Truth and Historicism in Kuhn's Thesis of Methodological Incommensurability

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Methodological incommensurability and incomparability

The thesis of incommensurability is a much discussed subject in Kuhn's philosophy of science, which, since it has been proposed by Thomas Kuhn and Paul Feyerabend in 1962, has given rise to very different interpretations. This is partially due to the multidimensional nature of the concept of "incommensurability" and sometimes to the lack of clarity of Kuhn himself. In *The Structure of Scientific Revolutions* he distinguishes three aspects of incommensurability, each of which could easily appear independent from the others.

To sum up, Kuhn says that the main features of incommensurability are as follows: a) first, the proponents of paradigms do not agree about methods, standards and aims of science[1]; b) second, and accordingly to the holistic nature of theory change, although the new paradigms holds many concepts of the old theory "within the new paradigm, old terms, concepts and experiments fall into new relationship one with the other"[2]; c) finally, the third aspect of incommensurability is that "the proponents of competing paradigms practice their trades in different worlds"[3]. We can call these aspects of incommensurability a) methodological, b) semantic, c) ontological[4]. In this

[1] Kuhn, 1970a, 148.
[2] Ibid., 149.
[3] Ibid., 150.
[4] Buzzoni, 1986, 111, partially Hoyningen-Huene, Sankey 2001b, ix.

paper I will focus especially on methodological aspect and on his relationship with semantic incommensurability[5].

Methodological incommensurability is a specifically Kuhnian theme. Though also Feyerabend is an opponent of scientific method's monism, he never talks about incommensurability in this context: he has always restricted incommensurability to its semantic dimension. Instead, in *The Structure of Scientific Revolutions*, Kuhn affirms that "the proponents of competing paradigms will often disagree about the list of problems that any candidate for paradigm must resolve. Their standards or their definitions of science are not the same."[6] According to this thesis there are not shared, objective methodological rules or neutral scientific standards for theory comparison and choice; and that is because every paradigm determines its own standards of evaluation and scientific propriety[7]. Incommensurability is due to the lack of external standards which do not depend on the paradigms themselves and can reduce theory choice to a neutral mechanical algorithm. In sum, two paradigms are incommensurable from a methodological point of view because: a) they focus on different problematic fields; b) they disagree on the priority to be given to these problems in the context of their research program; c) they define in different ways the most basic problems, which reflect the pragmatic, the research strategies and the specific interests of the same paradigm[8].

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[5] Despite to Kuhn's exposition, Hoyningen-Huene and Sankey (2001b) distinguish only two aspects of incommensurability: methodological and semantic. And indeed it is probably right, since the third aspect, the "world changes" thesis or "ontological relativism" (Sankey, 1997) is a complex position which involves not only the thesis of incommensurability, but also the structure of paradigms and the refutation of the correspondence theory of truth (Bird, 2011).

[6] Kuhn, 1970a, 148.

[7] "To the extent, as significant as it is incomplete, that two scientific schools disagree about what is a problem and what a solution, they will inevitably talk trough each other when debating the relative merits of their respective paradigms. In the partially circular arguments that regularly result, each paradigm will be shown to satisfy more or less the criteria that it dictates for itself and to fall short of a few of those dictated by its opponent. There are other reasons, too, for the incompleteness of logical contact that consistently characterizes paradigm debates. For example, since no paradigm ever solves all the problems it defines and since no two paradigms leave all the same problems unsolved, paradigm debates only involve the question: Which problems is it more significant to have solved? Like the issue of competing standards, that question of values can be answered only in terms of criteria that lie outside normal science altogether, and it is that recourse to external criteria that most obviously makes paradigm debates revolutionary." (Kuhn, 1970a, 109-110)

[8] See Doppelt, 1978/1983, 121.

Many critics have interpreted this claim as something like radical incomparability between rival scientific theories[9]. Methodological incommensurability has been regarded as a source of epistemological relativism about theory comparison: if theories are incommensurable (or, according to this interpretation, incomparable), scientific changes are fundamentally irrational, since they cannot be explained by means of rational procedures. Scientific revolutions would merely be "conversions"[10]. But such an interpretation has been strongly refuted by Kuhn himself: he explicitly says that incommensurability does not imply incomparability[11].

> Remember briefly where the term 'incommensurability' came from. The hypotenuse of an isosceles right triangle is incommensurable with its side or the circumference of a circle with its radius in the sense that there is no unit of length contained without residue an integral number of times in each member of the pair. There is thus no common measure. But lack of a common measure does not make comparison impossible. On the contrary, incommensurable magnitudes can be compared to any required degree of approximation.[12]

In responding to his critics, Kuhn affirms that is aim was not to make theory choice an irrational process. He would only saying that, although theory choice is generally rational, it is not mechanical and regulated by only one scientific method; as he has written in *The Structure of Scientific Revolutions* "there is no neutral algorithm for theory choice, no systematic decision procedure which, properly applied, must lead each individual in the group to the same decision"[13]. The evaluation of scientific theories is necessary a practical process, which involves decisional, deliberative and subjective elements. Kuhn does not want to say that scientists do not use logic and experience[14]; but rather that logic and experience are not able to force theory choice; the evaluation of a scientific theory is very different than a mathematical proof:

> In a debate over choice of theory, neither party has access to an argument which resembles a proof in logic or formal mathematics. In the latter, both

[9] See among the others Lakatos, 1970, 179 n. 1; Newton-Smith, 1981, 9-10; Putnam, 1981, 118, Scheffler, 1967, 16-17; Shapere, 1966, 67-68.
[10] The term "conversion" is used by Kuhn sixteen times in Kuhn, 1970a, 144-159.
[11] Among the critics who have denied the identification between incommensurability and incomparability see Bernstein, 1983, 82, and Hoyningen-Huene, 1989/1993,. 218-221.
[12] Kuhn, 1983/2000, 35. See also Kuhn, 1970c/2000, 163; Kuhn, 1976b/2000, 189; Kuhn, 1979/2000, 204.
[13] Kuhn, 1970a, 200.
[14] Kuhn, 1970c/2000, 156.

> premises and rules of inference are stipulated in advance. If there is disagreement about conclusions, the parties to the debate can retrace their steps one by one, checking each against prior stipulation. At the end of that process, one or the other must concede that at an isolable point in the argument he has made a mistake, violated or misapplied a previously accepted rule. After that concession he has no recourse, and his opponent's proof is then compelling. Only if the two discover instead that they differ about the meaning or applicability of a stipulated rule, that their prior agreement does not provide a sufficient basis for proof, does the ensuing debate resemble what inevitably occurs in science.[15]

To replace the scientific standards based model for theory comparison, in the seventies Kuhn has provided a value based model[16]. He lists several values used by scientific communities[17]: a) accuracy (of the factual statements, both from a quantitative and qualitative point of view); b) consistency (absence of internal contradictions); c) scope (the domain of possible application); d) simplicity (the ability to unify apparently different group of phenomena); e) fruitfulness (the ability to predict and to apply to new phenomena). Scientists do not considered these values rules which determine choice, but rather "values, which influence it"[18]; moreover they can be interpreted in different ways and, in some situation, they can conflict with one other.

Without going further into the problem of Kuhn's theory of scientific method and his adequacy[19], we are probably faced with a reason which forced Kuhn, in his latest work, to break down the problem of incommensurability and the problem of scientific method in theory comparison. Indeed, defending his philosophy from the accusation of relativism, he said that

> Nothing […] implies either that there are no good reasons for being persuaded or that those reasons are not ultimately decisive for the group. Nor does it even imply that the reasons for choice are different from those usually listed by philosophers of science: accuracy simplicity, fruitfulness, and the like. What it should suggest, however, is that such reasons function as values and that they can thus be differently applied, individually and collectively, by men who concur in honoring them.[20]

[15] Ibid.
[16] Kuhn, 1977b/1977a.
[17] Ibid., 321-322.
[18] Ibid., 331.
[19] See Nola, Sankey, 2000b, 26-30.
[20] Kuhn, 1970b/1970a, 199.

As it has been remarked by Siegel[21], this argumentation for incommensurability already does not involve incommensurability, but only a theory of value based theory choice in scientific practice. Also Bird says that, in the kind of semantic incommensurability developed in his works of the eighteens, the question of relativism or absolutism about theory comparison criteria is simply not being asked[22]. It appears, at first sight, that Kuhn, by means of his discussion on scientific values, merely drops out of the problem of methodological incommensurability and relegates incommensurability to his semantic aspect. Kuhn himself seems to confirm this interpretation where he says that

> Both Feyerabend and I wrote of the impossibility of defining the terms of one theory on the basis of the terms of the other. But he restricted incommensurability to language; I spoke also of differences in "methods, problem-field, and standards of solution", something I would no longer do except to the considerable extent that the latter differences are necessary consequences of the language-learning process.[23]

Kuhn makes methodological incommensurability dependent from semantic incommensurability. But this assertion does not imply that methodological incommensurability is dissolved; rather, we have to look for the foundation of this kind of incommensurability in the semantic dimension of incommensurability itself. For this I will divide Kuhn's thesis of methodological incommensurability in two sub-theses:

1) *There is not a scientific method which constraints theory choice and assures his correctness: theory choice is a deliberative process*. We have just discussed this thesis; it does not necessary imply neither relativistic consequences nor incommensurability. Moreover it is not a particularly original or revolutionary thesis. Also Karl Popper and many others philosophers of science have said that scientific method cannot force scientist's choices and that theory choice entails practical decisions[24].

2) *Incommensurability does not mean incomparability*: *we can compare scientific theories' accuracy, fruitfulness, scope, consistency, simplicity. But we cannot compare them to discover which theory is closer to truth.* While the first sub-thesis has been shelved in the development of Kuhn's work, this second thesis constitutes the linkage between methodological and semantic

[21] Siegel, 1987, 57.
[22] Bird, 2000, 240-241.
[23] Kuhn, 1983/2000, 34 fn. 2.
[24] Popper, 1959, 61.

incommensurability and it has been supported by Kuhn in his whole scientific life. I will explain the reasons of this linkage in the next section.

Methodological incommensurability, truth, historicism

Discussing the critics on epistemological relativism, Kuhn himself relates methodological incommensurability with his critique of truth as the aim of science[25]. Referring to the above analysis of the role of proof in theory choice, he compares mathematical proof and truth, since they both suppose inter-theoretical applications, i.e. the applications in which incommensurability plays a role[26]. Proof and truth are meaningful concepts only in a shared practical context, which constitutes the basis of the agreement between scientists about the empirical assertions of a theory confirmed by experiments and then regarded as true (or false, or not tested). But, when we try to extend the use of terms like 'proof' and 'truth' above the intra-theoretical context, Kuhn affirms that "dealing with the comparison of theories designed to cover the same range of natural phenomena, I am more cautious"[27].

Incommensurability blocks the possibility of a neutral comparison between scientific theories. This statement does not mean that paradigms are incomparable, because we can always compare their accuracy, consistency and so on; instead, paradigms are incomparable referring to the evaluation of their respective likeness to truth. In his evolutionary account of the development of science, truth has no place[28]. At least, incommensurability, also in his methodological feature, does not involve relativism about the rationality of theory choice, but rather it is a form of relativism about truth. Kuhn has always refuted the accusations of irrationalism, but, about truth, he says that he can rightly be called a relativist: "one scientific theory is not as

[25] For Kuhn's critique of the idea of truth and especially of the theory of truth as correspondence, see Bird, 2000, 209-266; and Kuakkunen, 2007.
[26] Kuhn, 1970c/2000, 162.
[27] Ibid., 160.
[28] "It is now time to notice that until the last very few pages the term 'truth' had entered this essay only in a quotation from Francis Bacon. And even in those pages it entered only as a source for the scientist's conviction that incompatible rules for doing science cannot coexist except during revolutions when the profession's main task is to eliminate all sets but one. The developmental process described in this essay has been a process of evolution form primitive beginnings – a process whose successive stages are characterized by an increasingly detailed and refined understanding of nature. But nothing that has been or will be said makes it a process of evolution toward anything." (Kuhn, 1970a, 170-171).

good as another for doing what scientists normally do. In that sense I am not a relativist. But there are reasons why I get called one, and they relate to the contexts in which I am wary about applying the label 'truth'"[29]. Then methodological incommensurability does not imply that all the theories are equally good, but that all the theories are equally close (or far) to the truth.

Kuhn returns more explicitly and deeply on this argument in his latest works: the evaluation of change of belief is now embedded in the evolutionary dimension of scientific knowledge[30]. This evolutionary account does not try to explain the rationality and the correctness of our convictions, but rather the change of convictions itself. The non evolutionary point of view's aim is to evaluate scientific theories isolated, in order to calculate their truth or probability, where truth means "something like corresponding to the real, the mind-independent external world"[31]. But, Kuhn adds that

> Sticking therefore with the formulation that assumes truth to be the goal of evaluations, notice that it requires evaluation to be indirect. Seldom or never can one compare a newly proposed law or theory directly with reality. rather, for purposes of evaluation, one must embed it in a relevant body of currently accepted beliefs-for example, those governing the instruments with which the relevant observations have been made-and then apply to the whole a set of secondary criteria. Accuracy is one of these, consistency with other accepted beliefs is another, breadth of applicability a third, simplicity a fourth, and there are others besides. All these criteria are equivocal, and they are rarely all satisfied at once.[32]

Kuhn reiterates that the verification of truth and the validity of proof is not an inter-theoretical function; a theory cannot be tested by means of a direct clash with reality. Moreover scientific values are meaningless if they are not placed in the context of scientific community's shared practice. In such a context the application of scientific values is more fruitful, although it cannot serve to eliminate disagreement at all. The evaluation of the change of convictions is more ductile "especially since what must be compared are only sets of beliefs actually in place in the historical situation"[33]. As we have

[29] Kuhn, 1970c/2000, 160.
[30] "For the philosopher who adopts the historical perspective, the problem is the same: understanding small incremental changes of belief. When questions about rationality, objectivity, or evidence arise in that context, they are addressed not to the beliefs that were current either before or after the change, but simply to the change itself." (Kuhn, 1992/2000, 112)
[31] Ibid., 114.
[32] Ibid.
[33] Ibid., 115.

previously said, Kuhn admits the possibility of the evaluation of theory referring to scientific values: a paradigm can be more accurate, more consistent, can have a broader field of application and can be simpler than his rivals "without for those reasons being any truer"[34]. A clash between two rival theories is conceivable and it could be productive in an evolutionary perspective; but a direct clash between theory and reality, in a classical perspective, is just not an option. Theory evaluation is an historical process which can only be realized by a comparative point of view. And, as Kuhn himself says, incommensurability is "an essential component of any historical, developmental, or evolutionary view of scientific knowledge"[35].

According to our interpretation, a connection between methodological incommensurability, truth and history of science is emerging. This connection will become clear returning to Kuhn's early works. In *The Structure of Scientific Revolutions*, Kuhn introduces his first extended description of methodological incommensurability by means of a statement about the historical and evolutionary conception of science.

> *Paradigms differ in more than substance, for they are directed not only to nature but also back upon the science that produced them*. They are the source of the methods, problem-field, and standards of solution accepted by any mature scientific community at any given time. As a result, the reception of a new paradigm often necessitates a redefinition of the corresponding science. Some old problems may be relegated to another science or declared entirely "unscientific". Others that were previously non-existent or trivial may, with a new paradigm, become the very archetypes of significant scientific achievement. And as the problems change, so, often, does the standard that distinguishes a real scientific solution from a mere metaphysical speculation, word game, or mathematical play. The normal-scientific tradition that emerges from a scientific revolution is not only incompatible but often actually incommensurable with that which has gone before. (Italics mine)[36]

In this passage Kuhn describes the alteration of scientific standards, problem fields, and scientific aims after scientific revolutions. Merely, he resumes the features of methodological incommensurability that we have presented in the first section. But, in addiction to that, he relates methodological incommensurability to a consideration about the historical structure of paradigms: "they are directed not only to nature but also back upon the science that produced them". According to Kuhn, paradigms have a double directionality. From one hand they are connected to nature and, from

[34] Ibid.
[35] Kuhn, 1991/2000, 91.
[36] Kuhn, 1970a, 103.

the other hand, to their historical tradition and past science. This assertion summarizes Kuhn's historicism. He does not want to say only that every scientific paradigm is relative to the historical and social context in which it develops; rather the historical structure of paradigms is inextricably linked to the knowledge of nature embodied in the paradigms themselves.

In fact, as we have just seen, the confrontation between paradigm and nature is not immediate: a direct contact between theories and reality cannot exist. However Kuhn does not affirm simply that the contact between paradigm and nature is mediated by the paradigm itself. If this were the case, Kuhn would only say that observation is theory laden, which is an achievement accepted by nearly all of the philosophers of science. Instead Kuhn's claim is more radical. He states not only that the relationship between paradigm and nature is mediated by the paradigm itself, but that it is mediated also by the relationship between the current and the past paradigm. Anyway the relation between historically successive paradigm is incommensurability, and exactly semantic incommensurability, since every paradigm inherits his lexicon by the science which come first it. Roughly, incommensurability influences the connection between paradigms and nature. In fact, as we have seen, if two theories are incommensurable, we cannot determine which one is closer to truth. Summarizing, the historical nature of paradigms (their constitutive relation with paradigms which produce them) plays a fundamental role in the determination of the relationship between paradigm and world, which consequently cannot be a direct clash, but always a comparative evaluation between two theories. That is because the historical relation between current and past paradigm is expressed by incommensurability, which denies the possibility of an evaluation of the likeness to truth of a single theory. Incommensurability, truth and historicism (i.e. the evolutionary model of scientific progress) create a circle in which every element implies the others.

In Kuhn's philosophy of science, both incommensurability and truth are historical concepts. To be more exact, the fact that incommensurability is an historical concept does not mean that it is a concept gathered from the analysis of the history of science[37]. Kuhn tells us that it was not by reflecting on the history of science that he first thought about incommensurability, but on his very activity as an historian of science[38]. The historian experiences

[37] For Kuhn's conception of history of science see Hoyningen-Huene, 1989/1993, 3-27.
[38] "Feeling that way, I continued to puzzle over the text, and my suspicions ultimately proved well-founded. I was sitting at my desk with the text of Aristotle's Physics open

incommensurability when he is studying an ancient scientific text and he notices apparently nonsensical passages. While many researchers have considered these passages as signs of antique mistakes, Kuhn believes that they are the results of the incommensurability between successive paradigms. Kuhn denounces the impossibility of an Archimedean, external point of view from which we understand history of science as a cumulative development: "for the historian, in short, no Archimedean platform is available for the pursuit of science other than the historically situated one already in place"[39].

The connection between this kind of historiography in which incommensurability plays a constitutive role and the truth relativistic conception of methodological incommensurability is immediately observed by Kuhn: "though both rationality and relativism are somehow implicated, what is fundamentally at stake is rather the correspondence theory of truth"[40]. As we have seen regards to truth and proof, also the concept of an external Archimedean point of view on history of science presupposes inter-theoretical applications. But, again, knowledge cannot be evaluated in isolation, but only in a shared practical context: another time, only the change of belief can be justified, while all single theories are equally distant to truth:

> On the developmental view, scientific knowledge claims are necessarily evaluated from a moving, historically situated, Archimedean platform. What requires evaluation cannot be an individual proposition embodying a knowledge claim in isolation: embracing a new knowledge claim typically requires adjustment of other beliefs as well. Nor is it the entire body of knowledge claims

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in front of me and with a four-colored pencil in my hand. Looking up, I gazed abstractedly out the window of my room-the visual image is one I still retain. Suddenly the fragments in my head sorted themselves out in a new way, and fell into place together. My jaw dropped, for all at once Aristotle seemed a very good physicist indeed, but of a sort I'd never dreamed possible. Now I could understand why he had said what he'd said, and what his authority had been. Statements that had previously seemed egregious mistakes now seemed at worst near misses within a powerful and generally successful tradition. That sort of experience – the pieces suddenly sorting themselves out and coming together in a new way-is the first general characteristic of revolutionary change that I shall be singling out after further consideration of examples. Though scientific revolutions leave much piecemeal mopping up to do, the central change cannot be experienced piecemeal, one step at a time. Instead, it involves some relatively sudden and unstructured transformation in which some part of the flux of experience sorts itself out differently and displays patterns that were not visible before." (Kuhn 1981/2000, pp. 16-17). See also Kuhn, 1989/2000, 59 fn. 1.

[39] Kuhn, 1991/2000, 95.

[40] Ibid.

> that would result if that proposition were accepted. Rather, what's to be evaluated is the desirability of a particular change-of-belief, a change which would alter the existing body of knowledge claims so as to incorporate, with minimum disruption, the new claim as well. Judgments of this sort are necessarily comparative: which of two bodies of knowledge-the original or the proposed alternative-is better for doing whatever it is that scientists do.[41]

Better, in the process of evaluation an external point of view seems to exist. But it is only a temporally, historical situated pseudo-Archimedean point of view: it is constituted by the same agreement of scientific community on the paradigm itself[42] (i.e. also on the scientific values previously presented): "the historical perspective, thus, also invokes an Archimedean platform, but it is not fixed. Rather, it moves with time and changes with community and sub-community, with culture and subculture"[43]. The conditions of theory comparison are paradigm-dependent. The traditional non evolutionary philosophy of science fails because it designates neutral language and observation as judge of scientific theories' likeness to truth[44]; or equally, as the Archimedean platform for theory choice. Instead Kuhn's opinion is that every evaluation is relative to a scientific community and his shared lexicon:

> From the historical perspective, however, where change of belief is what's at issue, the *rationality* of the conclusions requires only that the observations invoked be neutral for, or shared by, the members of the group making the decision, and for them only at the time the decision is being made. By the same token, the observations involved need no longer be independent of all prior beliefs, but only of those that would be modified as a result of the change. The

[41] Ibid., 95–96.
[42] Ibid., 96.
[43] Kuhn,1992/2000, 113.
[44] "The semantic conception of truth is regularly epitomized in the example: 'Snow is white' is true if and only if snow is white. To apply that conception in the comparison of two theories, one must therefore suppose that their proponents agree about technical equivalents of such matters of fact as whether snow is white. If that supposition were exclusively about objective observation of nature, it would present no insuperable problems, but it involves as well the assumption that the objective observers in question understand 'snow is white' in the same way, a matter which may not be obvious if the sentence reads 'elements combine in constant proportion by weight'. Sir Karl takes it for granted that the proponents of competing theories do share a neutral language adequate to the comparison of such observation reports. I am about to argue that they do not. If I am right, then 'truth' may, like 'proof', be a term with only intra-theoretical applications. Until this problem of a neutral observation language is resolved, confusion will only be perpetuated by those who point out (as Watkins does when responding to my closely parallel remarks about 'mistakes') that the term is regularly used as though the transfer from intra- to inter-theoretical contexts made no difference." (Kuhn, 1970c/2000, 161-162)

> very large body of beliefs unaffected by the change provides a basis on which discussion of the desirability of change can rest. It is simply irrelevant that some or all of those beliefs may be set aside at some future time. To provide a basis for rational discussion they, like the observations the discussion invokes, need only be shared by the discussants. There is no higher criterion of the rationality of discussion than that.[45]

Then, like proof, truth can be only an intra-theoretical concept and consequently an historical concept: truth is not correspondence with a mind-independent reality, but only the result of a rational evaluative process. The product of a successful theory comparison is internal to the historical situation which enables the evaluation itself: the problem of the truth or falsity (intended as a relation between a language and something external to it) simply is not the question being asked: "justification does not aim at a goal external to the historical situation but simply, in that situation, at improving the tools available for the job at hand"[46]. Or, referring to the lack of an Archimedean point of view: "Only a fixed, rigid Archimedean platform could supply a base from which to *measure* the distance between current belief and true belief. In the absence of that platform, it's hard to imagine what such a *measurement* would be, what the phrase 'closer to the truth' can mean" (italics mine)[47].

In this last passage I have stressed the words "measure" and "measurement" because they are strictly related to incommensurability. As Kuhn has repeated several times, incommensurability is a mathematical term which means "no common measure". But outside of its original context, its function is metaphorical: "the phrase 'no common measure' becomes 'no common language'. The claim that two theories are incommensurable is then the claim that there is no language, neutral or otherwise, into which both theories, conceived as sets of sentences, can be translated without residue or loss"[48]; obviously we must specify that the lack of common measure does not imply incomparability. But the measure metaphor does not stop there. As well as denouncing the absence of a common measure to explain inter-theoretical relations, Kuhn compares paradigms just to units of measurements or, better, to metric or coordinate systems[49].

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[45] Kuhn, 1992/2000, 113.
[46] Kuhn, 1991/2000, 96.
[47] Kuhn, 1992/2000, 115.
[48] Kuhn, 1983/2000, 36.
[49] "Two people may use a set of interrelated terms in the same way but employ different sets (in principle, totally disjunct sets) of field coordinates in doing so. Examples will be found in the next section of this paper; meanwhile the following metaphor may prove suggestive. The United States can be mapped in many different

A metric system is a condition for the possibility, or a formal matrix, of justification and truth-value attribution and discussion in the domain of the system itself. Probably, in this conception Kuhn is debtor of Wittgenstein's discussion about the standard meter[50]. Wittgenstein says that if we want to know if is it true or false that something is a meter long, we can (ideally) compare this object with the standard meter in Paris. "The table is one meter long" is an empirical proposition verifiable or falsifiable relatively to the metric system of measurement. But a question such as "Is the standard meter in Paris a meter long?" is meaningless referring to the same system; the proposition "the standard meter in Paris is a meter long" is not an empirical proposition, but a grammatical proposition and consequently it is neither true nor false[51].

Kuhn's description of paradigms is very similar to this: truth, proof and justification are meaningful only in an intra-theoretical context, while it is impossible to evaluate the likeness to truth of a paradigm[52]. Every shared paradigm is a system of measurement which enables theory evaluation and justification by means of common scientific values such as accuracy,

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coordinate systems. Individuals with different maps will specify the location of, say, Chicago by means of a different pair of coordinates. But all will nevertheless locate the same city provided that the maps are scaled to preserve the relative distances between the items mapped. The metric that accompanies each of the various sets of coordinates must, that is, be chosen to preserve the structural geometrical relations within the mapped area." (Kuhn, 1989/2000, 63).

[50] Kuhn's paradigm are just been compared with Wittgenstein's standard meter and color samples (Baltas, 2004, Malone, 1993, but also Glock, 1996). For a discussion of the relevance of standard meter in Wittgenstein's philosophy see Baker and Hacker, 2005, 189-199).

[51] "There is one thing of which one can say neither that it is one meter long, nor that it is not one meter long, and that is the standard meter in Paris.–But this is, of course, not to ascribe any extraordinary property to it, but only to mark its peculiar role in the language-game of measuring with a meter-rule.–Let us imagine samples of color being preserved in Paris like the standard meter. We define: "sepia" means the color of the standard sepia which is there kept hermetically sealed. Then it will make no sense to say of this sample either that it is of this color or that it is not." (Wittgenstein, 1958, § 50, 25).

[52] "A lexicon or lexical structure is the long – term product of tribal experience in the natural and social world, but its logical status, like that of world meaning in general, is that of convention. Each lexicon makes possible a corresponding form of life within which the truth or falsity of propositions may be both claimed and rationally justified, but the justification of lexicon or of lexical change can only be pragmatic. With the Aristotelian lexicon in place it does make sense to speak of the truth or falsity of the Aristotelian assertion in which terms like 'force' or 'void' play an essential role, but the truth values arrived at need have no bearing on the truth or falsity of apparently similar assertions made with the Newtonian lexicon." (Kuhn, 1993/2000, 244)

consistency and so on. Thanks to these values we can compare the respective merits of two rival theories in relation to their respective methods, standards, aims: the meter of comparison is not an absolute Archimedean platform, but the same scientific practice and the concrete historical situation. But, according to Kuhn, traditional epistemology just looks for an objective meter to evaluate isolated scientific theories' truth or probability. Kuhn denounces the impossibility of such an inter-theoretical meter: since every theory is a metric system which enables truth-value attributions, in order to attribute a truth-value to the metric system itself, we need for a meta-metric system (i.e. an Archimedean platform) able to map the different paradigms more or less close to truth. Kuhn refers to this meta-metric system by different expressions: an Archimedean platform, a common measure, a neutral observational language, truth, the world-in-itself. Every one of these concepts, attributed by Kuhn to the traditional non evolutionary epistemology, supposes the possibility of a non historical evaluation of theories: a direct clash between theories and reality which Kuhn considers absolutely impossible.

It remains that Kuhn, in his works of the eighties and nineties, puts the methodological thesis of incommensurability aside to examine in depth its semantic implications. The reason can now become clearer. We have seen that the discussion about the justification of conviction change can be meaningful only in an evolutionary perspective which does not aim to overstep the historical situation. The discussion about theory choice comes true in the light of a horizon of agreement within the scientific community; in other words a provisional Archimedean platform, i.e. a shared paradigm, or lexicon or language: "'no common measure' becomes 'no common language'"[53]. Only a neutral lexicon in which the statements of every theory are translatable could constitute a direct access to reality and a source of inter-theoretical truth evaluation. The transition from methodological to semantic incommensurability is due to Kuhn's analysis of the origin of the agreement within scientific communities about paradigm. Shortly, Kuhn discovers the roots of such an agreement in the constitutive role played by paradigm learning in scientific practice[54].

The applicability of scientific values in theory choice, although in a non inter-theoretical sense, presupposes a shared perspective enabled by scientific training: "I spoke also of differences in "methods, problem-field, and

[53] Kuhn, 1983/2000, 36.
[54] Kuhn, 1974/1977a.

standards of solution", something I would no longer do except to the considerable extent that the latter differences are necessary consequences of the language-learning process"[55]. Though I cannot analyze here the constitutive nature of learning process in science, I want only to remark that this is also a Wittgensteinian theme. Kuhn says that, like Wittgenstein's standard meter, a paradigm cannot be justified recurring to reality. The foundation of paradigms (or grammar) lies in scientific (or linguistic) practice itself, institutionalized by scientific (or simply linguistic) training: "How do I know that this color is red? – It would be answer to say: 'I have learnt English'"[56]. The priority of scientific learning process finds the foundation of incommensurability of standards, methods and problem-fields in the semantic question of the dependence of meaning (and then of meaning change) from scientific practice and uses[57]: "kind terms [the constituents of the structure of a lexicon] are learned in use: someone already adept in their use provides the learner with examples of their proper application"[58].

Anyway, the pragmatic (un)foundation of paradigms repurposes the main consequence of methodological incommensurability thesis: since a direct clash between a theory and reality is impossible, all the theories are equally close to truth.

Conclusions: two problems on falsification

We have seen that methodological incommensurability concerns with the impossibility of a direct access to reality (a meta metric system or Archimedean platform) which enables us to map theories in a range of increasing likeness to truth. Truth is a meta-meter which plays no role in

[55] Kuhn, 1983/2000, 34 fn. 2. Or equally, "my original discussion described nonlinguistic as well as linguistic forms of incommensurability. That I now take to have been an overextension resulting from my failure to recognize how large a part of the apparently non linguistic component was acquired with language during the learning process" (Kuhn, 1989/2000, 60 fn. 4).
[56] Wittgenstein, 1958, § 381, 176.
[57] With regards to Wittgenstein, about the constitutive nature of learning process in relation with the structure of grammar see Williams, 1999, in particular 58-59 and 206 and ff. This is a good exposition also referring to Kuhn's conception of scientific training and, again in accordance with Kuhn's philosophy of science, stresses the social nature of learning.
[58] Kuhn, 1993/2000, 230.

Kuhn's philosophy of science[59]. This observation about the always indirect relationship between theories and reality can help us to solve two problems regarding Kuhn's interpretation of falsificationism. Confirming the connection between these problems and incommensurability, Kuhn exposes them just before introducing the three aspects of incommensurability (methodological, semantic, and ontological) quoted at the beginning.

In *The Structure of Scientific Revolutions*, Kuhn says that verification and falsification are after all equivalent. Falsification cannot be identified with anomalous experience, but rather it is "a subsequent and separate process that might be equally called verification since it consists in the triumph of a new paradigm over the old one"[60]. Especially because this criticism is referred explicitly to Popper, it could sound bad because Popper has always stressed the asymmetry between verification and falsification. This apparent misunderstood is due to the fact that this criticism to the falsificationist method has been interpreted simply as a refutation of the concept of neutral observation: since observation cannot be the final and irrevocable judge of theories, scientists are not forced to abandon a theory after a falsification. This is true and supported by Kuhn, but also by Popper who have often reaffirmed the inexistence of neutral observations and ultimate falsifications. Then the source of the disagreement between Kuhn and Popper must be another. This source is the idea expressed by Popper that we can test theories by a match with reality. Kuhn criticizes Popper not only by a technical insight about the difficulties of falsificationism, but also from a more general epistemological point of view. For Kuhn verification and falsification are equivalent because they both presuppose the possibility of a direct clash between scientific language and reality.

[59] Hoyningen-Huene remarks the connection between the refutation of the theory of truth as correspondence and the impracticality of a direct access to reality. He demonstrates that the main argument presented by Kuhn against the correspondence theory (Kuhn, 1970b, 206) is rather an epistemological argument which "proceeds from the assumption that it's essentially meaningless to talk of what there really is, beyond (or outside) of all theories. If this insight is correct, it's impossible to see how talk of a 'match' between theories and absolute, or theory – free, purely object – sided reality could have any discernible meaning. How could the (qualitative) assertion of a match, or the (comparative) assertion of a better match, be assessed? The two pieces asserted to match each other more or less would have to be accessible independently of one another, when one of the pieces is absolute reality. But if we had access to absolute reality – and here we can only return to our initial premise – what interest would we have in theories about it?" (Hoyningen-Huene, 1989/1993, 263-264).

[60] Kuhn, 1970b, 147.

Again in *The Structure of Scientific Revolutions*, Kuhn affirms that the question of the agreement between theory and reality becomes meaningful only in a comparative perspective. While Kuhn has rejected the problem of theories' verisimilitude, "questions much like that can be asked when theories are taken collectively or even in pairs"[61]. This assertion has often been interpreted in connection with another previous thesis: since no theories is completely successful in his problem- field, if anomalies were falsifications, we would reject all theories at all time[62]. This connection seems to mean that scientists' dogmatism up against falsification is reasonable because it will be damaging for science if we drop out of our best theory without a better alternative[63]. But, again, Kuhn's critique is also more general. Kuhn says that theory comparison can only be a theory-theory match and not a theory-reality match because the latter kind of comparison is, in principle, impossible. We have just seen the historical and evolutionary reasons which have led Kuhn to such an intra-theoretical conception of truth. Anyway, the affinity between the always indirect match between paradigm and reality and incommensurability is now reaffirmed: in fact, after these considerations about theory comparison, Kuhn introduced the most detailed analysis of incommensurability. Again, methodological incommensurability is not a relativistic and irrationalist danger for theory comparison: we can, more or less easily, establish which theory is more accurate, consistent, simply and so on; but, without a "common measure", we cannot decide which theory is closer to truth.

[61] Ibid.
[62] Ibid., 146.
[63] Also this traditional interpretation is surely right and Kuhn supports them explicitly: "once it has achieved the status of paradigm, a scientific theory is declared invalid only if an alternate candidate is available to take its place. No process yet disclosed by the historical study of scientific development at all resembles the methodological stereotype of falsification by direct comparison with nature. That remark does not mean that scientists do not reject scientific theories, or that experience and experiment are not essential to the process in which they do so. But it does mean –what will ultimately be a central point - that the act of judgment that leads scientists to reject a previously accepted theory is always based upon more than a comparison of that theory with the based upon more a comparison of that theory with the world. The decision to reject one paradigm is always simultaneously the decision to accept another, and the judgment leading to that decision involves the comparison of both paradigms with nature and with each other." (Ibid., 77).

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