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Juggling increases brain power

Complex tasks such as juggling produce significant changes to the structure of the brain, according to scientists at Oxford University.

In the journal, Nature Neuroscience, the scientists say they saw a 5% increase in white matter - the cabling network of the brain.

The people who took part in the study were trained for six weeks and had brain scans before and after.

The volunteers were taught to juggle with three balls

Long term it could aid treatments for diseases like multiple sclerosis.

Diffusion MRI

The team from Oxford's Department of Clinical Neurology used a diffusion MRI which is able to measure the movement of water molecules in the tissues of the brain.

The signal changes according to how many bundles of nerve fibres there are and how tightly packed they are.

> **"It's extremely exciting to see evidence that training changes human white matter connections"**
>
> Professor Cathy Price, Wellcome Trust Centre for Neuroimaging

Changes in grey matter, where the processing and computation in the brain happens, have been shown before, but enhancements in the white matter have not previously been demonstrated.

Three ball cascade

The scientists studied a group of 24 healthy young adults, none of whom could juggle.

They divided them into two groups.

One of the groups was given weekly training sessions in juggling for six weeks and was asked to practice 30 minutes every day the other 12 continued as normal.

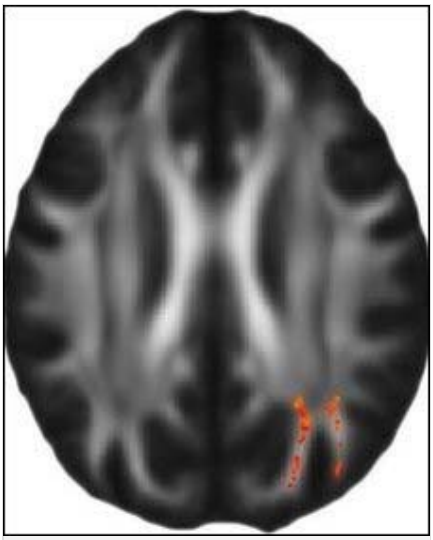
After training, the 12 jugglers could perform at least two continuous cycles of the classic three ball cascade.

Both groups were scanned using diffusion MRI before and after the training.

At the six week point, a 5% increase in white matter was shown in a rear section of the brain called the intraparietal sulcus for the jugglers.

This area has been shown to contain nerves that react to us reaching and grasping for objects in our peripheral vision.

There was a great variation in the ability of the volunteers to juggle but all of them showed changes in white matter.



The red area shows the part of the white matter of the brain that is enlarged by learning to juggle

It is in the intraparietal sulcus at the back of the brain

The Oxford team said this must be down to the time spent training and practising rather than the level of skill attained.

Dr Heidi Johansen-Berg, who led the team, said: "MRI is an indirect way to measure brain structure and so we cannot be sure exactly what is changing when these people learn.

"Future work should test whether these results reflect changes in the shape or number of nerve fibres, or growth of the insulating myelin sheath surrounding the fibres.

"Of course, this doesn't mean that everyone should go out and start juggling to improve their brains.

"We chose juggling purely as a complex new skill for people to learn."

Clinical Applications

Dr Johansen-Berg said there were clinical applications for this work but there were a long way off.

She said: "Knowing that pathways in the brain can be enhanced may be significant in the long run in coming up with new treatments for neurological diseases, such as multiple sclerosis, where these pathways become degraded."

Professor Cathy Price, of the Wellcome Trust Centre for Neuroimaging, said: "It's extremely exciting to see evidence that training changes human white matter connections.

"This complements other work showing grey matter changes with training and motivates further work to understand the cellular mechanisms underlying these effects."