

Enhancing Sensorimotor Activity of Stroke Patients by Controlling Virtual Objects with Gaze

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INTRODUCTION:

Motor deficits are one of the main negative consequences of brain damage. Complications that affect the upper limbs are among the most disabling.

- Most treatments consist of physical therapy, which requires the preservation of certain motor skills in the affected limbs
- These capacities may be very limited or even not present, especially in the early stages of the injury.

For this reason, many times other types of approaches are required to help to recover functions without resorting to limb movements. Increasing brain activity is essential for the recovery of motor functions

In a previous neuroimaging study we have shown that the control of virtual elements with the eye enhances brain activity in sensory and motor brain regions of healthy volunteers.

Our aim is to explore the brain activity of stroke patients who manipulated a virtual object by using their gaze. On the basis of our previous works, we expect to find activations in sensorimotor brain regions associated with eye control of virtual objects.

RESULTS:

Individual results of the patients revealed extended bilateral activations during the movement condition in cortical and noncortical regions typically involved in visuomotor tasks, including the supplementary motor area, the premotor cortex, the basal ganglia, and the cerebellum.

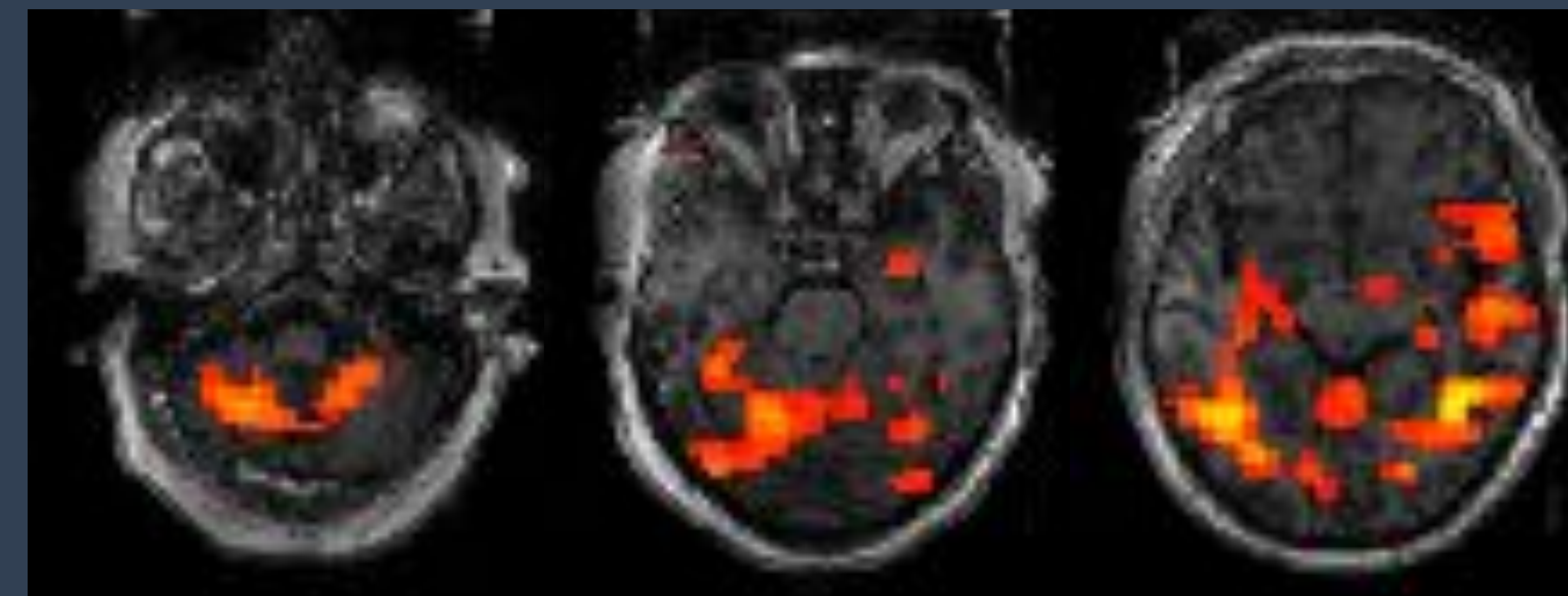


Figure 2: Brain activity of a stroke patient who manipulated a virtual object by using his gaze

DISCUSSION:

The execution of the eye-controlled tracking task was associated with extended activations in sensorimotor regions, what is consistent with previous experiments based on eye-controlled tasks and healthy volunteers. To the best of our knowledge, this is the first work in clinical populations studying brain activity related to the eye control of virtual elements. The present results may be of interest in neurorehabilitation to activate the motor systems and help in the recovery of motor functions in stroke patients without resorting to limb movements, which is not always possible because of limitations in the affected limbs.

METHODS:

We registered brain activity of three subacute stroke patients (mean age = 65; SD = 8.1; one female) using fMRI. Inside the MRI scanner, the participants were engaged in a continuous tracking of a target moving horizontally in a sine-cosine waveform. To do this, they controlled a circle with the eyes by using an MRI-compatible eye-tracking system.

The experiment consisted of two conditions: *movement* (tracking blocks) and *fixation* (focus the gaze on a gray cross on a black screen; this is a basal condition).

fMRI data processing was done using SPM12 (www.fil.ion.ucl.ac.uk/spm/).

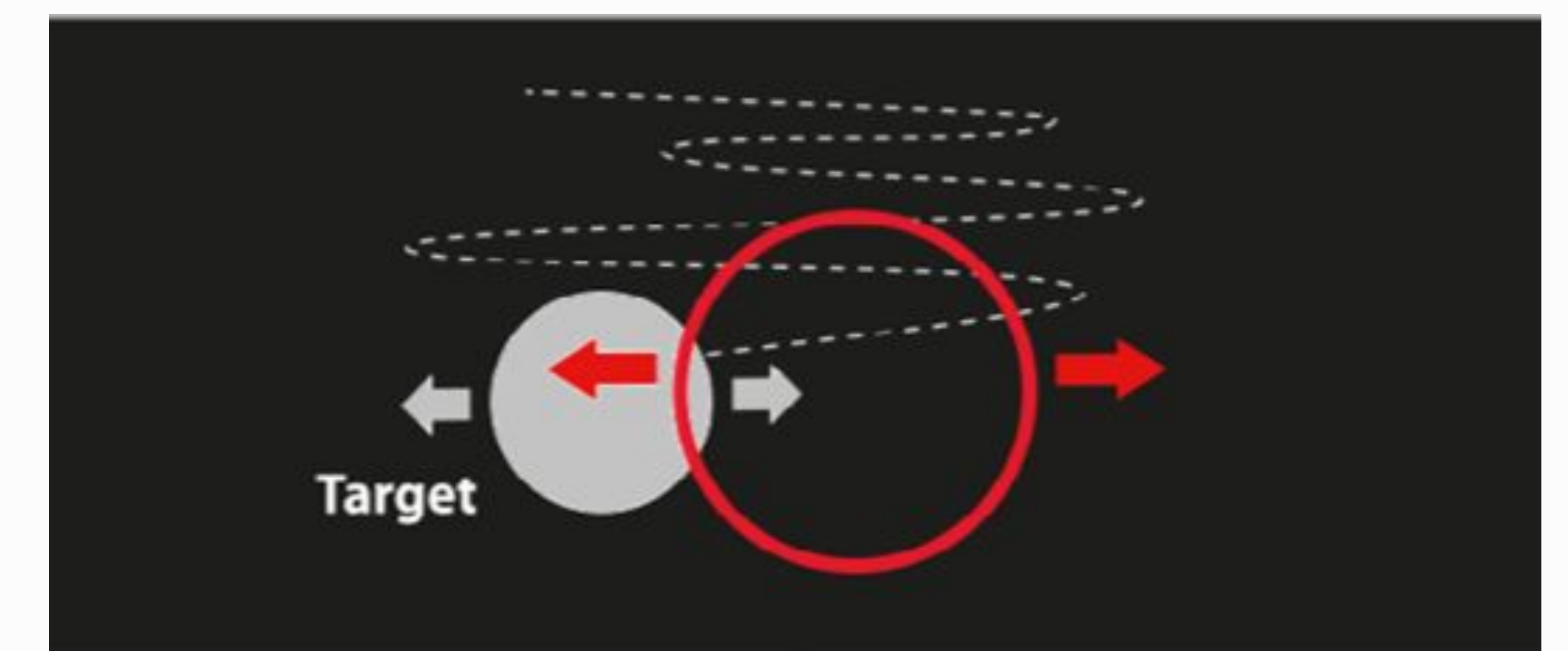


Figure 1: The continuous tracking of a target moving horizontally in a sine-cosine waveform