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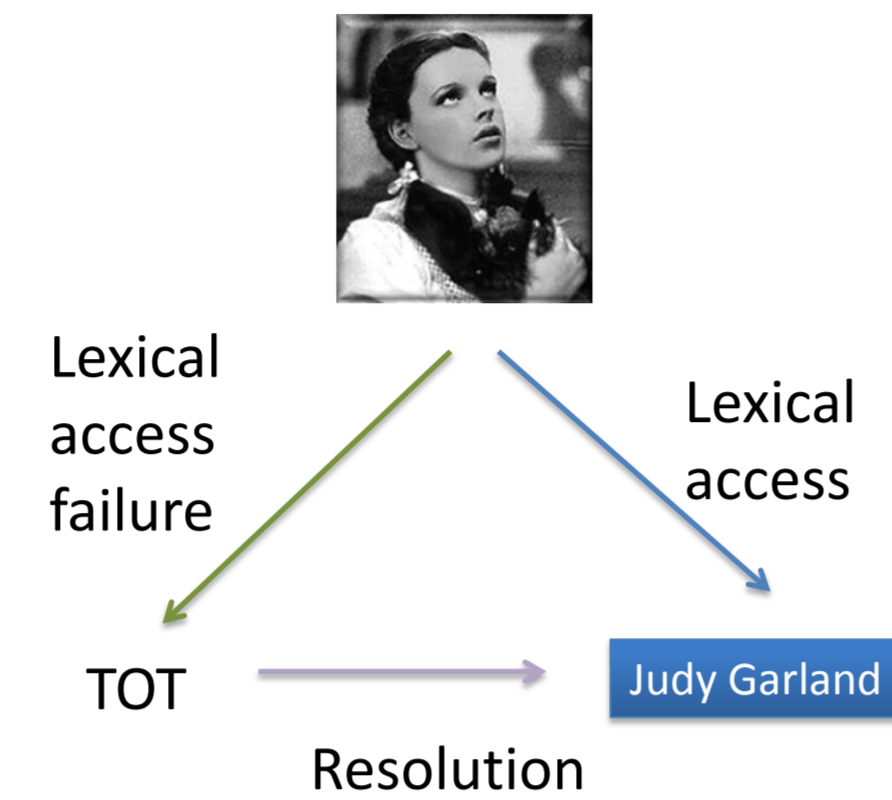
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Introduction

Tip-of-Tongue states (TOTs):

- Temporary word finding failures for familiar words, increase with age
- Previous evidence suggests TOTs reflect **language-specific** lexical access deficit¹
- TOT resolution may rely on **domain-general** processes^{2,3}
- Older adults worry their TOTs reflect **domain-general** cognitive decline⁴

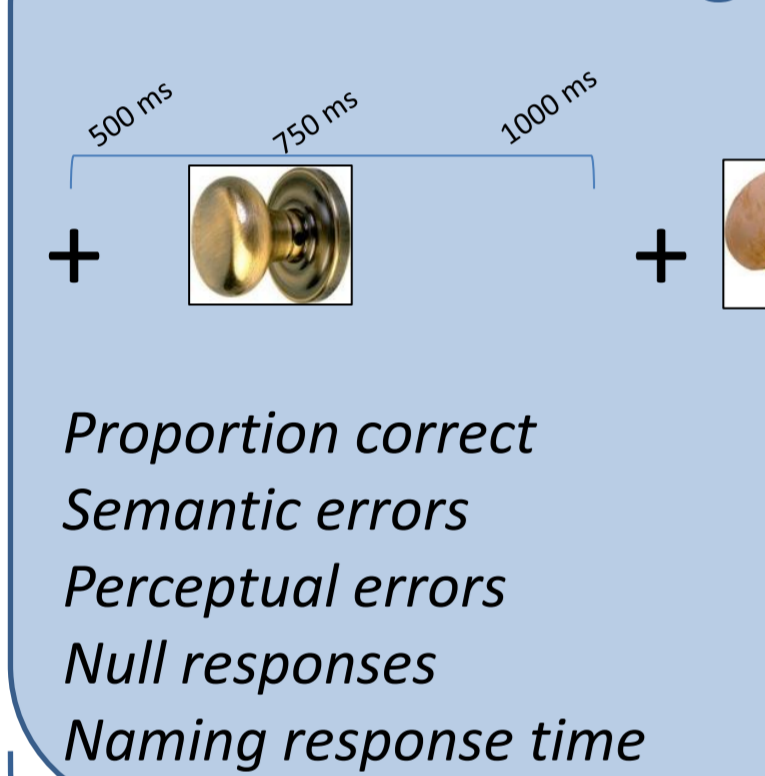


Do **language-specific** and **domain-general** processes predict TOTs differently across the lifespan?

Method

Behavioural tasks and measures

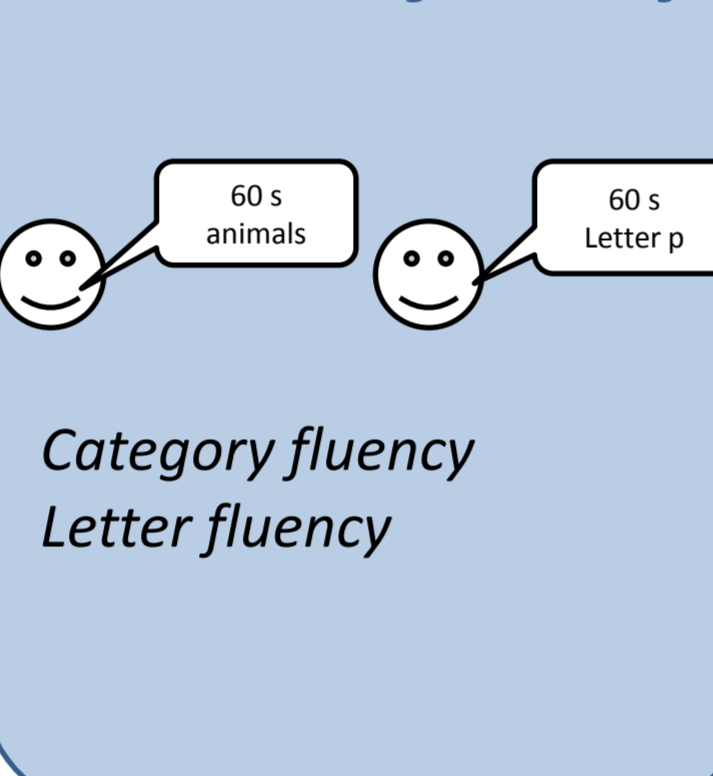
1. Picture naming



2. Picture –picture priming



3. Verbal fluency



PCA components

4. Tip-of-the-tongue (TOT)



Participants

- Cam-CAN cohort, population-based recruitment⁵
- N=577 (N=534 for MRI)
- Age 18-88 (M=54.4, SD=18.4)
- 290 males, 287 female

MRI details

*T1-weighted sequence GRAPPA; repetition time (TR) = 2,250 ms; echo time (TE) = 2.99 ms; inversion time (TI) = 900 ms; flip angle $\alpha = 9^\circ$; field of view (FOV) = 256 × 240 × 192 mm³; resolution = 1 mm isotropic; accelerated factor = 2; acquisition time of 4 min 32 s

*Co-registered T1 and T2 images were used in a multi-channel segmentation (SPM12 Segment, based on "New Segment" in SPM8[®]) routine in order to extract probabilistic maps of 6 tissue classes: GM, WM, cerebrospinal fluid (CSF), bone, soft tissue, and residual noise.

*Native-space GM images for all participants submitted to DARTEL⁷ to create group template images. The group template was then normalized to the MNI template, and normalization parameters were applied to each individual participant's images.

*Individual normalized images were smoothed (10mm FWHM Gaussian kernel)

Results : Word production factors

PCA with production measures:

| | Accuracy | Fluency | Priming |
|---------------------------|----------|---------|---------|
| Semantic errors | 0.87 | -0.16 | -0.09 |
| Correct naming | -0.83 | 0.36 | 0.31 |
| Perceptual errors | 0.80 | 0.04 | 0.14 |
| Letter fluency | 0.06 | 0.84 | -0.02 |
| Category fluency | -0.25 | 0.77 | 0.07 |
| Naming RTs | 0.10 | -0.58 | -0.02 |
| Phonological facilitation | 0.06 | -0.01 | 0.72 |
| Semantic interference | -0.09 | 0.03 | 0.65 |
| Null responses | 0.38 | -0.44 | -0.45 |

Three production factors:

1. Accuracy
2. Fluency
3. Priming

Interpreting factors:

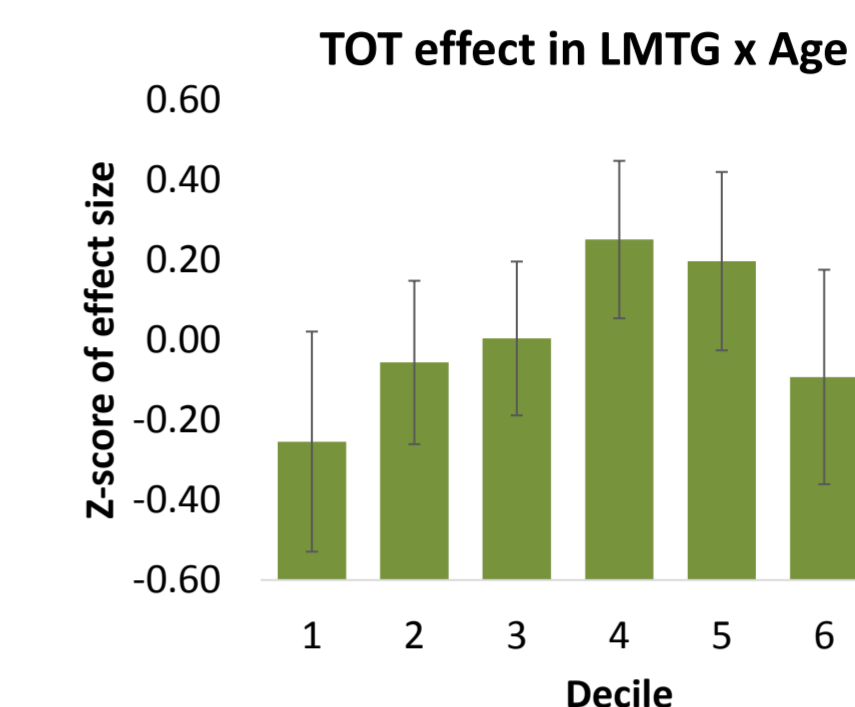
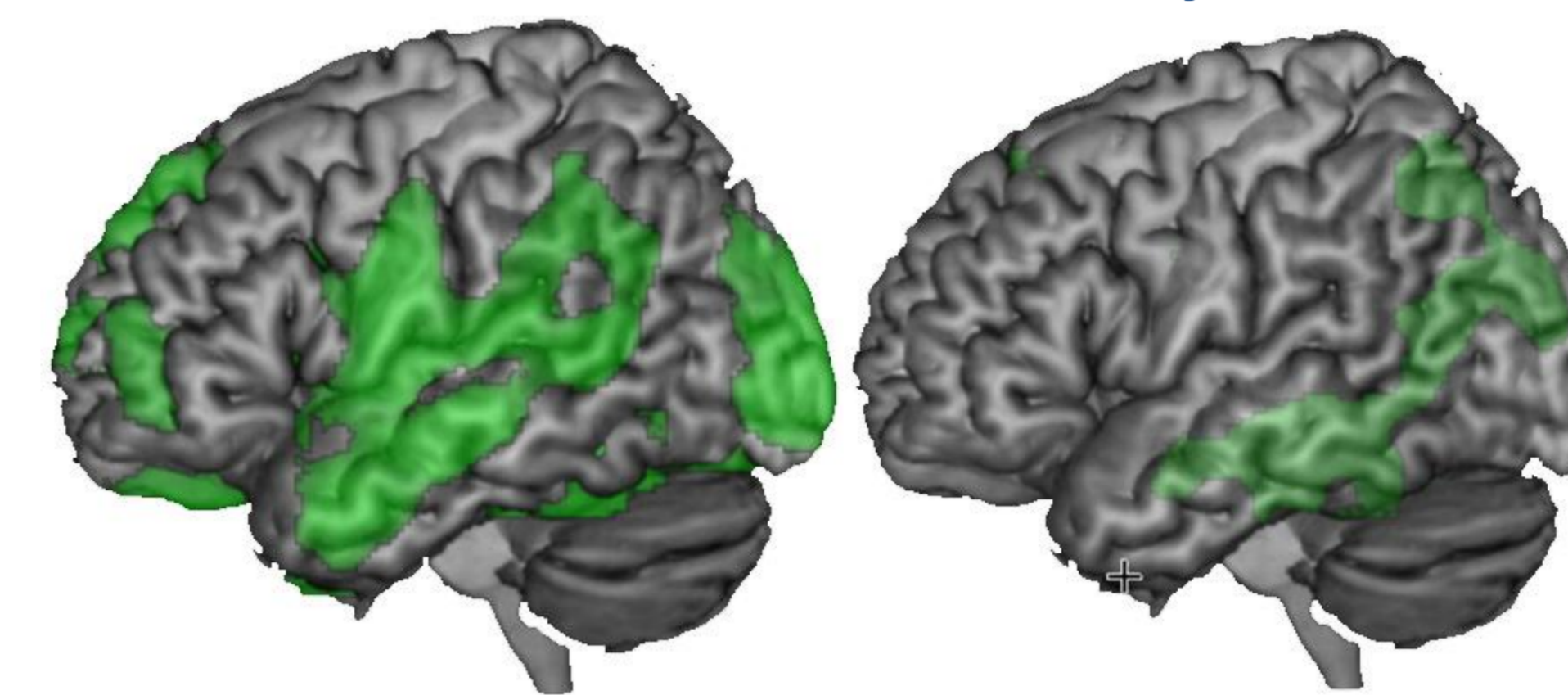
- All 3 factors related to TOTs
- Accuracy and Fluency related to domain-general fluid intelligence

| | TOTs | Fluid Int. |
|----------|-------|------------|
| Accuracy | .056 | -1.1 |
| Fluency | -.076 | 1.3 |
| Priming | -.019 | .247 |

Multiple regr. Beta values, controlling for age, gender, education

Results: Age and Grey matter

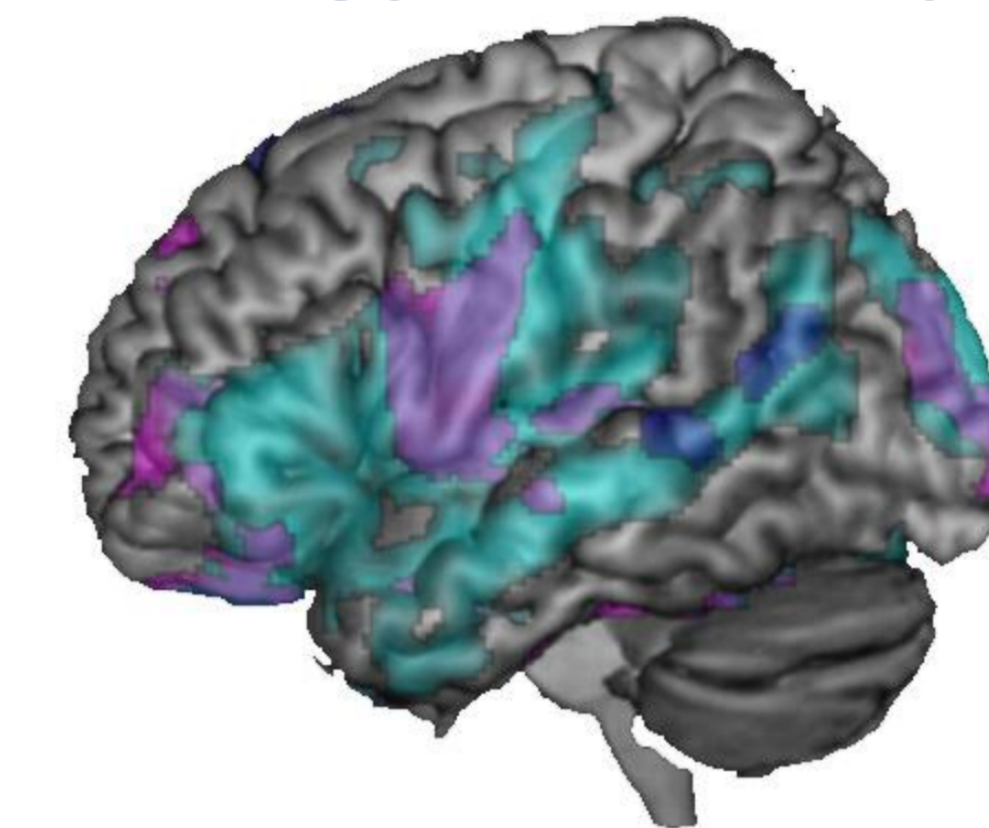
TOTs & Grey matter



TOTs most strongly related to grey matter in middle age

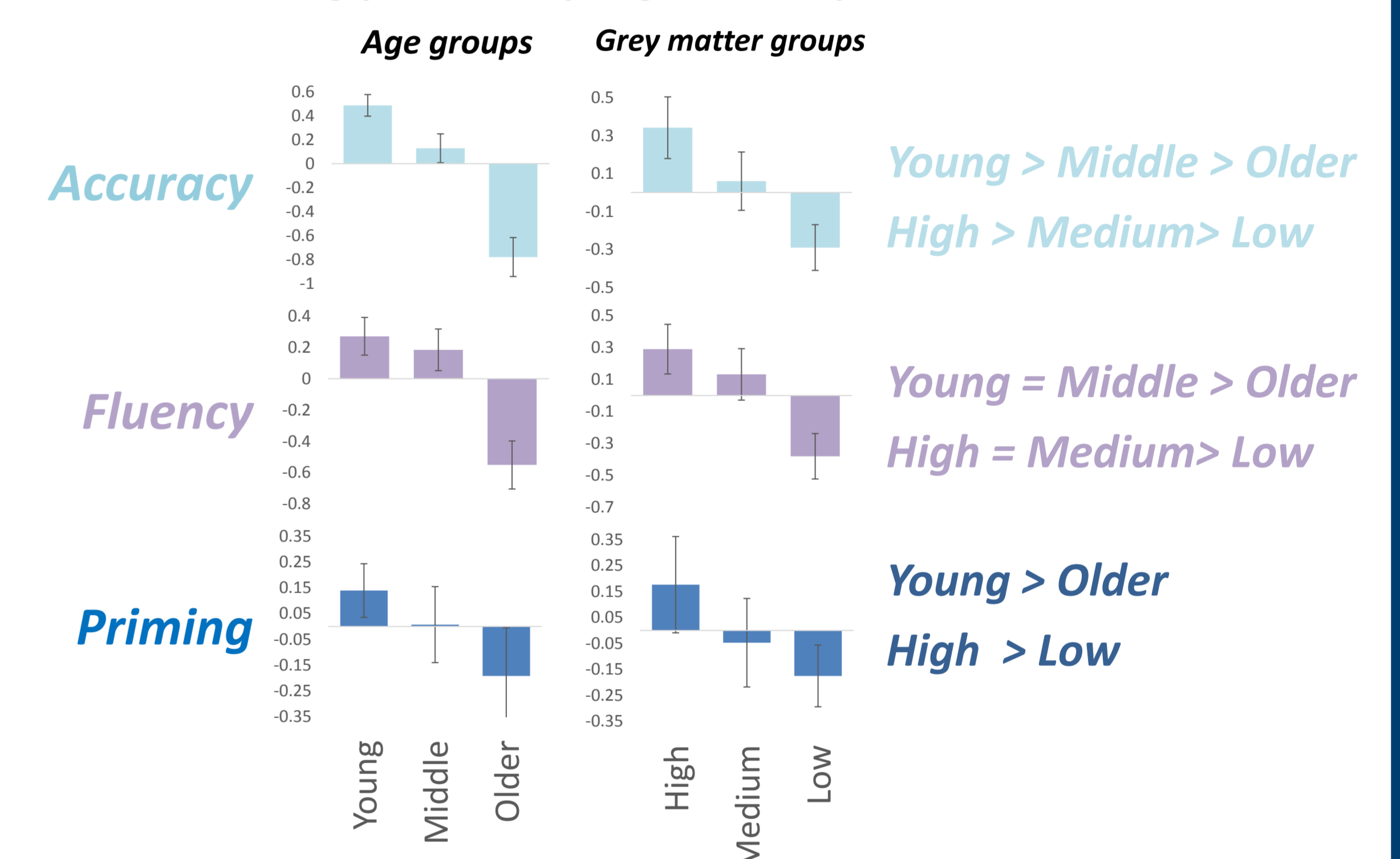
Interaction with age primarily in temporal language rather than frontal domain-general regions

Naming factors & Grey matter



Accuracy
Fluency
Priming

Naming factors by Age & Grey matter



Factors & TOTs x Age

| | Younger | Middle | Older |
|----------|---------|--------|-------|
| Accuracy | -.045 | -.073 | -.049 |
| Fluency | -.051 | -.079 | -.078 |
| Priming | .009 | -.008 | -.038 |

Multiple regr. Beta values, controlling for age, gender, education

Factors & TOTs x Grey matter

| | High | Middle | Lower |
|----------|-------|--------|-------|
| Accuracy | -.030 | -.065 | -.082 |
| Fluency | -.054 | -.088 | -.065 |
| Priming | .006 | -.010 | -.043 |

Multiple regr. Beta values, controlling for age, gender, education

TOTs predicted by Accuracy and Fluency across the lifespan and a range of grey matter levels
TOTs predicted by Priming only in older group and lowest grey matter group

Summary

- TOTs → domain-general and language-specific processes
- Factors relate differently to age and grey matter
 - General factors widely predictive of TOTs
 - Priming factor only related to TOTs for older adults or low grey matter
- Supports language-specific model of older adults' TOTs

References

1. Burke, Deborah M., et al. "On the tip of the tongue: What causes word finding failures in young and older adults?" *Journal of memory and language* 30.5 (1991): 542-579.
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3. Shafto, Meredith A., et al. "Word retrieval failures in old age: the relationship between structure and function." *Journal of Cognitive Neuroscience* 22.7 (2010): 1530-1540.
4. Reese, Celinda M., Katie E. Cherry, and Lisa E. Norris. "Practical memory concerns of older adults." *Journal of Clinical Geropsychology* 5.4 (1999): 231-244.
5. Shafto, Meredith A., et al. "The Cambridge Centre for Ageing and Neuroscience (Cam-CAN) study protocol: a cross-sectional, lifespan, multidisciplinary examination of healthy cognitive ageing." *BMC neurology* 14.1 (2014): 204.
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Online Reprints:

http://www.cam-can.com/publications/posters/CC-DR-MS-004_poster.pdf

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