

Comparison between cytoarchitectonic and MRI based parcellation of the human auditory cortex

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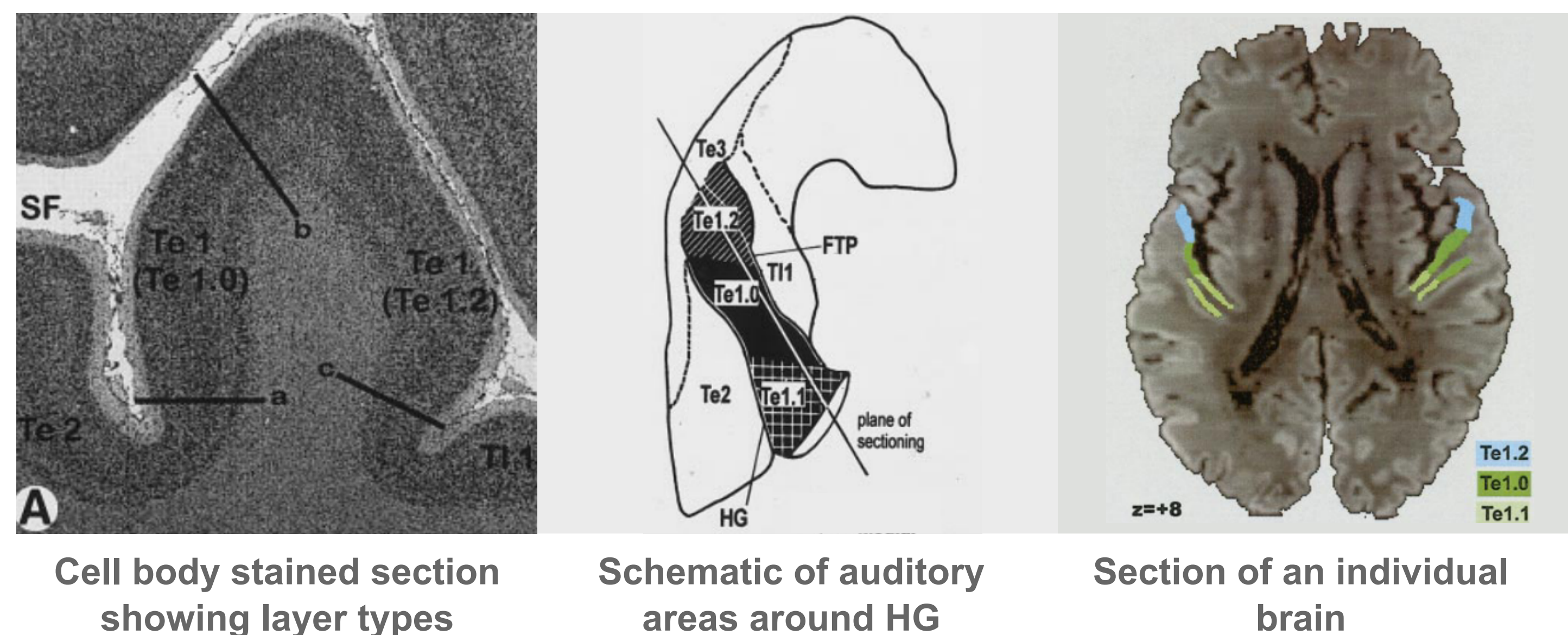
Introduction

Identifying location of human auditory cortical areas based on MRI remains challenging for primary auditory cortex [1]. The correspondence between parcels identified using in-vivo MRI and post mortem-atlases could be affected by anatomical inter subject variability in the temporal lobes [2, 3, 4]. Here we re-address this issue by modernizing analysis of a seminal cytoarchitectonic study of the human auditory cortex [2]. We compare the cytoarchitectonically labeled regions to a prominent multi-modal MRI atlas [5] to investigate the correspondence of the proposed MRI-based parcels around superior temporal cortex with post-mortem identification of cortical areas.

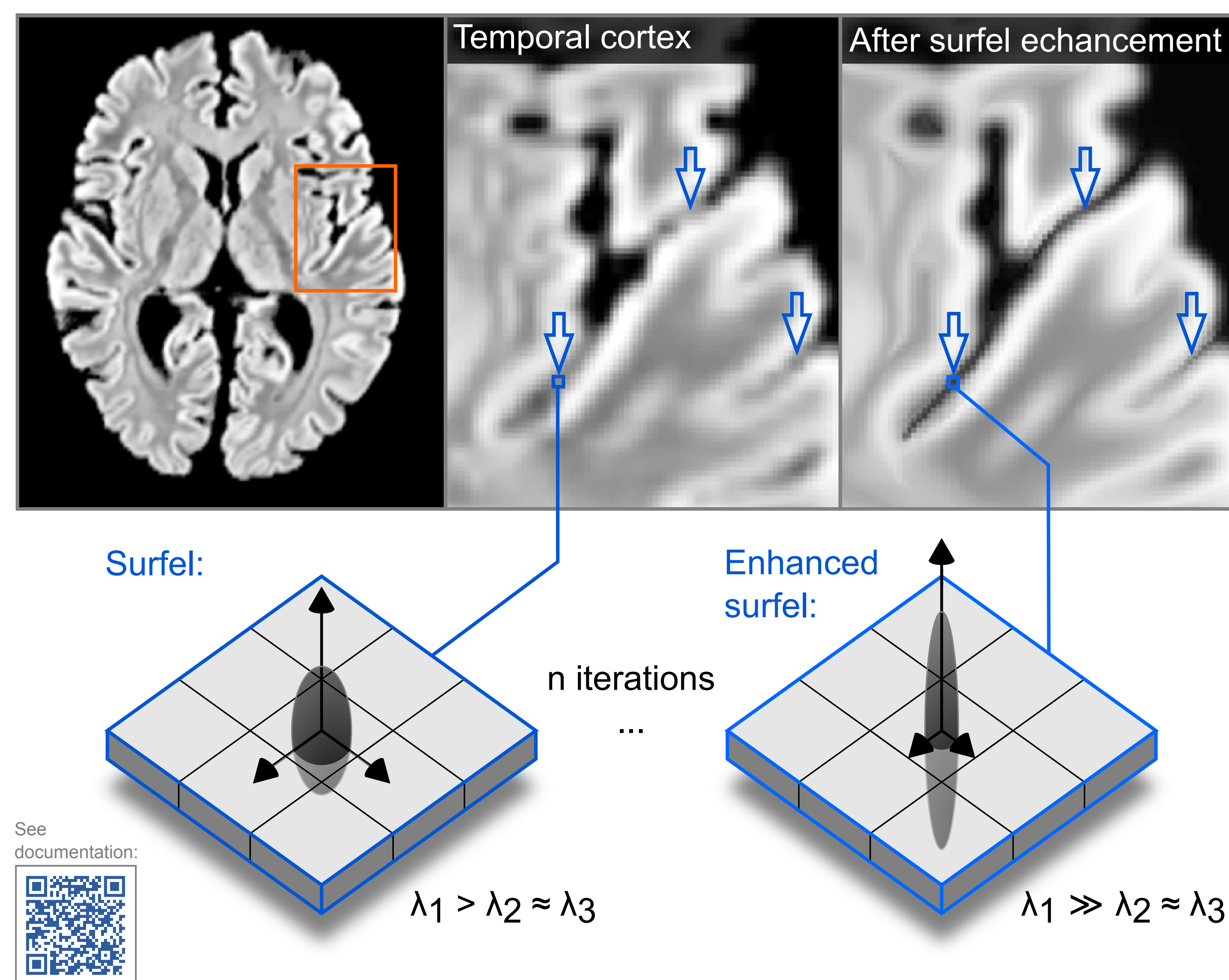
Methods

- 10 post-mortem brains acquired at 1x1x1.17mm resolution (T1w FLASH, see [2]).
- Cytoarchitectonic areal borders were defined at superior temporal gyrus [6].
- Tailored surfel enhancing structure tensor based filtering [7, 8].
See <https://github.com/ofgulban/segmentator> for implementation of this filter.
- Initial intensity-gradient magnitude 2D histogram interactive WM segmentation.
- Manual edits with joint surface reconstruction until Euler characteristic becomes 2.

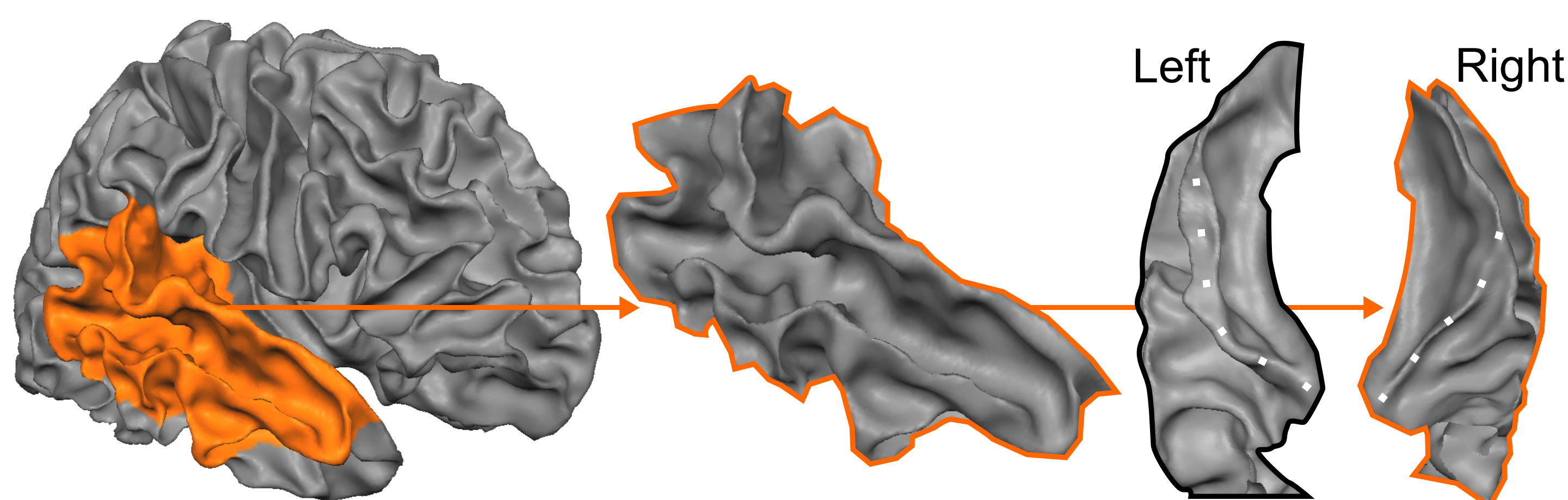
1. Figures adapted from Morosan et al. 2001 summarizing procedure of cytoarchitectonic area definitions:



2. Surfel enhanced MR images are used to reduce sulcal blurr and help white matter segmentation process:

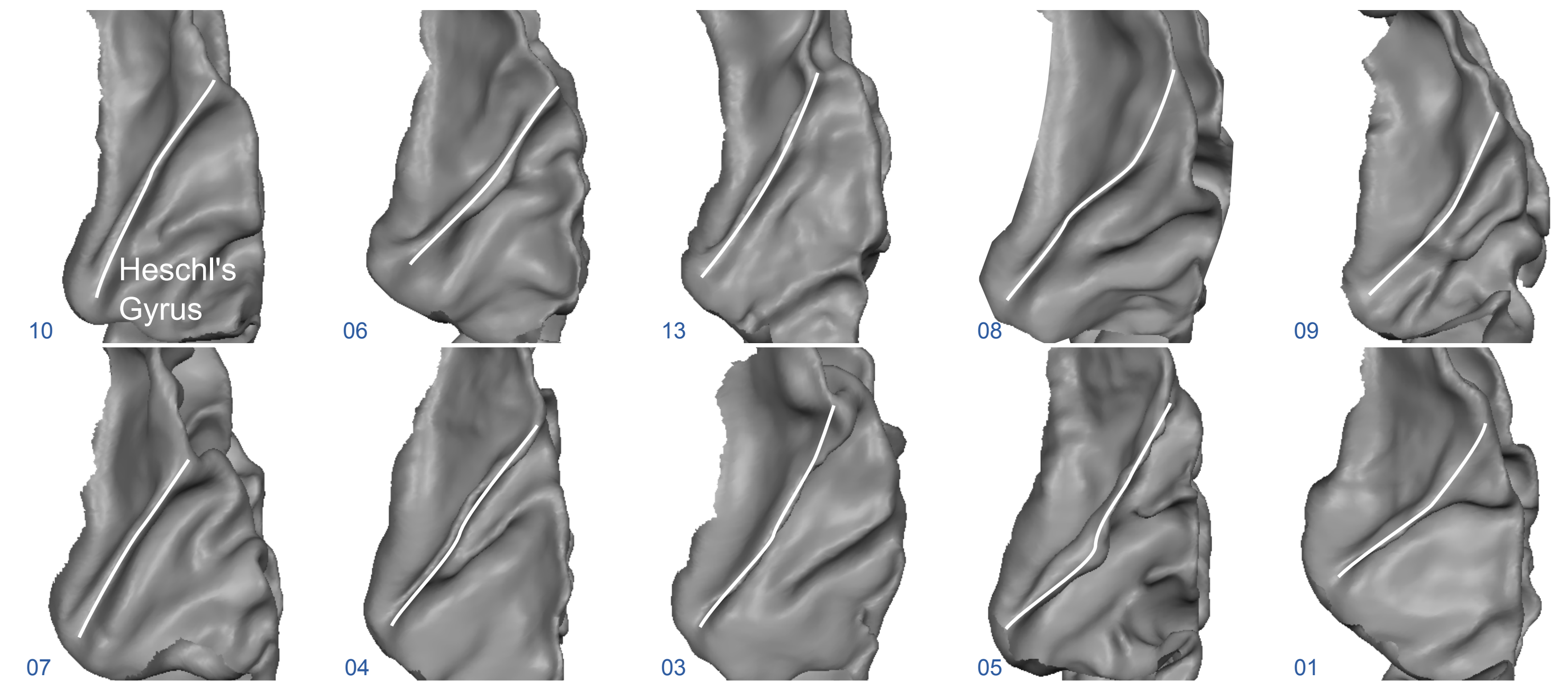


3. Reconstructions of superior temporal cortex. See the amount of shape difference between two hemispheres in the same brain:

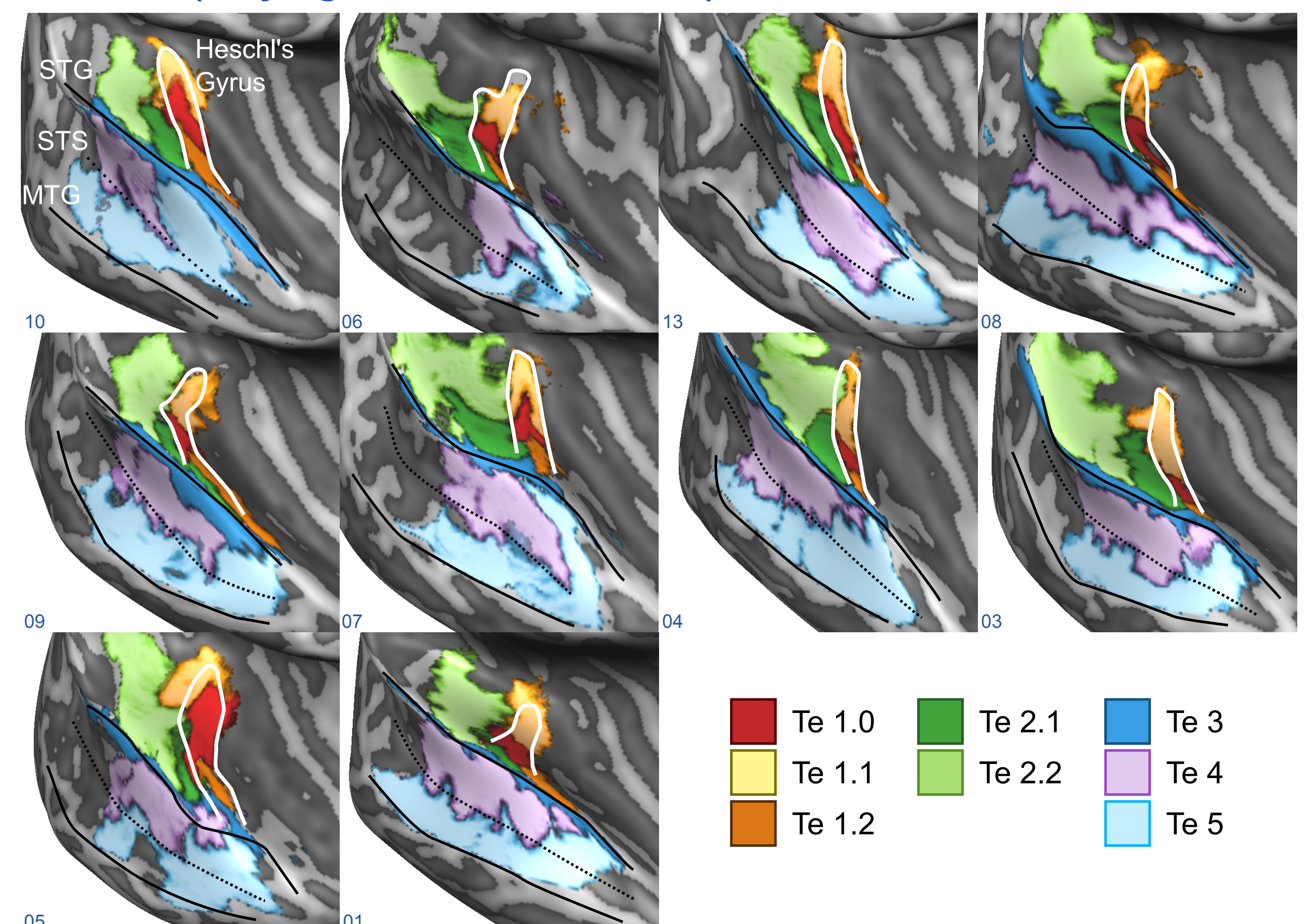


Results

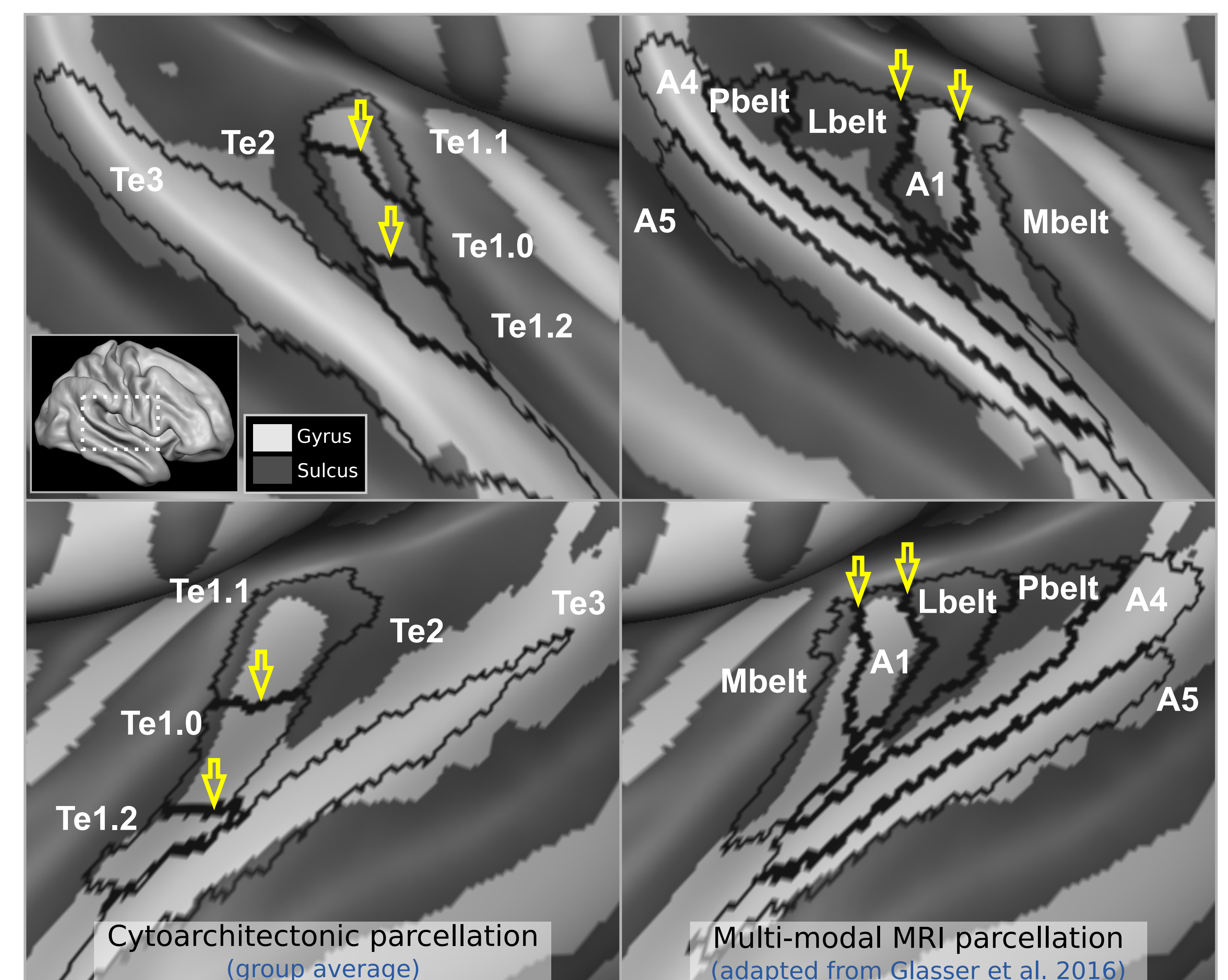
4. Individual surface reconstructions show individual sup. temp. cortex shape differences (only right hemi. shown here):



5. Cytoarchitectonic parcels visualized on individual inflated brain surfaces (only right hemi. shown here):



6. Direct comparison between cytoarchitectonic and MRI-based parcellations shows major differences on Heschl's Gyrus



Future directions

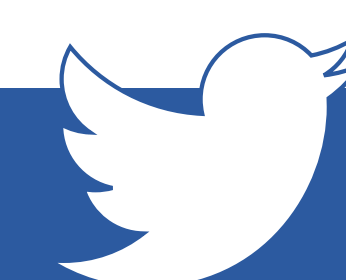
- Tailored cortex based alignment to better account for inter-subject differences at superior temporal cortex.
- Creating templates for different gyrification types with cytoarchitectonically labelled parcels to validate previous parcellation methods [5, 9].

References

- [1] Dick, et al. (2012)
[2] Morosan, et al. (2001)
[3] Rademacher, et al. (2001)
[4] Hackett, et al. (2001)
[5] Glasser, et al. (2016)
[6] Schleicher, et al. (1999)
[7] Weickert, et al. (1998)
[8] Mirebeau, et al. (2015)
[9] Kim, et al. (2000)

Acknowledgments

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