

Husserl, Einstein, Weyl,
and the Concepts of Space, Time, and Space-Time

Extended abstract

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Already Søren Kierkegaard (1813 – 1855) wrote in *The Concept of Dread*: "... Time and space are for the abstract thinking completely identical". Minkowski gave this a mathematical expression. However, to *understand* the mathematical language of the Minkowski space physically, it is necessary to understand the concepts of space and time as such, as well as the meaning of the mathematical structure by which they are expressed. One approach to this problem is the phenomenological, which originates in Edmund Husserl (1859 – 1938). Husserl was a mathematician by education who turned to philosophy, motivated by his interest in the problem of how the objectivity of mathematics and logic is possible in a world which basically is a world of appearances for human subjects. Hermann Weyl (1885 – 1955) was, at least for a part of his life, a disciple of Husserl, and the introduction to his book "Space-Time-Matter" (SPT, 1918) is based on phenomenological concepts. Even Einstein's "The Meaning of Relativity" (MR, 1922) is basically phenomenological in its approach; not due to a direct influence from Husserl, but – apparently – rather because of Einstein's attachment to the philosophy of David Hume (1711 – 1776) and Ernest Mach (1838 – 1916), who were two of Husserl's predecessors.

My aim is to investigate the relation between space and time as so-called intentional objects for consciousness and the abstract mathematics of the Minkowski space, by presenting an exegesis and a critical discussion of the aforementioned classical texts of Einstein and Weyl. Human consciousness has an immediate experience of space and time, or rather, of spatiality and timeliness. The two phenomena play completely different roles in our consciousness. Husserl investigates how consciousness is basically time-dependent, e.g. how the act of reflection, basic to any act of abstraction and comprehension, is a process in time. Moreover, the basic dimensions of time, past, present, and future, are fundamentally different, corresponding to different intentional acts, since only the present is existent as reality in a physical sense. Contrary to this, all parts of space exist simultaneously.

In MR, Einstein tries to construct the abstract concept of space from the immediate subjective experience, from what he, in accordance with Hume, calls "sense impressions". However, he quickly, and without further mediation, makes a conceptual leap into a consideration in terms of spatial solid bodies. Although unaware of this, Einstein has thus made the move from Humean empiricism into Husserlian phenomenology. Husserl stressed that we do not experience naked "sense impressions", but a perceptual whole, consisting of parts with a meaningful appearance, like a solid body with a particular spatial form and at a particular

position relative to other bodies. Thus, he looks at perception as a process where the raw material from the senses is somehow elaborated by consciousness in a process called *constitution*. Solid bodies are constituted as given with a form and a position in space. From the experiential concept of a solid body, Einstein introduces the concept of empty space as a lack, an absence of such bodies, an absence which again can only be experienced relative to some present body. Thus, to Einstein, empty space has no independent meaning; its meaning is based on the concept of absence. The phenomenological concept of absence has been thoroughly investigated by another philosopher, Jean-Paul Sartre (1905 – 1981). To Sartre, the concept of space is one among many examples of absence, or, as he prefers to call it, “nothingness” (*néant* in French). Sartre and Einstein seem to be very close in their understanding of the phenomenon of space.

Also to Weyl, space is a “form of our perception”. In his introduction to *STM*, he explicitly introduces concepts from phenomenology, like intention, intentional act, and intentional object. He points out that the real world and every one of its constituents are, and can only be given as, intentional objects of consciousness. By this move, he takes a position between idealism and the naïve realism of everyday life. I have suggested calling this position *weak realism*. From this outset, Weyl makes a construction, similar to Einstein’s, of concepts like objective (although relative to a reference frame) time duration and those of space geometry, from which a mathematical structure can be built.

Weyl and Einstein have in common that they want to base the conceptual structure of physics on simple perceptions, followed by conceptual constructions to obtain a mathematical structure. My criticism will be that this approach neglects two important matters. One is the impact of language in the act of constituting even the most elementary perceptions. There are no such things as a theory-free perception. The perceived forms and structure are already inhabited by more or less explicit theories. The second is that mathematics is in itself a language and offers an extended conceptual structure interfering with our perceptions. Even if we accept, as I do, that to be is to be an intentional object for a consciousness (or an abstraction here from), this being may already be of a “mathematical” kind. This also applies to mathematical space-time.