FACULTY OF MEDICINE AND HEALTH SCIENCES

BRAINCOMM

De Letter Miet[1], Cocquyt Elissa-Marie[1], Knockaert Nils[1], van Mierlo Pieter[2], Szmalec Arnaud[3,4], Duyck Wouter[3] & Santens Patrick[5]

[1]Department of Rehabilitation Sciences, Ghent University, [2]Department of Electronics and Information Systems, Ghent University, [3] Department of Experimental Psychology, Ghent University, [4]Psychological Sciences Research Institute, Université catholique de Louvain, [5]Department of Neurology, Ghent University Hospital

Phonologically related EEG as a more reliable diagnostic tool in the recovery of aphasia in the different stages after stroke

Background

Stroke-related aphasia recovery follows different stages, evolving from the acute and subacute phase (< 6 months post stroke) into the chronic phase (> 6 months post stroke). In general, phonology remains tenaciously disturbed, making it a reliable language marker to investigate in every stage of recovery. Phonological abilities can be examined both on a behavioral and on an electrophysiological level (by means of phonological event-related potentials/ERP's).

In Aerts et al. (2015), phonological ERP's were suggested to be 1) a reliable tool for the follow-up of aphasia recovery and 2) more sensitive than the behavioral data. The current study was performed in order to sustain these preliminary findings.

Method

Patients (6 ♂ and 2 ♀)

- Mean age T1: 59.0 years (+/- 9.4); mean age T2: 59,4 years (+/- 9.5)
- Hemorrhagic stroke (n=4) or ischemic stroke (n=4) in the left hemisphere
- Right-handed (n=7)

Table 1: Demographic information of the 8 patients with aphasia

Patient	Lesion localization	Weeks post stroke (T1)	Recovery stage (T1)	Aphasia type (T1)	Weeks post stroke (T2)	Recovery stage (T2)	Aphasia type (T2)
1.	Posterior temporal	0.7	(sub)acute	Wernicke	26.1	chronic	Amnestic
2.	Parietal, insula, caudate nucleus, globus pallidus	1.0	(sub)acute	Wernicke	48.9	chronic	Amnestic
3.	Parieto-temporal	1.0	(sub)acute	Wernicke	24.0	chronic	UC
4.	Parieto-temporal	1.4	(sub)acute	Wernicke	20.1	chronic	Amnestic
5.	Temporal	49.0	chronic	Wernicke	80.6	chronic	Wernicke
6.	Mesencephalon, putamen, globus pallidus	196.1	chronic	Broca	233.1	chronic	Broca
7.	Caudate nucleus, putamen, globus pallidus	26.6	chronic	Global	48.6	chronic	Wernicke
8.	Basal ganglia, internal capsule	78.9	chronic	Global	135.1	chronic	Global

T1 = first evaluation moment; T2 = second evaluation moment; UC = unclassified

Behavioral evaluation: Aachen Aphasia Test (AAT)

Electrophysiological evaluation:

- Pre-attentive phonological discrimination - Mismatch Negativity/MMN
- Attentive phonological discrimination - P300

Results

1. The predictive value of the phonological MMN and P300 in aphasia recovery

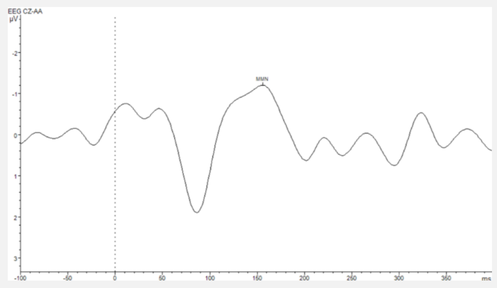

Fig. 1: Grand average of the MMN of the 4 patients in the (sub)acute stage (T1) – electrode position Cz

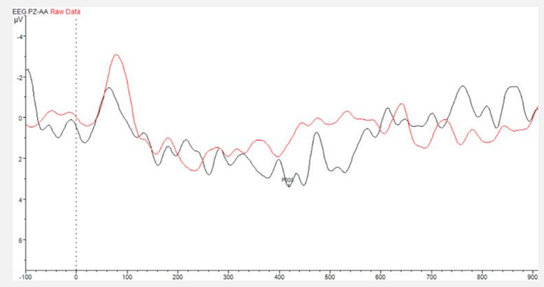

Fig. 2: Grand average of the P300 of the 4 patients in the (sub)acute stage (T1) – electrode position Pz red: standard stimuli, black: deviant stimuli

The presence of a phonological MMN or P300 in the (sub)acute stage is predictive of ceiling effects on several AAT-subtests in the chronic phase:

- Language comprehension (4/4 patients)
- Naming (3/4 patients)
- Written language (3/4 patients)

2. The sensitivity of the phonological MMN and P300 in aphasia recovery

- In both the (sub)acute and chronic stage, behavioral deficits (AAT) are confirmed by deviant amplitude and/or latency values of the MMN and P300 as compared to the normative data (Aerts et al., 2013).
- The MMN and P300 are highly sensitive for subtle language deficits since amplitude or latency deviations are detected even when behavioral ceiling effects have been reached.

Conclusion

The predictive value and high sensitivity of the MMN and P300 advocate a definite implementation of linguistic ERP's in aphasia examination. In this context, the development of a user friendly and financially acceptable EEG device is necessary.

References

Aerts, A., Batens, K., Santens, P., Van Mierlo, P., Huysman, E., Hartsuiker, R., ... & De Letter, M. (2015). Aphasia therapy early after stroke: behavioural and neurophysiological changes in the acute and post-acute phases. *Aphasiology*, *29*(7), 845-871.

Aerts, A., van Mierlo, P., Hartsuiker, R. J., Hallez, H., Santens, P., & De Letter, M. (2013). Neurophysiological investigation of phonological input: Aging effects and development of normative data. *Brain and language*, *125*(3), 253-263.

GHENT UNIVERSITY

Miet.DeLetter@UGent.be

BrainComm