Jess Jiang

Processing of acoustically degraded speech in primary progressive aphasia and Alzheimer's disease

Daily spoken messages are often "degraded" by competing sounds and vocal idiosyncrasies. Comprehension of degraded speech demands intense computations across distributed neural networks and is therefore likely to present a challenge for patients with neurodegenerative pathologies. However, this issue has not been studied systematically. We studied the processing of degraded speech signals in a cohort of patients representing all major variant syndromes of primary progressive aphasia (PPA) (N=32), in relation to patients with typical Alzheimer's disease (N=19) and healthy age-matched controls (N=25). As a model paradigm for the degraded speech signals, we used noise-vocoding: digital division of the speech signal into a variable number of frequency channels constituted from amplitude-modulated white noise (fewer channels convey less spectrotemporal detail and reduce intelligibility). We assessed the impact of noise-vocoding on the recognition of spoken three-digit numbers and used psychometric modelling to ascertain the threshold number of 'channels' required for intelligibility. Grey matter associations of the threshold were assessed using voxel-based morphometry. Compared with healthy controls, all patient groups showed normal comprehension of clear speech. For vocoded speech, all patients, except for semantic variant PPA, had a raised noise-vocoding threshold. Grey matter correlates were found in the left planum temporale and the cingulate cortex. Our findings suggest that degraded speech is a promising paradigm for probing real-world communication difficulties in people with dementia, and for stratifying syndromes and pathologies. Future work should assess the potential of this paradigm for developing new biomarkers and interventions to assess and improve communication function in these diseases.