Background

- Presbycusis is the third most common chronic problem in aging
  → prevalence 40% at age 65 and 83% at age 70

- Underlying causes could be
  (Martin & Jerger, 2005; Mazelová et al., 2003)
  → changes to the ear or auditory brain stem
  → changes in cortical auditory processing

- Most studies have been focusing on early processing stages but effects of aging on cortical auditory processing remain unknown

Hypothesis:
Evolution of representations within the nodes of auditory cortex changes through the lifespan

Choice of Stimuli

- Auditory cortex contributes to higher-level processes, such as stream segregation, attention, recognition, crossmodal integration

- To probe auditory cortical processing, it is important therefore to use a stimulus that is sufficiently complex to engage these processes

- We presented a naturalistic clip from a movie, and used the analysis method of Inter-Subject Correlation (ISC), which has been proven powerful in understanding higher-level auditory processing (Hasson et al., 2008)

Parcellating Auditory Cortex

- Need to be able to identify primary auditory cortex and successive regions in the processing streams

No sound consensus hackathon 2013
  → Use diffusion tractography and resting state to calculate connectivity for each voxel in seed in auditory cortex to 120 target ROIs spanning the brain (Human Connectome Project data)
  → Cluster seed voxels by their signature of connectivity and calculate a modularity score Q

http://www.cusacklab.org/nsc/

Results

- ISC in auditory cortex

  Strong ISC in all regions of auditory cortex
  Strongest ISC around primary auditory cortex
  (all modules significantly different from zero p<.0001 and different from each other p<.001)

- ISC in primary auditory cortex by age

  ISC in primary auditory cortex reduces with age
  Left: r=0.54
  +/-0.007 (***)
  Right: r=0.41
  +/-0.006 (***)

- Regional effects of age on ISC

  Anterior regions show greater drop-off in ISC with age
  (region x age interaction  p < .0001)

Conclusions

- Strong ISC in auditory cortex with highest values in primary regions

- ISC in primary auditory cortex reduces from age 18 to 89 years in an approximately linear manner
  → Evidence of age-related change in cortical input

- Changes in ISC with age show a posterior-anterior gradient with the strongest drop off in anterior auditory stream
  → compensatory use of top-down or crossmodal information, which is integrated in anterior temporal regions

  Information processing in auditory cortex changes as a function of age

Acknowledgements

We are grateful to the Cam-CAN respondents and their primary care teams in Cambridge for their participation in this study. We also thank colleagues at the MRC Cognition and Brain Sciences Unit MEG and MRI facilities for their assistance.

The Cambridge Centre for Ageing and Neuroscience (Cam-CAN) research was supported by the Biotechnology and Biological Sciences Research Council (grant number BB/H008217/1).

Contact: cherzman@uwo.ca www.cusacklab.org www.cam-can.org

References