"Poincaré and the problem of relativity in physical space"

Geometrical conventionalism is the idea that the true geometry of space is a non sense question because geometries are seen as complex language-systems. Geometry is the study of a group and among possible groups we choose the more convenient one to refer to it physical phenomena. Hence the choice of a metric geometry is similar to the choice of a coordinate system. Thus, the truth of the Euclidean group is not incompatible with the truth of other geometrical group (e. g. the Lobatchewskyan group or the Riemannian group).

This idea is focused on the concept of geometrical space which to Poincaré is an invention that we make to think consistently in spatial terms. It is constructed as a mathematical continuum and as such, it is amorphous and can be metrized in various ways. However, this space has no physical interpretation; hence amorphousness is not a property of physical but only of mathematical space.

Poincaré defined another kind of space which is not the geometric one neither the physical one. It is the representative or perceptual space which is a construction made up of our visual, tactile and motor space (the space based on our muscle sensations). This space is the product of genetics, natural selection and physical conditions, but is not the same as a physical space.

When we speak about physical space we mean the scene where physical phenomena take place. Poincaré avoided using this concept and we think that this was intentional because if he had defined such a concept he would have been forced to accept the existence of such an entity similar to Newton's *sensorium dei*. However, Poincaré thought the Principle of Relativity as a physical law and as we know this idea is not compatible with the one of an absolute space to which refer physical phenomena. For these reasons Poincaré avoided the concept of physical space, and when he had to refer experiments, he referred them to the bodies who occupied a place, but never to the space itself. So, physical space can only be defined by the relations between bodies occupying it.

In a paper published in 1912 called "Spazio e tempo" (*Scientia, Rivista di Scienza*), and also a year later as chapter II of his posthumously published volume *Dernières Pensées*, Poincaré explained the double nature of the Principle of Relativity: it is an experimental law and a convention too. This idea seems to be contradictory at first sight, but if we deep into the arguments proposed by Poincaré in that paper and also in other of his philosophical writings, we could see that there is no contradiction. Principle of Relativity is an experimental fact and as such, it is submitted to experimental verification. Though this empirical status it is a convention because we generalize it and we elevate it to the status of a conventional principle and as such it is not falsifiable by experience. The epistemological status of scientific statements is changeable and dependent on the decisions of the scientific community. This is the way in which Poincaré could combine apparently opposite ideas and make a coherent transition from geometrical to physical conventionalism.