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"A Turing Test for Visual Qualia and the Chaotic Spatiotemporal Fluctuation Hypothesis"

ABSTRACT

I propose an experimental method to test various hypotheses on consciousness. Inspired by Sperry's observation that split-brain patients possess two independent streams of consciousness, the idea is to implement candidate neural mechanisms of visual consciousness onto an artificial cortical hemisphere and test whether subjective experience is evoked in the device's visual hemifield. In contrast to modern neurosynthetic devices, I show that mimicking interhemispheric connectivity assures that authentic and fine-grained subjective experience arises only when a stream of consciousness is generated within the device. It is valid under a widely believed assumption regarding interhemispheric connectivity and neuronal stimulus-invariance.

If consciousness is actually generated within the device, we should be able to construct a case where two objects presented in the device's visual field are distinguishable by visual experience but not by what is communicated through the brain-machine interface. As strange as it may sound, and clearly violating the law of physics, this is likely to be happening in the intact brain, where unified subjective bilateral vision and its verbal report occur without the total interhemispheric exchange of conscious visual information.

Together, I present a hypothesis on the neural mechanism of consciousness, “The Chaotic Spatiotemporal Fluctuation Hypothesis” that passes the proposed test for visual qualia and also explains the violation of modern physics. Here, neural activity is divided into two components, the time-averaged activity and the residual temporally fluctuating activity, where the former serves as the content of consciousness (neuronal population vector) and the latter as consciousness itself. The content is “read” into consciousness in the sense that, every local perturbation caused by change in the neuronal population vector creates a spatiotemporal wave in the fluctuation component that that travels through out the system. Deterministic chaos assures that every local difference makes a difference to the whole of the dynamics, as in the butterfly effect, serving as a foundation for the holistic nature of consciousness.

Finally, minimal and realistic versions of the proposed test for visual qualia can be conducted on laboratory animals to validate the hypothesis. It deals with two biological hemispheres, which we know already that it contains consciousness. We dissect interhemispheric connectivity and form instead an artificial one that is capable of filtering out the neural fluctuation component. A limited interhemispheric connectivity may be sufficient, which drastically discounts the technological challenge. If the subject is capable of conducting a bilateral stimuli matching task with the full artificial interhemispheric connectivity, but not when

the fluctuation component is filtered out, it becomes a strong supporting evidence of the hypothesis.