Sex differences behind a “Gambling Brain”

Pilaf pod - Heat Waves

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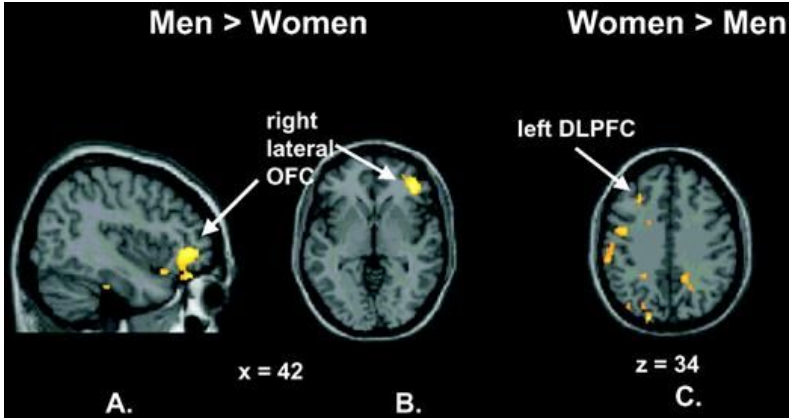
OUR QUESTION

Is there a difference in the way men and women anticipate a gamble?

Intro

When men and women engage in a gambling task, literature has shown a different pattern of performance and brain activity (Bolla et al., 2004).

In our work, we decided to focus on the feeling of **anticipation** that comes before the gambling task and see if we could find a gender specific pattern of brain activation.



Group differences in brain activation in men and women during performance on the Iowa Gambling Task (Bolla et al., 2004)

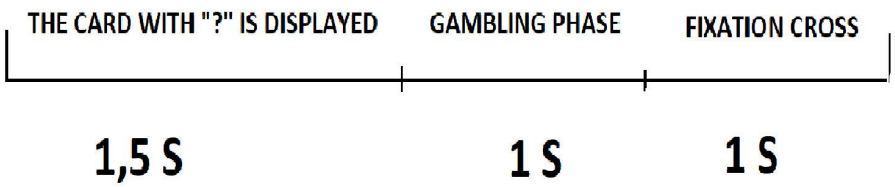
Reference:
K.I. Bolla, D.A. Eldreth, J.A. Matochik, J.L. Cadet, Sex-related Differences in a Gambling Task and Its Neurological Correlates, *Cerebral Cortex*, Volume 14, Issue 11, November 2004, Pages 1226–1232,

The HCP task dataset

This task was adapted from the one developed by Delgado and Fiez (Delgado et al. 2000).

Participants play a card guessing game where they are asked to guess the number on a card in order to win or lose money.

TASK DESIGN



The anticipation phase is defined as the first 1500ms of each trials where the participant is shown the “?” card, before they make their gamble

HUMAN Connectome PROJECT

What we did

Two levels of analysis:

- Find the brain region activation
- Compare activation differences between female and male subjects when they are anticipating the outcome of the gamble.

Challenges

We never worked with fMRI data before

Choose a correct model and understand how the model works.

How do we measure the anticipation?

Extracting anticipation state from the time series

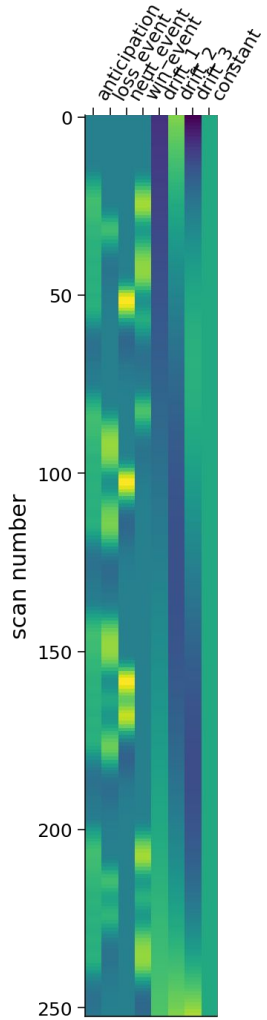
MODELLING

- Defining the anticipation state based on the event related task
- Extracting the time series signal for defined anticipation state of 1.5 s
- Run GLM with input as the signal and design matrix to find the beta weights that best approximate the true signal
- Compute SSE (Sum of Squared Errors)
- Run the model for 36 Female and 36 Male Subjects
- Average Beta Values

WENT WELL

- Second level Analysis using intercept, sex and age as regressors
- Statistical Analysis using T test

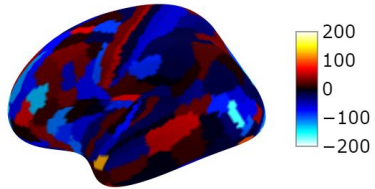
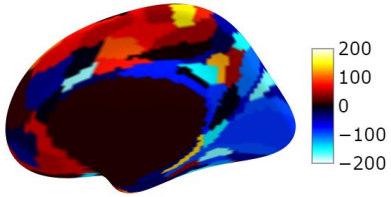
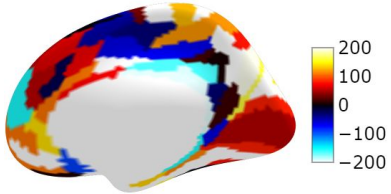
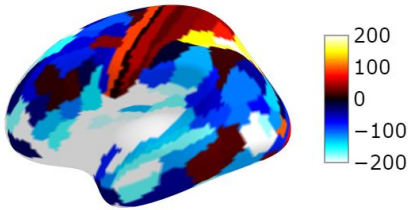
YET TO COMPUTE



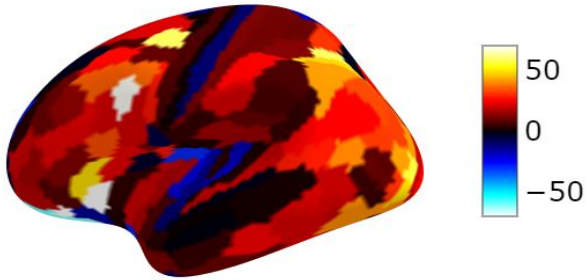
Design Matrix

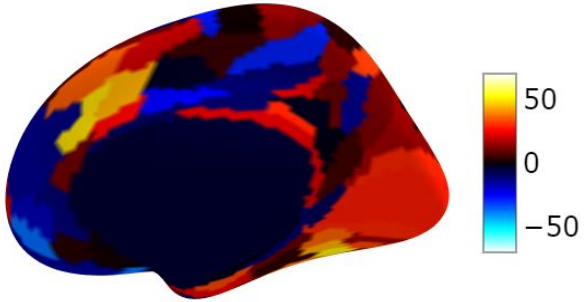
ANALYSIS

We can see differences in the parcel activation for anticipation state in men and women

	LEFT HEMISPHERE	RIGHT HEMISPHERE
FEMALE		
MALE		

Contrast in male and female : Left Hemisphere





Contrast in male and female : Right Hemisphere

Higher Differences have been observed in the ventral straitum, supplementary motor cortex

There are some differences, but quantitatively we are not sure yet.

No-RESULTS!

What we have learned:

- Understanding the data is the most important step
- Each modeling step comes with new questions, and it takes longer than expected
- Being persistent
- How to establish a research project

FUTURE DISCUSSIONS

Further analysis can be done on the topic of anticipation, in this case regarding how anticipation differs during a series of monetary reward compared to a series of loss.

A different version of the gambling task could help to study the anticipation phase better

Thanks to NMA, our Project TA Javier Guaje, Mentor Dr. Ting Xu and our TA Akanksha

It was an exciting journey, we hit quite a lot bumps along the way but and we learned a lot!