INTERHEMISPHERIC INTEGRATION IN THE NEURAL FACE RECOGNITION NETWORK: DOES STIMULUS LOCATION MATTER?

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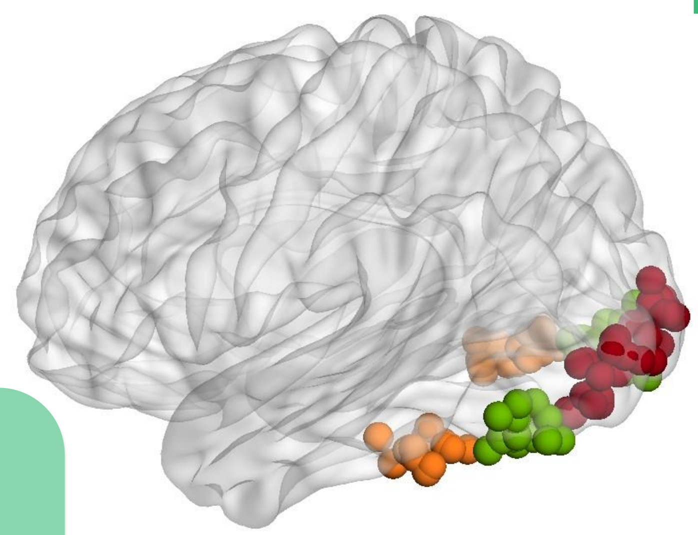
Introduction

For many years, face-sensitive brain areas such as the occipital face area (OFA) and the fusiform face area (FFA) have been studied for their functional differences. However, little attention has been paid to the interplay between these regions across the two hemispheres[1]. Here, we investigated **the interhemispheric interaction between these face-sensitive regions for central and peripheral face presentations**.

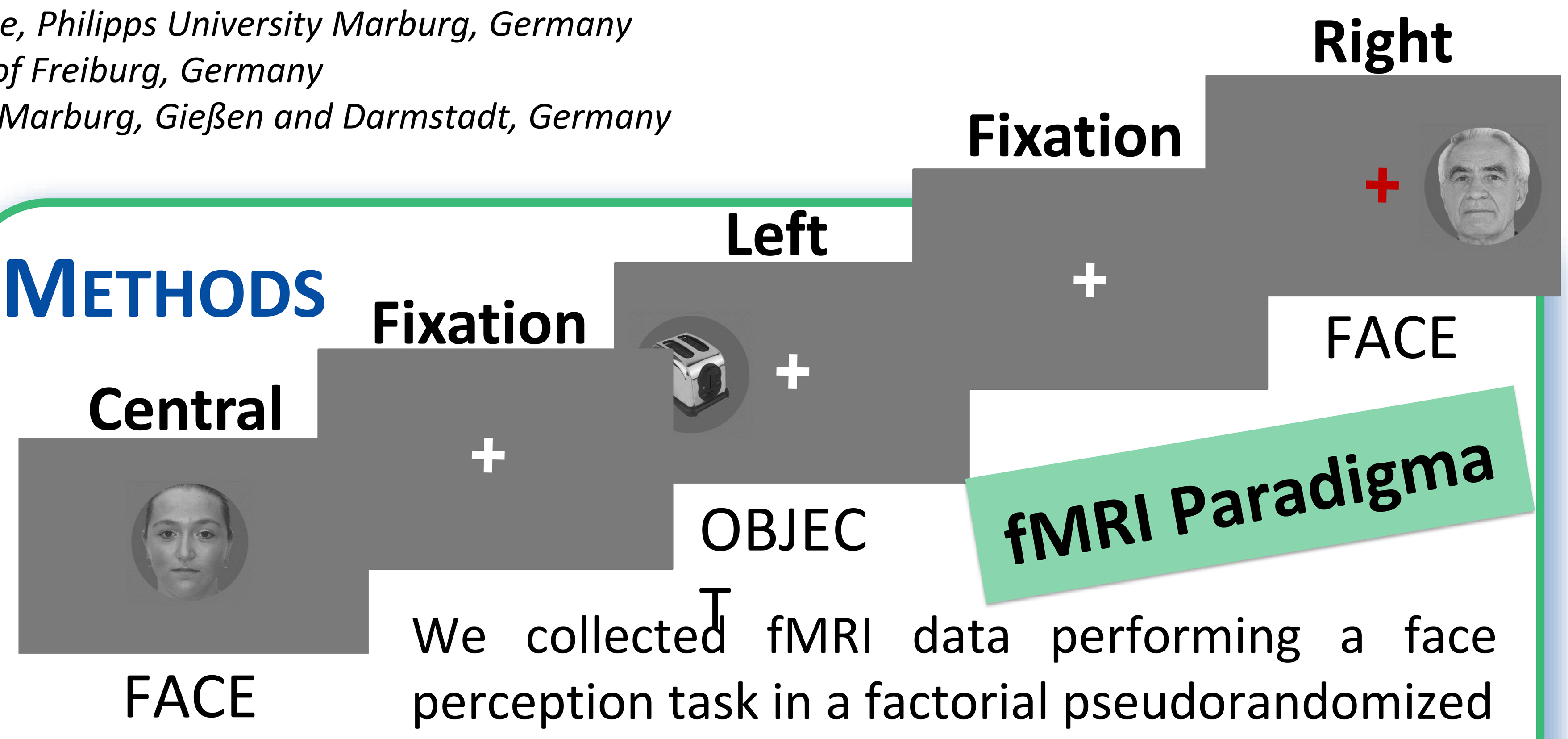
We use Dynamic Causal Modelling (DCM)[2] to calculate the effective connectivity between both OFAs and FFAs for different conditions.



Hypothesis

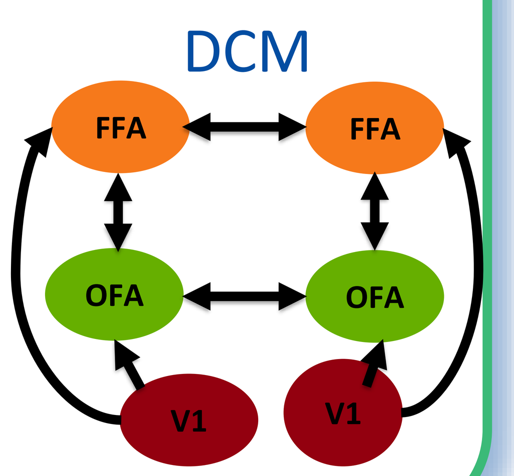
The interhemispheric transfer is larger when stimulus is shown at the periphery in comparison to when it is shown at the center of the visual field.

Methods



We collected fMRI data performing a face perception task in a factorial pseudorandomized block design. Participants viewed faces and objects either at the **center**, **left** or **right** visual field at a visual angle of 4,02°.

For **17 participants** we find our Regions of Interest (ROIs), the **OFA**, **FFA** and **V1**. Next, we construct five models with increasing complexity. We first estimate the model that best fits our ROI activities, then we use **Bayesian Model Averaging (BMA)** to extract the average of all model parameters.



Results

Endogenous Connectivity (A)

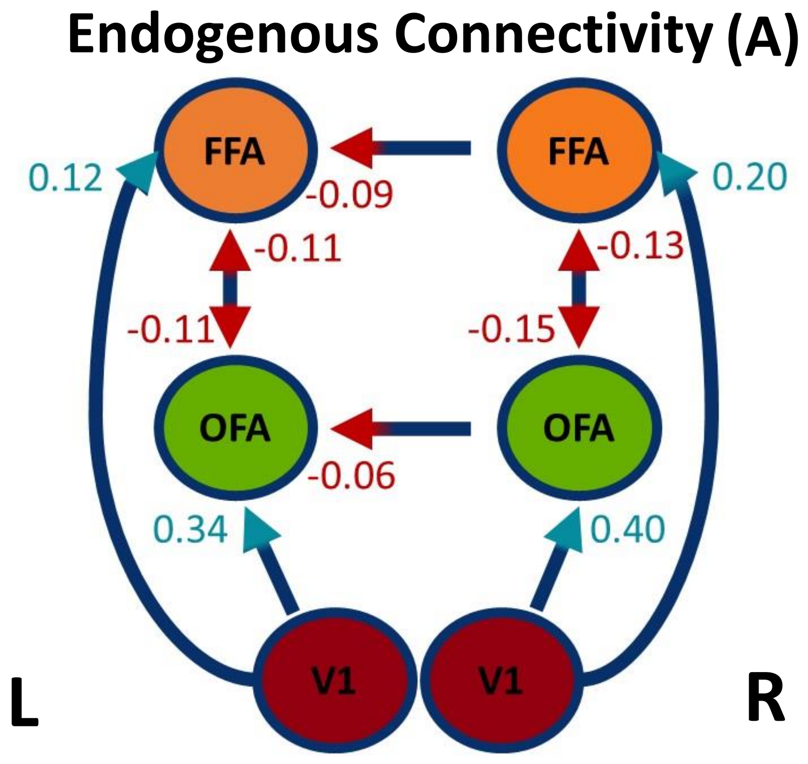


Figure 1. *Endogenous connectivities (A-matrix). The strength of connection is shown as the mean (posterior model prob. > .95) and the standard deviation of the averaged coupling parameters.*

1. Face Network Coupling

Our results show a preference for the most complex model with face stimulus modulating the inter- and intrahemispheric connectivities. Excitatory inputs emerge from the V1 regions to ipsilateral OFA and FFA, whereas all other connections modelled remain inhibitory. When faces are presented at the periphery of the visual field coupling parameters reveal an asymmetric connectivity pattern.

Modulatory Connectivity (B)

Interhemispheric Connection	Stimulus Condition: LEFT	CENTRAL	RIGHT
Left FFA ➡ Right FFA	**-0.33** ± 0.16	**0.27** ± 0.13	**0.83** ± 0.11
Left FFA ⬅ Right FFA	**0.38** ± 0.06	**0.23** ± 0.13	**-0.42** ± 0.15
Left OFA ➡ Right OFA	**-0.35** ± 0.14	0.02 ± 0.13	**0.15** ± 0.04
Left OFA ⬅ Right OFA	**0.38** ± 0.07	-0.12 ± 0.10	**-0.34** ± 0.13

Table 1. *Modulatory connectivities (B-Matrix) of interhemispheric connections for different conditions. Connection strength with prob. > .95 are shown in bold.*

2. Interhemispheric Transfer

Changes in Interhemispheric Transfer were described as the **interhemispheric transfer difference** (left-to-right minus right-to-left modulatory connectivity parameters) and **the interhemispheric transfer strength** (average of the absolute value of the interhemispheric connectivity parameters). A 2x3 factorial ANOVA of the transfer difference revealed a significant main effect of stimulus location ($F(2)=14.23$, $p<0.001$). A statistical analysis of strength did not show any significant main effect ($F(2)=1.04$, $p=0.359$). Overall, the magnitude of connectivity remains stable while the directionality differs for unilateral stimulations.

Interhemispheric Transfer

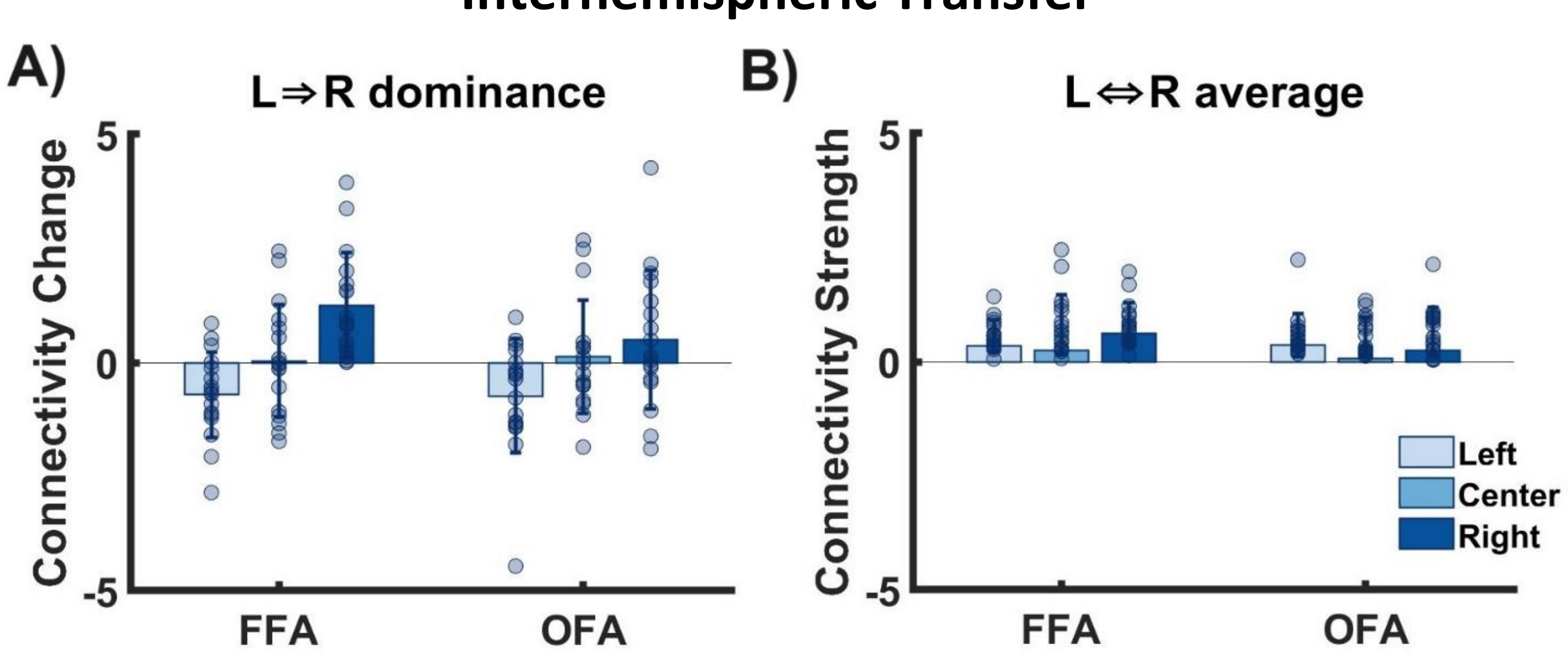


Figure 2. *Interhemispheric Transfer. A) Difference between interhemispheric modulatory connectivity, calculated as left-to-right minus right-to-left transfer strength, presented for both OFA and FFA as well as different stimuli locations (left, center, right). B) Average between interhemispheric modulatory connectivity calculated as the sum of absolute values divided by two.*

Conclusion

In this study we investigated the connectivity pattern in the core face recognition network for visual stimulus presented at different locations and found that interhemispheric coupling differs for left and right visual stimulation. Especially the interhemispheric transfer difference but not the interhemispheric transfer strength changes, indicating that for unilateral stimulation asymmetric patterns are necessary to rebalance the system. Our results suggest that both hemispheres are recruited and thus involved in face processing.

References

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