REICHENBACH'S USES OF NON-STANDARD SIMULTANEITY (ABSTRACT)

ROBERT RYNASIEWICZ
JOHNS HOPKINS UNIVERSITY

If distant simultaneity is conventional, shouldn't it be possible, at least in outline, to reformulate the theory of relativity starting with a non-standard simultaneity criterion rather than with the standard Einstein convention? Indeed, one might interpret Einstein's remarks in 1905 as suggesting so. But this project was not taken up until much later in the 20th century. In particular, Hans Reichenbach, who set out the limits of acceptable conventions in his famous ϵ-schema, had no intention of doing so. In apparent contrast, he in fact characterized the standard convention as "essential for the special theory of relativity." (*Philosophie*, 127) Can we make sense of this? What use, if any, did Reichenbach make of the ϵ-schema in his writings on space and time other than to argue that this is the range of epistemically acceptable criteria given a limiting velocity for causal signals?

In his major works from the 1920s, the *Axiomatik der relativistischen Raum-Zeit-Lehre* (1924) and the *Philosophie der Raum-Zeit-Lehre* (1927), Reichenbach indeed does employ the ϵ-schema using values other than $\epsilon = 1/2$ in ways essential to these works. My goal here is to explain these in detail. First is to establish a global time function for all observers whatever their state of motion. Second is to give a way of distinguishing "real" from "unreal" signals other than the mark method. Third, is to show that time is more fundamental than space in that spatial measurement is dependent on the choice of simultaneity. Finally, and most importantly, is to demonstrate that the choice between the light geometry of classical optics and the light geometry of special relativity is conventional. Both satisfy the same physical axioms, but differ in the coordinative definitions deployed towards the development of a complete kinematics, involving the Galilean transformations on the one hand and the Lorentz transformations on the other. The upshot is that the empirical content of special relativity is given by the so-called "matter" axioms, in particular, that rods and clocks conform with the Lorentz rather than the Galilean transformations. The choice of $\epsilon = 1/2$ is "essential" to relativity only in the sense that this value for the light geometry yields the usual Lorentz transformations.