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In Search of "That Which Has No Part"

Euclid, a Greek mathematician called the "Father of Geometry," wrote a text titled

Elements where he discussed early mathematics and set a basis through his definitions and

postulates for what we later named Euclidian geometry. He described several fundamental

entities for his geometry without arguing whether they should be taken to physically exist or not.

Instrumentalism and realism are attitudes toward scientific theories. To instrumentalists, a theory

is a statement that must be able to explain a given existing piece of data/observation and must

have also been able to predict it. To realists, a theory must follow the same definition as that for

instrumentalists but, in addition, must also reflect reality. The problem at hand is whether the

objects in Euclid's postulates, that is, points, lines, circles, etc. reflect reality. In this essay, I will

argue that an instrumentalist attitude toward Euclid's writings (focusing on the objects in his

third postulate specifically) is most appropriate by a) noting that we seem unable, in principle, to

detect many of his defined entities, b) examining the definitions Euclid himself set for the objects

in light of our three-dimensional world, and c) outlining the criteria that ought to compel a realist

attitude to mathematical entities, arguing that it is not presently justified.

Euclid begins his book with the definition of a point, the most basic definition on which

other definitions are built. He defines a point as "that which has no part" (Joyce). For something

to exist physically that has no part, it would have to be the simplest, most fundamental particle in

the universe. It would be impossible for this particle to be further broken down. Physicists are

still looking for such a particle. With all the research conducted thus far, we do not have (or have not yet found) an object in our world that is a representation of a "point" as Euclid defines it. Other definitions by Euclid are built on the point definition. A line is made up of infinite points and is defined as "breadthless length." This description effectively states that a line has only one dimension, length. Yet, nothing of one dimension physically exists around us; our world is built in three dimensions as far as we know. Euclid's slightly more complex definition of a circle builds on the other two definitions mentioned and states that a circle is a two-dimensional plane figure. By understanding that points and lines exist only conceptually in our three-dimensional world, a two-dimensional plane figure defined through points and lines becomes only conceptual as well. In summary, Euclid set definitions for basic objects in geometry – points, lines, and circles. I view these definitions, using modern understanding, to say that the objects are zero-dimensional, one-dimensional, and two-dimensional, respectively. If our world is indeed three dimensional, none of these objects may be physically reflected around us.

Still, despite the abstractness of the concepts discussed, Euclid's writings have great value. They help organize our thought about spatial surroundings through conceptual existence rather than physical. Points, lines, circles, and other Euclidian objects are building blocks for discussion and understanding of our world.

When discussing Euclid and Euclidean geometry we start with a fixed definition for a point (which Euclid set himself.) All of Euclid's writings are fundamentally based on definitions like this, so alternate definitions cannot be easily considered without losing the value of the work. By accepting the given descriptions of Euclidian objects, the only way to sway my opinion toward realism would be to first find and give me proof of physical existence of a "point"; proof of physical existence of "that which has no part" (Joyce). Then, give me a line; give me length

made up of multiple part-less things. One may argue that these objects exist and we have not yet discovered them, but that should not be enough to adopt a realist attitude. Until then, until I have physical evidence, I will appreciate these objects conceptually and adhere to an instrumentalist point of view.

Works Cited:

Joyce, David E. "Euclid's Elements, Book I." *Euclid's Elements, Book I*, Clark University, 1996, https://mathcs.clarku.edu/~djoyce/java/elements/bookI/bookI.html#guide .