

### Fold opening dynamics during the aging process highlight new sulcus communities

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# Fold opening dynamics during the aging process highlight new sulcus communities



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# Context



As life expectancy is increasing, maintaining brain health is prevailing societal challenge and calls for a better understanding of human cognitive decline.

The patterns of **cortical atrophy** associated with the spread of neurodegenerative diseases and the effects of aging are usually studied using features like cortical thickness, surface area or gyrification index [1]. In return, studies focusing on the slow opening of the cortical folds resulting from the continuous loss of tissues are rare [2-3]. To our knowledge, none of these studies have investigated the existence of sulcus communities following the same opening trajectory during aging: our work focuses on these communities and can be related to the study of structural cortical networks [4].

- > Two cohorts studied: UK Biobank and MEMENTO > T1-weighted MRIs
- > Brain features (cortical thickness and sulcal aperture) extracted for each sulcus using **BrainVISA**

-0.00



• 20,541 subjects

• Average age: 62 yrs

• No systematic memory

- **MEMENTO**
- 2,323 subjects
- No inclusion requirements At-risk subjects only (isolated SCCs or MCI while not demented)

# Method

**Observing an atrophy acceleration on** a general population (UK Biobank)



### **Piecewise modeling of age**dependency on sulcal openings

tests



- Average age: 71 yrs
- Systematic memory tests

Identification of new sulcus communities (spectral clustering)





### 9 clusters !

Clusters

### **Results** Transposition to an at-risk population (MEMENTO)

> Sulci with most stable modelization during bootstrap have higher correlation scores with FCSRT

> The fifth cluster (in yellow) yields higher correlation with FCSRT and higher predictive power for conversion to dementia

0.50



## Discussion

- \* Sulcal aperture is a better feature than cortical thickness to visualize and model brain atrophy during the aging process.
- The modelization is not relevant for some sulci, probably due to other ongoing aging phenomena.
- Physio-pathological processes in large-scale general population translate into older at-risk population study, hinting at
  results of the second study at the second study of the second study at t result reproducibility and overlay of the most common brain diseases in the general population ( $\neq$  healthy aging)

References [1] Fjell, A. M. (2014). "What is normal in normal aging? Effects of aging, amyloid and Alzheimer's disease on the cerebral cortex and the hippocampus" [2] Bertoux, M. (2019). "Sulcal morphology in Alzheimer's disease: an effective marker of diagnosis and cognition" [3] Tang, H. (2021). "A slower rate of sulcal widening in the brains of the nondemented oldest old" [4] Chen, Z. J. (2011). "Age-related alterations in the modular organization of structural cortical network by using cortical thickness from MRI" Supported by the FRM DIC20161236445, the ANR-19-CE45-0022-01 IFOPASUBA, the ANR-20-CHIA-0027-01 FOLDDICO.