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Imaging visually-evoked cortical activity

BrainsCAN, Western University

Blake E. Butler

Stephen Lomber

Kyle Gilbert

Mathias Dietz

Western BrainsCAN
Transforming brain research.

Project **Summary**

KNOWLEDGE MOBILIZATION & IMPACT

Imaging visually-evoked cortical activity

Background

At one time, the importance of hearing loss was not well understood, it was considered a peripheral deficit. However, it is now known to dramatically alter the structure and function of the brain. In addition to significantly impacting how we perceive the world around us, brain disorders that impact hearing have significant social and economic impacts.

For example, when a child loses their hearing before they begin to speak or they are born without hearing, their social and cognitive development can be significantly impaired. This kind of impairment is associated with a lifetime cost estimated to exceed $1M per child.

Age-related hearing loss has also been shown to accelerate cognitive decline in the elderly. Social isolation often accompanies elderly hearing loss, but the associated impairments to memory, attention and problem-solving appear greater than what might reasonably be attributed to the social isolation alone.

The Problem

Fortunately, advanced neural devices exist that can bypass hearing impairment to provide the brain with a representation of sound and outcomes from devices such as cochlear impants can be very good. However, there still remains a wide range of outcomes within recipient populations; despite receiving their device within the presumed sensitive period for normal recovery, some children with cochlear implants do not achieve normal language performance, and both children and adult implant recipients often have difficulty in the presence of background noise.

The reason for this variability is unknown. One theory is that 'cross-modal reorganization' in the deaf brain plays a significant role - regions of the brain that would normally process sound get repurposed to enhance function in the remaining senses. It has already been shown that in deaf subjects, an area of the brain normally associated with localizing sounds can instead contribute to peripheral vision. While that might seem initially advantageous within a deaf brain context, how can those regions then be returned to hearing purposes after hearing restoration?

Funding Program

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Additional BrainsCAN Support

Imaging Core

Western Faculty, Group or Institution

Department of Psychology, Faculty of Social Sciences

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The Project

To answer this question, we plan to complete a long-term analysis of brain activity related to auditory processes following hearing loss and restoration. This will provide the first ever detailed examination of the initiation of a sensory representation in the brain.

This work will significantly inform our understanding of 'neural plasticity', the ability of the brain to respond and reorganize to environmental changes or following an injury or disorder. It is also our hope that the results of this program will inform the design of devices to restore hearing - it might enable tuning of those devices to restore sensory representations in the brain in a patient-specific manner. We believe this will significantly reduce the impact of cognitive disorders that arise as a result of abnormal perception both in children and in older adults.

Western Researchers

Blake E. Butler
Stephen Lomber
Kyle Gilbert
Mathias Dietz