

Mirrors Trick The Mind And Help Alleviate Pain

Ed. Note: The following is a press release from the University of Bath.

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The treatment, being developed by researchers from the University of Bath and the Royal National Hospital for Rheumatic Diseases (RNHRD), is based on a new theory about how people experience pain even when doctors can find no direct cause.

This 'cortical' model of pain suggests that the brain's image of the body can become faulty, resulting in a mismatch between the brain's movement control systems and its sensory systems, causing a person to experience pain when they move a particular hand, foot or limb.

Researchers believe that this kind of problem could be behind a host of pain-related disorders, such as complex regional pain syndrome and repetitive strain injury.

In an investigation of whether this system can be corrected using mirrors to trick the brain, researchers asked a number of patients with complex regional pain syndrome (a chronic debilitating condition affecting 10,000 - 20,000 patients in the UK at any one time) to carry out routine exercises in front of a mirror.

More than half experienced pain relief during and after the exercise and further investigations showed that even greater improvements can be achieved if the tasks are practiced beforehand.

"By using a mirror reflection of a normal limb to convince the brain that everything is alright, we have found that we can correct this imbalance and help alleviate pain in complex regional pain syndrome," said Dr Candy McCabe who works in the University of Bath's School for Health and the RNHRD.

"We think it is the same system that is triggered when you are running down stairs, miss the last step and then feel a jolt of surprise.

"In missing that bottom step, you jar the prediction that your brain had made about what was going to happen, triggering an alert to the body that things are not as you expected, hence the feeling of surprise.

"This is because in most cases normal awareness and experience of our limbs is often based on the predicted state rather than the actual state.

"When the two do not match we think sensations are generated to alert the body that things are not as it thought - rather like an early warning mechanism.

"If the discrepancy is very large [like in the mirror experiment described below] then pain may be experienced, as pain is the body's ultimate warning mechanism.

"We think that this system may be responsible for a range of disorders where patients feel pain for apparently no clinical reason.

"Somehow the brain's image of the body differs from what it senses. When the patient moves their hand, foot or limb, they experience pain as a result.

"This could have important implications for the therapeutic management of people with chronic pain."

In a separate study published in the journal *Rheumatology* earlier this year, researchers from Bath, Cardiff and Exeter showed that it is possible to create sensations and feelings in one limb by looking at a reflection of the other limb in a mirror.

They asked 41 healthy people to sit with a mirror at right angles in front of them so that they could only see one side of their body at a time.

The volunteers were then asked to move their limbs in the same direction at the same time, and then in opposite directions whilst viewing the mirror reflection of one hand.

Within 20 seconds of starting, more than two thirds of people involved in the trial reported some kind of sensation in their hidden limb when the movement they were seeing in the mirror was different to what they were feeling in the hidden hand, for example by moving their hands in different directions.

These sensations included numbness, pins and needles, a change in temperature and moderate aching, despite receiving no neural damage to that limb.

"Some people felt pain in their arm after as little as twenty seconds but not all of our volunteers experienced these disturbances," said Dr McCabe.

"It would appear that innate susceptibility plays a part, with some individuals more vulnerable to, or simply better at detecting, these sensations."

The research is funded by the Arthritis Research Campaign.

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