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What is going on in the brain of simultaneous interpreters?

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Background:

- Simultaneous interpreting (SI) is the process of verbally translating incoming speech from one language (source) into another (target).
- SI is mostly used at conferences (conference interpreting), usually from a foreign language (L2) into the native language (L1).
- **Skills** involved in SI: working memory, attention, coordination, task switching, fast reaction time.

Research questions:

- To what extent does SI affect cognitive functions?
- Does SI cause neurophysiological changes in time?

Hypothesis: SI improves cognitive functions and produces changes in the brain.

Method:

- Systematic review of empirical studies investigating the effects of SI on cognitive functions.
- Studies up to 2016 selected from the databases PubMed and John Benjamins with the keywords ‘simultaneous interpreting’, ‘cognition’, and ‘neuroscience’. → 6 behavioral, 6 neuroimaging (fMRI, EEG, PET, DTI).
- The results (activation maps) of the fMRI and PET studies overlaid on standard (MNI) brain space for visualization using MRIcron software.

Results of behavioral studies:

- **Tasks**: lexical retrieval, processing/ motor speed, working memory, task switching, comprehension of accents and in noisy environments.

→ Long-term SIs (do not[12]) have[4,5] better working memory span than beginners.

→ When matched for working memory span, professional SIs perform better than SI students[10].

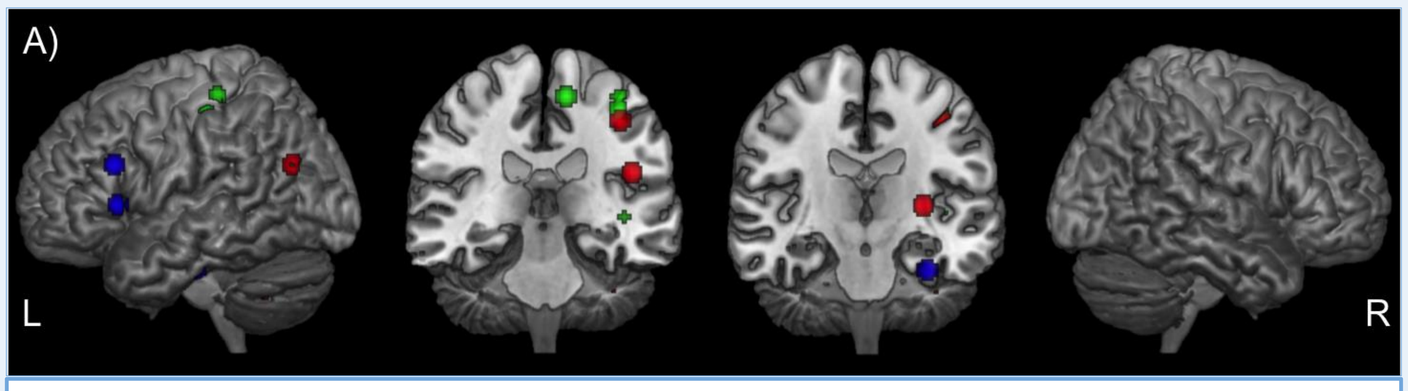

Fig.1A) Neural activity in the left hemisphere, in language-related areas: Broca‘s area, angular gyrus, motor inferior temporal cortex.

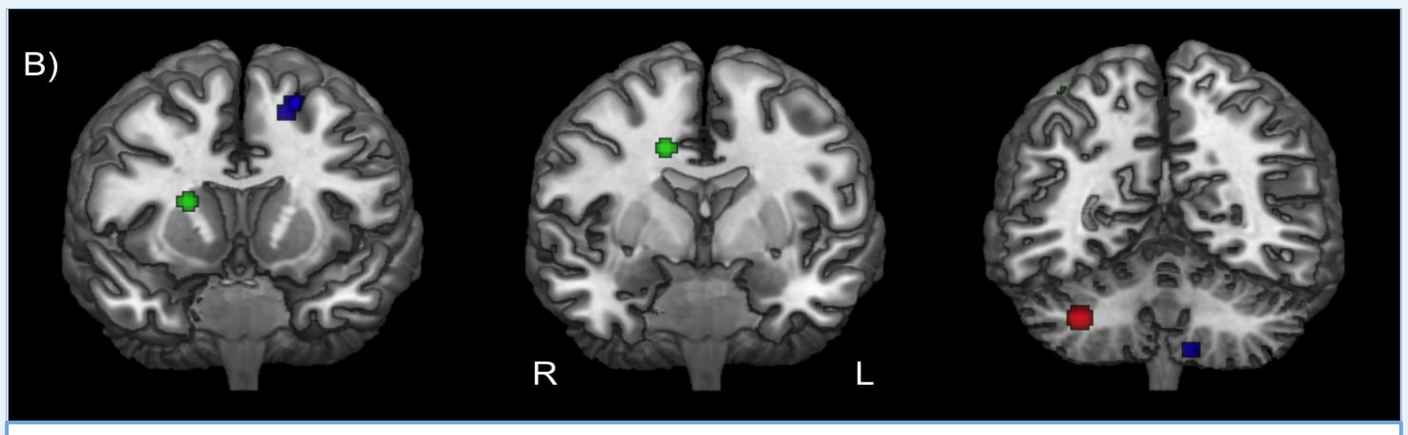

Fig.1B) Neural activity in the right hemisphere, in subcortical regions, cerebellum, and near corpus callosum.

Results of neuroimaging studies:

- **Tasks**: SI into L1 and L2, speech repetition[6], non-verbal auditory discrimination[3]
- *Figures 1 A) and B):* Brain region activated in SI (red[11], green[6], blue[3]).

→ SI into L1 activates more the left frontal brain areas (motor functions, planning, decision), SI into L2 activates also temporal brain areas (listening, speech comprehension)[11].

→ SI into L2 activates more the right hemisphere than SI into L1[8].

→ In professional SIs the right caudate nucleus (learning, motor control, domain-general executive functions) is less active than in beginner SIs[7].

→ SIs can discriminate and categorize sounds better than non-interpreters[1,3].

→ SIs show thicker white matter[2].

Discussion

- SI maintains and improves **verbal skills**, by engaging more often and intensely the language-related brain areas.
- SI trains and improves **non-verbal skills** like task-switching, attention, information processing, and concentration. However, working memory does not necessarily improve.
- **Information transfer** between the two brain hemispheres seems to be faster in profesional Sis.
- Professional SI supposedly have higher **neuroplasticity**, i.e. the ability of the brain to form new connections throughout life.
- Older long-term SIs report age-related difficulties with word finding and concentration, but intact interpreting ability, attention, and information processing[9]. → SI protects to some extent against **cognitive decline**.

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