the cortical representation and classification of the emotional connotations in words*. P81. Poster session presented at The Twenty Third Annual Computational Neuroscience Meeting: CNS\*2014, Quebec, Canada. <https://doi.org/10.1186/1471-2202-15-S1-P81>

### Document Version:

Publisher's PDF, also known as Version of record

### Queen's University Belfast - Research Portal:

[Link to publication record in Queen's University Belfast Research Portal](#)

### Publisher rights

© 2014 Gu et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License

(<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### General rights

Copyright for the publications made accessible via the Queen's University Belfast Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

### Take down policy

The Research Portal is Queen's institutional repository that provides access to Queen's research output. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact [openaccess@qub.ac.uk](mailto:openaccess@qub.ac.uk).

### Open Access

This research has been made openly available by Queen's academics and its Open Research team. We would love to hear how access to this research benefits you. – Share your feedback with us: <http://go.qub.ac.uk/oa-feedback>

POSTER PRESENTATION

Open Access

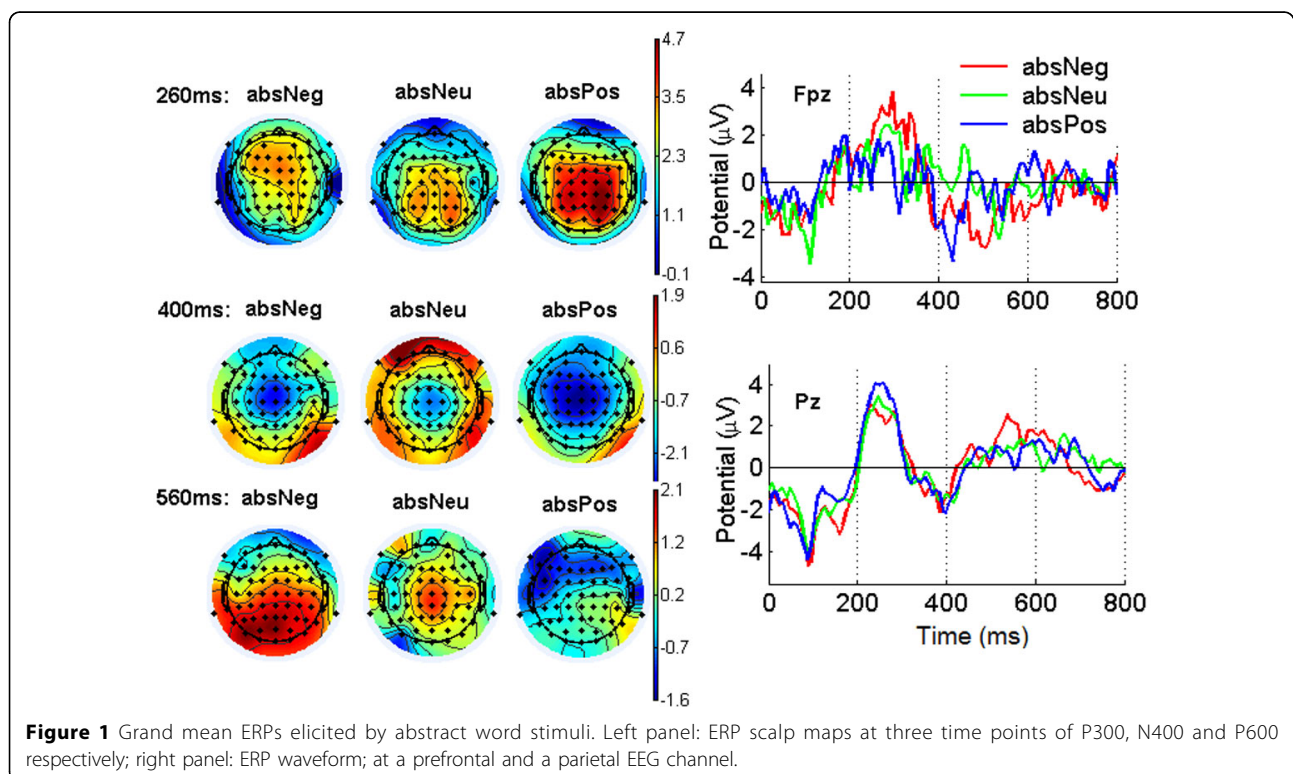
# EEG study of the cortical representation and classification of the emotional connotations in words

Yuqiao Gu<sup>1\*</sup>, Massimo Poesio<sup>1,2</sup>, Brian Murphy<sup>3</sup>

From The Twenty Third Annual Computational Neuroscience Meeting: CNS\*2014  
Québec City, Canada. 26-31 July 2014

There has recently been a surge of interest in searching the neural basis of emotional connotations in words, using fMRI, MEG and EEG [1-4]. In this work we use a linguistically controlled set of 36 English word stimuli, where emo-

tional valence and concreteness are cross-classified, and present them visually to five English native speakers (aged 26–39yrs, mean 34). EEG signals were recorded from the participants while they performed a mental simulation



\* Correspondence: yuqiao.gu@unitn.it

<sup>1</sup>CLIC, CIMeC - Center for Mind/Brain Sciences, Università degli Studi di Trento, Rovereto (TN), I – 38068, Italy

Full list of author information is available at the end of the article

task. We use event-related potential (ERP) and multivariate pattern analyses (MVPA) to investigate the cortical representation and classification of emotional valence, for concrete words and abstract words separately. The grand mean ERPs elicited by abstract words over the five subjects show four typical ERP components: N100, P300, N400 and P600 (Fig. 1). For the P300 waveform, in prefrontal areas the amplitude of negative words is the largest, while that of positive words is the smallest; in contrast, in central-parietal-occipital regions the amplitude of positive words is the largest, whereas that of the negative words is the smallest. For the N400, the negative deflection of positive words is the largest, while that of the neutral words is the smallest in frontal-central areas. For P600, the amplitude of negative words is the largest in the posterior regions. For concrete words, the ERP patterns are broader, but with some important differences with regard to abstract words. The amplitude of P300 of negative words are closer to that of neutral words in the prefrontal area. There are no clear differences between negative, neutral and positive words during the P600. We then Use EEG amplitudes features extracted in the time-domain to train a sparse multinomial logistic regression (SMLR) classifier for three-way valence classification. The mean classification accuracy over the 5 subjects is 39.5% for abstract words and 41.0% for concrete words, which are above the chance level of 33.3%.

#### Authors' details

<sup>1</sup>CLIC, CIMeC - Center for Mind/Brain Sciences, Università degli Studi di Trento, Rovereto (TN), I – 38068, Italy. <sup>2</sup>School of Computer Science and Electronic Engineering, University of Essex, Colchester, CO7 9QZ, UK. <sup>3</sup>Knowledge & Data Engineering (EECS) Queen's University Belfast, UK.

Published: 21 July 2014

#### References

1. Crosson B, Radonovich K, Sadek JR, Gökçay D, Bauer RM, Fischler IS, Cato MA, Maron L, Auerbach EJ, Browd SR, Briggs RW: **Left-hemisphere processing of emotional connotation during word generation.** *NeuroReport* 1999, **10**(12):2449-2455.
2. Hamann S, Mao H: **Positive and negative emotional verbal stimuli elicit activity in the left amygdala.** *NeuroReport* 2002, **13**(1):15-19.
3. Hirata M, Koreeda S, Sakihara K, Kato A, Yoshimine T, Yorifuji S: **Effects of the emotional connotations in words on the frontal areas—a spatially filtered MEG study.** *Neuroimage* 2007, **35**(1):420-429.
4. Inaba M, Kamishima K, Ohira H: **An electrophysiological comparison of recollection for emotional words using an exclusion recognition paradigm.** *Brain Research* 2007, **1133**:100-109.

doi:10.1186/1471-2202-15-S1-P81

**Cite this article as:** Gu et al.: EEG study of the cortical representation and classification of the emotional connotations in words. *BMC Neuroscience* 2014 **15**(Suppl 1):P81.

**Submit your next manuscript to BioMed Central and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
www.biomedcentral.com/submit

