Information Processing in Consciousness

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The Merriam-Webster dictionary defines consciousness as "the quality or state of being aware especially of something within oneself" [1]. Variants of this definition abound in philosophy [2], psychology [3], and science [4]. And yet, no one really seems to know what consciousness *is* exactly and how it reallyworks. Opinions on the subject vary widely. At one end of the spectrum, we have suggestions that consciousness is an epiphenomenon [5],a mere illusion [6] that "adds little if any benefit for rational thinking, intentional action, executive function, or complex reasoning," [7]. At the other end of the spectrum sits the claim that explaining consciousness is (no less than) *the* hard problem [8]of our time.

While it is difficult to give an estimate of the exact, or even approximate, number of articles and books that have been written on the subject of consciousness, it is safe to say that it is an enormous one, likely in the tens of thousands. Speculations about consciousness cover a very wide range, from quantum physics (e.g. [9]), to neuroscience (e.g. [10]), to self-reference (e.g. [11]), to Panpsychism (e.g. [12]), among many other interpretations. Despite all this, no proposal for explaining consciousness has succeeded in answering the fundamental metaphysical and mechanistic questions of why, where, and how consciousness exists.

Unquestionably, at the time of this writing, no existing theory of consciousness passes the test of *falsifiability*. Indeed, none has been tested conclusively for confirmation, none has been definitively proven correct, and none is universally accepted. This, in no way, is a criticism of the field; rather, it is a description of the current state of its knowledge.

As cognitive scientists, our aim in this paper is to clarify the sense in which consciousness is an *information* process.To begin this work, we explore the following hypothesis: Consciousness is an information-carrying process only when the objects of consciousness are information-bearing objects, but contrary to a reductive analysis, this situation holds only for agents who have developed in a cognitive niche that has representational tools, e.g., language.

For our purposes, the two key assumptions of information theory are these:

1. In every information transmission event, *what* is transmitted is information *content*, as we will be calling it;
2. Information transmission events are bookended by encoding and decoding events respectively.

The standard view of consciousness is a reductive information processing one: whatever metaphysical account of consciousness we give, the information content in a moment of consciousness is the result of lower-level information processes. This idea is inspired by computers, paradigmatic information processors. The devil is in the details, of course, and when we unpack the analogy, we find a critical flaw.

Natural language sentences are encoded into ASCII symbols which are then converted (compiled) into electrical impulses or magnetic bits. Once the input is processed in the requisite way, enacted by mechanical causal relations that march in step with the higher-level information relations, the end state is decoded back into natural language and displayed on a screen to a human user.

On the informationprocessing metaphor of consciousness, sensory bits of information from the environment are theinput analogues and mental contents — for example, perceptions of apples — are the output analogues. The sensory input is encoded by neurons into electro-chemical 'signals', neural processing ensues, and the result is decoded into mental content.

One of the glaring differences between the two cases, one that has stymied AI researchers for sixty odd years, is that the inputs and outputs *mean* something to human cognitive agents, while in the computer case, and this is true of even our best attempts at AI, there is no understanding anywhere. In other words, there is content *for* the human but no content *for* the computer. This contrast is hardly surprising once we notice the deep disanalogy between the two cases: with computer processes the input and the output content is *given* and then encoded and processed by lower-level activity; with consciousness, the content is thought to "emerge" out of the lower-level processing activity. In the first case, the lower-level activity is a processing of higher-level content; in the second case, the lower-level activity *constitutes* the higher-level content.

We argue that this reductive information-processing metaphor is unsalvageable and should be discarded. Instead, we should be adopting a non-reductive, information-processing account that explainshow the inputs and outputs of consciousness are contentful by examining the external factors that give rise to them.

References

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