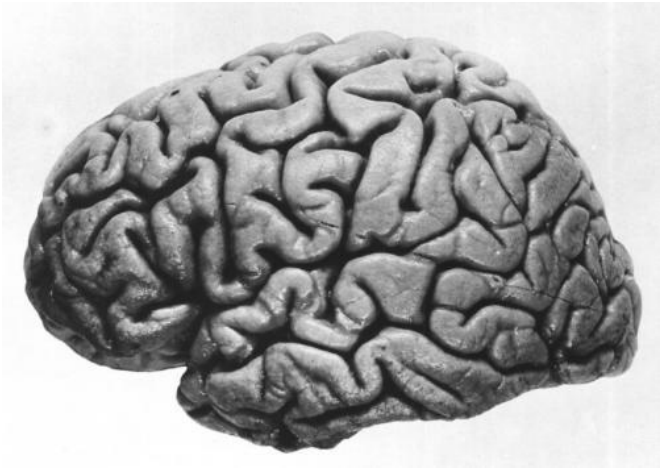
Learning at an advanced age makes the brain fit but age-related brain changes cannot be undone

16 June 2016



Left hemisphere of J. Pi?sudski's brain, lateral view. Credit: public domain

As a person ages, perception declines, accompanied by augmented brain activity. Learning and training may ameliorate age-related degradation of perception, but age-related brain changes cannot be undone. Rather, brain activity is enhanced even further, but for other reasons and with different outcomes. Researchers at Ruhr-Universität Bochum discovered these facts in a recent study, the results of which have now been published in *Scientific Reports*.

Enhanced brain activity at old age

The researchers asked test participants in different age cohorts to feel two needlepoints that were located closely to each other with the tips of their fingers. Older participants perceived two points as a single event even when they were located quite far apart, whereas younger people were still able to distinguish them as two distinct points, which is evidence for degraded tactile perception at higher age. This impaired perception experienced by older people goes hand in hand with a spatial enhancement of brain activity, which researchers generally interpret as a compensatory mechanism.

Learning and training improve perception

"Age-related degraded perception is not irreversible; rather, it can be improved through training and learning," explains Dr Hubert Dinse from the RUB Neural Plasticity Lab. The question researchers then asked was: if age-related impaired perception can be restored, will the age-related expansion of brain activity be reduced as well? In other words: can training and learning lead to a "rejuvenation" of the brain?

Learning too enhances brain activity

Studies with young adults have shown that learning processes are typically associated with an enhanced and broadened brain activity. If age-related impaired perception can be restored through learning, learning should have a different effect on the brain in older people than in young adults: the age-related enhanced brain activity should be reduced. Yet, as the neuroscientists from Bochum observed, the opposite is the case: learning processes in old people result in a further enhancement of brain activity too, which is associated with improved perception.

Learning to understand ageing and learning processes with the computer

"We asked ourselves: how can the different effects of enhanced brain activity on perception in older people be explained?" recounts Dr Burkhard Pleger from the RUB Neurology Clinic in Bergmannsheil Hospital. For the purpose of the study, the researchers used computer simulations to model

both brain activity and associated perception. To this end, they simulated a number of alternatives of how those results might have been generated. These simulations showed that the observed pattern of age-related changes at the level of brain activity and perception could only be explained by the weakening of a mechanism that limits spread of activation, thus keeping activity focussed. In contrast, the observed learning effects could only be explained by reduced inhibition, which leads to higher brain activity. This mechanism is operating in both young and older people. Thus, the older brain learns according to the same principles as the younger brain. Considering the magnitude of learning-induced improved perceptual ability in younger and older participants, the study shows that older people improve even more than younger people. This result too can be explained by the computer simulations through reduced suppressive neural mechanisms in the elderly participants.

Training pays off at every age - but it does not rejuvenate the brain

"The computer simulations explain how changed brain activity can have opposite effects on the level of perception. In addition, they explain the observation that the 'treatment' of ageing processes does not reverse age-related brain changes, but rather remodels them," says Hubert Dinse. "They demonstrate that training and learning pay off at every age, in order to remain fit."

More information: Burkhard Pleger et al, A complementary role of intracortical inhibition in age-related tactile degradation and its remodelling in humans, *Scientific Reports* (2016). DOI: 10.1038/srep27388