Abstract

"Husserl, Jacob Klein, and Minkowski Space-Time"

Joseph K. Cosgrove, Providence College

In his *Crisis of the European Sciences* (1936), Edmund Husserl calls for an historical phenomenology through which the "sedimented meanings" of modern mathematical science would be "reactivated." Only through such a phenomenology, based on actual historical research, could symbolic mathematical physics be adequately grounded in the intuited "life-world," the only "real world." Moreover, in the absence of such a phenomenology, Husserl maintains, "science as given in its present-day form . . . . is mute as a *development of meaning*." Elaborating on this theme, Husserl describes the substitution in modern mathematical physics of symbolic mathematical idealities for intuitable physical realities as a form of reification of method: "Mathematics and mathematical science, as a garb of ideas, or the garb of symbols of the symbolic mathematical theories, encompasses everything which, for scientists and the educated generally, *represents* the life-world, *dresses it up* as 'objectively actual and true' nature. It is through the garb of ideas that we take for true being what is actually a *method* . . . ." How then, asks Husserl, can the symbolic entities of modern mathematical physics be "cashed in," as it were, in the directly intuited life-world, the world in which we actually live?

In *The Reign of Relativity: Philosophy in Physics 1915–1925* (2005), Thomas Ryckman shows that Hermann Weyl in his writings on general relativity during the period 1918–23 (thus predating Husserl's *Crisis*), set forth an interpretation of Einstein's general theory of relativity on the basis of Husserlian transcendental phenomenology.

Weyl developed what he called a “purely infinitesimal geometry” founded on the intuitive “givenness” of space, and applied it to general relativity. We must nevertheless observe that while Weyl constructed a phenomenologically-grounded theory of relativity, he did not carry out the even more basic *historical* investigation called for in Husserl’s *Crisis.* That is to say, Weyl’s phenomenology is not “genetic” in the historical sense of Husserl’s later philosophy. Yet such an historical investigation was carried out, at least in part, by Husserl's student Jacob Klein in his seminal *Greek Mathematical Thought and the Origin of Algebra* (1936), based on work carried out in the early 1930s (thus also predating Husserl’s *Crisis*). Klein uncovers a transformation in the intelligibility of number from the Greek conception, governed by a natural intelligibility, to the modern conception (assuming its modern form first in Vieta) governed by a *symbolic* intelligibility. He further suggests that the new science of the seventeenth century identifies, in a way necessarily hidden from itself, the symbolic mathematical *representation* of nature with nature itself. That is to say, annexed to the modern symbolic conception of number is a "symbolic nature" serving as the proximate object of modern mathematical physics. The point of departure for this symbolic nature, according to Klein, is the "symbolic space" of Descartes' analytical geometry.

However, Klein did not himself do the corresponding work in the history of science, specifically the algebraization of physics, that he did in the history of mathematics. In this paper I show that while symbolic algebra was gradually assimilated, albeit with significant resistance, into mathematical physics through the eighteenth and into the nineteenth centuries, it remained in principal subject to an intuitive interpretation via translation to the traditional mathematics of proportion, the latter based on the

comparison of intuitable of ratios of homogeneous physical quantities. However, with the advent of four-dimensional “space-time” beginning with Minkowski’s (1908) formulation of the special theory of relativity, mathematical physics becomes *intrinsically* symbolic, no longer subject to the intuitive grounding demanded by Husserlian phenomenology. I reach this conclusion by demonstrating that the properties of “space-time” can be expressed mathematically solely through symbolically constituted "number" as identified by Klein in his historical phenomenology of mathematics, with the result that space-time *in principle* cannot be encountered intuitively. My conclusion therefore calls for a reformulation of the goals of historical phenomenology of science.