

Introduction

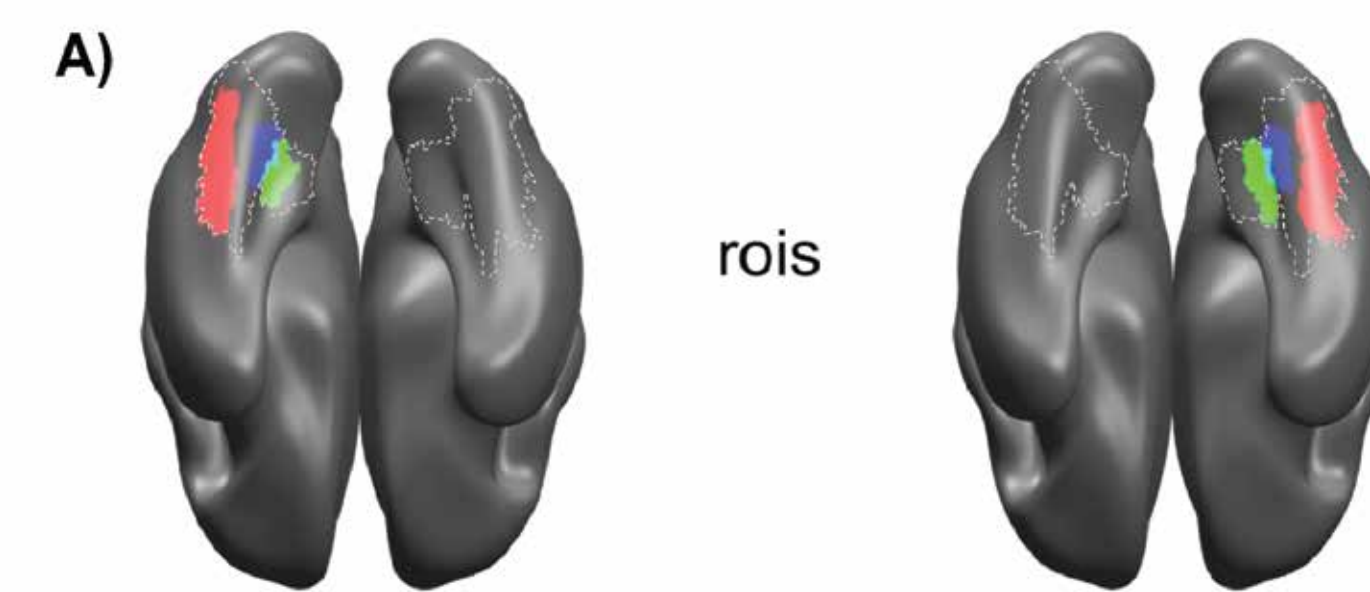
- By four months, infants can form perceptually based categories.
- It is unclear when infants go beyond perceptual categories to form adult-like cross-modal and affective associations.
- The associations are thought to be encoded in each region's 'connectivity fingerprint'.
- In infants, category-selective regions are functioning, but long range, distinctive, structural connectivity has not been explored.
- If connectivity is mature early, distinctive connectivity patterns might be the origin of functional category selectivity.

Our Aim

To characterize the development of category-selective region's structural connectivity

Methods: Experiment 1

- HCP localizers were used to identify the face (fusiform complex), place (ventromedial visual area 2), and tool (ventromedial visual area 3) areas.

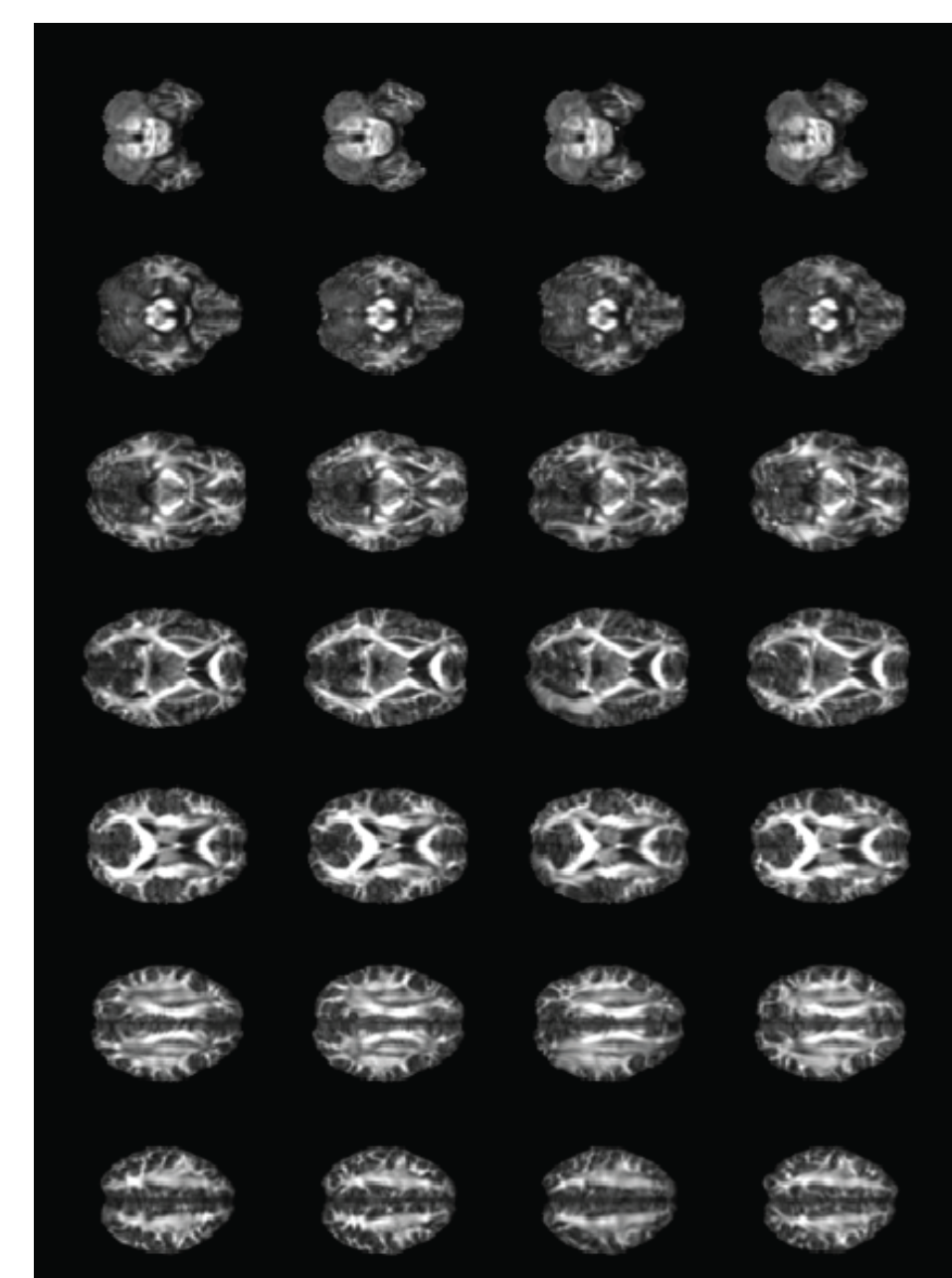


Depiction of the face, place and tool regions from the HCP localizers and atlas.

- In adults, three linear discriminant classifiers were trained to identify if a voxel was inside a category selective region from its signature of connectivity (cf., Saygin et al, 2011).
- The classifiers were evaluated in the adults using leave-one-subject-out cross validation, and then applied to the infants.

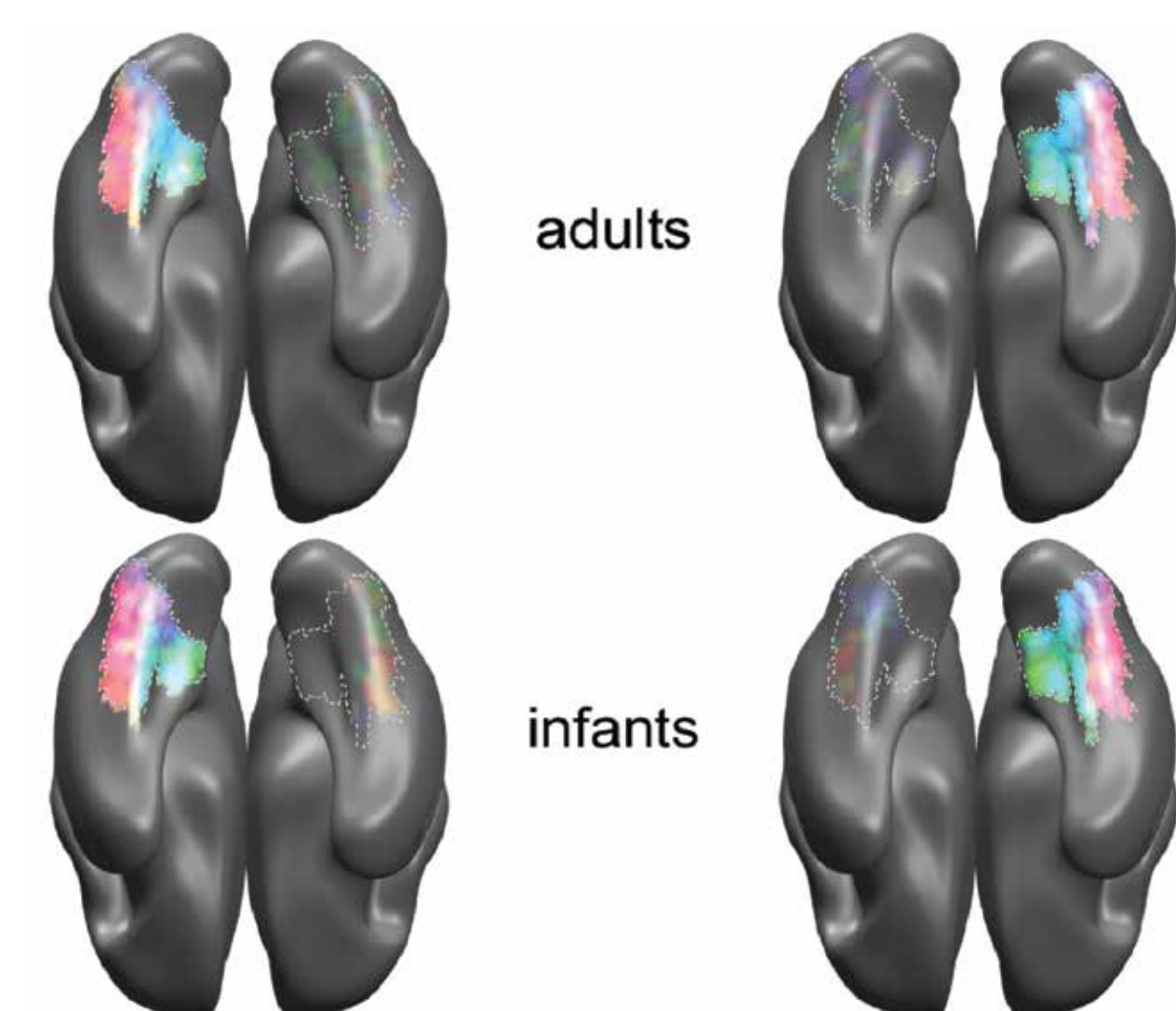
Methods: Experiment 1

- Diffusion weighted images were acquired in 14 adults and 11 infants (Mean age=6.4 months).
- Each voxel in the human connectome project (HCP) parcellation of the ventral stream region was used as a seed and the others were used as targets.



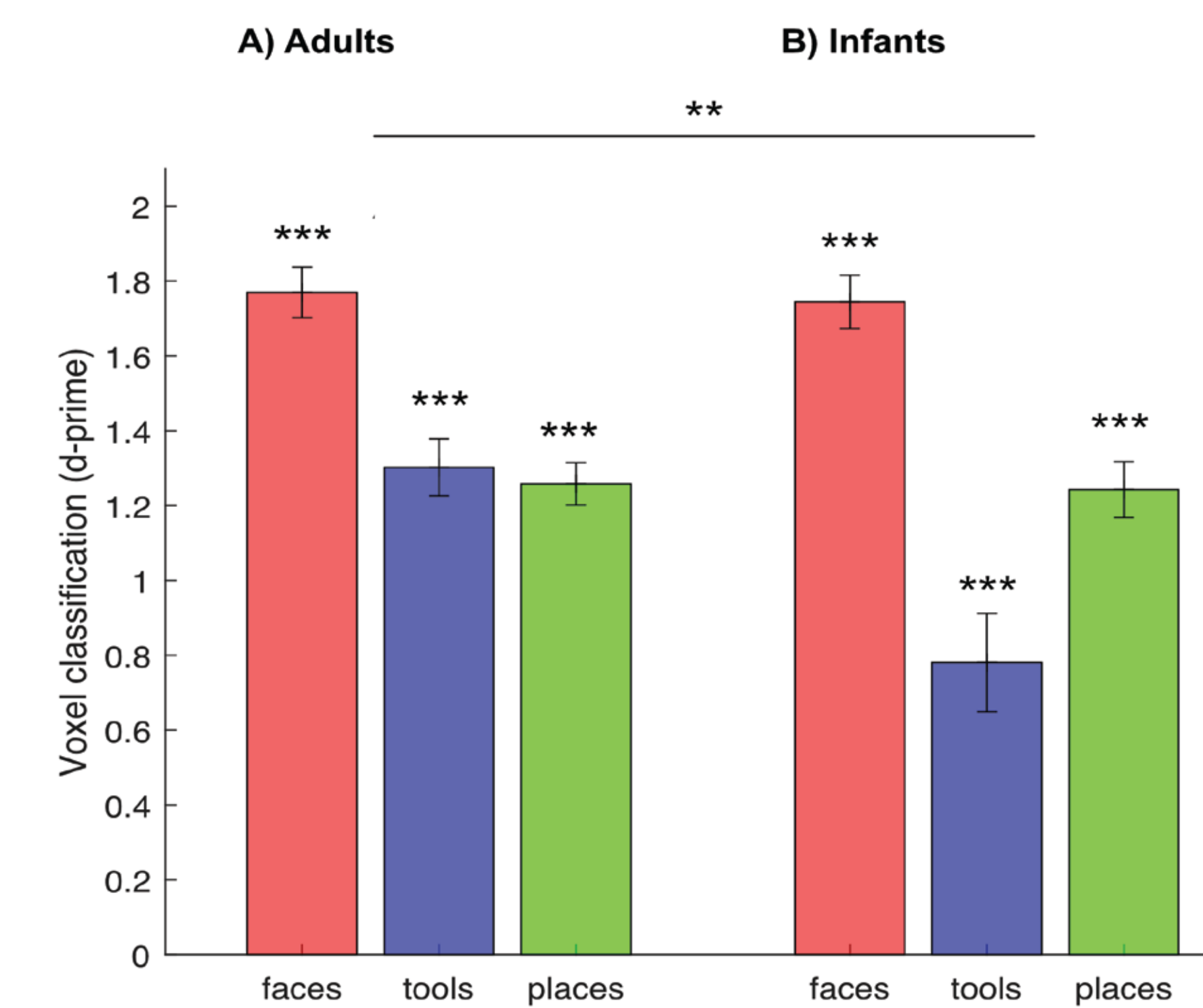
Diffusion weighted images (FA) for four representative infants, which illustrate the quality of registration

Results: Experiment 1

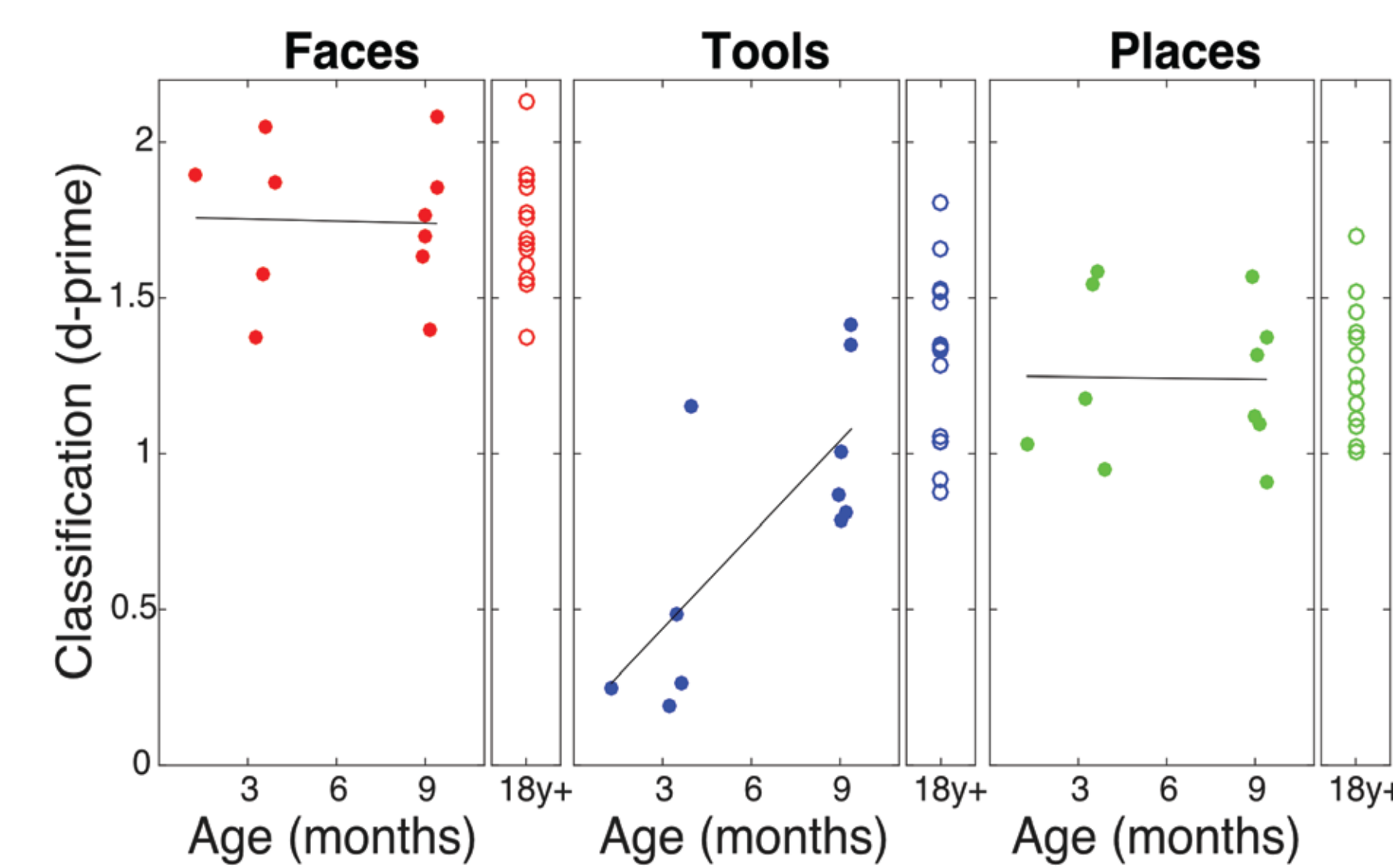


Group overlays of voxels selected by the classifiers to be part of the face, place and tool regions

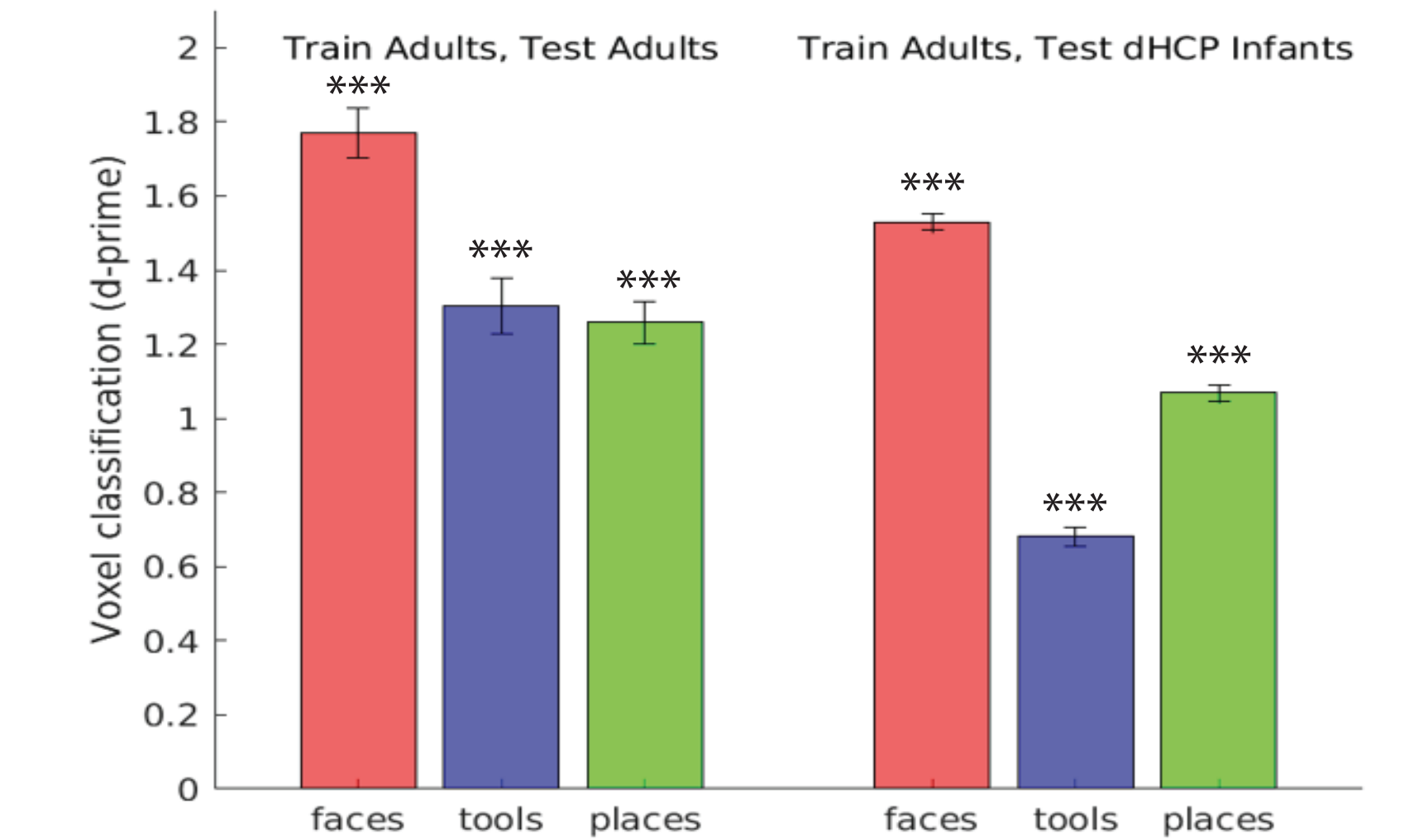
- The face and place regions were equally robustly detected in infants and adults, but the connectivity of the tool region was less developed in infants than adults ($p < 0.01$).



- While face and place accuracy remained stable over the first 9 months of postnatal life, tool accuracy continued to increase $r(9)=0.75, p < 0.01$.



Experiment 2: Results



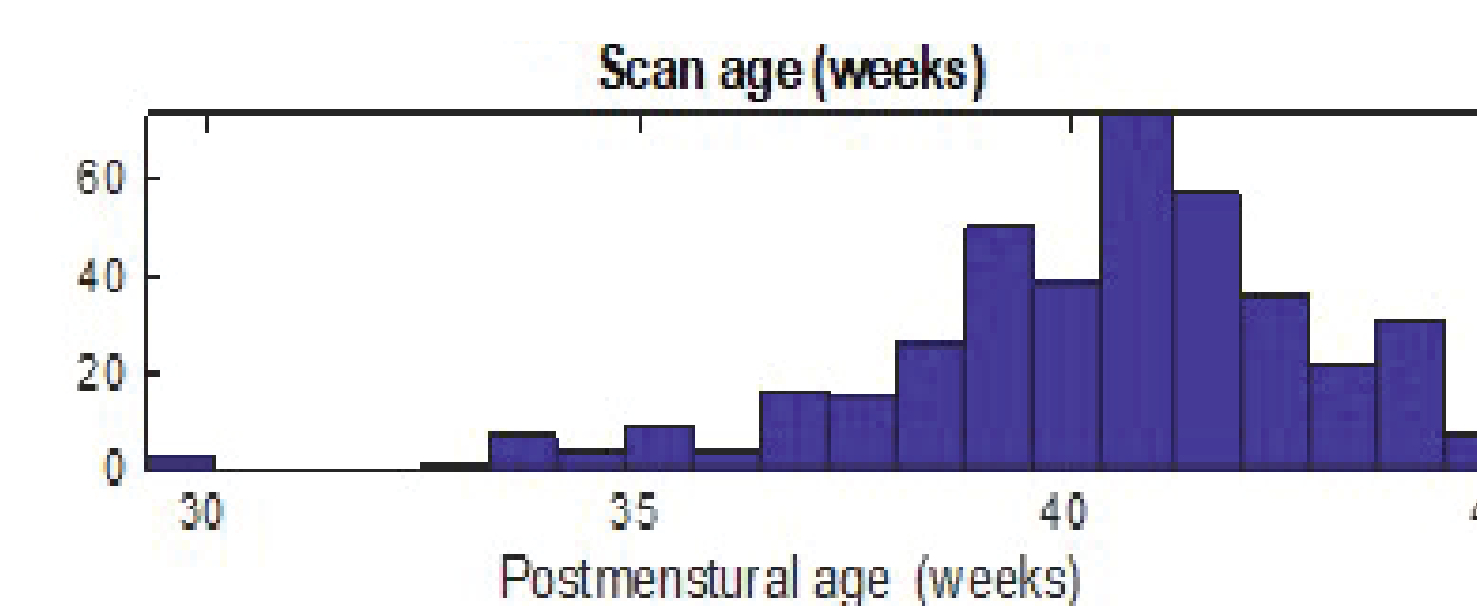
- Face, place and tool regions were detected in young infants.



- We examined the effect of postnatal experience and birth age on d-prime.
- Postnatal experience was not related to detection accuracy.
- Birth age (controlling for scan age) was associated with accuracy in the face and tool networks $r(399)=0.11, p < 0.05, r(399)=0.12, p < 0.05, r(399)=0.03, p > 0.05$.

Experiment 2

- Replicate experiment 1 with diffusion weighted images from a larger (N=400 infants) and younger dataset from the Developing Human Connectome Project.



References

- Glasser et al. (2016) A multimodal parcellation of human cerebral cortex, Nature.
Deen et al. (2017) Organization of high-level visual cortex in human infants, Nature Communications.
Saygin et al. (2011) Anatomical Connectivity patterns predict face selectivity in the fusiform gyrus. Nature Neuroscience.
Bastiani et al. (2018) Automated processing pipeline for neonatal diffusion MRI in the developing Human Connectome Project. NeuroImage.

Conclusions

- Broad category-specific networks are present in infancy.
- The tool network appears to be less mature early in life.
- As the networks mature early and their development isn't associated with experience, the distinctive connectivity of ventral temporal regions might be the origin of their functional category selectivity.

Acknowledgments



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