ENGINEERING A VISUAL FIELD

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Abstract: *Of the branches of mathematics, geometry has, from the earliest Hellenic period, been given a curious position that straddles empirical and exact science. Its standing as an empirical and approximate science stems from the practical pursuits of artistic drafting, land surveying and measuring in general. From the prominence of visual applications, such as figures and constructions in the twentieth century Einstein's General Theory of Relativity holds that the geometry of space-time is dependent upon physical quantities. On the other hand, earlier on in history, the symmetry and perfect regularity of certain geometric figures were taken as representative of a higher order knowledge than that afforded by sense experience. Concerns with figures and constructions, instead of with numbers and computations, rendered geometry amenable to axiomatic formulation and syllogistic deduction, establishing a paradigm of demonstrative visual and intuitive knowledge that has spanned two millennia.*

In geometry and as followed in geometrical art there remains a connection that distinguishes between the unboundedness of spaces as a property of its extent, and special cases of infinite measure over which distance would be taken is dependent upon particular curvature of lines and spaces. The curvature of a surface could be defined in terms only of properties dependent solely on the surface itself as being intrinsic. On the empirical side, Euclidean and non-Euclidean geometries particularly Riemann's approach effected the understanding of the relationship between geometry and space, in that it stated the question whether space is curved or not. Gauss never published his revolutionary ideas on non-Euclidean geometry, and Bolyai and Lobachevsky are usually credited for their independent discovery of hyperbolic geometry. Hyperbolic geometry is often called Lobachevskian geometry, perhaps because Lobachevsky's work went deeper than Bolyai's. However, in the decades that followed these discoveries Lobachevsky's work met with rather vicious attacks. The decisive figure in the acceptance of non-Euclidean geometry was Beltrami. In 1868, he discovered that hyperbolic geometry could be given a concrete interpretation, via differential geometry. For most purposes, differential geometry is the study of curved surfaces by way of ideas from calculus. Geometries had thus played a part in the emergence and articulation of relativity theory, especially differential geometry. Within the range of mathematical properties these principles could be expressed. Philosophically, geometries stress the hypothetical nature of axiomatizing, contrasting a usual view of mathematical theories as true in some unclear sense. Steadily over the last hundred years the honor of visual reasoning in mathematics has been dishonored. Although the great mathematicians have been oblivious to these fashions the geometer in art has picked up the gauntlet on behalf of geometry. So, metageometry is intended to be in line with the hypothetical character of metaphysics.

Geometric axioms are neither synthetic a priori nor empirical. They are more properly understood as definitions. Thus when one set of axioms is preferred over another the selection is a matter of convention. Poincare's philosophy of science was formed by his approach to mathematics which was broadly geometric. It is governed by the criteria of simplicity of expression rather than by which geometry is ultimately correct. A sketch of Kant's theory of knowledge that defined the existence of mathematical truths a central pillar to his philosophy. In particular, he rests support on the truths of Euclidean geometry. His inability to realize at that time the existence of any other geometry convinced him that it was the only one. Thereby, the truths demonstrated by Euclidean systems and the existence of a priori synthetic propositions were a guarantee. The discovery of non-Euclidean geometry opened other variables for Kant's arguments. That Euclidean geometry is used to describe the motion of bodies in space, it makes no sense to ask if physical space is really Euclidean. Discovery in mathematics is similar to the discovery in the physical sciences whereas the former is a construction of the human mind. The latter must be considered as an order of nature that is independent of mind. Newton became disenchanted with his original version of calculus and that of Leibniz and around 1680 had proceeded to develop a third version of calculus based on geometry. This geometric calculus is the mathematical engine behind Newton's *Principia*.

Conventionalism as geometrical and mathematical truths are created by our choices, not dictated by or imposed on us by scientific theory. The idea that geometrical truth is truth we create by the understanding of certain conventions in the discovery of non-Euclidean geometries. Subsequent to this discovery, Euclidean geometries had been considered as a paradigm of a priori knowledge. The further discovery of alternative systems of geometry are consistent with making Euclidean geometry seem dismissed without interfering with rationality. Whether we utilize the Euclidean system or non-Euclidean system seems to be a matter of choice founded on pragmatic considerations such as simplicity and convenience.

The Euclidean, Lobachevsky-Bolyai-Gauss, and Reimannian geometries are united in the same space, by the *Smarandache Geometries*, 1969. These geometries are, therefore partially Euclidean and partially Non-Euclidean. The geometries in their importance unite and generalize all together and separate them as well. Hilbert's relations of incidence, betweenness, and congruence are made clearer through the negations of Smarandache's Anti-Geometry. Florentin Smarandache's geometries fall under the following categories: Paradoxist Geometry, Non-Geometry, Counter-Projective Geometry, and Anti-Geometry.

Science provides a fruitful way of expressing the relationships between types or sets of sensations, enabling reliable predictions to be offered. These sensations of sets of data reflect the world that causes them or causal determination; as a limited objectivity of science that derives from this fact, but science does not suppose to determine the nature of that underlying world. It is the underlying structure found through geometry that has driven the world of geometers to artistic expressions. Geometrical art can through conventions and choices which are determinable by rule may appear to be empirical, but are in fact postulates that geometers have chosen to select as implicit definitions. The choice to select a particular curve to represent a finite set of points requires a judgment as to that which is simpler. There are theories which can be drawn that lead to postulate underlying entities or structures. These abstract entities or models may seem explanatory, but strictly speaking are no more than visual devices useful for calculation.

Abstract entities, are sometimes collected under universal categories, that include mathematical objects, such as numbers, sets, and geometrical figures, propositions, and relations. Abstracta, are stated to be abstracted from particulars. The abstract square or triangle have only the properties common to all squares or triangles, and none peculiar to any particular square or triangle; that they have not particular color, size, or specific type whereby they may be used for an artistic purpose. Abstracta are admitted to an ontology by Quine's criterion if they must exist in order to make the mechanics of the structure to be real and true. Properties and relations may be needed to account for resemblance among particulars, such as the blueness shared amongst all blue things.

Concrete intuition and understanding is a major role in the appreciation of geometry as intersections both in art and science. This bares great value not only to the participating geometer artists but to the scholars for their research. In the presentation of geometry, we can bridge visual intuitive aspects with visual imagination. In this statement, I have outlined for geometry and art without strict definitions of concepts or with any actual computations. Thus, the presentation of geometry as a brushstroke to approach visual intuition should give a much broader range of appreciation to mathematics.

References

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