ABSTRACT

Human consciousness has been linked to “the feeling of being totally in control of one’s one brain function”, to “the ability of recalling memories at will”, to “making decisions without any concurrent somatosensory input”, to “introspecting one’s own thoughts” -- and doing all this without any particular effort. Yet we know for a fact that any mental task, however simple, is the result of the electrical interaction of about $10^{12}$ neurons, each one wired to hundreds, in many cases thousands, of others. In more specific terms, the brain is a complex non-linear self-organizing system which (i) encodes information acquired through the senses by creating images, maps or models of external world events in the form of specific spatio-temporal distributions of electrical neural activity that are in one-to-one correspondence with that which is being imagined: and (ii) creates order and unity through coherent, cooperative interactions ... Whoa! Stop! Read the previous sentence again: IT’S THE LANGUAGE OF PHYSICS! Any physicist, particularly a condensed matter physicist, would quickly comprehend the meaning of these words -- but psychologists, philosophers, even neurobiologists without an advanced training in physics, have difficulty in understanding them unambiguously. This is creating a rift among researchers in this field, pointing to the dire need for more physicists to get involved in it.

Studies of traumatic brain injury and schizophrenic behavior, and functional nuclear magnetic resonance imaging and positron emission tomography of healthy brains are providing crucial new information. I will try to explain in terms familiar to physicists the current thinking about how the brain manages to let its myriad of elements cooperate to create the coherent functional whole we call consciousness.