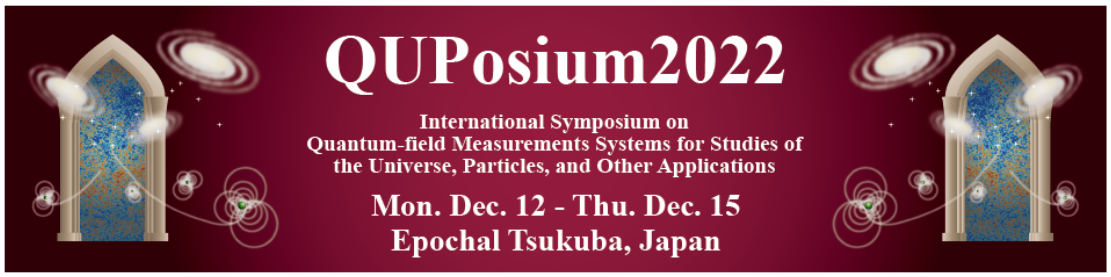

The relationship between micro- and macro-physics and micro- and macro-perception

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Abstract:

Broadly speaking, physics can be divided into two separate domains whose central cores are seemingly irreconcilable: on the one hand there is the physics of the very small (quantum physics) and on the other that of the very large (gravitation and relativity physics). The hope of physicists for the past 70 years or so has been to reconcile the two in some formulation that would unify them within a theory that would constitute a "theory of everything".

In the same way, visual perception can be divided into two domains - the micro-perceptive (less than 150 ms after the appearance of a visual stimulus) and macro-perceptive (over 150 ms after its appearance). In the micro-perceptive world we see basic visual attributes of colour, form and motion, asynchronously, with colour being perceived 40 ms before form and 80 ms before motion. Hence, when two properties of an object, say its colour and its direction of motion, change simultaneously in veridical terms, they are not perceived simultaneously but asynchronously. The consequence is that subjects bind the colour of a stimulus that they had seen at time t to its direction of motion that they had seen 80 ms earlier. Hence the two simultaneously presented attributes are bound together incorrectly; in other words, they are 'mis-bound'. This implies that, within this micro-perceptive time-scale, there is no brain area that waits for all the specialized visual areas that process these separate visual attributes to terminate their processing before combining the results of their processing into a unified whole. By contrast, in the macro-perceptive world, these separate visual attributes are bound correctly and therefore perceived to be in perfect temporal and spatial registration. A problem for neurobiologists is therefore to account for the transition between the micro-perceptive world, when visual attributes are mis-bound, to the macro-perceptive state, when they are correctly bound. The quest for the transition from one perceptive state to another parallels the quest of the physicists and would probably also require a unifying theory of perception.

Perhaps more speculatively, but not entirely so, I believe that, in both fields, the formulation that will unite the two disparate worlds in each will have to obey Paul Dirac's Principle of Mathematical Beauty, which I will discuss in terms of brain imaging experiments.

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Brief biography:

Semir Zeki holds the Chair of Neuroesthetics at University College London, having previously held the Chair of Neurobiology there. He specializes in studying the organization of the visual brain and has shown that separate visual attributes such as colour, form and motion are processed separately and in parallel, but asynchronously, in anatomically distinct visual areas. More recently he established the field of neuroesthetics and widened his field to study the neural mechanisms that are engaged during aesthetic and allied experiences, such as those of love and desire. He is a Fellow of the Royal Society, London, of the American Philosophical Society and of the Academia Europeae. His books, including A Vision of the Brain, Inner vision: an exploration of art and the brain, and Splendors and miseries of the brain, together with a book co-authored with the late French painter Balthus, have collectively been translated into seven languages, including Japanese.