Distributed representations of behaviorally-relevant object dimensions in the human brain

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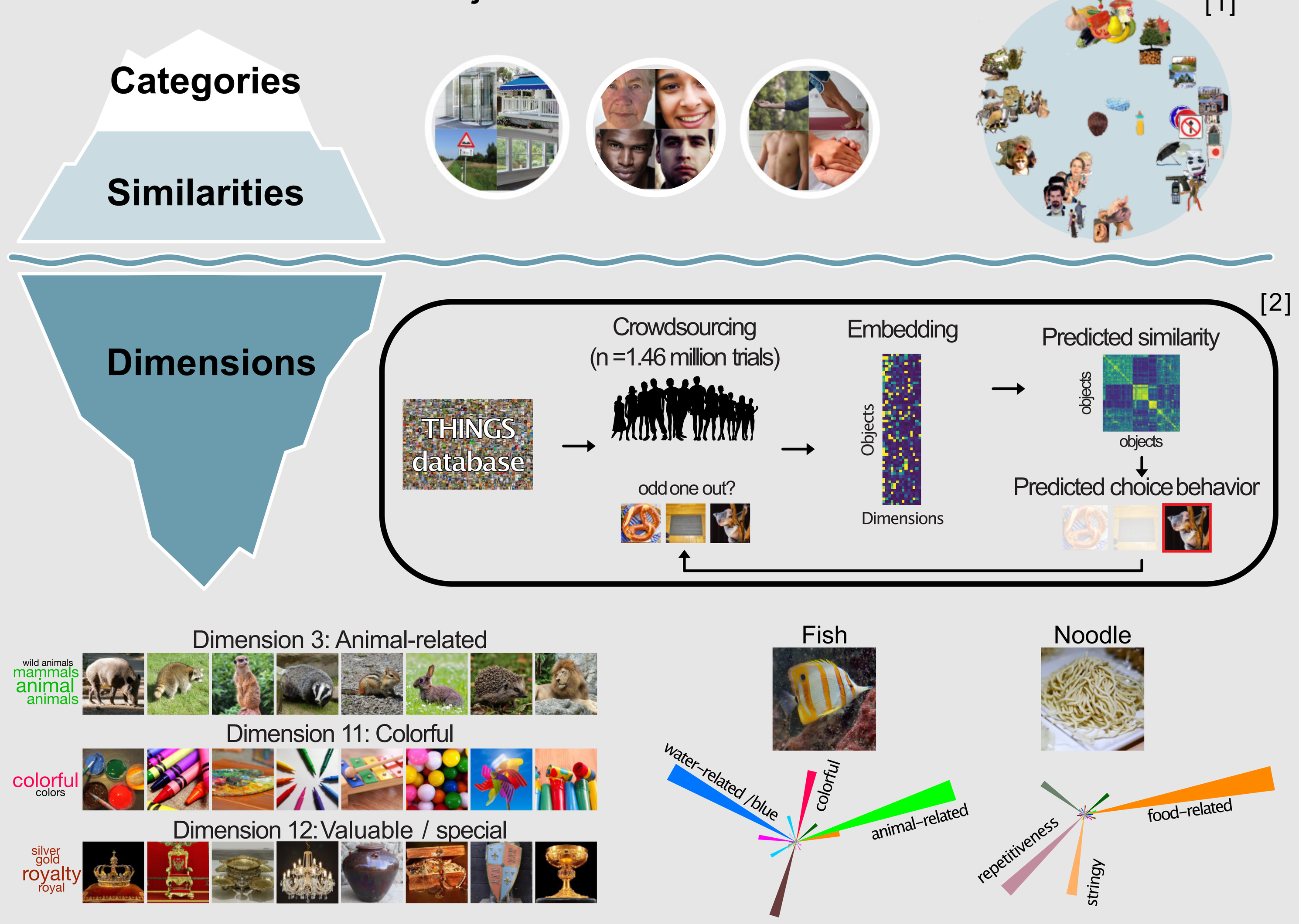
Background

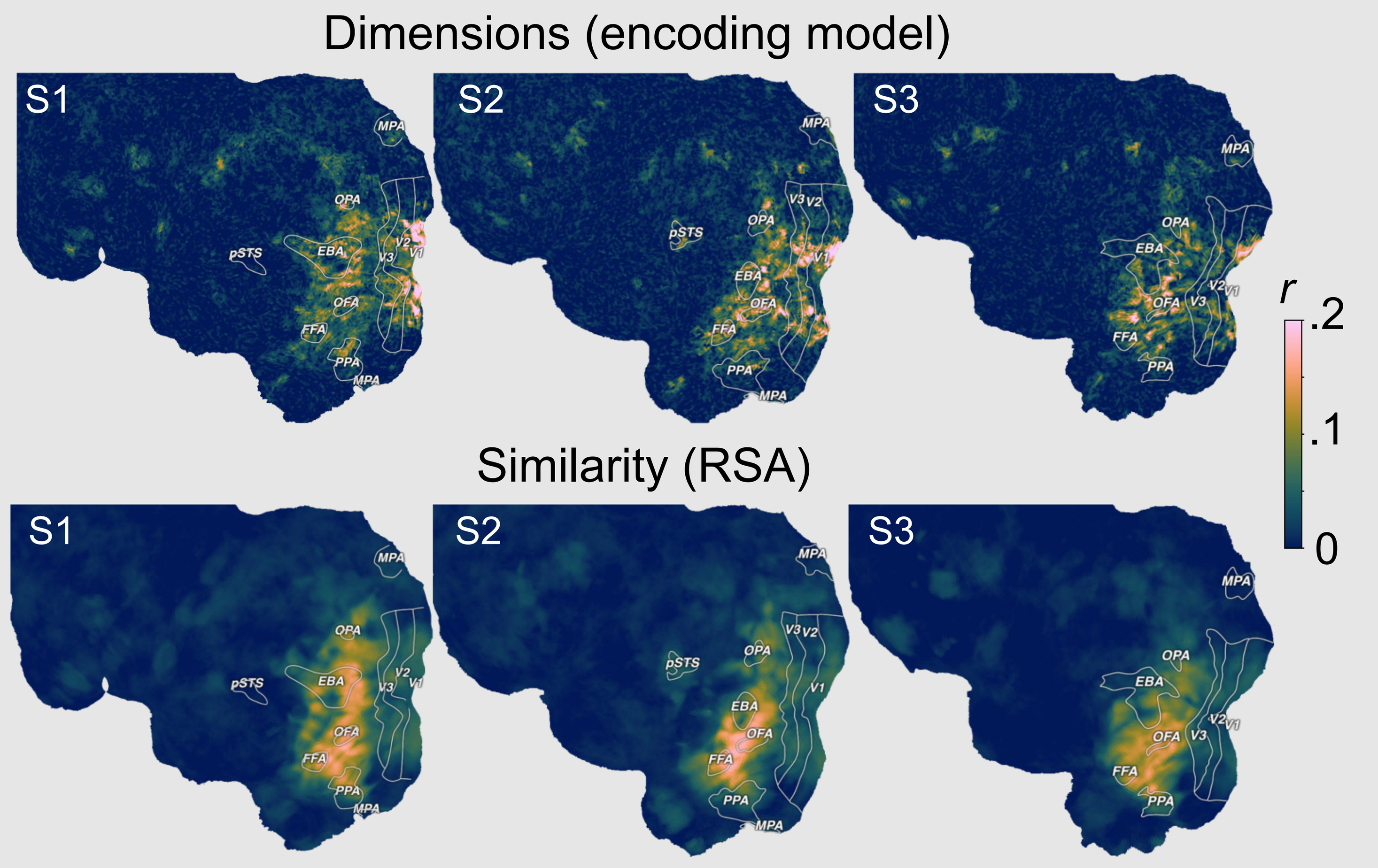
How does the human brain represent the relevance of every-day objects to our behavior?



Methods

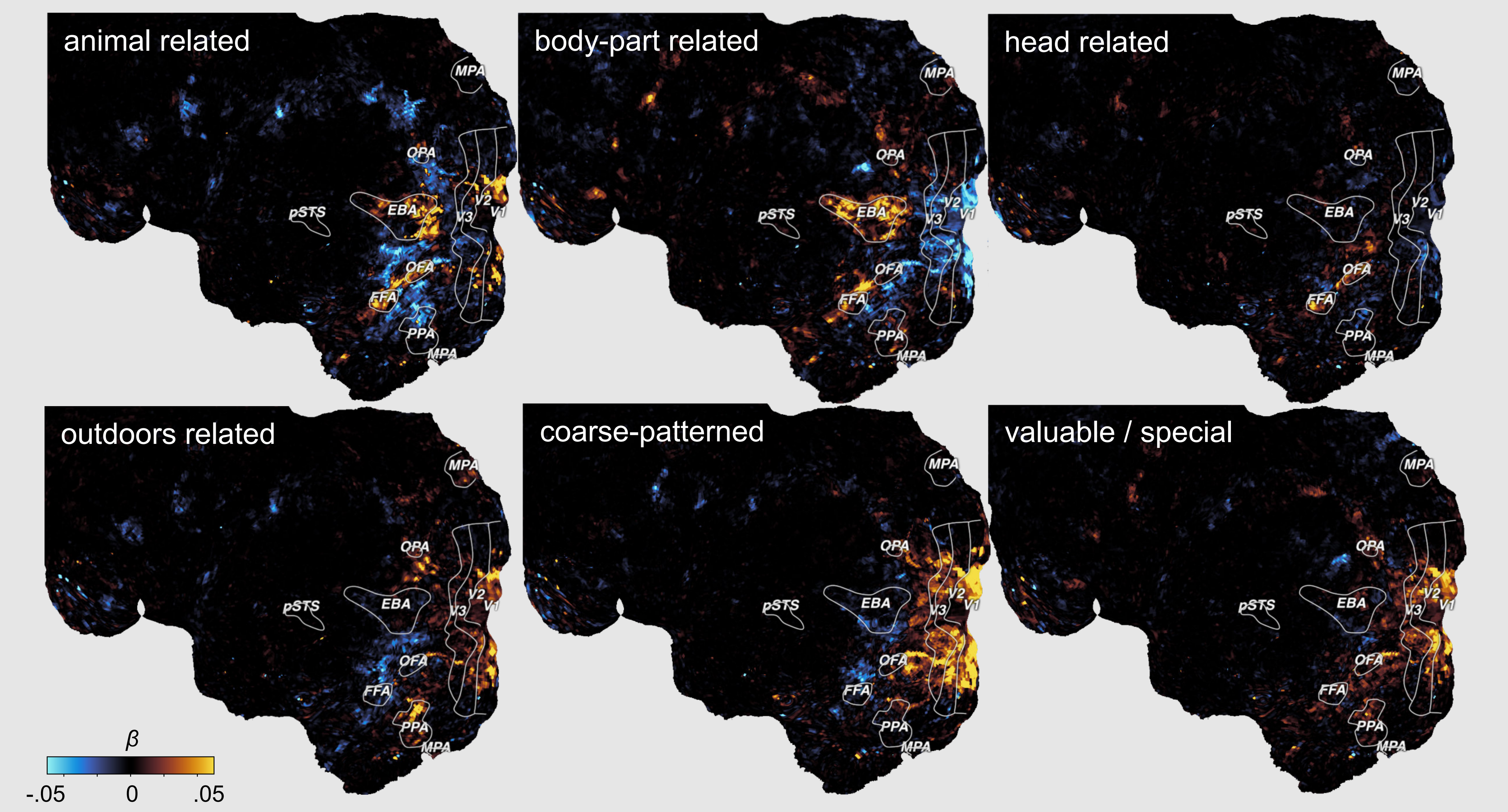
- **fMRI voxel-wise encoding model**
- Model: **49 behaviorally relevant object dimensions** [2]
- 3 Participants, 8,740 unique images of 720 objects
- 3 Tesla fMRI, 2mm, 1.5 s TR, 12 sessions

Where are object dimensions represented?



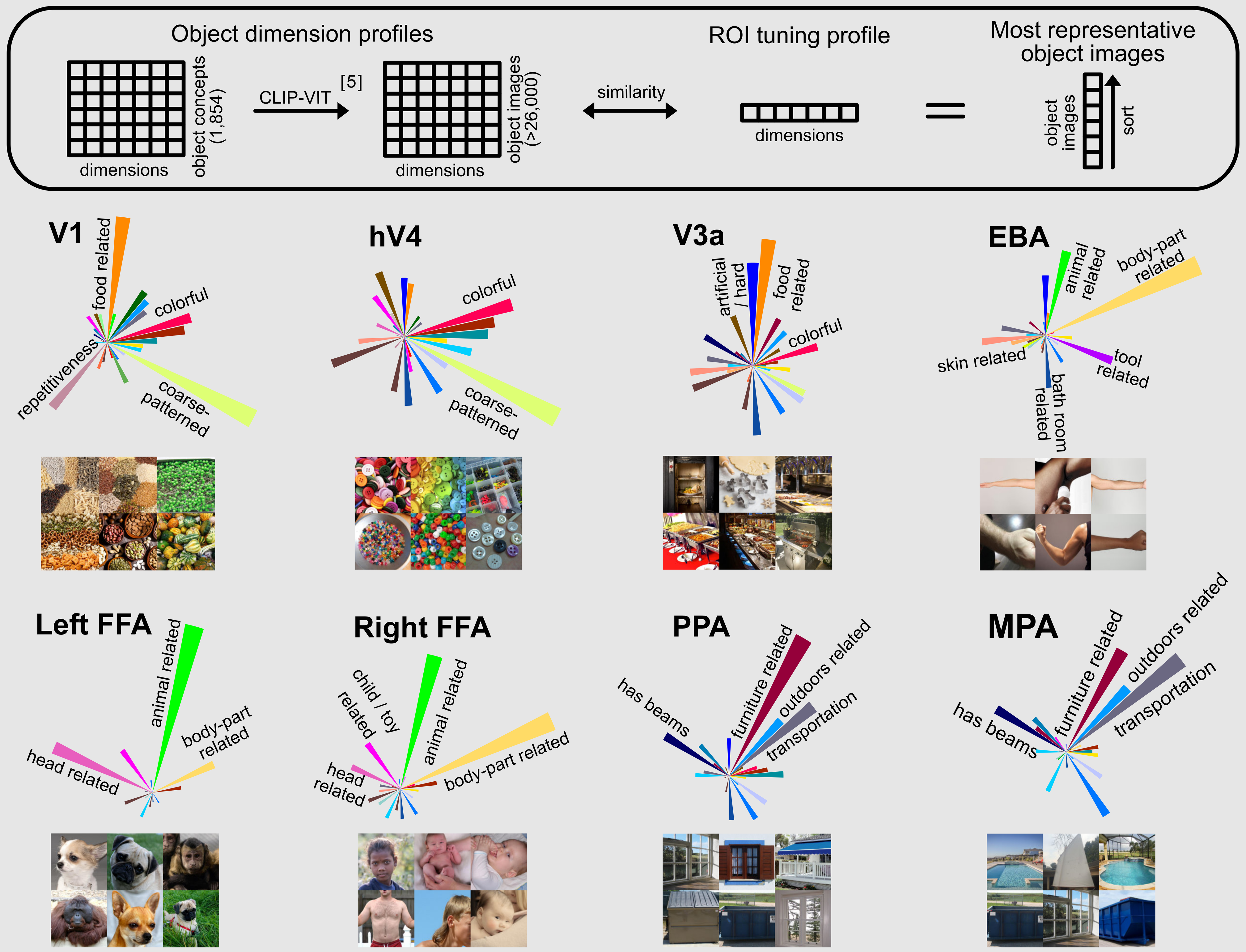
- Dimensions predict activity **throughout the visual system.**
- Similarity is primarily linked to activity in higher-level visual cortex. [3,4]

What's the functional topography of object dimensions?

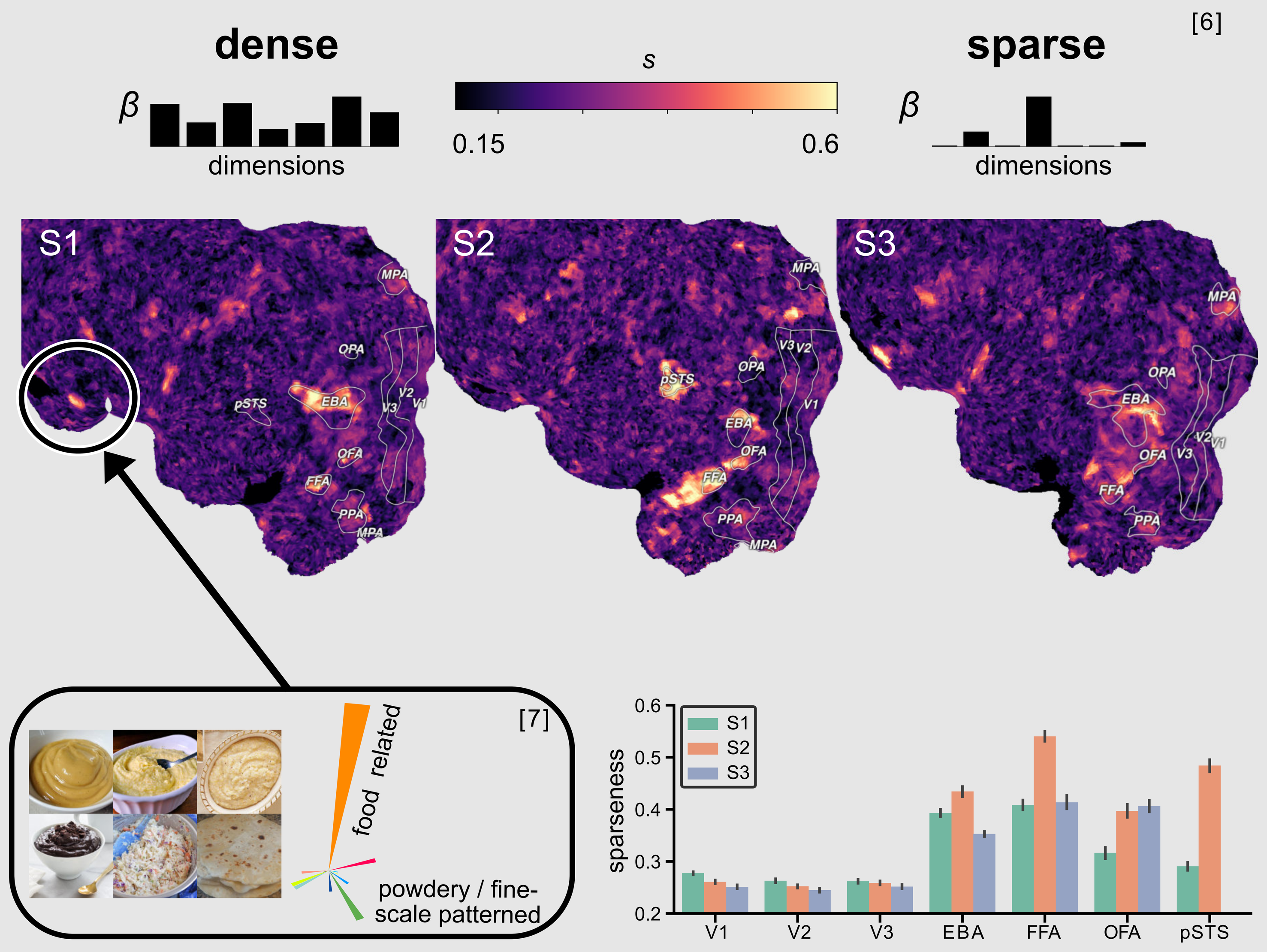


- **Highly distributed**, covering **early visual** as well as **category-selective** areas

How are visual brain regions tuned towards object dimensions?



Is category-selectivity a special case?



- **Category-selective regions** are characterized by a **sparse representation** of behaviorally-relevant object dimensions.
- Sparse clusters point to functionally selective regions.

Conclusions

- Behaviorally-relevant object dimensions can reveal **more fine-grained** cortical representations than similarity and categories.
- The behavioral relevance of objects is not confined to higher visual regions but **represented more globally**.
- Multidimensional approach **captures representation** in visual brain regions and can identify most representative images.
- **Category-selectivity** may be a special case of **sparse tuning** towards behaviorally-relevant object dimensions.
- Object dimensions can provide **interpretable** description of behavioral relevance of the different processing stages in the visual system.

References

[1] Mur et al., *Frontiers in Psychology* (2013)
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