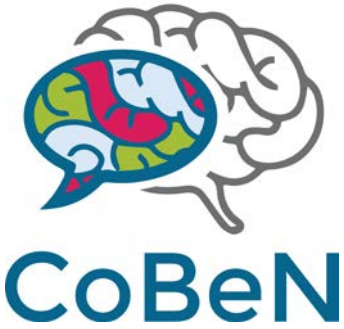

Novel Network-Based Approaches for Studying Cognitive Dysfunction in Behavioural Neurology

H2020-MSCA-RISE-2016-734718

D2.1 Pilot fMRI data for language and acoustic assessment

Work Package:	WP2
Task:	-
Deliverable due date:	31.12.2017
Responsible partner:	MU
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D2.1 Pilot fMRI data for language and acoustic assessment

Pilot fMRI data for language and acoustic assessment:

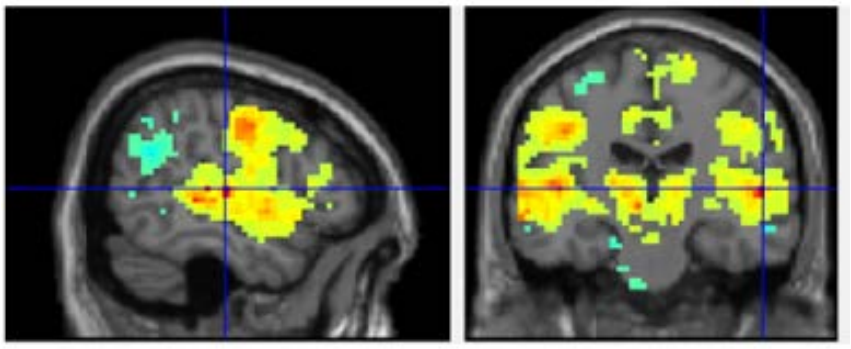
We designed and test an fMRI protocol (an event-related fMRI task-induced activation design) to test reading of emotionally neutral short sentences in the scanner.

Each participant (young healthy controls; n=20) performed a distinct reading task inside the MR scanner prior to and immediately after each stimulation session. This speech task lasted 15 minutes and consisted of reading emotionally neutral indicative, imperative and interrogative sentences aloud or viewing a string of "Xs" (a baseline condition).

Data analysis was performed in SPM12 (running under Matlab 2014a) using a general linear model. Contrast maps were created to evaluate the reading effect compared to baseline condition; one-sample t-test was used, $p(FWE)<0.05$.

Results: The fMRI contrast between the reading task and the baseline condition revealed significant activation in basal ganglia, thalamus, left primary motor orofacial area, supplementary motor area, anterior cingulate cortex and bilateral STG (predominantly on the right side), see Figure 1.

Figure 1 fMRI contrast between reading task and baseline



The speech data was acquired and assessed offline using acoustic data analysis that was described in our published article (acoustic analysis was performed in healthy controls and Parkinson's disease patients previously (Mekyska et al.,2014).

Mekyska J, Galaz Z, Mzourek Z, Smekal Z, Rektorova I, Eliasova I, et al. Assessing progress of Parkinson's disease using acoustic analysis of phonation. In: 2015 4th International Work Conference on Bioinspired Intelligence (IWOBI) [Internet]. IEEE; 2015. p. 111–8. Available from: http://ieeexplore.ieee.org/document/7160153/

Results: In the current study the audio recordings were performed directly inside the MR scanner while the subjects were performing the reading task described above. It turned out that we were not able to precisely analyse the voice intensity and harmonic-to-noise ratio from the audio recordings because of a high level of acoustic noise produced by the MR scanner. Therefore, we focused solely on assessment of speech prosody and articulation. We quantified speech prosody (relative standard deviation of fundamental frequency), inappropriate silences and speech rate (speech index of rhythmicity, total pause time, net speech rate), and rigidity of tongue and jaw (range and relative standard deviation of the first and the second formant), see the Table 1.

Table 1 Results-acoustic parameters in 20 HC (audio recordings acquired inside the MR scanner]

	Rel. SD of F0	SPIR	TPT	NSR	Range of F1	Range of F2	Rel. SD of F1	Rel. SD of F2
Median	0.131	0.041	0.529	13.586	3154.399	2481.262	0.425	0.131

Legend: Rel. SD of F0- relative standard deviation of fundamental frequency, SPIR- speech index of rhytmicity, TPT- total pause time, NSR- net speech rate, Rel. SD of F1- relative standard deviation of first formant, Rel. SD of F2- relative standard deviation of second formant