Reconstruction of concept of Paradigm in Thomas S. Kuhn

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Abstract

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Keywords: Paradigm, Kuhn, Economics, Stegmüller, Epistemology.

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This article aims to discuss an evaluation of the concept of paradigm of T. Kuhn in his representative work: *The Structure of Scientific Revolutions* ERC, [Ku96] and the complementary version by W. Stegmüller, *Structure and dynamics of theories* EDT, [Steg83]. This refined interpretation of the concept of paradigm allows for a more complete set of central Kuhnian concept.

Introduction

With regard to the concept of paradigm of T. Kuhn much to say, many commentators on his work have been forced to reject the accusation of "relativism" and "irrationality" which they say is reflected in the Kuhnian thesis, others for their part have used this argument against the possibility of finding a logic of scientific discovery [Popp59]. Amid sharp debate on the 80 is the work of W. Stegmüller *Structure and dynamics of theories* (EDT). In the words of author Kuhn's commentators "followed a path that led nowhere." Stegmüller's work often works on the premise that Kuhn actually outlined throughout his work a new conception of philosophy of science.

In this perspective includes the controversial work Stegmüller T. Kuhn [Ku96]). And contrary to argue from the sociology and history of science to acknowledge the relativism of Kuhn, the author assumes the defense of rational behavior in Kuhn's scientific and scientific theories. Stegmüller believes that Kuhn is primarily a historian of science and not a logical, and for this reason that in his more many psychological and sociological explanations such as historical examples. But consider that progress is possible Stegmüller work on refining Kuhnian concepts of ERC.

Stegmüller that protect the work of Kuhn not to say that in addition structure and dynamics of theories, EDT, will show a natural sympathy on all Kuhnian concepts. In fact the exact opposite occurs with the central concept: paradigm, which is not very fond Stegmüller. Moreover, Stegmüller found many difficulties in ERC, which he said are part of a work written with the naturalness of the historian of science. In his book Stegmüller expresses a kind of honesty to leave open the controversy as the circumstances must.

With regard to the accusation of irrationality, Stegmüller Kuhn observed a persistence of a fissure "irrational" manifested in the question: "Why in times of crisis in which a theory is exposed to an increasing number of abnormalities not abandoned this theory if you have not found a new one? ". The question opens up a fissure with Ockham's razor. The crack could not close and the psychological appeal that seeks Stegmüller-it's better to have something bad to have nothing-not presented as justification. In the case of

Kuhn's work fortunately this is rare. In *Structure and Dynamics of Theories*, EDT, find an extension to the Kuhnian concepts that we consider essential to understand the Structure of Scientific Revolutions, ERC.

"Nothing is easier than creating a distorted image of a place or philosophical theory. It rarely happens that even with largest efforts to avoid such distortions is achieved "[Steg83]. The theory was an effort Stegmüller higher against these strains has allowed to appreciate at its best after the outline dimension of the Kuhnian ideas, surpassing even those critical reactions that seem (omit). The reconstruction of the Kuhnian concept of paradigm in *Structure and Dynamics of Theories*, for the same reasons, will always be indebted to Stegmüller.

The goal now is to see how it behaves when the concept of paradigm is extracted from the set of arguments that develops Kuhn in *Structure of Scientific Revolutions* ERC. Search matrix functions in other schemes of explanation, and finally get their epistemological value to judge a specific area of financial theories: epistemological consistency.

Concept of Paradigm in Wittgenstein

Let's start with the presentation that makes the same Stegmüller wittgensteniano concept of paradigm, from the explanatory model which can then extend the contribution of T. Kuhn.

In the fifth chapter of the *Structure of Scientific Revolutions*, ERC, about the priority of paradigms, Kuhn referred to this affirming Wittgenstein who gave partial answers to the question of what binds a scientist-a lack of a relevant body of rules "to a particular tradition of formal science.

While the answer to this question Wittgenstein made from a very different context of Kuhn, such a context, "elementary" and "family" deserves the attention of the author of *Structure of Scientific Revolutions*. This suggests that between Wittgenstein and Kuhn there is a relationship that, while difficult to define in principle, will decide some of the arguments given by him to his most recognized.

Wittgenstein makes use of the processes called "games" against the belief that when there is a common feature underlying concept exclusive to the things designated by the concept. Put another way, for Wittgenstein there is no set of characteristics that applies simultaneously to all elements of the class and only them. In games, however there is a network of similarities overlapping and criss-cross without an essentially common property.

Consider the definition of a game with more beautiful detail in trying to extend the Kuhnian case that we deem essential. First, given a list of cases known to play later

modified by the inclusion or elimination of some of these games. This task is done within what Stegmüller called a first "period of insecurity."

After change of the original list, some activities that were initially counted as games and not be taken into account and other new games join the list to the extent that our knowledge about the meaning of more accurate game. The only period of uncertainty over when following perpetual changes of the original list of games results in an irreducible list of them, though likely to increase in tandem with our knowledge of the game progresses.

Excursus on set theory

Assisted set theory is able to solve the problem of game theory with some clarity.

So is the irreducible minimum list of games. *S* denotes the entire set as the "universal" games. In set theory is often advisable to define a universal set *U* to the pair which defines a set *A* of elements from *U*. Thus if A denotes the set of blocks for convenience *U* denote the set of all fruit, or if *A* includes rabbits, *U* conveniently include all four-legged mammals. In all cases it holds that *A € U* must be true then that *So € S*. *So* is this case means the list of game paradigms. So and S have the following relations:

(a) *So* extensional mode is given, i.e. its elements are listed in a list. To understand the concept of extensional we can use the analogy of numerals in axiomatic set [Cross.83] a set is countable when it is possible to assign each element of it is an ordinal number, ie first, second third and so on, identifying this clearly how each of the elements of the set. Sometimes no matter that can find all elements of the set, but selected a subset of it is possible to analyze all of its elements. Thus we have finite and infinite sets countable against the place that prevents the countability infinity. Thus the natural numbers are a countable infinite set, the real numbers uncountable infinite and *So* (*I* guess) a countable finite set. There may be a more appropriate analogy that relates to the idea of describing a set of "extension".

(b) In addition and as anticipated *So* is irreducible, it means not allowing the removal of its elements. Once assigned to a gaming property *m € So* you can not object to the condition set m.

(c) The fact that the presentation of a concept does not contain a common feature of the things that does not preclude an element of *So* may have common features. Common to the elements of *So* such as the property is displaying as human activities. The point is that possession of these common features is only a necessary but insufficient condition of membership of So. Can be stated mathematically as follows: Let m, n sets such that *m, n € So*, then we have that *m, n ¥ m € So, n* have a common feature. Note that the implication in the other direction cannot be valid. Possession of a common feature does not allow two events *m, n* to join the list of game paradigms. This brief scholiast fits

perfectly with the logic because otherwise any pair of activities, among which some similarity is found could belong to *So*.

(d) There is an ambiguity impossible to save in the sufficient condition for a game that belongs to S. For an element not in *So* becomes part of *S*, must have a number of properties that all elements of *So* have. That is, if *m € (S-So) ¥ n € So* we have that *m*, *n* have a common property. Note that the quantifier (for all) limits ostensibly belonging to (*S-So*) because if there is one element of *So* that has nothing in common with m is not possible that the latter is in (*S-So*).

(e) Following the above is not possible to develop a finite list of properties to make sure that belonged to S (this is due to the character ascribed to universal set *S*. For a fruit belonging to the set of all fruits is necessary that is a fruit and not a vegetable or any other vegetable. But what are enough conditions for a given plant is just a fruit? many. Likewise, a game that belongs to S is necessary to be a human activity, such as, but this is not enough to be considered once and for all as a game, hence the accuracy of the conditions of belonging to S will built the inaccuracy of the sufficient conditions of belonging to *S*.

A physical theory

Let *T* (*K, I*) a physical theory in the definition given by Sneed [Snned08] is [with *K* as a structural core for a theory of mathematical physics and *I* as a set of possible proposed uses of such a theory] to illustrate what said in the earlier section defines the paradigmatic set I did with S as in the example wittgensteniano. *So Io* corresponds to the previous examples.

For the scientist so *Io* is given as a set of extensional paradigmatic examples (note that now the elements of *I*, there are paradigms of games but paradigmatic examples of *T* in particular, as with S and So is it true that *I* and € Io conditions *a, b, c, d* and *e*. With respect to the ambiguity in dye, you could surmise that brings a great advantage to *T* for the following makes it immune to falsification, assuming that the physicist has a fundamental property that characterizes the elements of *I*. When he realizes the existence of an element of *I* which is not satisfactorily explained by T would have to admit that his theory has been affected empirically. What the physicist made hereinafter be explained by different options (Kuhnian or Popperian).

For Kuhn the scientist offers reluctance to abandon the theory after the discovery of empirical evidence against it. The empirical refutation is not enough to leave an explanatory framework. This reluctance should not be used, however, in favor of the allegation or accusation of irrationalism against Kuhn. Instead it should represent, and actually represented a rational and normal behavior of the scientist. Without the immunity provided by dye, the theory T would be too vulnerable to a persistent refutation.

There is one distinction that can be considered of utmost importance. The immunity does not apply to the case of paradigmatic examples. If *a n € Io* escapes any explanation given by *T* is unfailingly without *T*, but if *n €* (*I - Io*), the abandonment of *T* is not mandatory. We can illustrate this as follows. Among the methods of proof used in mathematics to find the counterexamples, a method developed under the principle of the third excluded middle. Io is a set of mathematical theorems anyone. If a *n €* Io is stated as follows: For all r belonging to the body of n p property holds `` then n will be refuted if there is one for the body *r* `*n*` *r* such that does not follow *P*.

Extending the analogy we take the example of Euclidean geometry theorem stated as: "for every triangle in the plane is satisfied that the sum of its interior angles is 180 º. This can be refuted if there is one triangle in the plane whose sum of interior angles is different from 180 º. Note that if n strongly supports a theory *E* (Euclidean) refutation of n will be extended to E and lead to their abandonment or reformulation. Now let I the set of all theorems with triangles in the plane, in space or elsewhere and Io is the theorem with triangle set in the plane.

Let *n €* (*I - Io*) if *n* is not true that the sum of interior angles of any triangle is 180 º their theory *E* cannot be refuted. In fact this was what happened when a triangle was placed on the surface of a solid sphere and found that the sum of its interior angles was greater than 180 º. E Euclidean geometry was not being refuted, but we were on the verge of coming of a new geometry *E*` (riemmaniana) incompatible with *E*. Clearly, the reasonable limit of analogy is not entirely convincing *Io* identifies a set of mathematical theorems, but the illustration is relevant enough.

This vagueness in determining the membership of *I* shows the use theory as a means of determining their own applications brings not enter any irrational element. Nor should argue for the idea of testing the theory by itself-self-test "for that this will serve to find their own application is a procedure that would not be objectionable from a methodological point of view. Also available is the only way to apply the method of the paradigmatic examples to define exactly the set I of proposed applications.

The concept of paradigm in Kuhn

While it is true that the above can be interpreted as a first approach between the concepts of paradigm of Wittgenstein and Kuhn, is not sufficiently clear Kuhnian paradigm identification with the class of proposed applications of a theory, identified by the use of paradigmatic examples. This is because in the *Structure of Scientific Revolutions* ERC the concept of paradigm presents a greater complexity in-game theory to Wittgenstein. The analogy on the paradigm should then be kept within certain limits. Your relationship is mainly linked to all applications of a theory. Other components of the paradigm, as judged Stegmüller may be subject to "rational reconstruction more accurate. These components of the Kuhnian concept of paradigm for which the analogy is not valid with Wittgenstein can be grouped into two heterogeneous classes:

Class I: Objects paradigm capable of a logical reconstruction

The mathematical structure of a theory is a representative part of the paradigm of the theory. According to Kuhn, specifically the mathematical structure is unchanged during periods of normal science, working around core fundamental agreements of the scientific community. Because during this period the structural core of the first part of a theory-K are subject to continuous changes of the mathematical structure (for the introduction of new laws and by her neglect of others) only survive its structural framework and its core as part of the paradigm. How they performed the reconstruction of such elements lies outside of this article.

On the other hand, the dynamics of science does not correspond exactly to the dynamics of theories (and this requires rigorous clarity), the possible transformations that may occur in the normal development of science need not be affecting continuously existing theories. The theory of "red-shift" expounded by Edwin Hubble that the universe is expanding in all directions continuously and at high speeds, was performed in principle and as a logical result of a large explosion that broke all the fragments of the universe, this meant that the amount of matter per unit of area decreased continuously. But in light of new discoveries is declining was not possible, so that H Bondi, T. Gold and F. Hoyle suggested the creation of new materials in the universe, thus creating his theory of the universe static.

Note that stationary universe theory actually represents a new interpretation of the "red shift" and does rather part of a dynamic pattern of our conception of the universe that a real change of the Hubble's original theory. So there is alarm at the possibility of changing our conceptual scheme on nature to do so without having to completely change the theories we have. The issues raised in these aspects should be investigated only by a theory of confirmation, he believes Stegmüller. All this means that for a new interpretation of the scope of group theory paradigm - in the Kuhnian sense, must necessarily take into account the rival interpretations. In the case of steady-this should explain why they are inappropriate interpretations of B. Lamatrie or G. Gamow, their opponents, if the aim is to become a new paradigm [Kuhn96].

Class II: Components of Kuhnian paradigm that belong to the field of psychology to the field of psychology and sociology are not analyzable by the philosophy of science.

The discomfort of some philosophers of science with Kuhn is that they say confuses the roles of psychology with theories of science showing a dual nature that leads inevitably to relativism [Kuhn77]. According Stegmüller this is exactly the impression left by a superficial reading of the *Structure of Scientific Revolutions* (ERC). To show that this place of the commentators actually corresponds to a wrong, Stegmüller retrieves one aspect of the Kuhnian paradigm known as "promise of success." This concept of

psychological appearance without major difficulties, we can define in terms of Class *I* seen before. Recall that this promise of success is actually the regular work of normal science. According to Kuhn, with the emergence of a paradigm emerges along a promise of success and the goals of normal science is working to comply. The task of the successful scientist depends essentially on the extension of the structural cores of all *K*-theory theory.

Viewed in this perspective is not entirely clear that Kuhn is arguing matters of psychology when it addresses the promise of success, data collection and experimentation in the normal development of theories. Nor is it clear that the author ERC is working with an intuitive basis on science, rather than the structural cores expanded it. Or, as judged Stegmüller the historian of science Kuhn makes statements in a metaphysical background of the scientific community itself. The theories do not exhaust the nature of rules, concepts, principles or laws. If the notion of paradigm incorporates various heterogeneous concepts is not surprising that critics of Kuhn have attributed it to the central concept of paradigm all sorts of ambiguities "contradictory".

A less superficial analysis as proposed in EDT Stegmüller shows that with the notion of paradigm we have one or the other. The different nuances that take the term in the *Structure of Scientific Revolutions*, however, favor the critical positions. Stegmüller prefers to work from this same approach to physical theories next. Another way to understand the paradigm in a semiotic fall hopelessly lost harmless the issues central to the philosophy of contemporary science.

Proposed applications of a theory (*K, I*)

As described above the set *I* of proposed applications of a theory can be described extensionally. However we have seen what the kind of adequate description was when this goal is not possible, study descriptions and non-extensional extensional while this was possible in the basic range of problems related to Kuhn's paradigm.

An extensional description of a set is essentially an elaboration of a list of individuals belonging to the set. This idea was connected with the mathematical equivalent of count ability. And the analogy is not farfetched. Indeed the notion of number can be reduced mainly to the presentation of a list explaining the elements belonging to a particular set. It remains to consider whether the order given in some denumerable sets is necessary in the sets described extensional. This may show more a technicality than a mandatory requirement of the description. As noted Stegmüller, any other type of description is called "intentional" or simply "not extensional.

But to know versus extensional or intentional description that we need to know all-sufficiency being described. For example, the set of proposed applications *I* cannot characterize extensional way as if it can be done with the set of paradigmatic examples Io (this is another point in favor of the analogy). Note that in general the universal set *U*

is not given extensional way, among other things, the inability to outline each and every one of the elements that compose it. Similarly it is unlikely to give a complete listing of the elements of *I*. This does not mean, however, not able to find a few of them arises precisely is where all I^{o} which supports a broad description of its elements.

An example, Let *U* be the set of all natural numbers ranging from one to hundred. The mathematician has a satisfactory knowledge of *U* through the concrete study of *A* (or other similar subsets) all of whose elements can be analyzed. The important point in this is that it is not possible to approach the study of natural numbers if not previously known and identified some natural numbers.

If *U* cannot be analyzed without reference to *A*, it is perfectly logical that *I* cannot study without having done the same with *Io*. Although this seems trivial aspect ceases to be studying the concept of paradigm in Kuhn. The interpretation of Stegmüller is within these terms, Do extensional and intentional descriptions of a set are not identified with the idea of "extension" and "understanding" of set theory? The answer may be yes. However when the mathematical means a universal set *U* always done through a feature common to all elements of *U*. In mathematical language U is "given by understanding." This is what was related before with what we call "the set of natural numbers. We were given a common characteristic of the elements of *U* namely the property of being natural numbers. With these elements takes place a short corollary:

Developing a list of elements of a set A € U is complementary mathematical form in which A is given by extension.

However, the possibility of describing the set *I* is more complex than we anticipated. A more systematic analysis should distinguish three types of *R* components: (a) the actual component *I* (b) the domain of individuals [the elements leading theory], (c) empirical functions [non-theoretical functions they strengthen the empirical knowledge of the person]. The relevant question at this point is "A system is described extensionally or intentionally? The answer requires separating for both cases.

With respect to the extensional description *I* can distinguish three aspects:

1. Simply extensional description of each element of *I*, ie, the extensional description of individuals and non-theoretical functions.

2. Intentional and extensional description for each element of *I* domain of individuals and the empirical functions.

3. Description entirely intentional domain of individuals and functions, but only for some elements of *I*.

The description includes intentional respects similar to the previous (i.e. 1, 2, 3, intentional changing extensional and vice versa.

We analyze each of the three possibilities. The look (1) according Stegmüller not need as much interest as the cases (2) and (3). A person at one time recognized the physical systems that relates to the theory. Well known individuals who appear in (omit) the systems, in addition to the values taken by non-theoretical functions. This extensional description *I* strip the *K* core of any theoretical basis, leaving a feeling is "superfluous" of the theory in question, in the words of Stegmüller. The variations are a resource math hypothetical analysis proposed by EDT.

The second aspect provides best ingredients as above. We present the elements of *I* in a list, for each of the elements we have a listing for the domain of individuals. Now let *m* € *I* an element of *I* for which *f1*, *f2*, *f3*, are given intentionally, while *F1, F2, Fn*, are given extensionally.

Hypothetically know all the values of the functions for each element of *I*, so it is necessary to make the structural core applications, i.e., the set *K* to predict values for each f, j, (where *0, E, j, i).* So who has the theory T will seek to work with that part of T that best fits the empirical data it has.

See if you can summarize with an illustration of the above. Be A. M. Ampere someone at some point *p* has *T* theory according to which "flows inside the conductors produce magnetic effects. Let m belonging to the field of applications *I T*, the fact that states that "a wire through which a current creates a magnetic field around it, and the function f is the function of m-theory which states that provides that two wires carrying currents attract each other ant parallel. How can the light of T proposed to explain the fact that f (that is, decide its value)? Experience shows that a wire current exerts force on the needle of a compass, but does this mean that the two wires have to attract each other? If two keys roasted iron should also attract each other and this certainly does not show the experience.

Because of this observation p decides that we need to increase the structural core of *T* so that explains why the wires attract each other while the keys are not. That is, work on that region *p T* known that best fits gives the observed phenomena. If p-like states, which effectively gave the forces of the (omit) magnetic fields generated by wires responsible for the attraction between them, we would have an extension of *T* that can help predict function values than non-theoretical *f*.

The third aspect mentioned in the second differs in that it helps to strengthen the predictive nature of theories. They are not only concerned exclusively with empirical functions for some given individuals, but also with the number of individuals present in all the proposed applications. This case also differs because the second refers to the "immunity of the theory" that we have spoken. If eventually the case that the extension of the theory leads to the prediction of the values of the empirical functions, then one would think to exclude the domain of individuals to those believed to produce such a difficulty. However, hypothetically the domain of these individuals is given intentionally (understandably) is reasonable considering that errors may occur in

assigning the common characteristic that distinguishes these individuals. A further intentional description, however, left out of all individuals to cause difficulties.

Stegmüller's contributions to the concept of paradigm in Kuhn (*EDT and ERC*)

In the central ideas in this paper Stegmüller above a long and complex study in many branches of knowledge, in addition to the philosophy of science itself. The analysis proposed Stegmüller Kuhnian concept of paradigm itself has a tendency toward mathematics and physical theories. However, we see that the author naked problems in complementary disciplines such as semantics and sociology of science. This presentation is very concise and with a different purpose to which epistemologists are accustomed.

One must stress again the validity and functionality of the analysis within the framework of the *Structure and Dynamics of Theories* (EDT) example is the construction of the set *K* or the structural core of a Theoretically, the more complex definition of an empirical function or identification of the elements that join the domain of individuals named. We have also left out some details, deliberately, whose clarification would have led to broader discussions of epistemology. A case epitomizes the notion of "having a theory" that involves the kind controversy about the theoretical terms of Kuhn / Sneed [Kuhn76].

Moreover this entry through the revision of Kuhn's paradigm concept corresponds to an illustration of the systematic review of Stegmüller that the detailed presentation of advanced problems in philosophy of science. Remain beyond our reach specialized approaches or possible solutions that seek to definitively resolve the original thesis of Kuhn in *The Structure of Scientific Revolutions* (ERC).

We have, however, ready to land apply some reflections on the scope that has the characterization of the paradigm in the case of financial explanation. This approach may be at greater risk. This is an unexplored area of one side as another. The epistemology of science has not shown more interest in a relatively subordinate to scientific research. And of course that finances were not originally mentioned by Kuhn in his work. If there was a fairly discreet mention, was the evolution of economic theory.

The evolution and dynamics of the concept of paradigm in Kuhn taught that we can tell with relative caution when theoretical functions are extended within a particular field of scientific knowledge. The set *Io* may be ineffective by the precariousness of their paradigmatic examples. The settings within a paradigm may not be forever, there are conditions that must fundamental changes. Classical mechanics Newton's Particles (MCP) was being displaced in some areas of theoretical physics when their explanations were limited and disadvantages [Moul02]

Key components of the concept of paradigm in Kuhn are discussed in greater scope in the reconstruction by Stegmüller [Steg83]. Structuralist version broadens the scope of the paradigm in several aspects: the role of theoretical concepts, copies paradigmatic methodological values and rules within a scientific community. The operating hypothesis with Stegmüller reprocessing can be linked to the need to explore the paradigm proposed by Mandelbrot unpublished aspects: what is at the core of finance theory *K*? What paradigmatic examples offer extensive feature description in terms of Stegmüller?

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