**THE PLASTICITY OF TACTILE PERCEPTION**

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# **INTRODUCTION**



**Figure 1**: Touch discrepancy device.

Based on previous studies focused on how the brain establishes a map of the body, it appears that the individual’s concept of self is plastic and may be manipulated through tactile and visual means. It has been found that “the body schema reflects a practical attunement of the body to its environment” [2]. The Rubber Hand illusion is one example that shows how an artificial limb may be incorporated into one’s body schema by coupling simultaneous visual and tactile touches to a rubber hand [1]. Other studies have found that by using vibration on tendons in the biceps or triceps, subjects holding the index finger of the adjacent hand had the sensation that their finger was elongating [3]. It has yet to be determined, however, whether it is possible to train the brain to believe that the body is being touched in a different location than reality.

The point that touches the skin

The handle that subjects see

Box to house the device

With the recent application of Targeted Reinnervation (TR) surgery [4] to lower limb amputees, little has been discovered in terms of the acuity of tactile sensations in the leg. It is expected that the plasticity of one’s body schema, as seen in the previously mentioned experiments, will also apply to amputated limbs that have undergone TR surgery. If body schema plasticity exists it may allow amputees with TR surgery to incorporate sensory feedback capable prosthesis into their own body schema. That is, a prosthesis that relays sensory information back to an amputee could be integrated into the amputees’ sense of self and utilized to replace lost limb sensation. Therefore, we are proposing to investigate if touch sensation and localization of said touch can be systematically altered through a haptic-visual sensory intervention. The proposed experiment aims to demonstrate body schema plasticity.

# **METHODS**

Using a tactile-visual discrepancy test on subjects, participants will be biased into associating a new sensation of touch to various locations on their upper leg.

*Initial Assessment:* Each subject will have a ruler drawn along the length of their upper leg, measured in ¼ inch increments. The researcher will select ten consecutive points to touch, each one being touched a total of ten times, in random order. The subject will be blindfolded while the researcher touches a point, but will then be able to uncover their eyes to look at their leg and determine where they think they were touched.

*Intervention:* By touching test subjects in one location while simultaneously creating an illusion that makes the touch appear to be occurring one inch proximally, the individuals will adapt their self-awareness to the new tactile sensations (see Figure 1). In the figure, a box contains the tactile wand, which has one end protruding from the box for the subjects to

see, and a tip that is offset with the container. This will lead the subject to associate the feeling of touch from one location as coming from a different location.

*Post Intervention Assessment:* The initial assessment described above will be performed again to quantify the effect of the intervention.

# **CONCLUSIONS**

The ability to adjust one’s body schema will be useful to benefit from lower limb prosthetics with sensory feedback. If confirmed that sensations felt in the lower limb are plastic and that body schema can be adapted, newly designed prosthetic for an amputee with TR may not need sensory transducers to be exactly aligned with the amputees’ initial TR mapping. Instead, the brain will have the capacity to adapt the body’s internal map through intervention, training, and daily use. This could enable sensory feedback capable prosthetics to become commercially available and more widely used, ultimately improving the lives of many amputees.

# **REFERENCES**

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