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Cortical thickness and sulcal pits extraction in schizophrenia patients with auditory hallucinations

B. Lerosier^{1,2}; G. Simon^{1,2}; O. Etard^{2,3}; S. Takerkart⁴; G. Auzias⁴; Sonia Dollfus^{1,2,5}

¹ Normandie Univ, UNICAEN, ISTS, 14000 Caen, France

² GIP Cyceron, 14000 Caen, France

³ CHU de Caen, Service d'exploration neurologiques fonctionnelles, 14000 Caen, France

⁴ Institut de Neurosciences de la Timone UMR 7289, Aix-Marseille Université, 13005 Marseille, France

⁵ CHU de Caen, Service de Psychiatrie, 14000 Caen, France

✉ baptiste.lerosier@unicaen.fr



Introduction

Auditory hallucinations are the most common and invalidating symptom in schizophrenia, affecting more than 70% of patients. The Superior Temporal Sulcus (STS) is involved in the perception of the human voice (1), and several studies show its implication in Auditory verbal hallucinations (AVH) (2,3). Sulcal patterns in the white matter set up at a very early stage and are very stable over the life course (4). They are therefore a good method that reflects an early vulnerability, probably genetic. On the other hand, the variation of cortical thickness, is much more dynamic (5) and represents an interesting method for studying the environmental role in the maturation of the brain and in auditory hallucinations. **The aim of this study is therefore to determine whether verbal auditory hallucinations are associated with morphological changes of the superior temporal sulcus and in particular, whether it is possible to find anatomical markers of early and environmental risk factors.** Therefore we included patients with a proneness to hallucinate (AVH+), patients who have never hallucinated (AVH-) as well as healthy controls (HC)

Methods

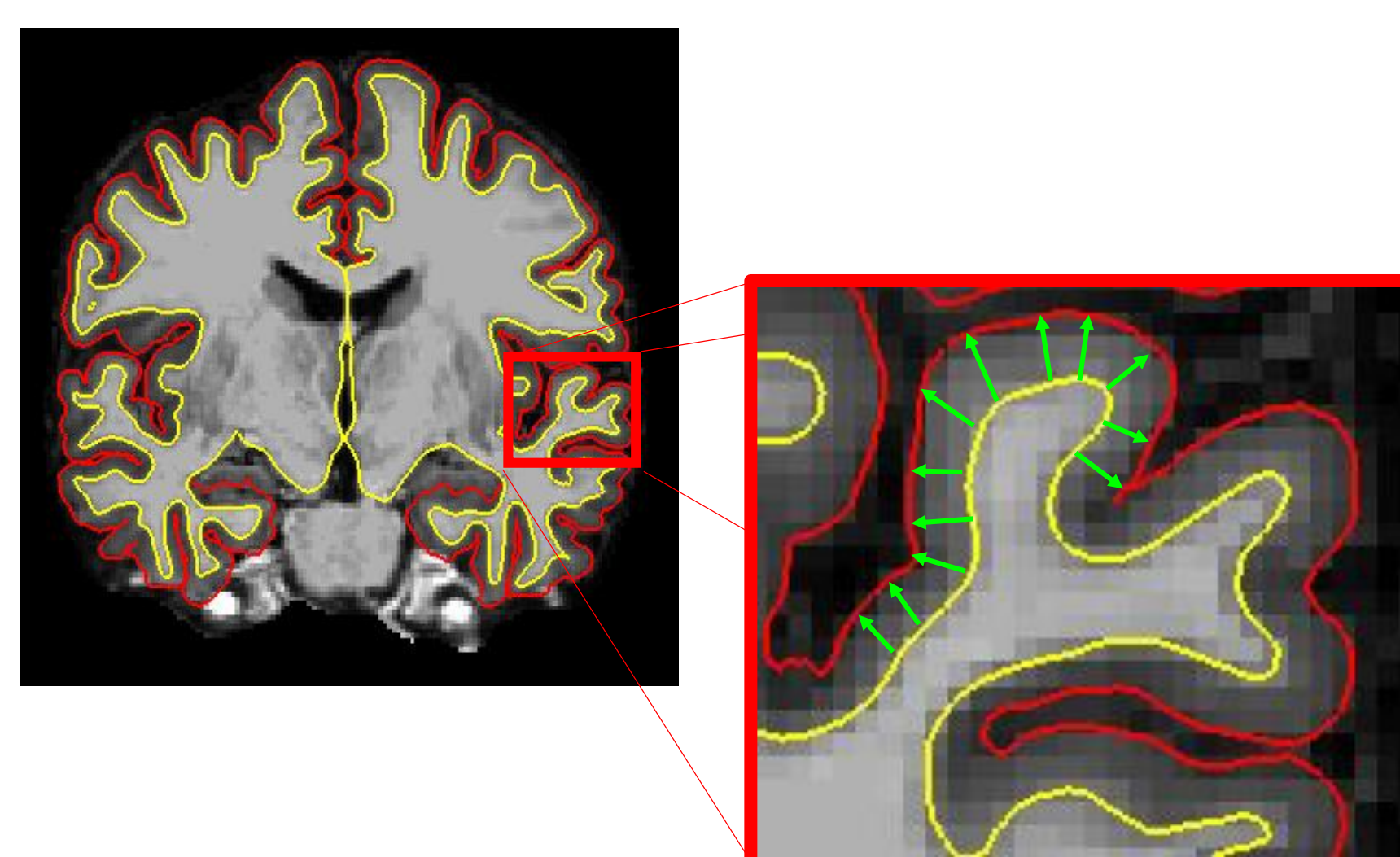
PARTICIPANTS

- 53 AVH+; 20 AVH-; 100HC
- Matched for Age, Gender, laterality and Education level
- The psychopathological state of schizophrenia patients was assessed by the Mini International Neuropsychiatric Interview (MINI) and by the Auditory Hallucination Rating Scale (AHRs).

ACQUISITION AND PRE-PROCESSING

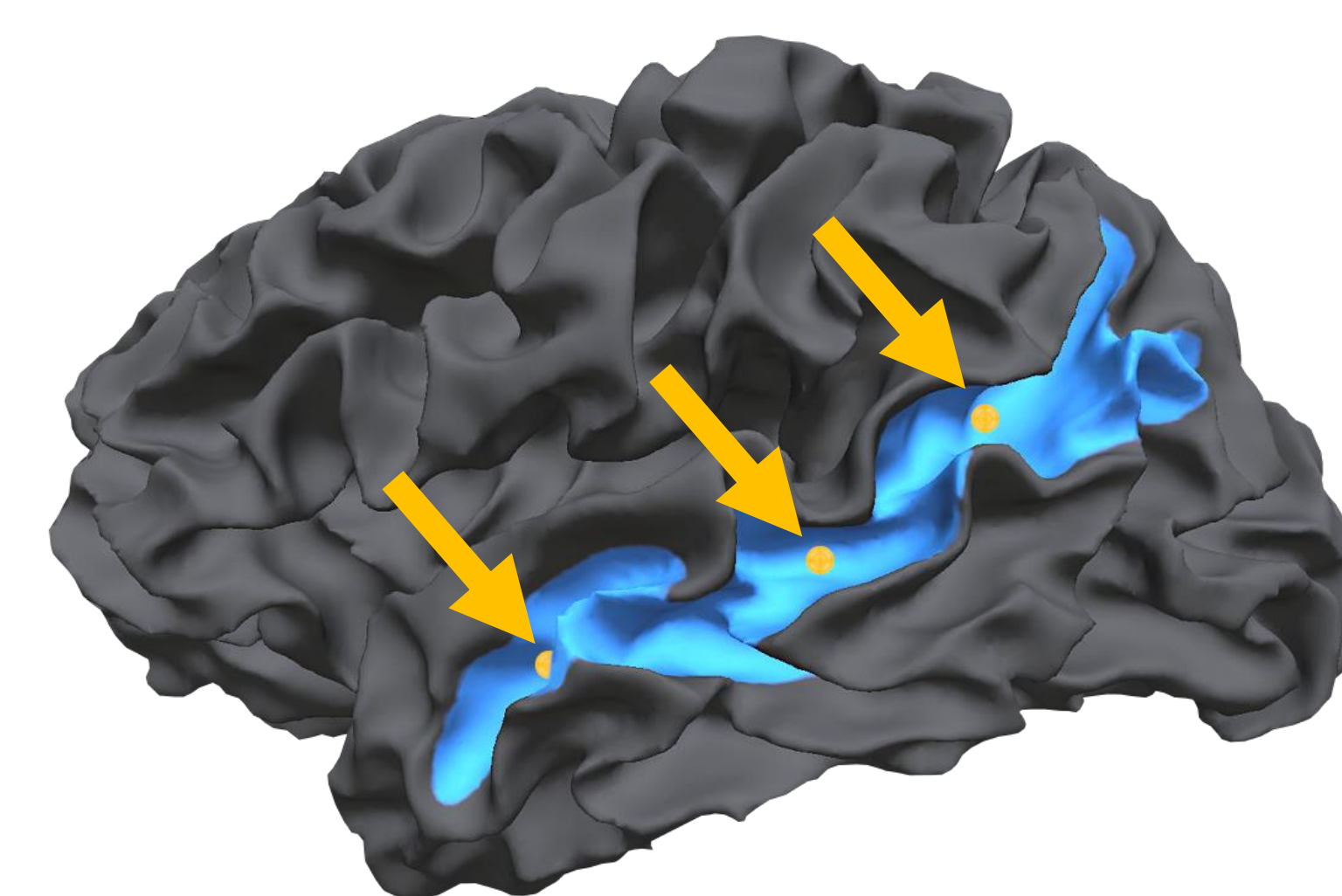
- 3T MRI (T1 sequence)
- Isotopic resolution of voxels of 1 mm³
- Pre-processing of anatomical data using Freesurfer (6)

CORTICAL THICKNESS MEASUREMENT



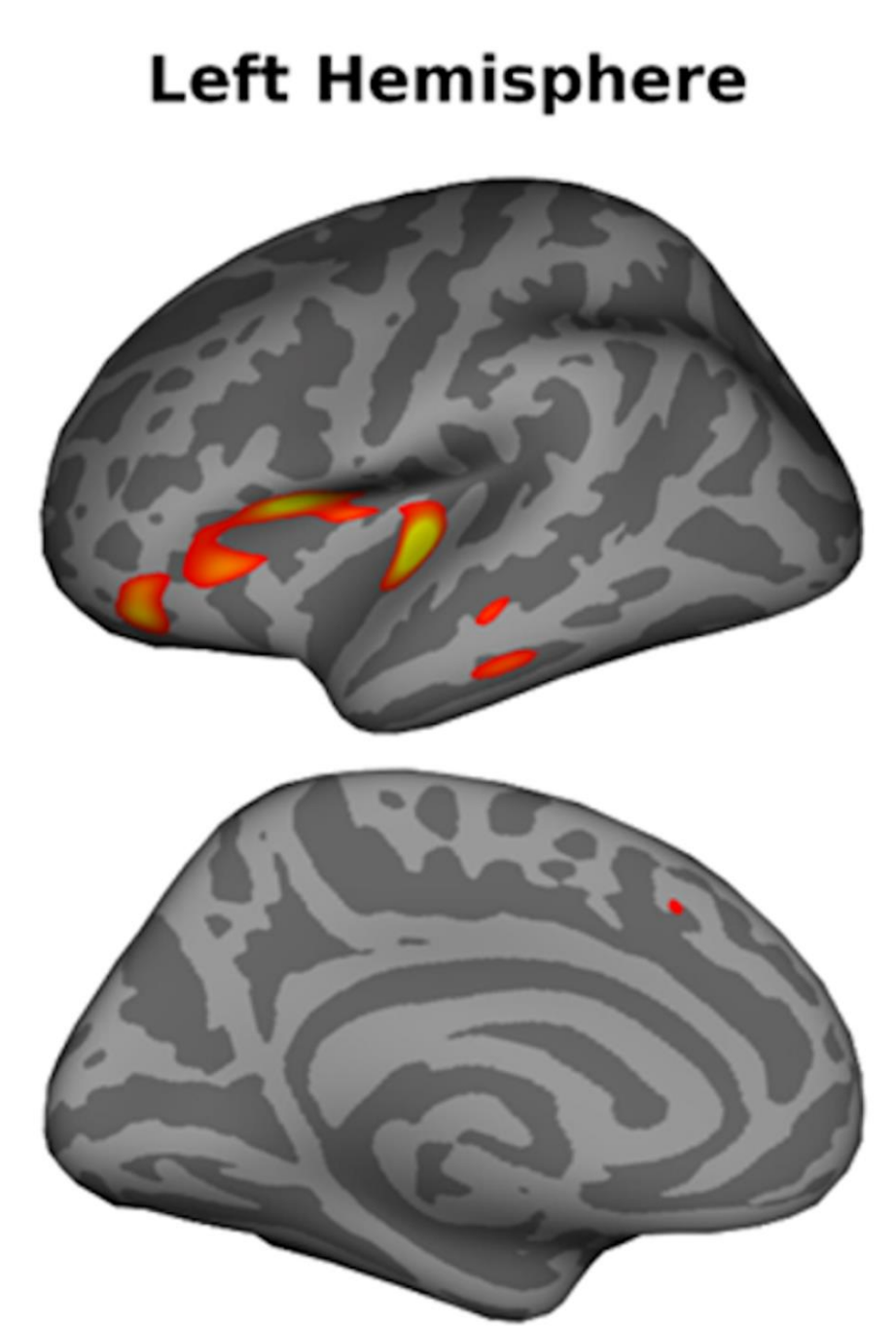
- Cortical thickness (CT) is the distance between the white matter surface and the grey matter surface. CT was measured over the entire brain for all our subjects.

EXTRACTION OF SULCAL PITS

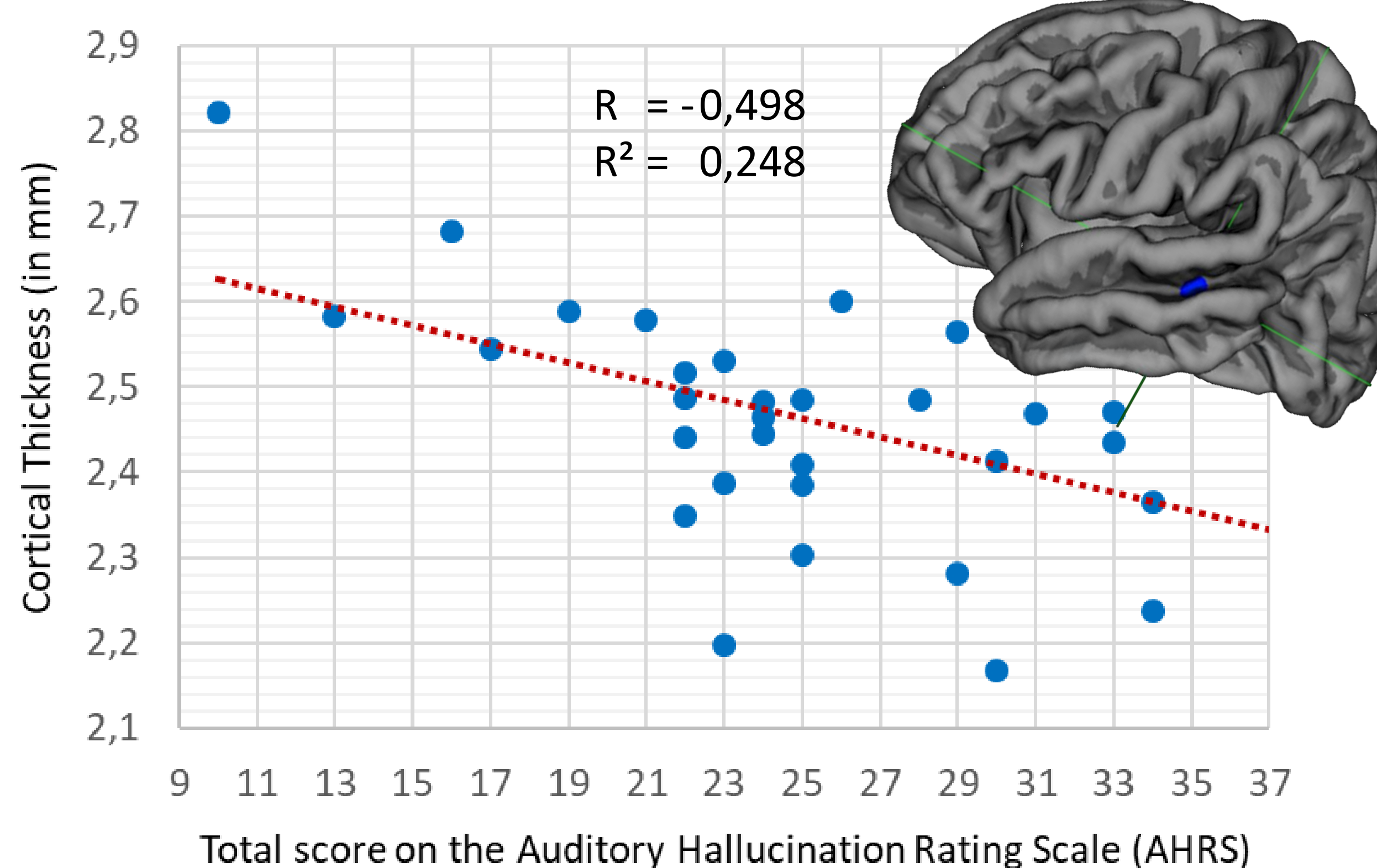


- A sulcal pit (SP) is the position with the maximum depth in the sulcus. Multiple SP can be identified in the same sulcus. They are identified on the white matter in the left and right STS in all subjects. (7)

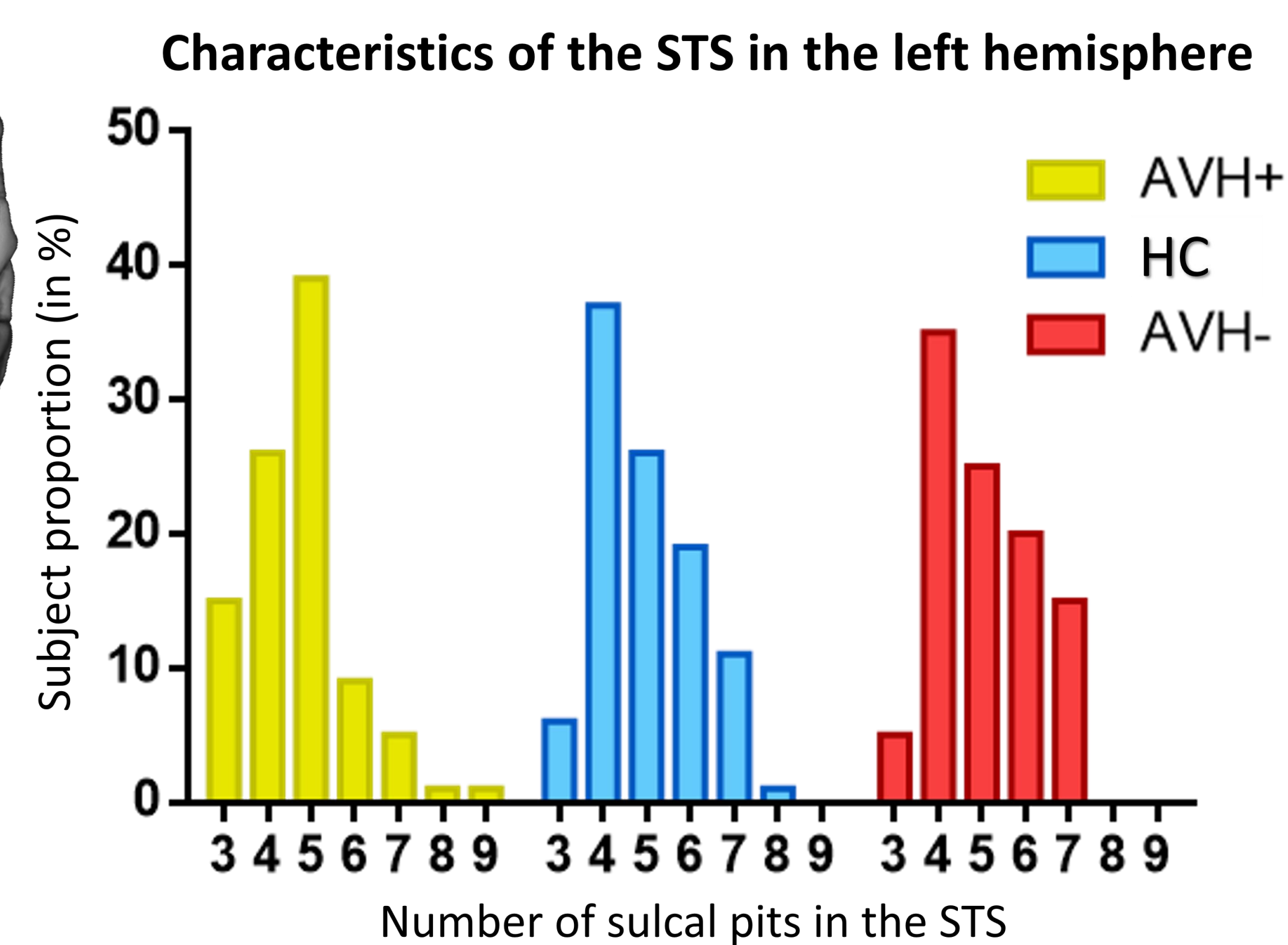
Results



Thinner cortical thickness in AVH+ patients vs. HC, only in the left hemisphere. $p \leq 0.05$ FDR Corrected



The more severe the auditory hallucinations are, the thinner the cortical thickness is, in this part of the STS (Talairach x,y,z = [-49;-41;-2], in blue on the brain illustration) in 33 patients with hallucinations 24h before the MRI session. $p = 0.01$ not corrected



A different distribution of the number of pits in the left STS is found in AVH+ patients compared to HC. HC vs. AVH+ → Fischer test $p = 0.05$

Conclusions

- ✓ The results suggest that AVH+ patients compared to HC **have a lower cortical thickness in the left STS**, but also have a **specific white matter pattern of the left STS**.
- ✓ These results support the hypothesis that a **particular morphology of the STS** can be related with auditory hallucinations in schizophrenia patients.
- ✓ These changes in brain morphology, in STS in particular, might be predictive of the response of the **repetitive transcranial magnetic stimulation (rTMS) treatment**. (8)

References

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