Shift It: The Rationality of Paradigm Shifts

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In *The Structure of Scientific Revolutions*, Thomas Kuhn lays out a number of doctrines which have lead many to conclude that his theory implies there is no rational basis for choosing one paradigm over another. That is to say if this interpretation of Kuhn's account of science is correct, then the decision to accept one paradigm over another is, and historically has been, based only upon irrational decision-making processes, and it would have been just as valid to reject our present paradigms and adhere to the older ones they replaced, as it was to make the shift as we did. This undermines the entire concept of scientific progress and leaves us unjustified to claim that our beliefs are any closer to the truth, or in any other way better, than those we have discarded in their favor. However, Kuhn himself denies this interpretation. In this paper I intend to explore one of the doctrines which seems to imply this irrationality of paradigm shifts, that of incommensurability of meaning, and see if this doctrine really leads to such radical conclusions.

Incommensurability of meaning is the notion that the very language used by adherents of one paradigm is fundamentally different in important ways from the language used by adherents of other paradigms. That is, even if researchers between paradigms speak the same natural language such as English, French or German, and use the same technical terms such as as "mass" or "geodesic" to discuss their different theories, those terms have different definitions or meanings to the adherents of different paradigms, and so scientists operating in different paradigms cannot even properly speak to each other about their differences on the subject matter. This can be illustrated if we consider an example debate between a person who believes that the Earth is flat and one who believes (as we now do) that the Earth is round, over the shortest route from the tip of Baja California to the island of Taiwan, both of which lie on the Tropic of Cancer. The flat-earther would argue that, quite obviously, the shortest route will be a straight line along

the Tropic of Cancer, because a straight line is the shortest distance between two points, and so it would be silly to wander from the nice straight latitudinal line that connects the two points in question. However, while the round-earther would certainly agree that a straight line is the shortest distance between two points, he would argue that the shortest surface route from the tip of Baja California to the island of Taiwan would arc quite far into the North Pacific Ocean, along the path of a Great Circle; and that if you really wanted to take the absolute shortest route, a straight line, you would have to dig diagonally into the Pacific sea floor and back up to Taiwan on the other side. To the flat-earther that would sound ridiculous. How could arcing north en route to a place on the same latitude possibly be shorter than just following that latitude line, and how could a so-called "straight line" possibly dig down into the Earth and back up again elsewhere?

Here we see the incommensurability of meaning at play. Because the flat-earther conceives of the Earth as a flat Euclidian surface, to him an east-west "straight line" *necessarily* follows a latitudinal line, because latitudinal lines are defined in his paradigm as those lines running straight from east to west. But to the round-earther, no line on the Earth's surface is truly straight; the closest thing is a path that follows a Great Circle — a circle which perfectly bisects the Earth's surface, which no latitude line but the equator does — and any truly straight lines from one surface point to another must traverse the interior of the sphere enclosed by the Earth's surface. What constitutes a "straight line" to a flat-earther and a round-earther is something entirely different, and so even though both would agree that the shortest distance between Baja California and Taiwan is a straight line, they could argue forever about what particular path actually is a straight line and never make any progress, so long as each held on to his paradigmatic assumption about the geometry of the Earth's surface.

A very similar issue arose during the shift from Newtonian physics to Einstein's relativistic physics. To Newton, space was a passive, immutable, flat, Euclidean backdrop against which objects were placed, but with which they did not interact. To Einstein, space is a

dynamically changing curved manifold whose shape affects and is affected by the objects in it. Both Newton and Einstein will agree that an object in motion will continue in that same motion along a geodesic path — roughly speaking, the shortest distance between two points in three-dimensional space, analogous to the shortest surface distance between two points on the Earth — unless acted upon by an external force. But beyond there, any talk about what exactly is a geodesic can go nowhere, so long as each party holds on to his respective paradigm concerning the geometry of space. To Newton, a geodesic is a "straight line" through space, which intuitively must be (to his contemporaries and predecessors) and flat Euclidean manifold. To Einstein, no path through three-dimensional space is truly straight, because space itself is curved; so a geodesic is instead something other than a straight line, determined by the local geometry of space. This one paradigmatic difference has huge implications on the rest of their respective theories. To Newton, it implies that the observed deviation of objects from straight lines requires some sort of explanatory force, which he called gravity; a modern flat-earther might be tempted to posit a similar force to explain the observed fact that polar-arcing Great Circle routes take less time to travel as the same speed than "straight" latitudinal routes. But to Einstein, the observed deviation of objects from "straight lines" is simply the natural route for an object following a geodesic path to take; there is nothing to explain that is not explained just by the geometry of space, and thus no need to posit any force of gravity. Thus an Einsteinian physicist would say that gravity does not exist; objects merely travel along geodesic paths. But a Newtonian physicist would think that ridiculous, for gravity must exist to explain why objects observably do *not* travel along geodesic paths. The source of this conflict is the fact that "geodesic path" means something subtly different to the two physicists, and so long as they hold to their assumptions about the geometry of space, no amount of argument or evidence will reconcile these differences.

This sort of incommensurability is supposed, by the standard interpretation of Kuhn, to show that one cannot convince a person who believes in one paradigm to believe in another

paradigm through strictly rational means, by presenting them with evidence and logical argument from that evidence, because the most fundamental axioms of any such argument, the meanings of the words themselves, are determined by the paradigm. As the paradigm is the thing contested in such debates, this results in both sides making circular arguments past each other, merely trying to define the terms of the debate such that their own conclusions follow. And it seems to me that Kuhn is indeed committed to say that such proselytization across paradigms is futile, if he is to claim that there really is incommensurability of meaning between paradigms.

However, this does not mean that all paradigm choice must be completely irrational. It merely means that one cannot positively convince another of the truth of the alternative hypothesis. But one can still argue negatively against a competing paradigm by pointing out the problems that it presents for itself. One can still 'put on' the mindset of a competing paradigm, and argue (using that paradigm's own terms as it's own adherents would) that the paradigm is problematic because of such-and-such anomalies. For example, a round-earther could point to approaching ships appearing mast-first over the horizon, and challenge the flat-earthers to explain this observation; if the flat-earthers cannot do so, it casts doubt upon their paradigm. In this way, one can give adherents of one paradigm good reasons *not* to believe something. But as Kuhn emphasized, no one is going to give up on their only theory just because it is problematic; the alternative would be to believe nothing at all. So at this point, after casting doubt on one theory, one can then explain an alternate paradigm, present an alternate picture to the problematic one, and ask the adherents of the first paradigm to consider, just for the sake of argument, *what if* things were like that instead. One could then ask them to look about at the various anomalous data and see if they appear so anomalous given the principles of this alternative paradigm.

For example, a round-earther could explain that he believes the earth to be round, not flat, despite how ridiculous that may sound at first; and so the taller parts of ships appear first just because the geometry of the Earth dictates that they must. The flat-earther will certainly have

objections to the round-earth hypothesis, such as asking why ships don't all fall off the world as they sail around it; to which the round-earther could explain his conception of gravity as pulling toward the center of the earth, not linearly "downward". Such conversation would have to continue for a long while until the round-earther had explained all the ways in which his paradigm's basic principles differed from those of the flat-earth paradigm, and how taken together these principles form a new paradigm which is self-consistent and consistent with the known data. The flat-earther would still likely have great trouble seriously accepting these strange principles as true; but if the round-earther could convince him to just assume temporarily, for the sake of argument, that this whole explanation about a round earth and all the other necessary auxiliary hypotheses are true, then he could then ask the flat-earther, "As strange as this whole picture sounds to you, do you see any logical problems with this theory itself, or empirical discrepancies between it and the body of known observations?" Even if the flat-earther does see some such problems, the round-earther could still argue that they are fewer, less severe, or generally more surmountable than the problems with the flat-earth paradigm seem to be, and so if the flat-earther could get over his irrational attachment to his particular paradigm, and "try on" the alternate paradigm honestly without bias, he might find that it is a better fit after all. It is the resistance to consider alternate paradigms, not the acceptance of them, which is irrational.

In short, given incommensurability of meaning, it seems that there is indeed no rational way to directly convince someone who believes in one paradigm that they ought to believe in another paradigm. However, there is a rational way to convince someone that their own paradigm is highly problematic; and it may be possible to convince sufficiently open-minded people to consider things, just for the sake of argument, from within your alternative paradigm, which maybe turn out to be less problematic. For a person in such a position, having looked at things from within each paradigm, it would then be a perfectly rational choice to accept the paradigm with fewer and less severe anomalies, even if it presents other smaller problems of its own.