# Temporal dynamics and effective connectivity in the distributed system of familiar face processing

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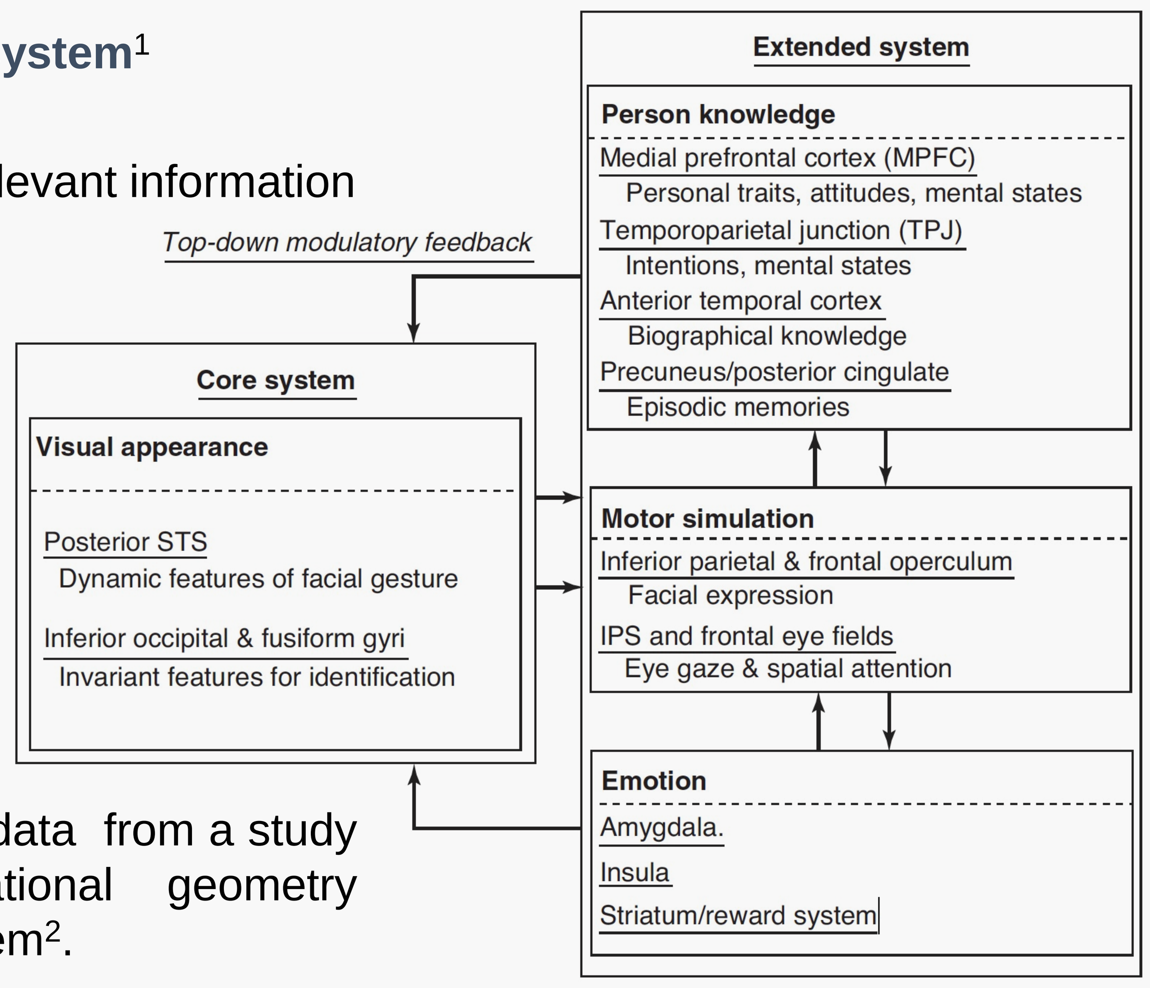
## Background

**The human face processing system[1]**

- Core system: visual analysis
- Extended system: socially relevant information




face-specific responses in both core and extended system areas can be **modulated by familiarity**[1].

This project is a **reanalysis** of data from a study investigating the representational geometry within the face processing system[2].

## Objectives

**Temporal dynamics: How does the representation of personally familiar and unfamiliar faces change over time?**

- Acquired visual familiarity modulates activity in core system areas (Fusiform gyrus, OFA, STS) and some extended system areas (Precuneus, posterior cingulate gyrus)[3].
- Changes in response to personally familiar faces have not been investigated so far.
- This project aims at both replicating previous evidence about visual familiarity and exploring habituation of the response to personally familiar faces.

**Effective connectivity: How do the brain areas comprised in the human face processing system interact?**

- The core system largely follows a two-pathway feed-forward structure[2,4].
- The potential links between core and extended system areas remain under debate[5].
- Previous attempts used Dynamic Causal Modelling to investigate interactions between a smaller number of ROIs[4,6,7].
- This project aims to explore functional integration between a larger range of brain areas (30 ROIs) in both the core and extended system.

## Methods

**MRI acquisition**

- 3T Philips Achieva Intra Scanner
- 32 channel head coil
- Functional images: EPI, 35 axial slices, 3 x 3 mm in-plane resolution

**Original fMRI experiment**

- 33 participants, 11 functional runs
- Oddball-task, event-related design
- **Face stimuli: personally familiar** (4), **unfamiliar** (4), and self (1)

**GLM analysis**

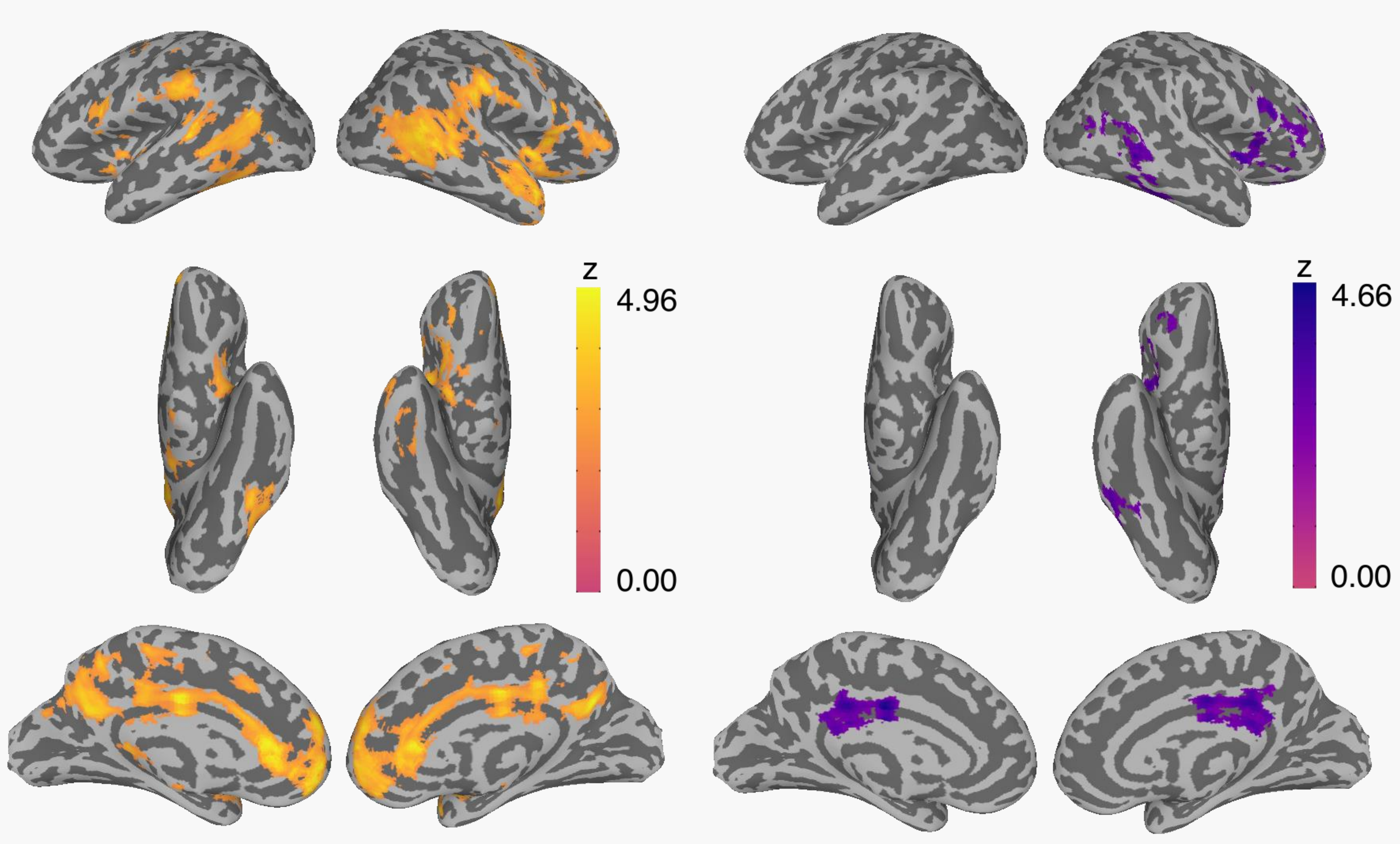
- Standard preprocessing pipeline
- **Linear covariate** in 2nd level model to account for changes in familiarity effects across functional runs

**Effective connectivity analysis**

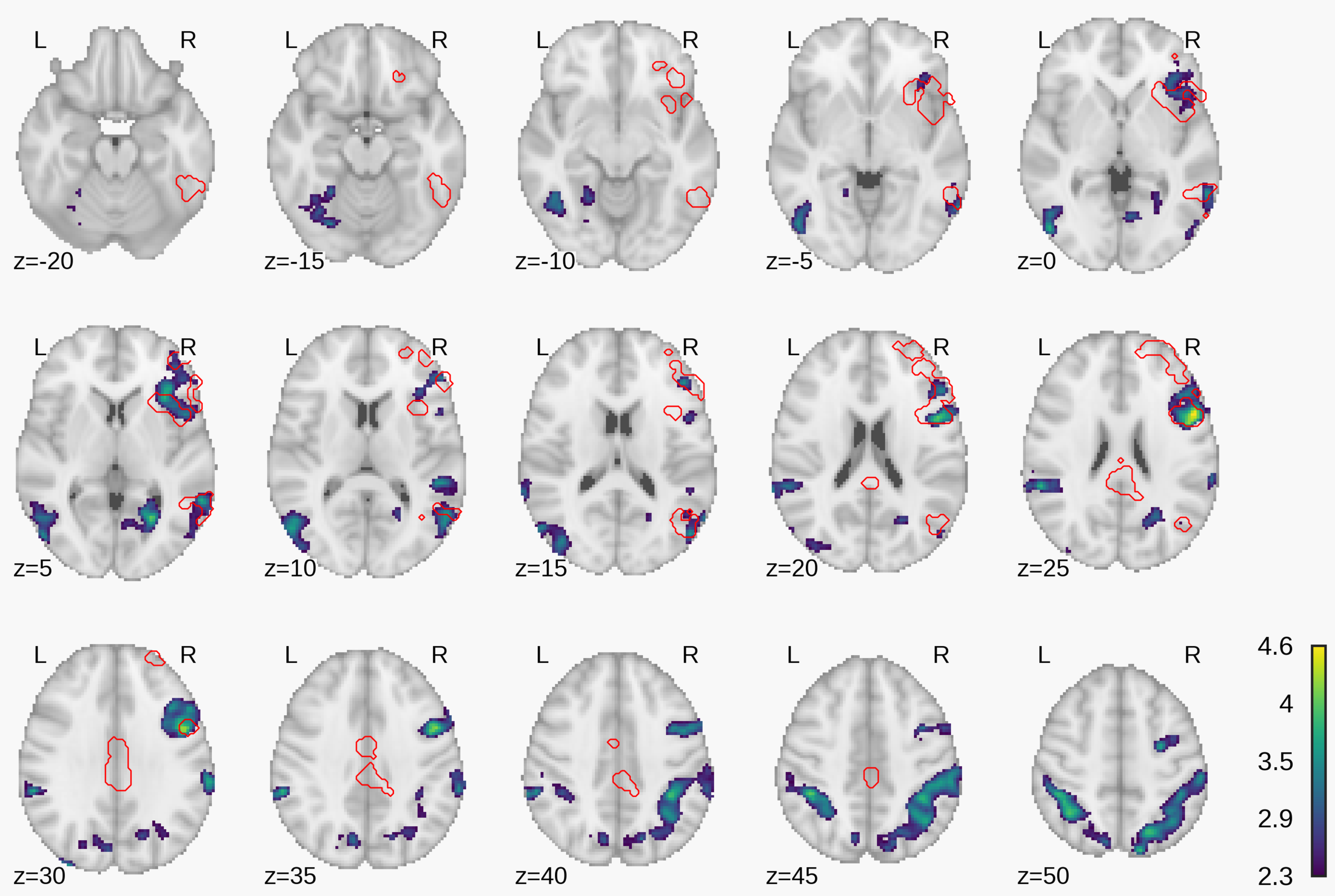
- **30 ROIs** previously identified to encode information about personal identity and familiarity[2]
- **network discovery algorithm IMaGES+LOFS**[8]

## Results

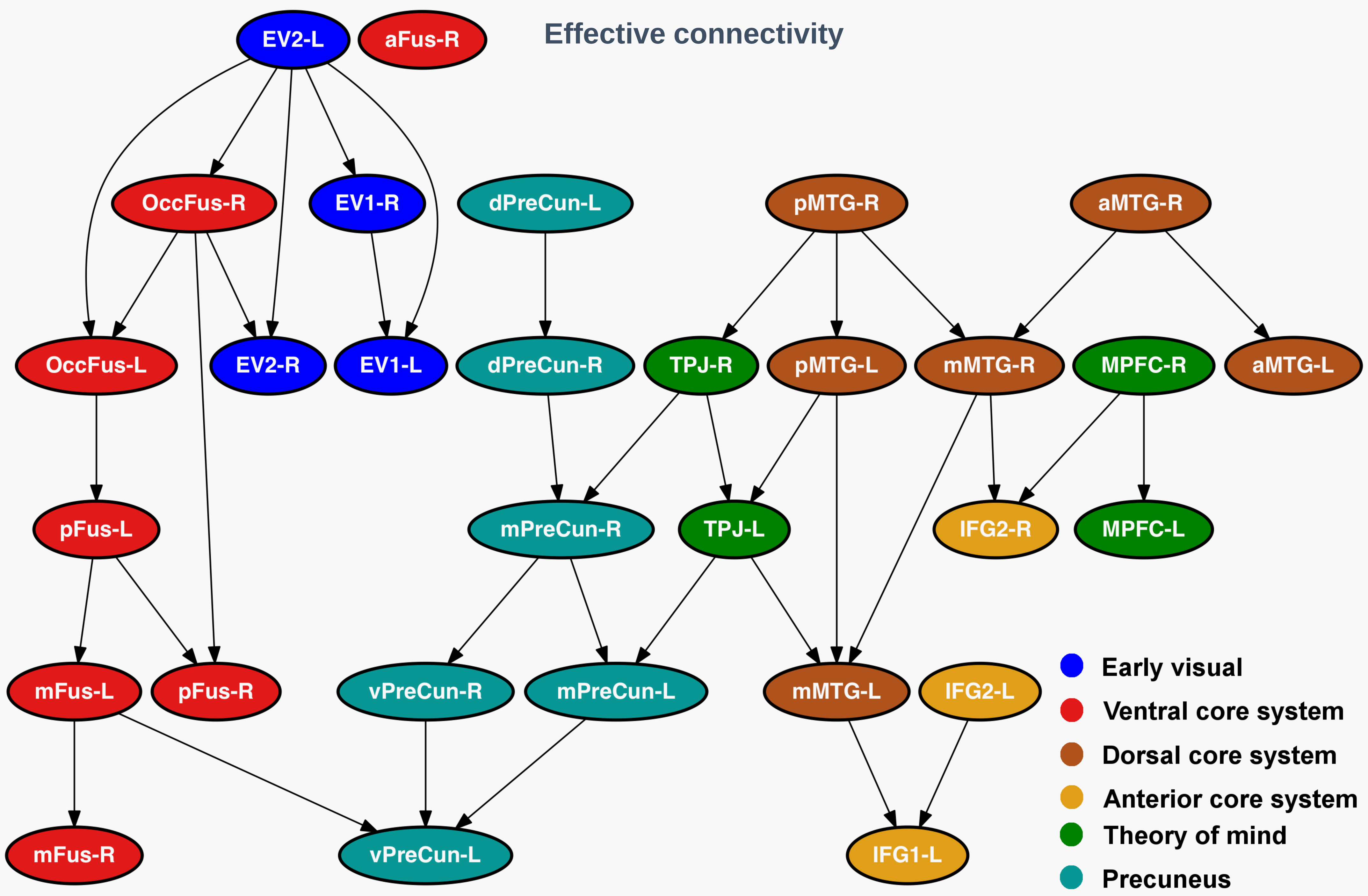
**Average familiarity effect** **Decreasing familiarity effect**




**Habituation of response to personally familiar faces**




**Effective connectivity**




## Conclusions

**The GLM results…**

- … did not confirm the hypothesized effects of visual familiarity, i.e. of initially novel faces becoming increasingly well-known.
- However, they provide first evidence for the habituation of the neural response to personally familiar faces in large parts of the core system as well as some extended system areas associated with emotional responses (insula), biographical memory (PC), and the internal simulation of facial movement (FOC).

**The Effective Connectivity results…**

- … suggest that the ventral part of the core system – represented by the fusiform gyrus – forms a distinct bottom-up pathway originating from early visual areas.
- The dorsal (MTG/STS) and anterior (IFG) parts of the core system appear highly interconnected with extended system areas instead, allowing for multiple routes of information transfer between the sub-systems underlying the visual analysis and representation of socially relevant information associated with a perceived face.
- These results represent an important step towards a more comprehensive and integrated framework of the neural underpinnings of human face perception.

## References

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**Availability**
Data (DataLad), Code (GitHub),
Results (NeuroVault), Preregistration (OSF)