

Insight 5.3

3 The Abstract Intelligibility of Space and Time

- 1.1. **Concrete extensions and concrete durations** (material element), Space for us, Time for us, ordered by frames of reference (formal element).
- 1.2. **However**, this formal element, these frames of reference, do not explain concrete extensions and durations intrinsically. Thus, one can construct any number of a set of reference frames in which some geometrical object, movement, etc., has a different “intelligibility.” Yet, it is the same object, the same movement, and thus cannot really be different. This difference is because of the relativity of frames of reference, and that they do not really abstract from space and time as such, and thus are intelligibilities only relevant to a particular spatially and temporally bound frame of reference.
- 1.3. **At the same time**, frames of reference cannot be entirely eliminated. It is in and through these frames of reference that we come to the search for an enriching explanatory account of Space and Time, and likewise, whenever we return to concrete Space and concrete Time, from an enriching explanatory account, we do so through frames of reference.
- 1.4. **What are we seeking?** Invariance. The properties of our expressions reflect properties of our thoughts, and since we are trying to get insights into things, and not just relations of things to us, we are seeking enriching intelligibilities referring to these objects of our thoughts. Thus, invariant expressions are rooted in insights that abstract from the empirical residue.
 - 1.4.1. **Classical laws**
 - 1.4.2. **Thus**, “the immanent intelligibility of Space and of Time will be formulated in one of the geometries that fall under the general notion of geometry.”

3.1 The Theorem

The abstract formulation, then of the intelligibility immanent in Space and in Time is, generically, a set of invariants under transformation of reference frames and specifically, the set verified by physicists in establishing the invariant formulation of their abstract principles and laws. (Insight, 151)

Since the possible solution will relate extensions and durations via definitions, postulates, inference, it will be a geometry.

The solution will be invariant, because the definitions, postulates, inferences will need to be independent of particular places and times, and thus relevant “universally.”

And the solution will need to be invariant “under transformations of reference frames” because a geometrical explanation can only relate to Space and Time through reference frames, and such references are a multitude, thus since the reference frame is not abstract from particular places and times, the laws which remain the same no matter what the reference frame will be the solution.

Thus the Generic Solution: “The abstract formulation of the intelligibility of Space and Time consists in a **set of invariants under transformations of reference frames**. However, there is a range of such sets of invariants, and so there remains the task of determining the specific solution.

Canon of Complete Explanation: Scientists have the task of explaining all experiences (colors, sounds, heat, electromagnetic phenomena), including concrete extensions (Space) and concrete durations (Time).

The Specific Solution: “the set” of invariants “verified by physicists in establishing the invariant formulation of their abstract principles and laws.

Corollary: This specific immanent intelligibility that is expressed invariantly is obtained always by studying objects in Space and in Time, thus if one removes the objects, eliminate the intelligibility.