Learning languages is a workout for brains, both young and old

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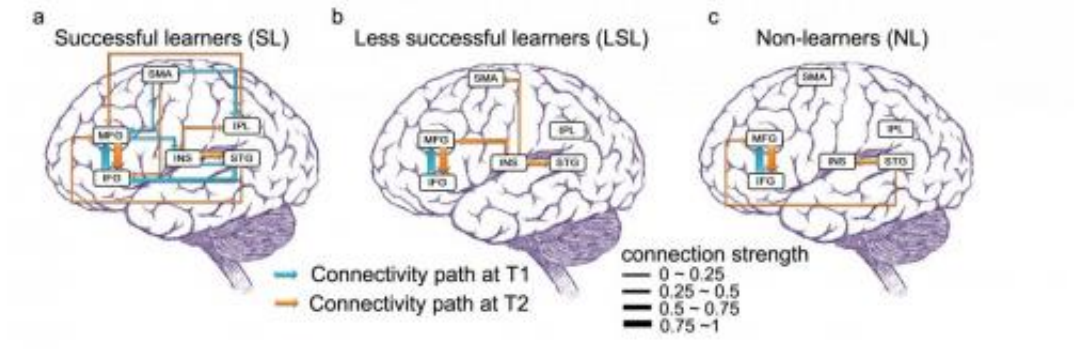

These are schematics of connectivity in the brain showing connectivity at two different times with strength indicated by line thickness. a) Is the connectivity of a successful learner, b) connectivity of less successful learner and c) is connectivity of non learners. Credit: Li Lab, Penn State

Learning a new language changes your brain network both structurally and functionally, according to Penn State researchers. "Learning and practicing something, for instance a second language, strengthens the brain," said Ping Li, professor of psychology, linguistics and information sciences and technology. "Like physical exercise, the more you use specific areas of your brain, the more it grows and gets stronger."

Li and colleagues studied 39 native English speakers' brains over a six-week period as half of the participants learned Chinese vocabulary. Of the subjects learning the new vocabulary, those who were more

successful in attaining the information showed a more connected brain network than both the less successful participants and those who did not learn the new vocabulary.

The researchers also found that the participants who were successful learners had a more connected network than the other participants even before learning took place. A better-integrated brain network is more flexible and efficient, making the task of learning a new language easier. Li and colleagues report their results in a recent article published in the *Journal of Neurolinguistics*.

The efficiency of brain networks was defined by the researchers in terms of the strength and direction of connections, or edges, between brain regions of interest, or nodes. The stronger the edges going from one node to the next, the faster the nodes can work together, and the more efficient the network.

Participants each underwent two fMRI scans—one before the experiment began and one after—in order for the researchers to track neural changes. At the end of the study period, the researchers found that the brains of the successful learners had undergone functional changes—the brain network was better integrated.

Such changes, Li and colleagues suggested while reviewing a number of related studies, are consistent with anatomical changes that can occur in the brain as a result of learning a second language, no matter the age of the learner, as they reported in a recent issue of Cortex.

"A very interesting finding is that, contrary to previous studies, the brain is much more plastic than we thought," said Li, also co-chair of the interdisciplinary graduate degree program in neuroscience. "We can still see anatomical changes in the brain [in the elderly], which is very encouraging news for aging. And learning a new language can help lead

to more graceful aging."

Meanwhile, Li and colleagues have begun working on interactive ways to teach language using virtual 3-D-like environments with situation-based learning to help the brain make some of those new connections more effectively. Such studies hold the promise that the process of learning a second language as an adult can in fact lead to both behavioral and physical changes that may approximate the patterns of learning a language as a child.

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