THE IMPLICATIONS OF CONSIDERING CORTICAL NEURONS AS COINCIDENCE DETECTORS

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In 1982 in my Doctoral Thesis I proposed that neurons do not act as integrators but as coincidence detectors. Since then it has been shown that this statement was only half true! Indeed, neurons can operate, depending on the duration of the interval over which they effectively summate incoming synaptic potentials, either as integrators or as coincidence detectors. If the neuronal integration interval is in the order of or longer than the mean interspike interval, neurons act as temporal integrators and transmit temporal patterns. If, on the other hand the integration interval is short compared to the interspike interval, then neurons assume the role of coincidence detectors.

There are many lines of evidence that argue for coincidence detection being the prevalent mode in which cortical neurons operate. This has profound significance for the way we perceive reality and deep philosophical consequences on the question of what reality is! In addition, it allows for fresh speculation on the so called "hard problem of consciousness," i.e., how and why sentient organisms - that is organisms that are capable of feeling, perception or having subjective experiences - have qualia or individual instances of subjective, conscious experience. In other words, it permits us to speculate as to why and how some of our internal states (e.g., heat or pain or, even, happiness) are felt by us rather than just being "unfelt" or just reported the way a thermostat acts upon a set temperature.

My presentation will evolve around (1) the historical and experimental basis of coincidence detection in the nervous system, (2) the question of what reality is - in neural terms - and (3) the emergence of consciousness. Finally, the meaning and implications of actual versus virtual reality will be discussed.