Planning to incorporate cognitive measures in your next clinical study? – These are the learnings so far, evaluating 54 studies in a systematic scoping review

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OBJECTIVE: To understand to what extent different neurocognitive factors influence speech perception in postlingually deaf adult CI users, by performing a systematic scoping review (PRISMA guidelines, Registered: 10.17605/OSF.IO/Z3G7W, last search April 2022).

PAPERS INCLUDED: One or more speech perception outcome metrics = word and sentence perception in quiet and noise (CI-only, bimodal & bilateral) AND one or more cognitive measures = all measures capturing any of the six neurocognitive domains as defined by the DSM -5 (Figure 1).

OUTCOME: Systematically reviewing 54 studies, results are inconsistent, thus no conclusions can be drawn. Therefore, more and improved data are needed.

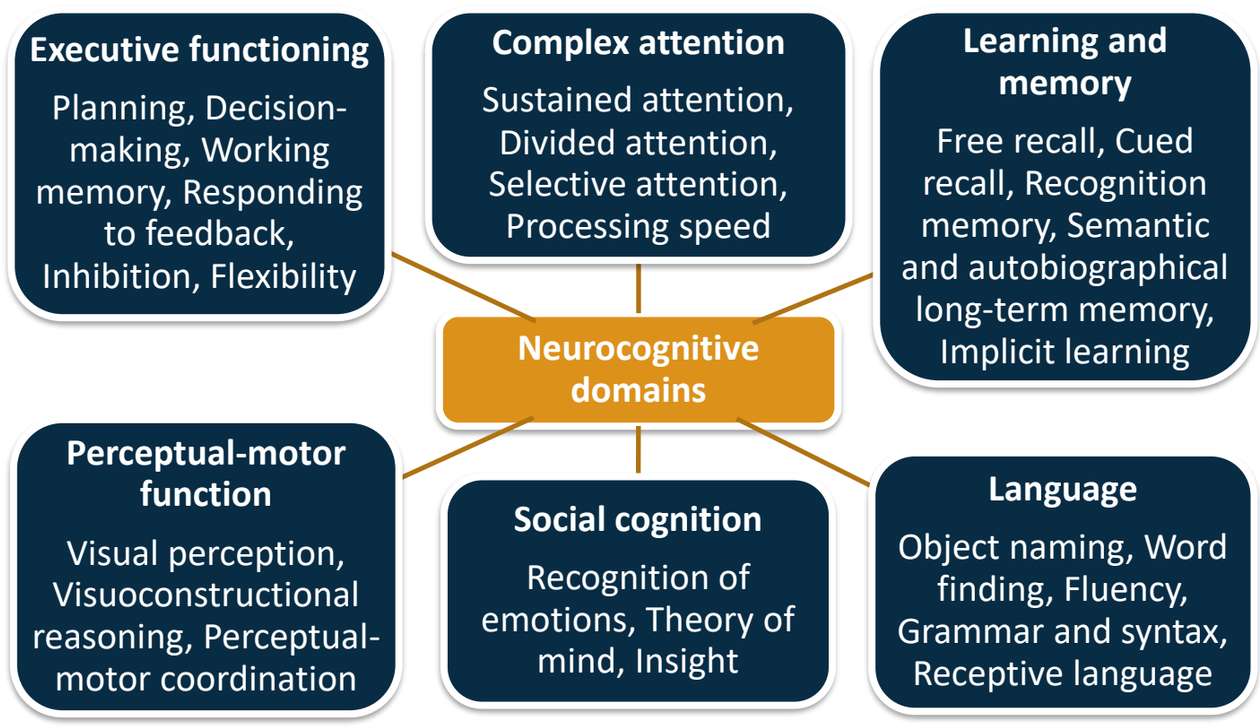

figure 1. Key cognitive domains defined by the Diagnostic Statistical Manual of Mental Disorders, Fifth Edition (DSM-5).[1]

METHODS

SEARCH: cochlear implants **AND** adults **AND** speech perception **AND** cognition (in PubMed, Embase, PsychINFO, WEB of SCIENCE, bioRxiv, medRxiv)

Records after duplicate removal (n=5,652)

Records screened on title/abstract (n=150)

Full-text articles assessed for eligibility (n=56)

Studies included in review (n=54)

MORE INFORMATION

Scan the QR code to find the full paper: Beckers, L., Tromp, N., Philips, B., Mylanus, E., & Huinck, W. (2023). Exploring neurocognitive factors and brain activation in adult cochlear implant recipients associated with speech perception outcomes-A scoping review. Frontiers in neuroscience, 17, 1046669. https://doi.org/10.3389/fnins.2023.1046669

In the paper you will also find a summarized overview of each of the 54 included articles.

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RESULTS: SUMMARY OF 54 INCLUDED PAPERS

- **SUMMARY of papers looking at brain activation (N=19):** Better performance is linked to increased activation in the 1) frontal cortex, indicating the use of higher-order cognitive functions, 2) occipital cortex, indicating the use of visual cues and 3) temporal cortex, which still needs to be recruited during auditory processing.
- **SUMMARY of papers using cognitive/linguistic assessments (N=36):** Only performance on the Ravens task (non-verbal intelligence) was consistently positively correlated with speech perception outcomes (9 of 13 studies). Performance on auditory or visual working memory (11 of 15), memory and vocabulary tasks (7 of 10) were systematically unrelated to speech perception outcomes and the Stroop task unrelated to word perception in quiet.

DISCUSSION: RECOMMENDATIONS FOR FUTURE RESEARCH

	Possible reasons for inconsistency:	Suggestions to improve future studies:
1 Cognitive test	Tasks capture scores in different ways when evaluating a cognitive skill *(e.g response time vs accuracy, level of "engagement" of a task).*	Test, compare, and report on findings obtained in different conditions and cognitive tests (optional to add neuroimaging).
2 Assessment time	Cognitive assessment before or after implantation show different outcomes[2] and is not tested in each study.	Performing the same cognitive test before and after implantation within one study to unravel when inconsistencies occur.
3 Speech perception metric	Lack of data comparing different conditions during speech perception tests: noise vs quiet, words vs sentences or presentation mode (CI-only vs best aided).	Report on and test speech perception in more different conditions.[3]
4 Statistics	Different cognitive domains and factors might not be independent of each other and lack of statistical power.	Make use of regression analysis models instead of correlation analysis to observe any interplay or overlapping factors and provide sufficient power / report effect sizes.

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