Complex learning dismantles barriers in the brain

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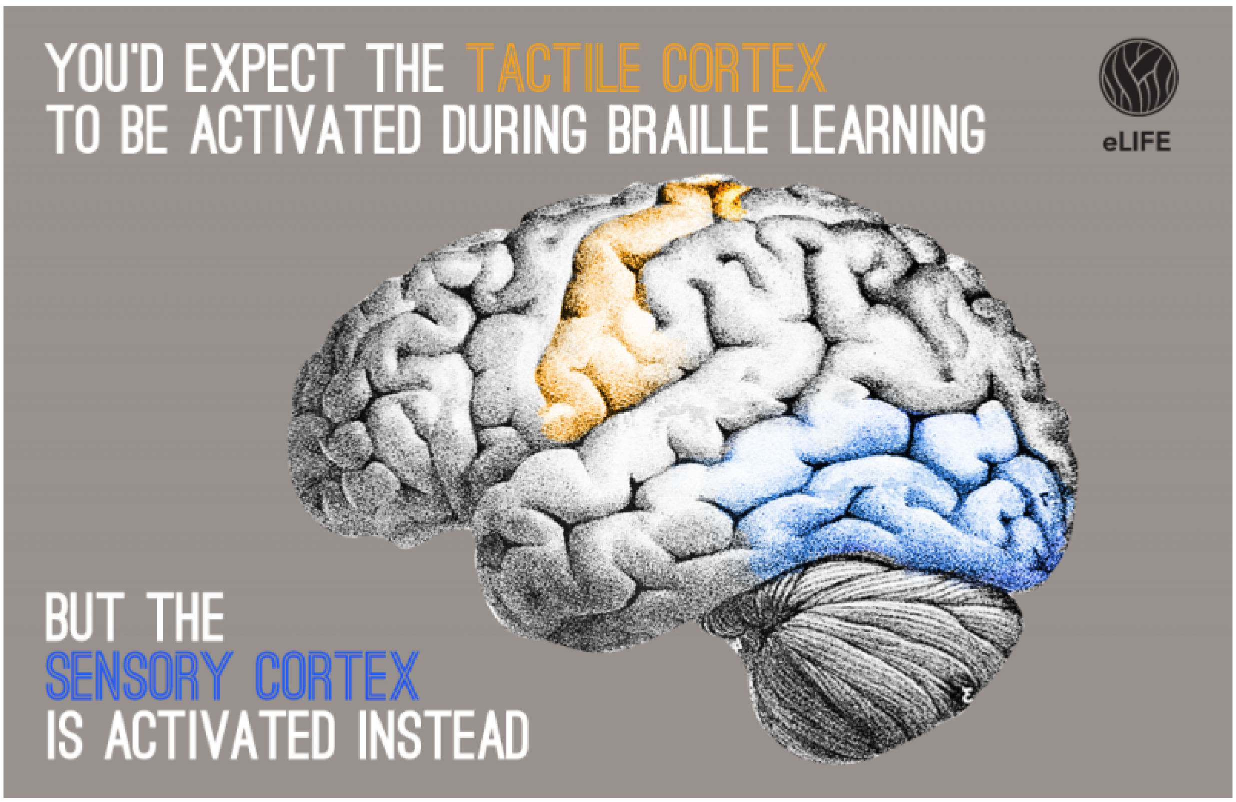

You'd expect the tactile cortex to be activated during Braille learning. But the visual cortex is activated instead. Credit: eLife

Biology lessons teach us that the brain is divided into separate areas, each of which processes a specific sense. But findings to be published in *eLife* show we can supercharge it to be more flexible.

Scientists at the Jagiellonian University in Poland taught Braille to sighted individuals and found that learning such a complex tactile task activates the visual cortex, when you'd only expect it to activate the tactile one.

"The textbooks tell us that the visual cortex processes visual tasks while the tactile cortex, called the somatosensory cortex, processes tasks related to touch," says lead author Marcin Szwed from Jagiellonian University.

"Our findings tear up that view, showing we can establish new connections if we undertake a complex enough task and are given long enough to learn it."

The findings could have implications for our power to bend different sections of the brain to our will by learning other demanding skills, such as playing a musical instrument or learning to drive. The flexibility occurs because the brain overcomes the normal division of labour and establishes new connections to boost its power.

It was already known that the brain can reorganize after a massive injury or as a result of massive sensory deprivation such as blindness. The visual cortex of the blind, deprived of its input, adapts for other tasks such as speech, memory, and reading Braille by touch. There has been speculation that this might also be possible in the normal, adult brain, but there has been no conclusive evidence.

"For the first time we're able to show that large-scale reorganization is a viable mechanism that the sighted, adult brain is able to recruit when it is sufficiently challenged," says Szwed.

Over nine months, 29 volunteers were taught to read Braille while blindfolded. They achieved reading speeds of between 0 and 17 words per minute. Before and after the course, they took part in a functional Magnetic Resonance Imaging (fMRI) experiment to test the impact of their learning on regions of the brain. This revealed that following the course, areas of the visual cortex, particularly the Visual Word Form Area, were activated and that connections with the tactile cortex were established.

In an additional experiment using transcranial magnetic stimulation, scientists applied magnetic field from a coil to selectively suppress the Visual Word Form Area in the brains of nine volunteers. This impaired their ability to read Braille, confirming the role of this site for the task. The results also discount the hypothesis that the visual cortex could have just been activated because volunteers used their imaginations to picture Braille dots.

"We are all capable of retuning our brains if we're prepared to put the work in," says Szwed.

He asserts that the findings call for a reassessment of our view of the functional organization of the human brain, which is more flexible than the brains of other primates.

"The extra flexibility that we have uncovered might be one those features that made us human, and allowed us to create a sophisticated culture, with pianos and Braille alphabet," he says.

More information: Katarzyna Siuda-Krzywicka et al. Massive cortical reorganization in sighted Braille readers, *eLife* (2016). DOI: 10.7554/eLife.10762

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