

11. Quantum social science, quantum phenomenology

Our conceptual structure evolves based on our experience and rational inquiry. Science is the constant exploration of new and effective ways of thinking about the world. We cannot abandon our way of thinking, but we can modify it from within, testing it for consistency and comparison with experience. We carry the concepts of space and time from classical physics from Newton in the 17th century. He advocated a new way of thinking about space and time, against the prevailing views of his time. His concepts of space and time were widely discussed and used, and over time they were absorbed by our culture and became the dominant view. In the early 20th century came the relativistic revolution, which showed us that there was a more effective way of understanding space and time, but it had not yet been integrated into the mainstream or even the learned way of thinking about the world. The relativistic revolution differs from the Newtonian picture primarily on the question of the ontological status of spacetime. Newton conceives of time as a fixed structured entity in the background of material reality. Einstein abandons this absolute time and space and says that they are only local configurations of a physical entity-gravitational field. The theory of relativity has taught us that an effective way to think about the world is to abandon the notions of "spatial and temporal entities" altogether.

In the West, there are two traditional ways of understanding space as an entity or as a relationship. Space is an entity means that space exists even when there is nothing but space. It exists by itself and entities can move within it. Space is a relation means that the world consists entirely of physical objects (particles, bodies, fluids, fields). These objects may or may not touch each other. Space is this relationship of touch, adjacency or contiguity between objects.

Much of the understanding of time also dates back to the 17th century, when Galileo first used the mathematical variable of time t to formulate equations describing the motion of the earth. We never directly measure this variable t , we only make an approximation of a hypothetical real time t . In GR there is no background spacetime, and thus no background time by which things are done. Many different notions of time are used in GR: coordinate time t , proper time, clock time T , cosmological time t_{Fr} , asymptotic Poincare time y . The last two are only concerned with describing special solutions of Einstein's field equations. They are irrelevant to the discussion of the ontology of time. Hourly times are simply data of certain physical quantities that can be used locally as an independent variable for convenience. Coordinate time is unobservable (unless there is a fixed scale, in which case it denotes something else) because of general coordinate invariance. The only residual notion of time that retains similarity to temporality is proper time. Eigentime does not flow uniformly in the universe. It is defined along a world line, and in general, if two world lines meet twice, the two elapsed proper times between the two meetings differ. The proper time S depends on the gravitational field, which is affected by the interaction with many systems.

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