Quantum Organisation: In search for an organisational paradigm for the network age.
By Patrick Naef, 2017

The economic world is not linear anymore (as it might have been during the industrial age), but is today mostly dominated by networks.

For companies to be able to strive and survive in this networked economy, appropriate organisational models are required. The traditional hierarchical models from the industrial age aren't necessarily the best way to organise a company anymore, resp. can't cope with the complexity of networked environment.

Similar to physics, where the laws of the classical Newtonian physics don't work anymore once you enter the subatomic world or observe objects moving at very high speed (close to light speed) or objects exposed to very high gravitational forces, the classical approach to structure and organise companies don’t work anymore in the network age.

With Quantum Mechanics replacing Newton's laws in the subatomic dimensions as well as the theory of relativity replacing them in the "very large" and "very fast", completely new paradigms had to be adopted by physicists in the early 20th century, basically throwing the foundation of physics over board.

The basic principles of Quantum Mechanics were described in the “Copenhagen Interpretation” that was largely devised in the years 1925 to 1927 by Niels Bohr and Werner Heisenberg.

According to the Copenhagen interpretation, physical systems generally do not have definite properties prior to being measured, and quantum mechanics can only predict the probabilities that measurements will produce certain results. The act of measurement affects the system, causing the set of probabilities to reduce to only one of the possible values immediately after the measurement. This feature is known as wave function collapse. The inner workings of atomic and subatomic processes are necessarily and essentially inaccessible to direct observation, because the act of observing them would greatly affect them.

While elementary particles show predictable properties in many experiments, they become thoroughly unpredictable in others, such as attempts to identify individual particle trajectories through a simple physical apparatus.

Classical physics draws a distinction between particles and waves. It also relies on continuity and determinism in natural phenomena. In the early twentieth century, newly discovered atomic and subatomic phenomena seemed to defy those conceptions.

Quantum Mechanics cannot easily be reconciled with everyday language and observation. Its interpretation has often seemed counter-intuitive to physicists, including its inventors.

The properties of the system are subject to a principle of incompatibility. Certain properties cannot be jointly defined for the same system at the same time. The incompatibility is expressed quantitatively by Heisenberg's uncertainty principle. For example, if a particle at a particular instant has a definite location, it is meaningless to speak of its momentum at that instant.

This also means, that exact properties of a subatomic particle cannot be determined in absolute terms, but are always dependent on the observer and its context. The very moment one tries to measure the properties of the particle (i.e. an electron), the observer interacts with the observed object and with it, changes its behaviour. This means that the exact position of a particle is always relative to the observer and its context.

The Copenhagen interpretation intends to indicate the proper ways of thinking and speaking about the physical meaning of the mathematical formulations of quantum mechanics and the corresponding experimental results. It offers due respect to discontinuity, probability, and a conception of wave–particle dualism. In some respects, it denies standing to causality.

The wave–particle dualism describes the dual nature of subatomic particles, acting sometimes as solid objects and sometimes as waves of energy. An experiment can show particle-like properties, or wave-like properties, according to the complementarity principle of Niels Bohr.

Two camps of scientists were fighting for decades for what they both believed was the “only truth”. One camp was convinced that light was a particle while the other camp had proof that it must be waves. The fact that both camps had experimental evidence that served as the “proof” for their theory, kept the fight going. Only with the advent of Quantum Mechanics, the “schizophrenic” character of light (photons) started to make sense and today science is united in the understanding that light (photons), as well as other subatomic components are both, particle and wave at the same time.

The other principle emerging from the Theory of Relativity and Quantum Physics, is that matter is just a manifestation of energy. Einstein's equation $\mathbf{E = mc^2}$ underpins this mathematically. Matter becomes so to say “irrelevant”, as only the interactions between the particles are essential and will determine the characteristics of the particles themselves.

Richard Feynman described in his book about Quantum Electrodynamics (QED) how subatomic particles interact with each other by exchanging even smaller particles such as photons and other forms of energy (i.e. gluons, W particles etc.). The nature and essence of particles are mainly determined by these exchanges of energy, and are not primarily properties of their own.

In advanced experimental physics, where scientists try to find even smaller subatomic particles that constitutes the universe (quarks etc.), such as the experiments at The European Organization for Nuclear Research (CERN) near Geneva in Switzerland with its Large Hadron Collider (HLC), a strange phenomenon can be observed:

When scientist use extremely high energy to “shoot” subatomic particles at each other to split them apart into even smaller particles, they observed that the newly created fractions of the earlier particles can be heavier (bigger mass) than the originating particles. This can be explained with the fact that energy can be converted in matter and vice versa. So, the extremely high energy used to split particles into smaller components gets transformed into matter and creates "larger" particles instead of the smaller ones expected.

One can now easily imagine that this can be repeated infinitely and therefore keep these scientists busy for a long time in splitting particles into smaller components in their quest to find the “ultimate” smallest components or building blocks of the universe.

This means that particles themselves are actually not really relevant, but only the interactions between these particles, namely the exchange of energy amongst these particles.

Looking at these 3 basic concepts of quantum physics:

1. A particle cannot be assigned an exact and unique trajectory (position and speed) in space, but only a probability depending on its contextual situation and the observer
2. The properties of a particle itself is not primarily relevant, but rather the interactions between particles

3. Wave–particle dualism: particles can behave as waves and as particles, depending on the observer

Understanding that nature is also non-linear but dominated by networks, the conclusion is obvious, that we should look at these subatomic structures and interactions when trying to structure organisations who should survive in a networked economy.

If we apply these principles to organisations, we can try to understand how organisations work and we can try to derive a new paradigm of organisational understanding for the network age:

1. Units (individuals, resources, teams etc.) cannot be assigned (or should not) clearly and uniquely to a position (org unit, job, role, hierarchy etc.) in the organisation, but always have a certain probability to be in a certain position, reporting line etc., depending on the context, situation and observer
2. Move away from focussing so heavily on organisational structures, units and org charts, as the units themselves are not primarily relevant, but only a manifestation of the interactions between the "actors" (people, teams etc.) within (and ultimately also outside) of an organisation. Focus more on the interactions between people, than their organisational affiliation
3. While networks become dominant, a certain level of hierarchical structure will still be there. It is not about hierarchy or network but much more "and". The analogy to the wave–particle dualism is found in organisations, where hierarchies and network have to coexist and depending on the observer and context, one of the models becomes more dominant. We will have to accept and live with the “schizophrenic” character of organisations, as physicists had to accept the wave–particle dualism.

I have not yet been able to describe exactly how such a “Quantum Organisational Model” would look like, but using the abovementioned analogy from Physics, we can describe the characteristics of such an organisational model.

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