Lesion Neuroanatomy of Post Stroke Deficits in Selective Attention & Working Memory.

King, R. L., Gillebert, C. R., Bickerton, W-L., Humphreys, G.W. & Demeyere, N.

Introduction

The ability to selectively attend to goal relevant information to guide and modulate behaviour is a subtle but essential skill required in all daily tasks (Stuss et al., 1995; D'Esposito & Postle, 2015). For patients who are experiencing deficits in selective attention or working memory everyday living can become challenging and their prospect of successful long-term recovery is reduced (e.g. Marshall, 2011). In this study we aim to explore the underlying lesions associated with post-stroke deficits in selective attention and working memory by examining commission and omission errors, as well as post-task recall of target information.

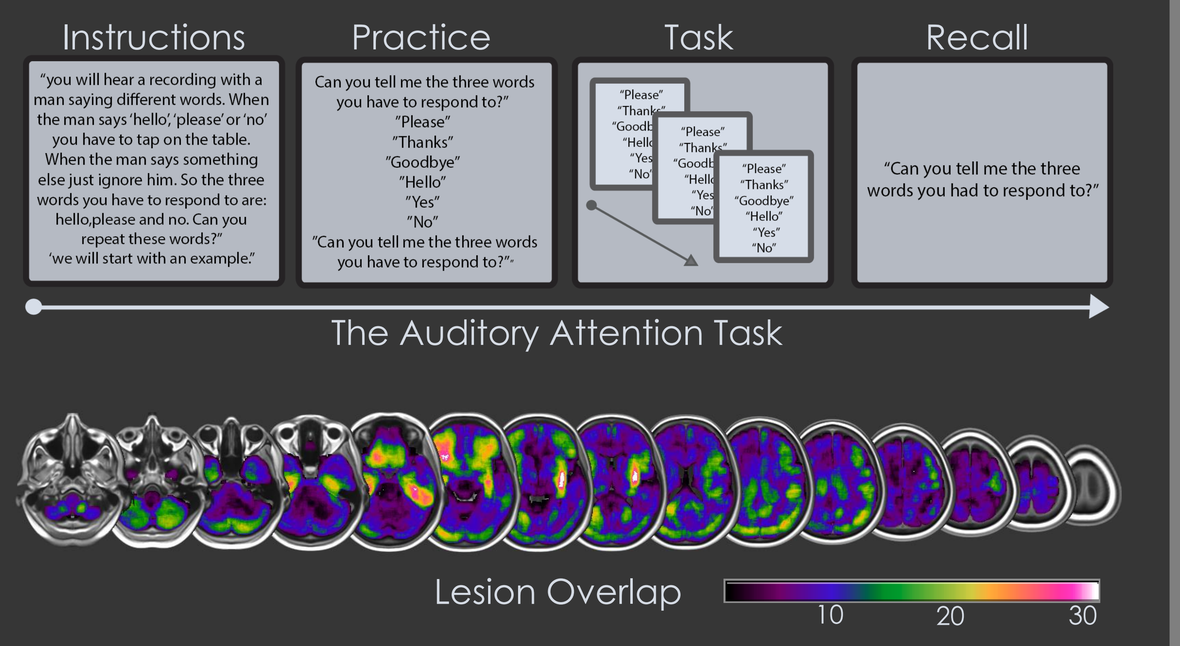
Method

Sample 334 subacute stroke patients (mean age 71, SD=11 years).

Task The auditory attention task (Humphreys et al., 2012) is a clinically sensitive 10 minute task requiring the patient to selective tap to previously learned target words (whilst ignoring distractor words) over 3 blocks of 18 word presentations.

Scans Clinical CT scans were pre-processed and lesions delineated using an automated toolkit (Gillebert et al., 2014).

VLSM Parametric voxel lesion symptom mapping. Only voxels where at least 10 patients have a lesion were considered. Covariates of no interest were age, gender, handedness, orientation in time/space and lesion size. Results reported at a P< 0.05 FDR corrected threshold (Bates et al., 2003).



Results

Score	Cluster	Area	MNI x y z	Extent mm3
Commissions N = 205	1	Right inferior frontal gyrus and middle frontal gyrus	41 15 26	4213
	2	Left operculum, putamen and white matter	-38 16 12	3519
	3	Left external capsular	-35 -4 -1	382
	4	Left precuneus	-15 -61 17	652
	5	Left insula	-34 -20 5	238
Omissions N = 334	1	Left supplementary motor area	-13 -4 63	248
Working memory N = 334	1	Left parietal operculum cortex	41 15 26	4213
	2	Right cingulate and precuneus	2 -51 27	225
	3	Left frontal pole	-35 47 19	232
	4	Left middle frontal gyrus	-38 16 38	136
	5	Left planum polare	-44 -8 -13	139
	6	Left superior occipital fusiform	-29 -78 -5	1630
	7	Left Inferior occipital fusiform	-29 -75 -18	138

Brain regions have been identified using the AAL and Oxford-Harvard atlases.

Conclusions

Overall our results suggest that post-stroke impairment in selective attention is associated with nodes within the executive and energising attentional control networks. Whereas, impairment in post-task recall was associated with areas suggested to be connected with the phonological loop. In particular **Commission** errors were associated with regions responsible for response inhibition, target monitoring/selection and sustaining attention. **Omission** errors were related to the SMA, which is involved in response preparation, selection and subvocal rehearsal. **Working Memory** performance was linked to areas involved in storage, working memory manipulation and processing of verbal information.

References

Bates, E., Wilson, S.M., Saygin, A.P., Dick, F., Sereno, M.I., Knight, R.T., Dronkers, N.F. (2003). Voxel-based lesion-symptom mapping. *Nature Neuroscience*. 6, 448–450.

D'Esposito, M., Postle, B. R. (2015). The Cognitive Neuroscience of Working Memory. *Annual Review of Psychology, 3*(66), 115-142.

Gillebert, C. R., Humphreys. G. W., & Mantini. D. (2014). Automated delineation of stroke lesions using brain CT images. *NeuroImage, 4*, 540-548.

Humphreys, G. W., Bickerton. W-L. , Samson. D., & Riddoch. J. M. (2012). *Birmingham Cognitive Screen*. Psychology Press, Hove and New York.

Marshall, G. (2011). Executive function and instrumental activities of daily living in MCI and AD. *Alzheimer's Dementia*, 7, 300–308.

Stuss, D. T., Shallice, T., Alexander, M. P. & Picton, T. W. (1995). A Multidisciplinary Approach to Anterior Attentional Functions. *Annals of the New York Academy of Sciences, 769(1)*, 191-212.

This work was supported by the European union FP7 Marie Curie INT Grant N.606901 (INDIREA).

Contact: rachel.king@psy.ox.ac.uk, B101 Cognitive Neuropsychology Centre, Tinbergen Building, 9 South Parks Road, Oxford, OX1 3UD