Research Update – End of Six-Year Tuning Project

By Mary Grasmeder

Cochlear implants are tuned for each person who receives them to ensure that sounds are comfortable and appropriately loud. Little attention is paid to the pitch of the sound (whether notes are 'bass' or 'treble') and how this might be affected by the implant settings, even though it is known that pitch perception can often vary along the electrode array. This study looked at which sounds are being directed to different electrodes and if the allocation to different electrodes should be adjusted for each cochlear implant.

Some studies suggest that the allocation should be adjusted, so that the sounds heard on each electrode stimulate the same part of the cochlea which would be used by people with normal hearing. Other studies suggest that people get used to what is provided by the implant, so it doesn't matter which sounds are sent to each electrode. Yet more studies suggest that pitch perception is poorer as you go deeper into the cochlea, so it may not be a good idea for important speech sounds to be directed too deep into the cochlea.

Twenty two adult cochlear implant users with MED-EL cochlear implants took part in a study here at the University of Southampton. It was found that allocating sounds as they would be heard by someone with normal hearing gave poor results on sentence tests. Allocating sounds to a reduced area of the cochlea was better from a technical point of view and cochlear implant users scored better with this map, but often not as well as with their normal (clinical) map. The results suggested that the implant users who took part in the study had got used to their maps and so the 'normal-hearing' map was no longer appropriate.

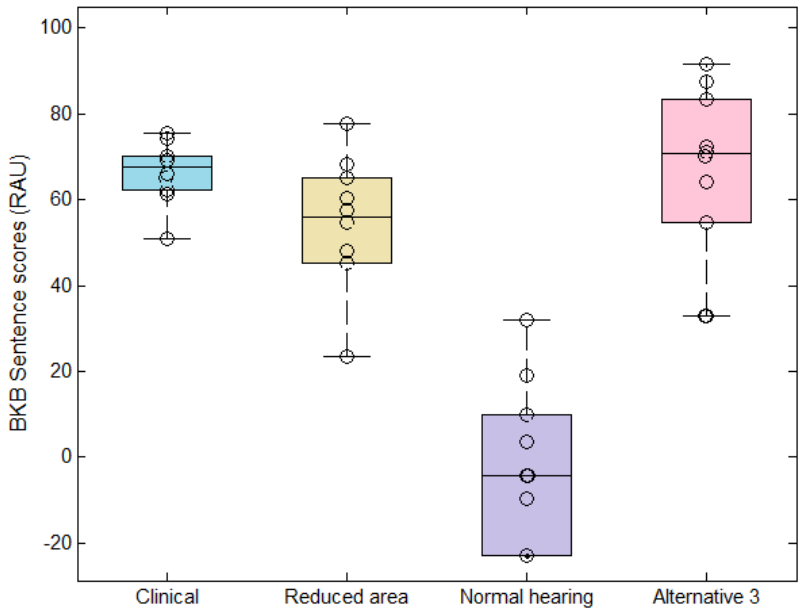

Figure 1 Sentence scores from experiment 1

A third alternative map was tested which sent less sounds to the deepest electrodes. Some cochlear implant users who struggled with pitch perception for their deep electrodes performed better with this map.

A second experiment was performed and a new test called the 'Pitch Contour Test' was performed, which compared the sound of neighbouring electrodes to see if they both sounded the same or if one sounded higher in pitch than the other. The scores for each electrode pair are shown below, with the best scores in green. Electrodes in the middle of the array gave high scores for everyone but some cochlear implant users struggled with the electrodes at either end of the array.

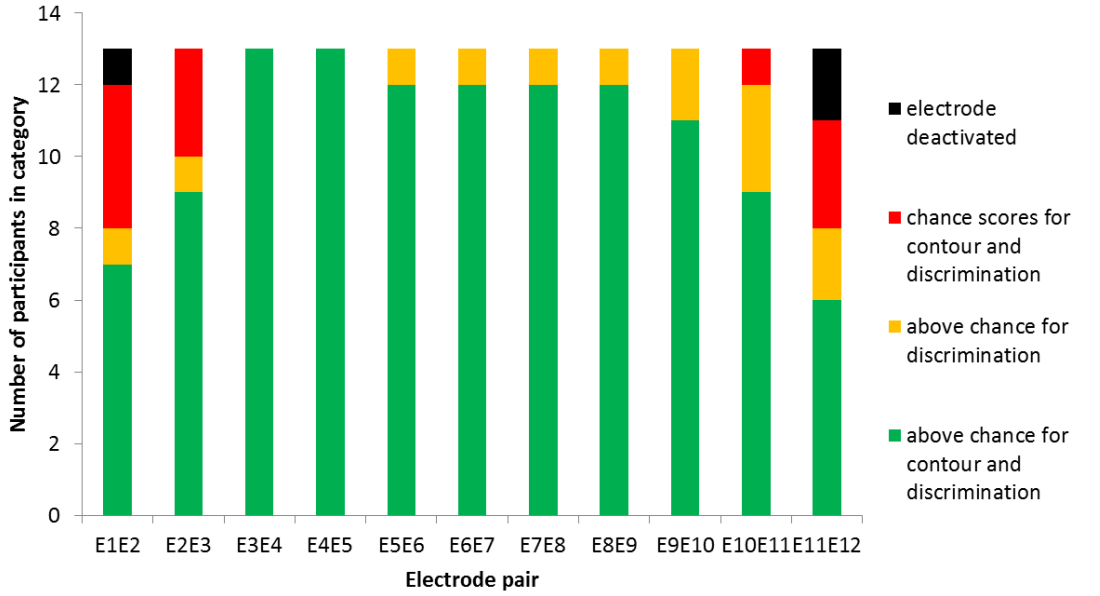

Figure 2 Pitch Contour Test scores

Ten different maps were tested using speech and music perception tasks. The alternative maps had sounds shifted away from the deep electrodes by different amounts. The results were different for people with good pitch perception at the high-pitched end of the cochlea, when compared with those with poor pitch perception at the high-pitched end of the cochlea.

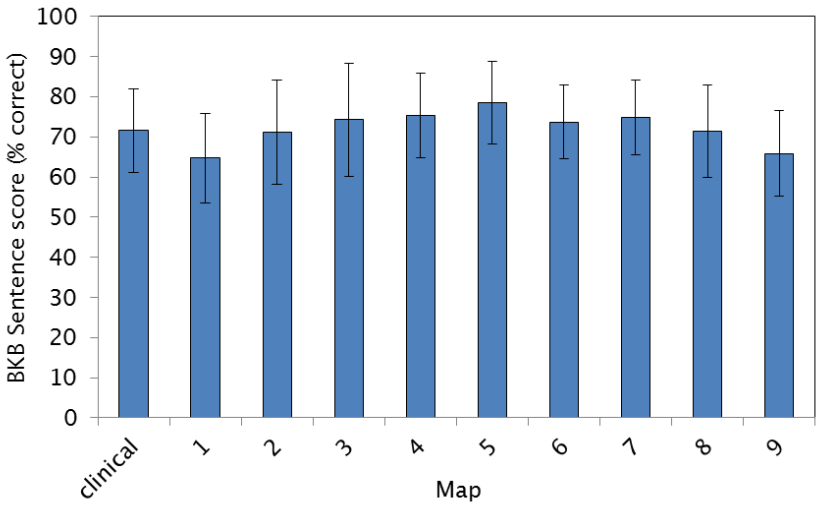

Figure 3 Sentence scores for those with good pitch perception at the high-pitched end of the cochlea

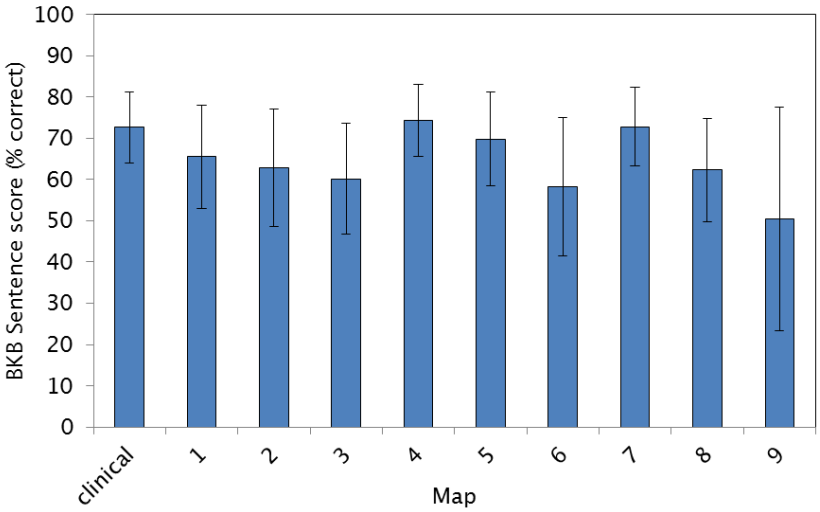

Figure 4 Sentence scores for those with poor pitch perception at the high-pitched end of the cochlea

For some people with good perception at the high-pitched end, maps 5 and 4 gave better results than the clinical map. For those with poor pitch perception at the high-pitched end, map 4 and the clinical map gave the best performance. We will look at how the findings can be incorporated into our clinical practice over the next few months, as it may be that some people would be better off with an adjusted map.

I would personally like to thank all the people who took part in the experiments. I would like to thank you for your patience and for completing the tests, which has given me lots of data to work with! The results of the first experiment have now been published and results from the second experiment will be published shortly.