

# Functional Brain Activation And Reorganization Before And After Tailored Speech Language Therapy In PPA: A FMRI Study

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## BACKGROUND AND AIMS

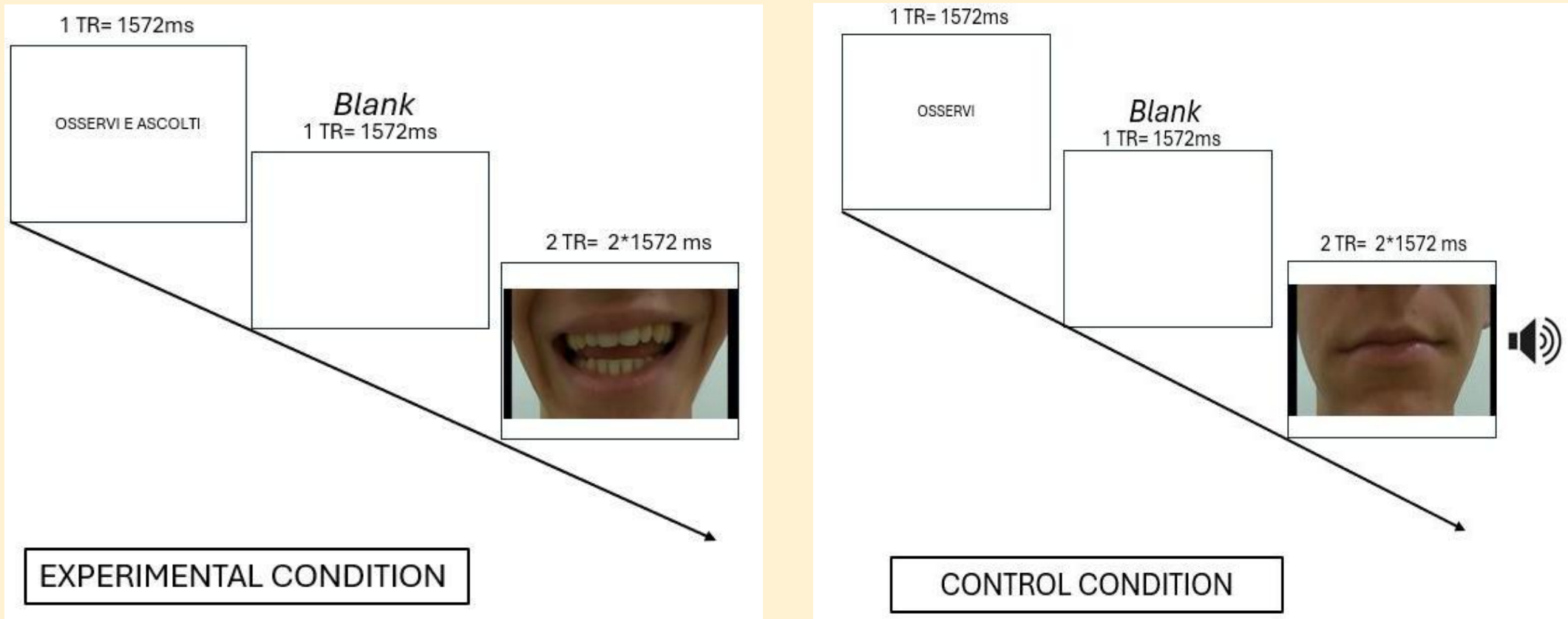
Primary Progressive Aphasia (PPA) is a neurodegenerative disorder characterized by progressive language impairment and includes three variants: logopenic (lvPPA), semantic (svPPA), and non-fluent/agrammatic (nfvPPA). Intensive speech-language therapy can improve naming and speech production but neural correlates of treatment across PPA variants remain poorly understood. This study aimed to:

1. Test two different fMRI tasks meant to activate brain regions involved in language network.
2. Investigate differences in fMRI activation during language tasks in PPA patients compared with healthy controls (HC).
3. Assess treatment-related changes over time in a subgroup of patients who underwent task-based fMRI before and after tailored Speech-Language Therapy

## MATERIALS AND METHODS

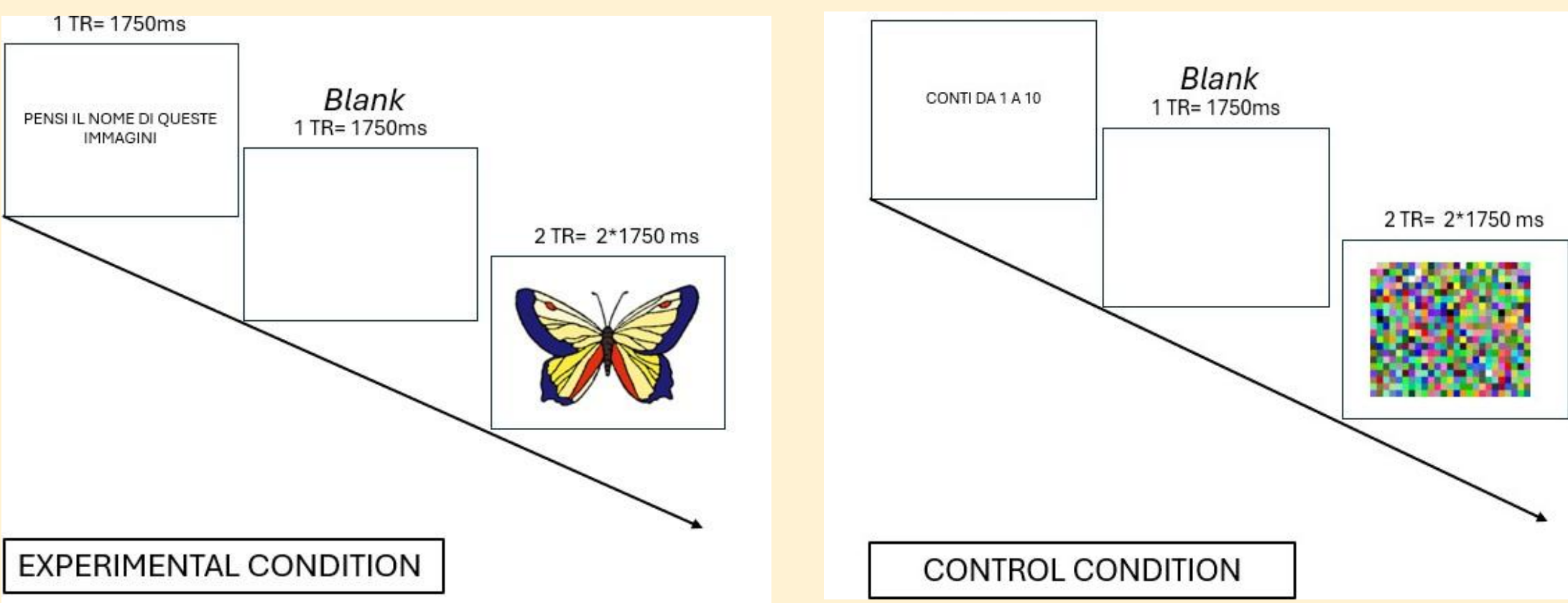
### SPEECH OBSERVATION TASK (SO)

For patients with Nonfluent/Agrammatic variant of PPA (nfvPPA)



### CONFRONTATION NAMING TASK (CN)

For patients with semantic (svPPA) and logopenic (lvPPA) variant of PPA



|                      | HC-SO      | HC-CN      | nfvPPA       | svPPA        | lvPPA        |
|----------------------|------------|------------|--------------|--------------|--------------|
| N                    | 10         | 14         | 4 (4)        | 6 (3)        | 6 (6)        |
| Age                  | 62.28±8.87 | 61.73±8.17 | 69.30±13.74  | 65.56±6.01   | 69.00±10.25  |
| Sex                  | 4/6        | 6/8        | 3/1          | 6/0 *        | 6/0 *        |
| Education(y)         | 15.60±4.79 | 16.42±4.96 | 17.33±9.50   | 11.75±1.50   | 14.33±2.31   |
| Disease Duration (m) | -          | -          | 40.33±2.08   | 49.00±29.22  | 23.67±10.02  |
| MMSE                 | 29.00±1.16 | 29.08±1.00 | 27.33±1.53 * | 25.25±2.22 * | 20.67±8.74 * |
| CDR                  | -          | -          | 0.33±0.29    | 0.38±0.25    | 0.67±0.29    |
| CDR-SB               | -          | -          | 2.00±2.00    | 1.88±1.55    | 2.50±1.32    |
| CDR-FTLD             | -          | -          | 3.83±3.25    | 3.88±2.59    | 4.83±2.25    |

**Table 1.** Sociodemographic characteristics of the cross-sectional sample. Values in parentheses indicate the corresponding sample size for the longitudinal cohort. \* p<0.05 vs HC.

## SO RESULTS

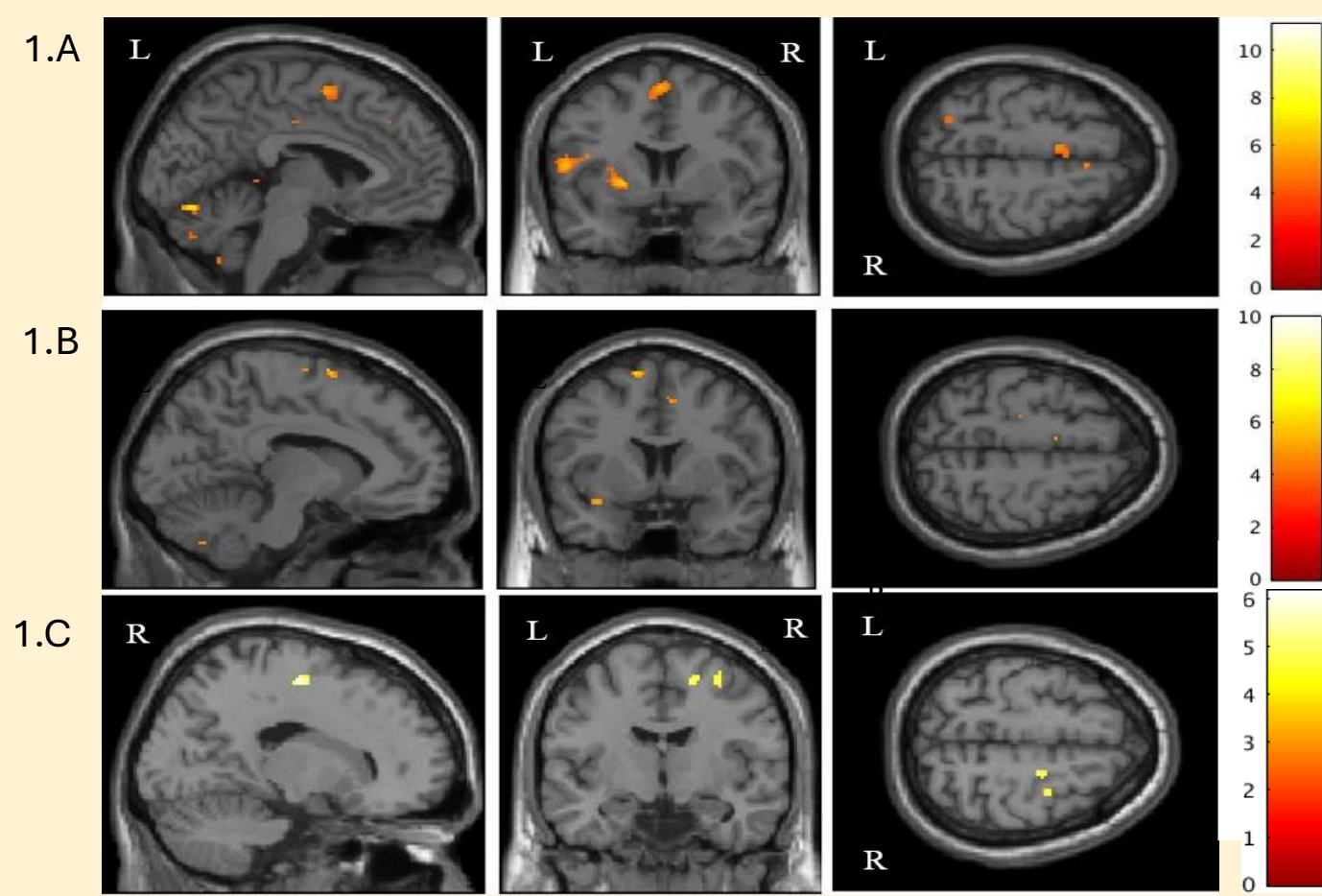


**Figure 1.** Cross-sectional results of the Speech Observation results task. (A) Activation map for HC; (B) Activation map for nfvPPA; (C) Contrast map showing greater activation in nfvPPA than in HC (nfvPPA > HC).

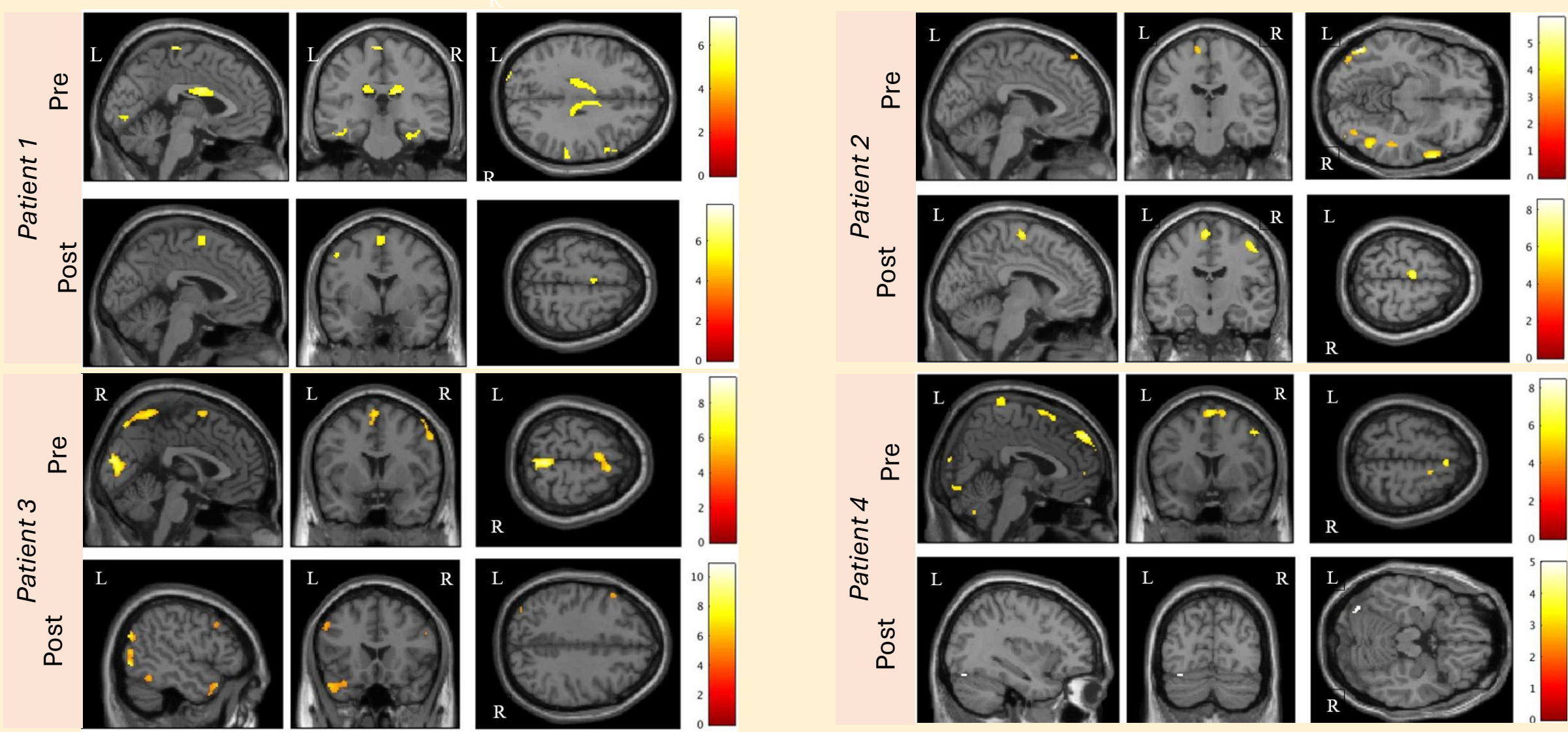


**Figure 2.** Single-subject activation maps in the longitudinal nfvPPA cohort.

## CN RESULTS

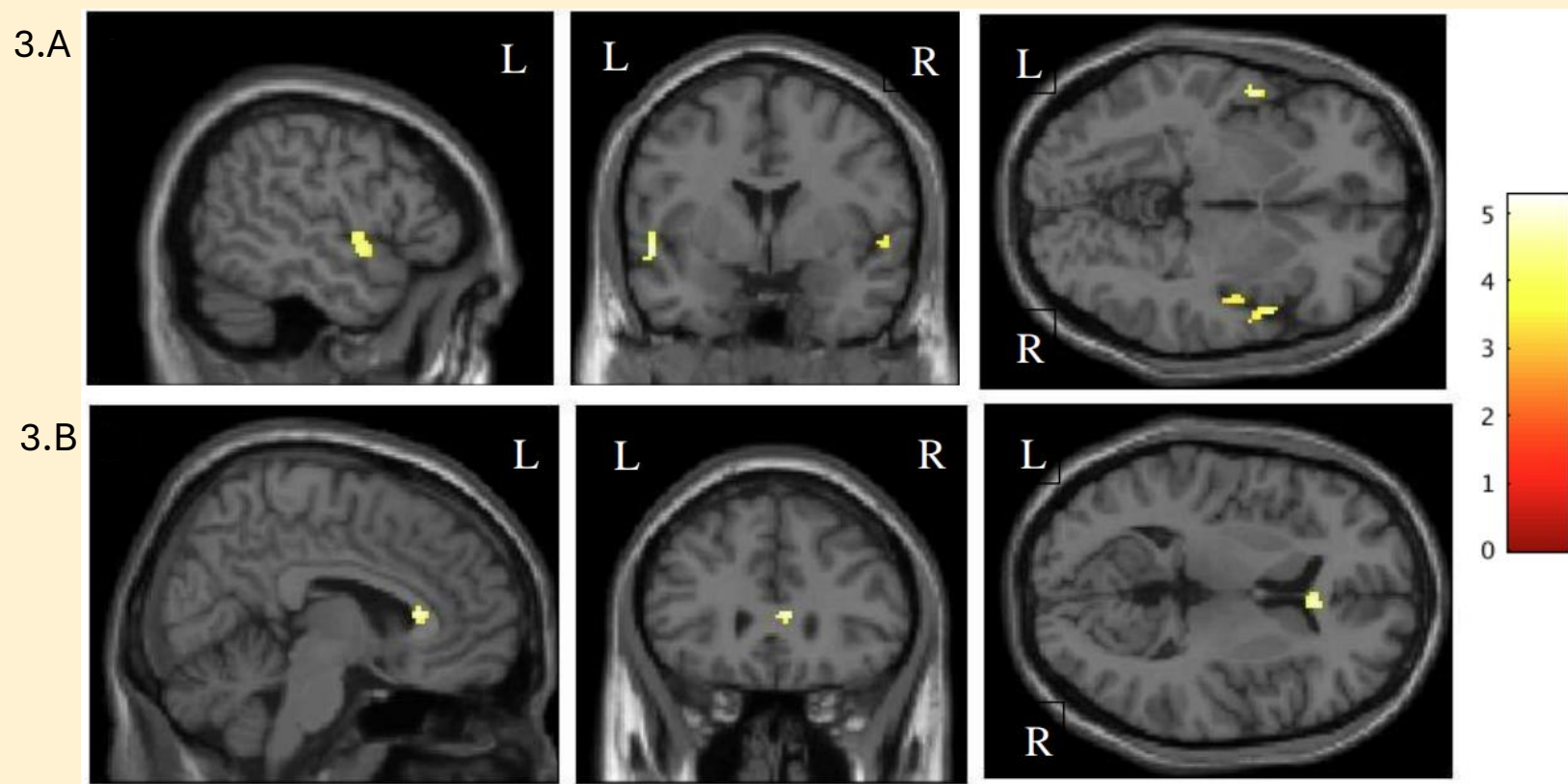


**Figure 3.** Cross-sectional results of the Confrontation Naming task. (A) Areas showing greater activation in healthy controls (HC > PPA); (B) Areas showing greater activation in patients with PPA (PPA > HC).

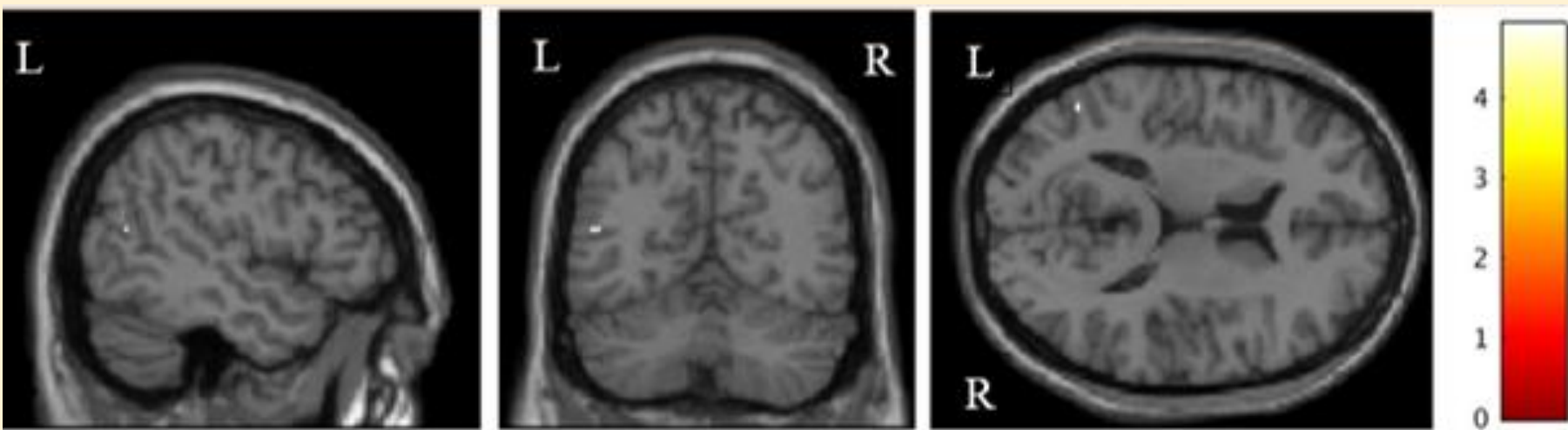


**Figure 4.** Longitudinal activation patterns in the lvPPA and svPPA cohort.

## CONCLUSIONS

- fMRI has proven effective for studying brain function in PPA patients and for investigating differences between patients and HC;
- All patients exhibited compensatory mechanisms during the tasks;
- The SO task successfully determined the activation of the SMA;
- The CN task has recruited effectively the left temporal lobe, in particular the superior temporal gyrus;
- Speech-Language Therapy has proven effective in modifying the brain function of the treated subjects, in all variants.