(Re)exploring the effect of the bilingual experience on brain structure

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The use of more than one language affects the structure of the brain and likely higher order cognitive processes (executive functions) (Bialystok, 2016a, b). However, the connection between bilingualism and neurocognitive changes remains poorly understood, given that results across studies are variable regarding both neurological (García-Pentón et al., 2015; Pliatsikas & Luk, 2016) and cognitive effects (Valian, 2015). A more nuanced examination of the different (linguistic) experiences of bilingualism is needed to assess its potential cognitive/neurological impacts (Luk and Bialystok, 2013) and these how these neural outcomes are modulated with changes in non-native language experience and ability (Abutalebi and Green, 2016; Grundy, Anderson, & Bialystok, 2017). This ongoing project examines bilingualism as a spectrum, specifically assessing the effect of specific factors within the bilingual experience, using a combination of behavioral and neuroimaging (MRI) methods.

Typically developing bilinguals (n= 65, 52 female, \textit{M}age= 31.8yrs, SD 7.59) were scanned for grey matter (GM) and white matter (WM), completed an English proficiency test (Oxford QPT; Geranpayeh, 2003), and a language background questionnaire (LSBQ) (Anderson et al., 2017; Luk & Bialystok, 2013). Demographics from the LSBQ, including length of second language (L2) immersion, bilingualism composite score (BCS), average switching, and L2 age of acquisition (L2 AoA) were run as predictors in analyses on the acquired structural. Preliminary results show that different experiential factors within the bilingual experience variably affect the brain. For example, L2AoA was found to predict differences in cortical GM and WM tracts (specifically left and frontal regions) (Fig. 1), whereas length of L2 immersion was found to predict GM volume increases in the parahippocampal gyrus and decreases in the hippocampus (Fig. 2). Results are discussed further in detail. Taken together, the data indicate that bilingualism is a dynamic process which crucially is modulated through time with changes to linguistic exposure and use.
Figure 1: Cortical grey matter differences (red, left) and white matter differences (green, right) as predicted by L2 AoA.

Figure 2: Grey matter decreases (light blue) in the hippocampus (blue), and grey matter increases in parahippocampal gyrus (red), as predicted by length of immersion.