“I would like to impress you with the vast range of phenomena that the theory of quantum-electrodynamics describes: its easier to say it backwards: the theory describes all the phenomena in the physical world except the gravitational effect, the thing that holds you in your seats [...], and radioactive phenomena which involve nuclei shifting in their energy levels.”

- Richard Feynman *QED* (p.8)
Information
– in the light of the strange theory of light and matter (quantum electrodynamics)

According to Shannon & Weaver’s mathematical theory of information, information is strictly speaking neither a value (number) nor a magnitude (quantity), but it can be treated symbolically in terms of so-called random variables: values governed by chance. But how can we have a mathematical theory of information, then? For treating it mathematically, they postulated a proportionality framework within which information is to be measured: the more information in a system, they assume, the less strictly organized is the system, and the more uncertain they take the system’s behavior to unfold. With their notion of information entropy, Shannon & Weaver have set up a framework analog to the dynamic paradigm of thermal machines. Within this paradigm, the goal for communication processing is clear: to help reduce uncertainty by organizing a systems flows, transformations and exchanges more strictly.

What if we tried to view a mathematical theory of information within a quantum paradigm, rather than within a thermodynamical paradigm? The most important change as opposed to the thermodynamic paradigm is that the formalism’s capacity does not have principle boundaries by restricting it to the real number space: instead of focusing on the determination of random variables, at interest here is the articulation of path integrals. According to a quantum paradigm, we can deal with a decoupling and open ended paralleling of what (within the thermodynamic paradigm) needs to be nested into one comprehensive system: in a quantum paradigm we can deal with a stream of ‘data’ (1) and a formalism that captures quanta from this stream (proportional to its individual capacity to integrate) (2), and an act necessary for deciding when and with regard to what the formalism is to capture and integrate ‘stuff’ from the live stream (3). The goal in this paradigm is to increase the tolerance for a model to cope with uncertainty, not to decrease it. The outlook promised by this paradigm is that the model’s capacity to integrate probable behavior can be developed by training (e.g. with self-organizing maps SOMs).

The main reading of this Kolloquium is Richard P. Feynman’s QED, The strange theory of light and matter (Princeton University Press 1983).
program & readings

Tuesday June 18 2013
Introduction to the program: the generic and the pre-specific

Tuesday June 25 2013
Computability and probability

Tuesday July 2 2013

Tuesday July 16 2013

Tuesday July 23 2013

Tuesday July 30 2013

Tuesday August 6 2013
The quantum view vs the thermodynamic view

Readings


