Bilingual experiences cause dynamic changes to the volumes of the basal ganglia: evidence from interpreters and translators

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Bilingualism has been linked to structural brain adaptations related to selecting the appropriate language to facilitate successful communication. The location and extent of these adaptations have been shown to be associated with the intensity with which bilinguals use and switch between their languages (e.g., Pliatsikas, 2020). Less is known about similar effects in interpreters, a unique group of bilinguals who master several languages and must switch between them under immense time-pressure, with existing research reporting changes in different regions and effects in different directions (Hervais-Adelman & Babcock, 2020). The reason for inconsistencies in results considered here is two-fold: (1) lack of information about respondents' bilingual language use other than their professional experience (2); the assumption that the relationship between bilingualism and brain structure is linear despite existing evidence that both brain and bilingual experience are dynamic systems with distinct trajectories (Pliatsikas, 2020). Here, we aim to address the first point by teasing apart the professional and general bilingual experiences to identify which effects they yield on caudate nuclei and putamen. These subcortical structures are known to structurally adapt as a result of bilingual language use. These adaptations were also reported to differ among translators, interpreters and non-professional bilinguals (Hervais-Adelman & Babcock, 2020). Second, we analyse the data using generalised additive models (GAMs), which have the power to identify non-linear patterns in brain volumes as a function of a continuous measure of bilingual experiences. We compared volumes of caudate nuclei and putamen between Czech-English interpreters (n=29), translators (n=37) and bilingual controls (n=47). We collected measures of language proficiency (LexTale), bilingual immersion (LSBQ) and IQ (WAIS-III). Bilingual controls showed smaller volumes of caudate nuclei and putamen compared to professional bilinguals. There were no significant volume differences between translators and interpreters. GAMs analyses run on the entire sample revealed that bilingual immersion is a significant non-linear predictor of caudate volumes beyond age. The results reveal that volumes plateau after a certain level of bilingual experience has been reached. For putamen, the bilingual experiences emerged as positive linear predictor. These results suggest that general bilingual experiences should be considered in studies of brain modifications induced by professional bilingual practices. Also, these findings offer support to existing theories on bilingualism-induced neuroplasticity, which postulate a decrease of volumes in caudate nuclei as a result of increasing efficiency in bilingual language control (Pliatsikas, 2020). We will discuss the current findings' potential to open a new horizon for investigation of experience-based structural modulations brought about by bilingual language use.

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