Tell Me More! Investigating Value Perception in Conversation Through Cortical Entrainment

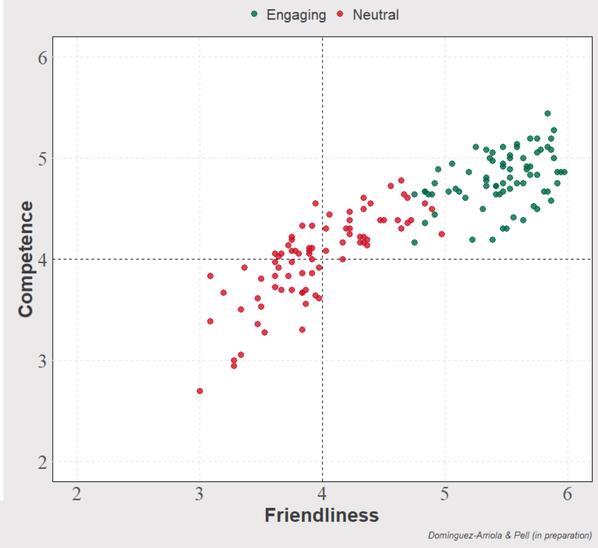
Marcos E. Domínguez-Arriola[1], Alejandro Pérez[2], & Marc D. Pell[1]

[1] McGill University, Canada [2] University of La Laguna, Spain

INTRODUCTION

- In social interactions, vocal modulation helps convey one's **relational stance** [1, 2].
- A conversation's **perceived value** may depend on:
  - its **semantic content**
  - the speaker's **vocally expressed attitude**.
- Perceived reward value is often indexed via **auction paradigms** [3, 4]. However, for social stimuli, **time** may serve as a more appropriate bidding currency (**Time-bidding**).
- Cortical entrainment to slow amplitude modulations in speech is associated with **attentional engagement** [5, 6].
- ***How do semantic content and vocal relational stance modulate perceived reward value and cortical entrainment in listeners?***

Adopting an engaging tone enhanced listeners' social evaluations of the speaker



METHODS

Auditory stimuli: conversational anecdotes

Boring

"Hey, guess what? So, Mary spent the afternoon cleaning and found an old pair of glasses. She said it turns out they're not her prescription anymore."

Interesting

"Hey, guess what? So, Sam spent the night in an underwater hotel room. He said he could watch sharks and other animals swimming by while he was in bed."

x13

"Neutral" tone

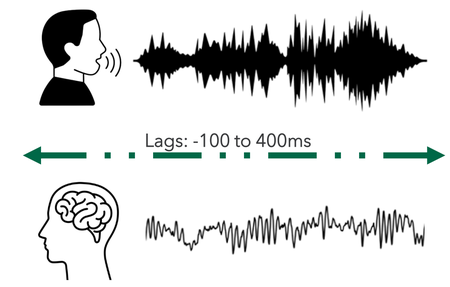
"Engaging" tone

- While **EEG** was recorded, 31 Canadian English speakers listened to the stimuli and judged:

"How much longer would you be willing to continue this conversation?"

0s 5s 20s 1m 3m 10m 30m 90m

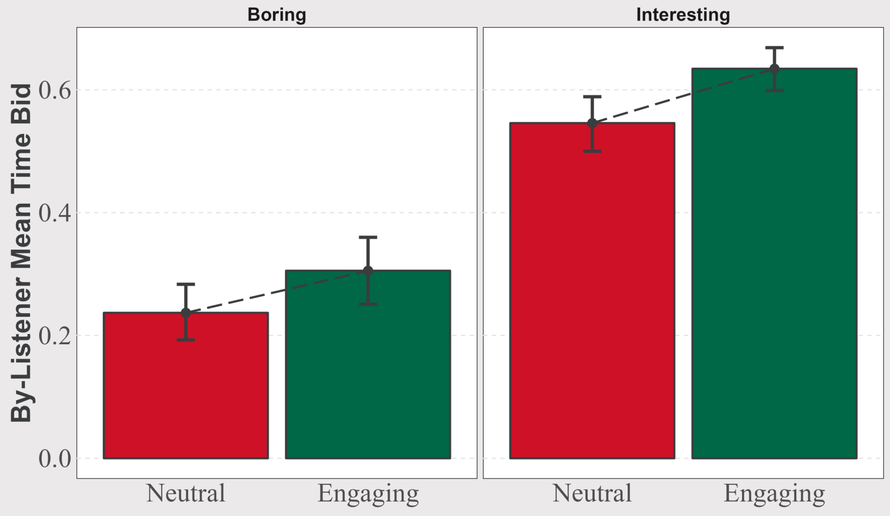
(time-bidding task)



- **Gaussian Copula Mutual Information (GCMI)** was computed between the 2–8 Hz amplitude envelopes of the stimuli and EEG data across a range of time lags [7, 8].

RESULTS

Time bids were higher for interesting content and engaging delivery



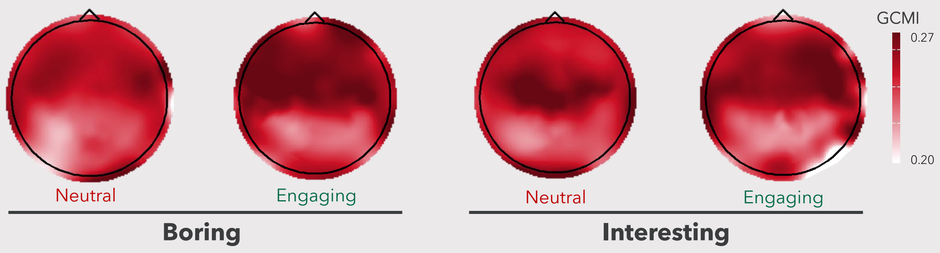
Bayesian Multilevel Beta-Regression (Time Bidding)

Semantic content: β = 1.43, CrI [1.10, 1.77], *pdir* = 1.00 , ROPE = 0%

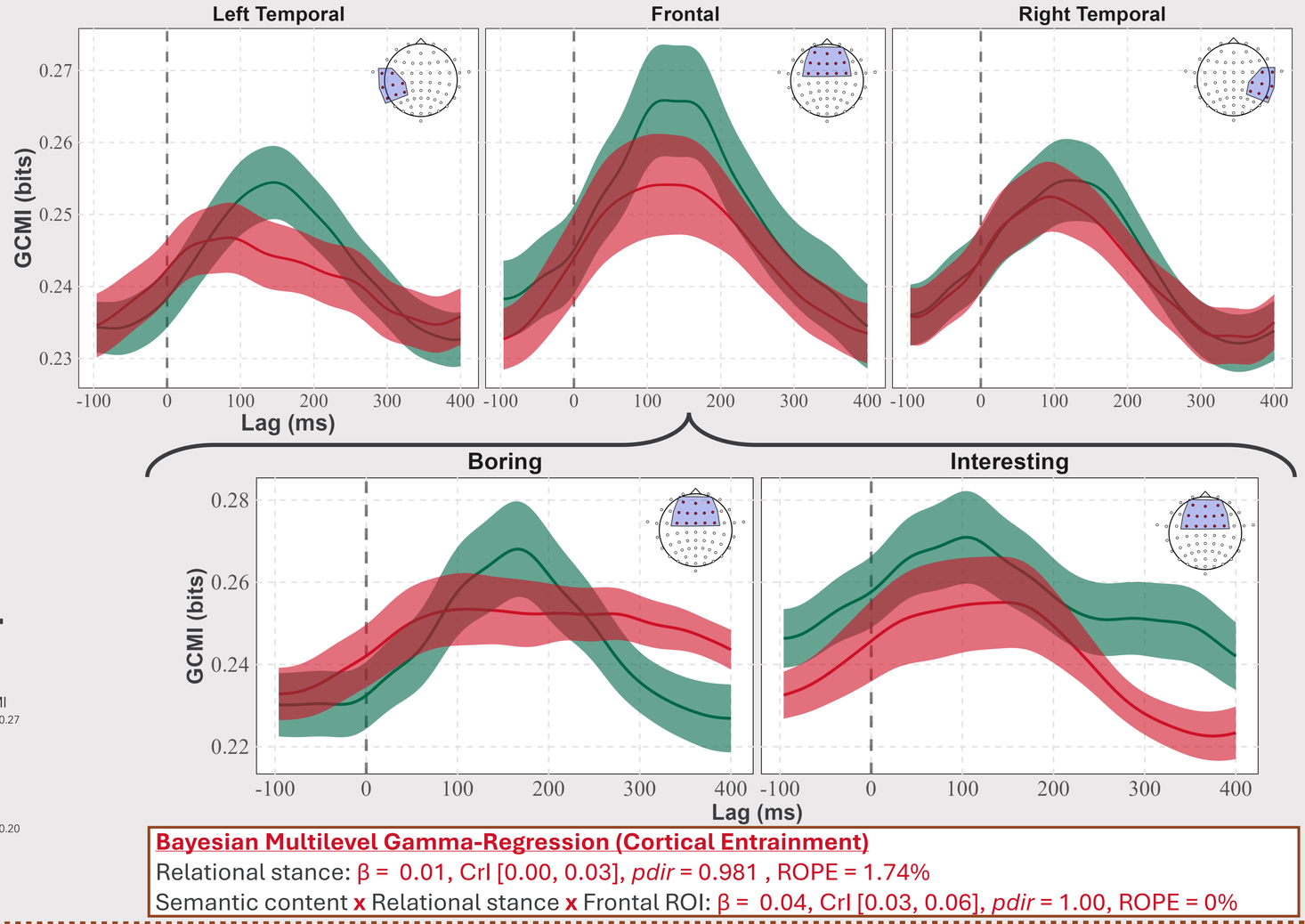
Relational stance: β = 0.36, CrI [0.20, 0.52], *pdir* = 1.00, ROPE = 0%

Interaction: β = 0.09, CrI [-0.01, 0.18], *pdir* = 0.965 , ROPE = 68.44%

GCMI scalp distributions at a 150ms time lag:



Cortical entrainment was enhanced for engaging utterances, particularly at frontal electrodes and when the topic was interesting.



Bayesian Multilevel Gamma-Regression (Cortical Entrainment)

Relational stance: β = 0.01, CrI [0.00, 0.03], *pdir* = 0.981 , ROPE = 1.74%

Semantic content **x** Relational stance **x** Frontal ROI: β = 0.04, CrI [0.03, 0.06], *pdir* = 1.00, ROPE = 0%

DISCUSSION

- Explicit **reward valuations** (time bids) were more strongly influenced by **topic interest** than by the speaker's vocal **relational stance.**
- **Semantic context** modulated the effect of relational stance on frontal cortical entrainment.
- Functional **dissociation** between **reward value perception** and **cortical entrainment**, each relying on distinct elements of the conversational input.
- Further research is needed to determine whether this pattern holds in more **ecologically valid** settings (e.g., real-time social interactions) and across **diverse social contexts** [9].

References:

[1] Burgoon, J. K., & Hale, J. L. (1984). The fundamental topoi of relational communication. Communication Monographs, 51(3), 193–214. https://doi.org/10.1080/03637758409390195

[2] Pell, M. D., & Kotz, S. A. (2021). Comment: The Next Frontier: Prosody Research Gets Interpersonal. *Emotion Review*, 13(1), 51–56. https://doi.org/10.1177/1754073920954288

[3] Salimpoor, V. N., van den Bosch, I., Kovacevic, N., McIntosh, A. R., Dagher, A., & Zatorre, R. J. (2013). Interactions Between the Nucleus Accumbens and Auditory Cortices Predict Music Reward Value. *Science*, 340(6129), 216–219. https://doi.org/10.1126/science.1231059

[4] Tamir, D. I., & Hughes, B. L. (2018). Social Rewards: From Basic Social Building Blocks to Complex Social Behavior. Perspectives on Psychological Science, 13(6), 700–717. https://doi.org/10.1177/1745691618776263

[5] Brodbeck, C., & Simon, J. Z. (2020). Continuous speech processing. *Current Opinion in Physiology*, 18, 25–31. https://doi.org/10.1016/j.cophys.2020.07.014

[6] Obleser, J., & Kayser, C. (2019). Neural Entrainment and Attentional Selection in the Listening Brain. Trends in Cognitive Sciences, 23(11), 913–926. https://doi.org/10.1016/j.tics.2019.08.004

[7] Ince, R. A. A., Giordano, B. L., Kayser, C., Rousselet, G. A., Gross, J., & Schyns, P. G. (2017). A statistical framework for neuroimaging data analysis based on mutual information estimated via a gaussian copula. *Human Brain Mapping*, 38(3), 1541–1573. https://doi.org/10.1002/hbm.23471

[8] Pérez, A., Davis, M. H., Ince, R. A. A., Zhang, H., Fu, Z., Lamarca, M., Lambon Ralph, M. A., & Monahan, P. J. (2022). Timing of brain entrainment to the speech envelope during speaking, listening and self-listening. *Cognition*, 224. https://doi.org/10.1016/j.cognition.2022.105051

[9] Wheatley, T., Thornton, M. A., Stolk, A., & Chang, L. J. (2023). The Emerging Science of Interacting Minds. *Perspectives on Psychological Science*. https://doi.org/10.1177/17456916231200177

I'm seeking a postdoctoral position starting next year! Get in touch:

marcos.dominguezarriola@mail.mcgill.ca

Website: elidom.github.io/home/