

Characterizing Incommensurability on the basis of a contextual theory of language

Conditions of Application and Inferential Relations
in M. Carrier's Reconstruction of Incommensurability

Léna Soler

LPHS, Nancy, France

Résumé : l'article, tout d'abord critique certains aspects de la manière dont Martin Carrier caractérise l'incommensurabilité sémantique à partir d'une théorie contextuelle du langage, puis introduit des distinctions et fait des propositions en vue de poursuivre le même projet. On soutient que deux conceptions différentes de la notion de 'conditions d'application', et corrélativement deux acceptions distinctes de la clause 'préservation des relations inférentielles', sont à l'œuvre dans la caractérisation de Carrier, et que sa thèse centrale ne tient que grâce aux déplacements de sens correspondants. On suggère de remplacer cette thèse — selon laquelle les concepts incommensurables sont ceux qui sont intraduisibles au sens spécifique où ils ont soit mêmes conditions d'application soit mêmes relations inférentielles mais jamais les deux à la fois —, par une caractérisation qui, d'un point de vue méthodologique, accorde une primauté aux relations inférentielles. Cette caractérisation est pour l'essentiel constituée : d'une part de la thèse (kuhnienne) selon laquelle les concepts incommensurables sont avant tout ceux qui présentent des relations inférentielles largement non superposables ; d'autre part d'une analyse des liens existant entre relations inférentielles et conditions d'application, en particulier d'une réflexion sur les conditions auxquelles certaines relations inférentielles peuvent et doivent être identifiées à des conditions d'application.

Abstract: In this article I present, first, a criticism of certain aspects of the way Martin Carrier characterizes semantic incommensurability on the basis of

a contextual theory of language. Subsequently I introduce some distinctions and put forward some proposals in order to pursue the same project. It will be argued that two different conceptions of the notion “conditions of applications” and, correlatively, two different meanings of the clause “preservations of the inferential relations”, are involved in Carrier’s characterisation, and that his central tenet holds only thanks to the corresponding meaning-shifts. According to Carrier’s thesis, the incommensurable concepts are those that are untranslatable in the following specific sense: they have either the same conditions of application or the same inferential relations, but they never satisfy both determinants at the same time. I suggest to replace this thesis by a characterisation that, from a methodological point of view, grants logical priority to the inferential relations. This characterisation is mainly based: on one side on the Kuhnian claim that the incommensurable concepts are those who have largely non superimposable inferential relations; on the other side on an analysis of the links between inferential relations and conditions of application, particularly on a reflection concerning the conditions under which some inferential relations can and should be equated with conditions of application.

Incommensurability is one of the most controversial issues of 20th century philosophy of science¹. It has to be said that lack of clarity affecting so many discussions about the incommensurability problem tends to hide the real difficulties that we encounter when we try to characterize precisely what is at stake. In this landscape, the work of Martin Carrier (MC) provides a welcomed, painstaking and stimulating attempt to characterize semantic incommensurability and its epistemological consequences².

MC gave two talks on the topic in France in March 2003, first in Nancy, at the Poincaré Archives, and then in Paris, in the seminar on incommensurability that I direct at the International College of Philosophy. I learned a lot from these talks and from the live discussions surrounding them. The present paper is a very extended version of the short commentary of MC’s talk that I presented in Nancy. As every philosophical work, it includes also critical remarks: without any doubt, this seems to me the best way to pay homage to MC’s work.

In this paper I will, to start with, bring to the foreground a few points: I will state (here without further justification) a few fundamen-

¹See [Hoyningen 1989]; [Sankey 1994]; [Hoyningen & Sankey 2001].

²Cf. [Carrier 2000], [Carrier 2001] and [Carrier 2002], in addition to the paper contained in the present book. The critical analysis I will propose here is not just about the later paper: it aims to cover MC’s different contributions to the incommensurability problem.

tal assumptions, that seem to me, after many years of research on the topic, to be required in order to achieve a deep and articulated characterization of semantic incommensurability. This will make possible to emphasize some fundamental points of agreement between MC and me, since we converge about the very essentials, and will at the same time provide the framework for further discussion. In a second moment, I will discuss some aspects of MC's work with which I feel uncomfortable. And in a third moment, I will suggest some ways in order to refine the characterization of incommensurability according to the same project. The reader will find a list of notations at the end of the paper.

1. Some fundamental assumptions in order to understand the incommensurability/commensurability problem

First, I of course assume, in agreement with MC's work (and in opposition to the thesis that incommensurability is an invention of philosophers of science), that semantic incommensurability is a real and historically instantiated phenomenon.

Second I think, as MC does, that we must rely on actual historical cases to elaborate and test our characterization of incommensurability (even if disagreements can of course arise about what 'actual historical cases' are and tell us).

Third I think, with MC, that semantic incommensurability names a deep conceptual restructuring. That is, we admit that there are indeed scientific revolutions, that revolutions are deep conceptual reorganisations, and that incommensurability labels the relations, to be characterized, between the initial and the final conceptual frameworks.

Forth, we agree that to admit revolutions and incommensurability is not to say that there is nothing in common between the two theories considered. Indeed, *there are* significant common points. More: there *must be* significant common points; otherwise, we would not consider the two theories as *rival* incommensurable theories, but as theories pertaining to two different disciplines, coping with different realms of objects, and in that case, incommensurability would not raise any epistemological problems (in particular, it would not have appeared to threaten theory comparison and realism). I think that this is a very important point, emphasized by MC in his papers, and also developed in some of my works³. In brief incommensurability, if it is to be of epistemological interest, has

³Cf. MC's paper, section 6; cf. also the analyses of MC, and the references he gave

to label very deep differences arising in the context of subsisting common points between successive theories. To characterize the very nature of these common points is an important aspect of the incommensurability problem.

Fifth I assume, again in full agreement with MC, that in order to be able to characterize incommensurability, we need to rely on a theory of language. Of course, this does not imply that science can be reduced to language and that incommensurability can be seen as a purely linguistic phenomenon. Rather, what is stressed is that that human science always involves language (ordinary, specialized, or mathematical) and that scientific revolutions indeed involve linguistic changes. Therefore, we must examine closely these linguistic changes and, for this purpose, we need a theory of language.

Sixth, I am convinced, as is MC, that the required linguistic theory has to be a contextual, holistic one. In other words, we acknowledge that science works as a system and that there are structural aspects of scientific practices, and we focus on the linguistic dimension of this assumption. Few years ago, I tried to understand incommensurability with the aid of a theory inspired by Ferdinand de Saussure's structural linguistic⁴. Now I think that MC's attempt to rely on a contextual theory inspired by Wittgenstein, Hanson and W. Sellars is more promising⁵. Indeed, MC's contextual theory seems to be more suitable to take into account the relations between the linguistic structures and the empirical world. This is precisely the role played by what MC calls "conditions of application".

Seventh, and last, I agree with MC that — as Kuhn himself repeatedly pointed out — incommensurable theories are not empirically incomparable⁶.

2. Two different notions of "CA" in MC's analysis: CA_1 and CA_2

The distinction between conditions of application (CA) and inferential relations (IR), and the idea that a good translation must satisfy both

of Feyerabend, Laudan and Papineau in [Carrier 2001, 83-84]. Cf. also [Soler 2003] and [Barker 2001, 250]. I already stated the problem and stressed its importance in the introduction.

⁴[Soler 2000b]. See also [Soler 2004b].

⁵For a general presentation of the context theory of meaning drawing on such references, see [Carrier 2001, 66-67].

⁶Although incommensurable theories generate special difficulties, that have to be taken into account, concerning the task of empirical comparison.

criteria, are at the heart of MC's characterization of incommensurability. Indeed, according to MC's central tenet, incommensurable concepts are untranslatable concepts, in the sense that they fail to satisfy at the same time the two conditions imposed on translation, namely, 'sameness of *CA*' and 'sameness of *IR*'.

The translation failure of incommensurable concepts arises from the impossibility to jointly fulfil the two conditions of adequacy that the context theory places on translation. Would be conceptual analogues either fail to maintain the conditions of application or to reproduce the concomitant inferential relations. [Carrier 2001, 77].

The exam of typical examples⁷

suggest that the type of conflict emerging here is a general feature of incommensurability [Carrier 2001, 77].

In brief, MC's definition of incommensurability can be schematically captured by the formula:

**Either [(same *CA*) and non(same *IR*)],
or [(same *IR*) and non(same *CA*)].**

By analysing the problem of incommensurability with the aid of these distinctions, MC helps us to take a great step forward. However, there is still some work to be done about these distinctions.

The first aspect concerns the notion of '*CA*'. This notion is important, because it has the function to help us to understand how a theory is connected to the world. Thus we absolutely need a notion of this kind. However, it seems to me that different senses of the notion of '*CA*' are involved in MC's developments, both at the level of general definitions and at the level of the application to particular historical cases. Although it is true that these senses are related, I believe that it is important to explore their differences and to render explicit their mutual relations.

First of all, I want to focus on what seems to me the major shift in the meaning of '*CA*', a shift that, I think, has important consequences for MC's central conclusion. I will argue that, in what MC names his "first try" and his "second try", two different (although related) concepts are referred to with the same label '*CA*'.

⁷In addition of the one analysed in the present volume, MC considers in other papers, other prototypical cases of incommensurable concepts like phlogiston/oxygen, impetus/moment, or geocentric planet/heliocentric planet.

Let us call L_1 any linguistic item pertaining to theory T_1 , L_2 any linguistic item involved in theory T_2 , and so on. By ‘linguistic item’, I mean a signifier or a group or signifiers forming an expression or a sentence. Here are some typical examples considered by MC:

Ex1. $T_1 =$ Lorentz’s *ED*; $T_2 =$ Einsteinian *SR*; $L_1 = L_2 =$ ‘mass’, or ‘length’, or ‘velocity’.

Ex2. $T_1 =$ Lorentz’s *ED*; $T_2 =$ Einsteinian *SR*; $L_1 =$ ‘real mass’, $L_2 =$ ‘rest mass’.

(*ED*: electrodynamics; *SR*: special relativity).

Ex3. $T_1 =$ phlogiston theory, $T_2 =$ chemistry of Lavoisier; $L_1 =$ phlogiston ; $L_2 =$ oxygen.

Let us consider the first try, that is, translation according to sameness of *CA*.

In the first try, MC exhibits two linguistic items L_1 of T_1 and L_2 of T_2 that are said to have the same *CA*⁸. In what sense do they have the same *CA*? In the sense that L_1 and L_2 are related to the same empirical situations (in the *ED/SR* example as described by MC, these situations correspond to identical measurement procedures).

Thus ‘*CA* of L ’ mean ‘empirical situations to which L is related in a given theoretical context T ’. Let us call this meaning ‘*CA* in the first sense’, and let us refer to it as CA_1 .

Let us now consider the second try, translation according to sameness of inferential relations.

In his second try, MC exhibits two linguistic items L_1 of T_1 and L_2 of T_2 that are said to have the same *IR*, and he concludes that such items have different *CA*. In what sense do L_1 and L_2 have different *CA*?

In order to answer, we have to examine what MC exactly does in the second try. Roughly speaking, he gives a theoretical definition of L_1 (resp. L_2): he explains the meaning (the sense) of the concepts used by the adherents of T_1 (resp. T_2). That is, he makes explicit the relations of L_1 (resp. L_2) with (in principle all) other relevant theoretical signifiers of T_1 (resp. T_2).

⁸This is supposed to be the case for $L_1 = L_2 =$ ‘length’ and $L'_1 = L'_2 =$ ‘velocity’, in the context of $T_1 =$ Lorentz’s *ED* and $T_2 =$ Einsteinian *SR* (cf. MC’s paper in the present volume, section 4); or for $L_1 =$ ‘phlogiston escape’ and $L_2 =$ ‘oxygen bounding’ in the context $T_1 =$ phlogiston theory and $T_2 =$ chemistry of Lavoisier [Carrier 2001, section 6].

Then he concludes that L_1 fails to apply, that L_1 does not apply at all from T_2 's point of view. What does it mean in this case? It means that, from T_2 's point of view, concept L_1 is "empty", that L_1 "is no longer legitimately applied to any phenomenon" [83⁹]; it means that "there is no such thing" as what T_1 names L_1 [Carrier 2002, 136]. In other words, 'to apply', in the context of the second try, is equivalent to 'to refer' (according to some determined subject or group of subjects). L_1 'fails to apply' means that L_1 does not refer to anything: that what T_1 describes under L_1 doesn't exist according to the adherents of T_2 .

(And this is so, because the state of affairs that T_1 describes under L_1 is incompatible with the state of affairs that T_2 describes under T_2 . It is not simply that L_1 does not exist according to T_2 ; it is, moreover, that the existence of L_1 is inconsistent with T_2 . What L_1 names cannot coexist with T_2 : it cannot be peacefully grafted on T_2 , it is incompatible, contradictory with T_2).

Hence, in the second try, L_1 of T_1 and L_2 of T_2 are said to have different *CA*, because they cannot both apply in the sense that the two states of affairs they describe cannot both exist: L_1 (resp. L_2) is, according to the adherents of T_2 (resp. T_1), an empty name, a description that does not apply to anything, that does not correspond to any real state of affairs in the physical world¹⁰.

Conclusion: in the second try, '*CA* of L ' means 'existence of the state of affairs named L ', 'truth of the statement L ', or, rephrased in a softer way, 'empirical adequacy of the description named L '. A linguistic item L will be thought to apply, to have *CA*, if it is thought to label an empirically adequate description, a really existing states of affairs, if it is thought to have a counterpart in reality. Let us call this meaning '*CA in the second sense*', and let us refer to it as CA_2 (or let us say that a linguistic item **applies**₂).

A striking way to show that CA_1 and CA_2 correspond to different concepts, is to point out that one and the same linguistic item, say L_1 , may apply₁ but fail to apply₂.

⁹The pages mentioned into brackets without further reference correspond to the pages of the present volume.

¹⁰By the way, the converse holds too, although it is never explicit in MC's presentation. Indeed MC, in the second try, always describes the situation from the point of view of the recent theory, that is, from the point of view of the adherents of T_2 . However this has, in principle, no damaging philosophical consequences for MC's argument, since the converse can be unproblematically stated in MC's framework.

Indeed, suppose that we are adherents of T_2 ; we think that L_1 of T_1 does not pick out anything in the physical world (that is, fails to apply₂).

But nevertheless, we cannot deny that L_1 is indeed linked by T_1 to some empirical situations. And if we admit the description involved in the first try, we admit that L_1 is linked by T_1 to *the same empirical situations* as L_2 by T_2 . In other words, we admit that L_1 and L_2 have the same CA_1 .

Thus, as L_2 indeed applies₁, we must conclude that L_1 applies₁ as well.

Therefore, L_2 applies₁ and does not apply₂.

I think that CA_1 and CA_2 should be carefully distinguished. Although CA_1 is, in my opinion, the most fundamental and useful determinant, we can hope to rely on both CA_1 and CA_2 in order to achieve a fined-grained analysis of the incommensurability problem based on a more complex and precise operational notion of CA .

3. Two different understandings of the clause ‘translation according to preservation of IR ’

I will now consider the notion of IR and the clause ‘preservation of IR ’, arguing that two different interpretations of the clause are involved in the first and in the second try.

In the first try, L_1 of T_1 and L_2 of T_2 are said to have different IR (or theoretical integration), because the theoretical network at the heart of which L_1 lies in T_1 , and the theoretical network at the heart of which L_2 lies in T_2 , are two linguistic systems of very different structures, indeed two incompatible systems (and this is so, as underlined by MC, because L_1 and L_2 appear in incompatible laws, and thus in non-overlapping classes of kinds, in T_1 and T_2).

Therefore, in the first try, ‘ IR of L ’ means ‘structure of the theoretical network surrounding L in T ’, or ‘system of the theoretical relations at the heart of which L lies in T ’.

Accepting this meaning, it is natural to understand expressions like ‘preservation of the IR of two linguistic items L_1 and L_2 ’, as something like ‘same structure of the theoretical networks associated to L_1 in T_1 and to L_2 in T_2 ’.

And then it is natural to expect that MC’s second try, that is, the attempt to translate according to the clause ‘preservation of IR ’, will

correspond to the search for linguistic items of T_1 and T_2 that seem, prima facie, to lie at the heart of two similarly structured theoretical networks.

However, this is *not* what MC looks for in the second try.

Under the heading ‘translation according to preservation of *IR*’, what MC does, in his analysis of historical examples, is the following thing: he associates, to a signifier L_2 of T_2 , a theoretical structure *different from* the one usually associated to L_2 in T_2 , a *foreign* theoretical structure corresponding to the theoretical network surrounding L_1 in T_1 . In other words, he “grafts” (as he says himself) the structure of relations characteristic of L_1 in T_1 on a linguistic item of T_2 .

Hence, in MC’s second try, ‘preservation of the *IR* of L_1 from T_1 to T_2 ’ means ‘importation in T_2 , and coordination to L_2 , of a foreign theoretical network deduced from the incommensurable rival theory T_1 and coordinated to L_1 in T_1 ’.

Conclusion: there are two possible ways to understand the clause ‘translation according to preservation of *IR*’, and two different associated procedures. Let us mark MC’s procedure in the second try with suffix 2 (to make short: **TIR₂**) and let us mark with suffix 1 the previously sketched procedure, which is involved in the first try, that is, ‘to look for linguistic items that have prima facie similar *IR*’ (to make short: **TIR₁**).

4. For an other characterization of MC’s second try

I have, so far, successively focused on each constraint upon translation considered in isolation and examined what it became, first when it is involved in the first try, then when it is involved in the second try. Keeping the conclusions of these reflections in mind, I want now to switch from ‘constraint entry’ to ‘try entry’: that is, I intend to consider MC’s first and second tries as two unitary wholes linking together both constraints, and, examining each unit one after the other, to discuss MC’s description of them.

MC’s account of his first try seems convincing to me. Roughly speaking¹¹, the first try (**t₁**) shows that in incommensurable theories: (**t_{1a}**) there are linguistic items which are grounded in the same empirical situations (in my vocabulary: which have the same CA_1) and which can

¹¹I say ‘roughly speaking’, because, as it will appear, the clause ‘linguistic items grounded in the same empirical situations’ is indeed vague, and need to be articulated (see sections 5 and 8).

then be translated according to this criteria); but (\mathbf{t}_{1b}) these linguistic items do not have the same *IR*, and then, they do not satisfy the second criteria (in my vocabulary: they cannot be *TIR*₁).

I'm not so convinced by MC's account of the second try. More precisely: what is pointed out in this second try is in itself instructive, but should be, I think, rephrased in a more adequate vocabulary — and this is of course not a purely linguistic disagreement. To explain why, let us examine again what is actually done in MC's second try.

A. Consider the first step of the second try (\mathbf{t}_{2a}).

This step is described under the label 'translation according to the preservation of *IR*'. But as pointed out before, in the second try, we are *not* looking, in T_1 and in T_2 , for terms presenting *similar IR*. Indeed in (t_{2a}), we in fact continue to focus on the *same* linguistic items L_1 and L_2 that were involved in the first try¹², that is, on items that are, from the beginning, assumed to have *different and incompatible IR* (since this is indeed the conclusion of the first try that the linguistic items under scrutiny have *different and incompatible IR*). Thus in (t_{2a}) we associate to L_2 the *IR* usually associated with L_1 in T_1 : we import in T_2 a linguistic network usually pertaining to T_1 (or conversely).

I do not think that this operation is well-labelled as a 'translation according to preservation of *IR*'.

Of course, we can identify some reasons why this operation has been associated with the expression 'preservation of *IR*': indeed, the operation consists in focusing on the *IR* of L_1 , in 'preserving' these *IR*, and then, in grafting them, untouched, on L_2 of T_2 . But it is nevertheless problematic to interpret this operation as a *translation* preserving the *IR*. It seems to me that a translation, even metaphorically understood, should at least entail the idea of the search *for an equivalence* (of a kind to be defined) between some elements of the two languages (or the two realms whatever they are) under comparison. This being admitted, a successful translation (here according to *IR*) should mean, if not an identity, at least a *sufficiently strong similarity* between two linguistic items pertaining to T_1 and T_2 respectively (here between the *IR* of these items).

As this condition is not satisfied in the case of the linguistic items L_1 and L_2 involved in MC's second try (as MC recognizes himself in the conclusion of his first try), I conclude that it is better to reserve the label

¹²Or almost the same: for ex. in the first try MC considers "phlogiston escape" and "oxygen bounding", and in the second one, "phlogiston" and "oxygen".

‘translation according to preservation of *IR*’ to the operation involved in t_{1b} (that is, to $TIR_1 = TIR$: to look for, and to find if the translation is successful, two linguistic networks of T_1 and T_2 that possess similar structures, that are superimposable).

As for the operation involved in t_{2a} , I will characterize it as a *graft* (**G**) of foreign *IR*: a *graft*, on a given linguistic item L_1 used in a well defined theoretical context T_1 , of a foreign network of *IR* (foreign in the sense that the linguistic item L_2 associated to this network is customarily used in a theoretical context T_2 different from T_1 , historically separated from T_1).

Note that to talk about a graft does not presuppose anything about the acceptance/rejection of the graft. In MC’s second try, the rejection of the graft is inevitable, because from the beginning, by construction, the graft deals with incompatible inferential networks. But we can perfectly imagine cases in which successful grafts take place. This happens if the foreign T_1 and T_2 under scrutiny are, although at first foreign in the sense of empirically separated, nevertheless compatible, additionable (not incommensurable).

Whatever label one is ready to use, I think that the operations involved in step (t_{1b}) on the one hand (in my notations: $TIR_1 = TIR$), and on the other hand in (t_{2a}) (in my notations: $TIR_2 = G$) should be carefully distinguished. Both could be taken into account in a fined-grained characterization of incommensurability.

B. Consider now the second step of the second try (t_{2b}).

Here one provides, for the relation between the two *incompatible* structures associated to L_1 and L_2 *already involved in the first try*, a *different description* from the one proposed in the first try. This different description consists in emphasizing that, according to T_2 , L_1 is empty. And such a description is categorized as a ‘failure to apply’, a failure of the clause ‘translation preserving the *CA*’.

Two remarks can be made about (t_{2b}).

First, to emphasize that from T_2 ’s point of view, L_1 describes a state of affairs that does not correspond to anything in the physical world, simply amounts to *clarify a necessary consequence of the premise of the second try*: namely, that the *IR* of L_1 and the *IR* of L_2 are incompatible. Indeed, as it is admitted from the beginning in the second try, at least tacitly, that the two chosen candidates to TIR_2 have inconsistent *IR*, they cannot *both* refer to existing physical states of affairs (or both be adequate descriptions of the physical world); *at least one of them* must

be empty (or inadequate). In brief, in (t_{2b}), what is actually done, is to continue to focus on the same inconsistent theoretical structures involved in the first try, and then, just to develop a little bit more the clause ‘to have incompatible IR ’.

Second, the question arises to decide if the judgments of the T_2 ’s adherents (resp. T_1 ’s adherents) about the emptiness of L_1 (resp. L_2) are well-labelled as judgments concerning CA (in my vocabulary: CA_2).

At first sight, the present terminological point seems less problematic than the previous one concerning ‘translation according to the preservation of IR ’. Indeed, neither of senses MC has given to the expression ‘ CA ’ stands in opposition with customary contemporary usages. In particular the second sense — the choice to name ‘ CA ’ what is analysed in t_{2b} , which is what we want now to discuss —, corresponds to one of the ordinary usages of the expression ‘ CA ’. True, we commonly say that a term ‘does not apply (at all)’ to mean that this term does not name anything existing in the physical world (licorns, for ex.).

Now, if we reflect a little bit more on the nature of judgments of the CA_2 -type, we can feel uncomfortable with the label ‘ CA ’. Judgments of the CA_2 -type are, in fact, *modal* judgments characterizing the status of *already available* statements holding in a theoretical context T . They are *second order* judgments about the adequacy and objectivity of some assumptions of T (if not about the independent existence of some states of affairs targeted by T). They are second order judgments in a *chronological* as well as in a *logical* sense: although we can be agnostic about the fact that a word L applies₂ when we have specified its theoretical content and the way it is connected to some empirical situations, we must necessarily have the latter specification at our disposal in order to be able to decide if L applies₂. Yet, to admit the preceding characterization is to admit that judgments of the CA_2 -type can be (and indeed are most of the time in MC’s examples) modal judgments *about* previously isolated IR . This may render confused the distinction between CA and IR .

This being said and kept in mind, I will nevertheless conclude, taking into account customary usages, that the problem, with MC’s notion of CA , is not so much in itself to have labelled ‘ CA ’ (tout court) what I have isolated as CA_2 , but to have conflated, under *one and the same* expression, two operations (my CA_1 and CA_2) which are not identical and which should be distinguished in the context of the incommensurability problem. In what follows I will, for my part, maintain the generic common expression ‘ CA ’, in order to indicate that there are substantial common points and relations between both determinants, but I will con-

tinue to distinguish with suffix 1 and 2 the two operations involved in the first and the second try, in order to stress the substantial differences spelled out above.

Let us recapitulate what is done in the first and second try:

t_{1a} = to look for some linguistic items that have the same CA_1 ; successful attempt; conclusion: L_1 and L_2 are translatable according to the CA_1 .

t_{1b} = to try to translate according to ‘sameness of IR ’ (= TIR); unsuccessful attempt; conclusion: L_1 and L_2 have different IR and are not translatable according to ‘sameness of IR ’.

t_{2a} = to graft the IR of L_1 on L_2 and reciprocally (= G, inadequately described as a TIR by MC);

t_{2b} = to examine the CA_2 of L_1 and L_2 ; conclusion: if L_1 have CA_2 , then L_2 does not apply₂, and if L_2 have CA_2 , then L_1 does not apply₂; thus L_1 and L_2 do not have the same CA_2 .

More will be said about the substantial common points and differences between CA_1 and CA_2 (see section 6). But first, we need to reflect again on the notion of CA_1 .

5. An analysis of the notion of CA_1

5.1. Several characterizations of the notion of CA in MC’s analysis of incommensurability

Several characterizations of the notion of CA_1 are used throughout MC’s various papers on incommensurability.

At the beginning and at a general level, the CA of a term (my CA_1) are said to be “determined by the set of situations to which the concept is thought to apply (or not to apply, respectively)” [77].

Subsequently MC uses several different expressions in order to explain the clause ‘same CA ’, for instance:

- to be “applied [non accidentally] to the same objects” [76]; to “refer to the same state of affairs” [76];
- to be “applied under the same observable circumstances” ([Carrier 2002, 137], and without the adjective “observable” [85]);

- to be “determined empirically in the same way” ([81], [Carrier 2002, 134];
- to have the “same empirical import” [Carrier 2002, 134];
- to satisfy the condition “equality of measuring *procedures*”¹³ [81], [Carrier 2002, 134] (emphasis added);
- to satisfy the condition “equality of measuring *indications*” [Carrier 2002, 134] (emphasis added);
- to satisfy the condition same “values obtained” [Carrier 2002, 137].

(Most of these expressions also appear in [Carrier 2001]).

Are these expressions all equivalent? It is doubtful that the answer could be positive. Particularly with respect to concepts linked to measurement practices, one may find natural to ask: is the use of the same instrument sufficient to conclude that the concepts have the same *CA*? Or do the results of the measurements have moreover to be the same? More generally, what has exactly to be identical, in order to be able to conclude that two words have the same *CA*? These are not trivial questions and, as we shall see, we will encounter similar problems in the following analysis.

Shifting to the analysis of particular examples, we find the same diversity of meaning concerning the notion of *CA* (CA_1). Let us list most of them.

- The term “length” is said to have the same *CA* (CA_1) in the lorentzian and einsteinian frameworks, because “measurements based on rod transport or transmission time of light signals are equally accepted within both theories. That is, classical electrodynamics (*ED*) and special relativity (*SR*) roughly agree on the acceptability of length measurements. Measuring lengths by registering the round-trip travel time of a light signal, as it is done, for instance, in a Michelson-Morley setup is endorsed within the two accounts, and the results of the procedure are unanimously acknowledged as reliable” [81].

¹³The expression is introduced putting the stress on the fact that the two incommensurable traditions agree on the “reliability” of some determined instrument-types and experimental procedures, and thus on the “trustworthiness” of the results obtained by the corresponding procedures.

- The *CA* (CA_1) of the lorentzian and einsteinian term “mass” are similar, since “mass is evaluated in the same way in the two accounts in question. They both endorse determining mass values using a balance or collision processes (thereby drawing on momentum conservation)” [84].
- The *CA* (CA_1) of “phlogiston escape” and “oxygen bounding” “roughly coincide”, since “in most cases in which partisans of the phlogiston theory thought it legitimate to apply the predicate “phlogiston escape”, adherents of the oxygen theory would speak of “oxygen bounding” [Carrier 2001, 75].
- “Impetus” and “momentum” are said to have the same *CA* (CA_1) because “both quantities are estimated by the product of a body’s velocity and its weight or mass” [Carrier 2001, 77].
- In order to spell out the *CA* (CA_1) of the concept of “geocentric planet”, MC lists the relevant celestial objects falling under the concept (Moon, Mercury, etc.) [Carrier 2001, 77].

Without pretending to give an exhaustive analysis of the clause ‘*CA* of a linguistic item’, I want to distinguish several CA_1 -types involved in MC’s papers, and to stress some difficulties about the CA_1 determinant.

5.2. Distinguishing several CA_1 -types: CA_{1obj} and CA_{1mes}

To begin with, let us describe the internal structure (or if one prefers, the ‘grammar’ in a wittgensteinian spirit) of any CA_1 , and let us fix some notations that will be used all along the paper. Any CA_1 may be decomposed in three components:

- The subject of the application (say **Sa**), which is a linguistic item (a single linguistic item L or a composed one like a sentence or a theory T);
- The point of application (say **Pa**) or the object of the application, that is, (the description of¹⁴) the set of empirical situations (say **Eis**) to which Sa applies;

¹⁴I add ‘the description of’ since I consider the situation from the point of view of the philosopher of science, who have to render things explicit.

- The relation (say **Ra**) constitutive of the application, that is, (the specification of) the kind of link which is supposed to hold between *Sa* and the *Eis* equated to the *Pa*. Although the ‘application’ lexicon is, as we will see, plastic and vague, not every relation can aspire to be a relation of application.

The ultimate motivation for introducing the notion of *CA* and for distinguishing it from the notion of *IR* — and, as we said, what makes the interest of the notion of *CA* — is, basically, the need to name and take into account the non linguistic dimension of science (embodied in our *Eis* above): the fact that science has the peculiarity to grow in a very intimate relation with extra-linguistic concrete experiences. In agreement with such a motivation, all the MC’s characterizations or instances of ‘*CA*₁’ given above have in common, beyond their differences, to target what (in a given state of knowledge) is taken as real empirical situations: either existing phenomena like observable combustions, observable celestial bodies, observable changes in the place and the velocity of macroscopic bodies, etc.; or real available experiments involving real scientists performing real manipulations on real instrumental objects, like mass measurements with the help of a balance, or length measurements by means of the Michelson-Morley device, etc.

Now, despite the fact that all of MC’s characterizations or instances of ‘*CA*₁’ share the feature to vindicate the rights of the extra-linguistic reality through the targeted *Eis*, they also manifest striking differences concerning the kinds of *Eis* involved.

- First, the *Eis* involved are sometimes ‘natural’ and sometimes artificially (experimentally) produced, and they correspond, sometimes to naked-eye (or naked-sense) observations, sometimes to highly instrumented observations.
- Second, these *Eis* may be divided into two different types: what I will call the objective *Eis* (or **Ei_{obj}**), and what I will call the auxiliary or measuring *Eis* (or **Ei_{mes}**).
 - The **objective** *Eis* are empirical situations taken to be manifestations of the object under study (of the physical reality for ex.), and correlatively, taken to provide phenomena that have to be explained by (that are relevant for) theories responsible of this order of reality (physical theories for ex.).
 - By contrast, the **measuring** *Eis* are empirical situations (in modern physics most of the time highly instrumented empirical situations) performed in order to determine (most of

the time to measure if we deal with modern physics) some variables defined by one or the other of the available theories about the object under investigation¹⁵.

- In other words we have:
 - On the one side, situations in which the linguistic item L is supposed to play a significant role (situations exhibited in order to show that the reality named L — whatever it is from an ontological and mathematical point of view — is indeed involved here, and thus that the linguistic item L is one of the relevant element in order to characterize the objective situation under scrutiny).
 - On the other side, situations conceived and performed in order to detect the presence of L , or to determine the amount or the value or the variation of L .
- In MC's examples the specification of the CA_1 of a linguistic item involves sometimes reference to some objective *Eis* (ex. Ei = combustions; L = 'phlogiston' or 'oxygen'), and sometimes reference to some measuring *Eis* (ex. Ei = experiments with a balance; L = 'mass').

Thus, on the whole, to specify the CA_1 of a linguistic item L in a theoretical context T may mean:

- Either to isolate objective empirical situations (whether naked-eye natural observations, naked-eye produced observations, or instrumentally produced observations) for which the L -variable is thought, according to the adherents of T , to be relevant, if not absolutely required, in order to achieve a sound characterization (and situations for which, correlatively, the reality named L is thought — by the same scientists — to be indeed actually present).

I will label such cases ' CA_{1obj} '.

In such cases the relation Ra underlying the verb 'to apply₁' corresponds to the relation: 'to be relevant' (in order to achieve a sound characterization of the objective situation under study).

¹⁵The distinction corresponds more or less to the one introduced, in the present volume, by Emiliano Trizio when explaining his notion of dual taxonomies (that is, taxonomies composed by a part about experimental instrumented practices and another part about the objective reality under study). Reading his paper while writing my own has helped me to recognize the need to use a distinction of this kind in order to analyse MC's notion of CA .

- Or to isolate (most of the time instrumented) experimental procedures conceived as relevant reliable means to determine (most of the time to measure) L .

I will label such case ‘ CA_{1mes} ’.

Here the relation Ra underlying the CA_1 corresponds to the relations: ‘to be relevant and reliable’ (in order to determine the magnitudes involved in some theory).

5.3. The dependance of the CA_1 upon IR , CA_1 in the enlarged/restricted sense

Remarks:

A. Although there are most of the time links between CA_{1obj} and CA_{1mes} , it is not necessary that they coincide. We can imagine that (and find historical examples in which) two scientific traditions roughly agree about the relevance of the same empirical situations (about the fact that their theories have to explain such situations), but do not agree about (all) the experimental instrumented means that are reliable in order to determine the central variables involved in the available theories.

This is a reason why it is better to distinguish carefully CA_{1obj} and CA_{1mes} , as two possible ways to understand the notion of CA_1 .

The term ‘ CA_{1obj} ’ refers to the set of the situations (possibly highly instrumented) to be explained (the relevant situations). It is the most intuitive and common way to understand the idea of ‘ CA ’ of a theory T or a particular linguistic item L . The term ‘ CA_{1mes} ’ refers to the experimental means supposed to be reliable with respect to the task of determining the magnitudes mentioned by available theories.

Shifting from the specification of CA_1 to the clause ‘to have the same CA_1 ’ we have the following equivalences:

- Same CA_{1obj} = same set of relevant empirical situations Eis .

The adherents of two incommensurable theories agree about the objective empirical situations to be explained — or about most of them, most of the ones known by both rival traditions.

- Same CA_{1mes} = same set of relevant reliable means for determining the scientific magnitudes involved.

The adherents of two incommensurable theories agree about the reliability of the experimental procedures adopted to measure theoretical variables — or about the reliability of most of them, of most of the ones known by both rival traditions.

B. The descriptions of the empirical situations involved at both levels are of course, even in the case of naked-eye natural observations, all theory laden: all of them rely on a (in principle potentially evolutive) taxonomy, be it a taxonomy covering naked-eye observations, or a taxonomy including instrument-types and experiment-types. This means that:

- (a) The descriptions of what the historian of science sometimes identifies trans-paradigmatically as one and the same empirical situation, may be, in actual episodes of the history of science, coordinated to ‘observational’ descriptions that change from a scientific tradition to an other incommensurable one. In that case the historian of science will be able to detect, by contrast, ‘tacit theoretical assumptions’ and ‘questionable inferences’ in the old scientists way of talking, where these old scientists themselves only saw ‘given observational descriptions’.
- (b) Some (more or less hidden) *IR* are thus involved in the specification of CA_1 (the one underlying the descriptions of the empirical situations involved), so that the specification of CA_1 *cannot avoid the specification of some IR*. In other words, the CA_1 determinant is *not* completely independent of the *IR* determinant.
- (c) In consequence, we have to distinguish between two kinds of *IR*: the ones to be associated with the theoretical integration of a concept, and the ones to be associated with its empirical application. Yet this is indeed a problem, because the theoretical and empirical levels are of course not separated *in re* by a natural and sharp dividing line. We do not have, on the one side the description of the relevant empirical situations (with their underlying ‘observational’ or ‘very empirical’ *IR*), and on the other side the theoretical descriptions (with their underlying ‘theoretical’ *IR*).

We will come back to points (b) and (c) section 6.

C. The situation is moreover complicated by the circumstance that the verb ‘to apply’ is currently employed in order to label epistemological configurations for which nobody assumes that the point of application *Pa* is ‘observational’ or even that it is a ‘faithful description of a real state of affairs’. We commonly say that a theoretical item *L* applies to this or that situation, where the situation involved is not, in any sense, an ‘immediately observational’ one, but is a highly theoretical and idealized

model supposed to cover an open class of empirical situations that may be perceptively very different¹⁶ from one another.

D. And that is still not all. Suppose that difficulties B(c) and C are set aside, that is, suppose that Pa is unproblematically ‘observational’ or ‘very empirical’, and that we are indeed allowed, for some practical purpose, to draw a well determined dividing line between, on the one hand, the level of what can be taken as given (naked-eye or instrumented) observations Eis and, on the other hand, the level of what can be taken as theoretical interpretation of these Eis .

This being admitted and according to our definition of CA_1 , to specify the CA_1 of L in the context of T should amount in principle:

- (i) To describe a set of (by hypothesis unproblematically observational) empirical situations Eis (let us label the network of IR constituting such descriptions IRE_i);
- (ii) To select these Eis on the grounds that they are — among the larger set of the Eis that appear to be relevant with respect to the theory T to which L pertains — the Eis to which L applies. (If we deal with $CA_{1_{obj}}$, it means that the linguistic item L is relevant and required in order to achieve a sound scientific characterization; and if we deal with $CA_{1_{mes}}$, it means that the Eis mentioned are relevant reliable means in order to measure L).

In principle (i) and (ii) should be enough¹⁷, but in reality, this is rarely the case¹⁸. Why? Because it seems that more can (if not must) be said about the link Ra between L and the Eis .

Saying that L is relevant for spelling out the Eis amounts apparently to stating nothing more than the fact that L indeed applies to the Eis .

¹⁶Kuhn’s texts offer many examples. Cf. for instance, in [Kuhn 1962], Kuhn’s analysis of the way the sketch-law $F = ma$ ‘applies to nature’. Here, as in many other illustrations of the function of exemplars in science, ‘nature’ does not equate with ‘direct observations’ or even with ‘low-level theoretical statements’. ‘Nature’ means ‘highly theoretical idealized models of nature’, although less theoretical (i.e., here, less general) than the covering law $F = ma$. For further developments on this point, see Emiliano Trizio’s paper in the present volume.

¹⁷And sometimes things work in this way in MC’s presentation: for ex., when he claims that “phlogiston escape” and “oxygen bonding” have the same CA (CA_1). Here the claim can be taken as implying that the phlogisticians and the lavoisians assume that roughly the same set of empirical situations are relevant (combustions, etc.), and that, in the presence of the same relevant phenomena, they will describe them, respectively as a phlogiston escape, or an oxygen bounding.

¹⁸Cf. the examples just below.

But couldn't L apply to the same *Eis* in many different ways? This is indeed a current way of talking. Think for example of the so-called empirically equivalent theories: they exactly embody such a configuration. This fact leads us to tell more about Ra : not only to state that L applies to the *Eis*, but moreover to clarify *how* L is linked to them, to spell out in what precisely consists, in each case, the relation of application involved.

Yet in order to do that, one has to introduce new demarcations within the total network of assumptions characterizing a given scientific tradition. Suppose that one has taken the linguistic item L as the subject of the application Sa . L is not *directly* linked to the *Eis*, and L is not *only* linked to these *Eis* but also to many theoretical items. Thus in order to specify the CA_1 of L one will have, given the *Eis*, to cut the whole inferential network surrounding L in two different parts: a theoretical 'essential' (or 'defining') fragment IR_{D_L} ; and a less theoretical fragment playing the role of bridge between the IR_{D_L} and the *Eis* ($IR_{B_{[L-Eis]}}$).

In that case, the specification of the CA_1 of L in the context T will require, besides the tasks (i) and (ii) mentioned above, the additional following task:

- (iii) To spell out the way L is related to the *Eis* (and in so doing, to rely on a network of relations IR_B); or in other words, to spell out through what precise connexions the *Eis* are relevant with respect to the application of L , to spell out how L applies to these *Eis*.

Let us label a specification of the CA_1 integrating this third component 'the **CA₁ in the enlarged sense**' (contrasted with the **CA₁ in the restricted sense**).

To specify the CA_1 of L in such enlarged sense implies, obviously, to enlarge the IR constitutive of CA_1 . Indeed, if we rely on the enlarged sense of the CA_1 , to accept the clause ' L_1 and L_2 have the same CA_1 ' amounts to accept *not only* that the same *Eis* are relevant with respect to L_1 and L_2 , but moreover that L_1 and L_2 are related to these *Eis* in the same way.

5.4. Applying the elaborated distinctions to MC's analysis of examples

The preceding remarks will be developed in section 6 below. By listing them here, I mainly intend: first, to provide more fine-grained analytical tools in order to analyse MC's examples and more generally examples

of incommensurability; second, to identify the reasons which — altogether or separately depending on the particular case under issue — work toward the undesirable effect that, in MC’s analysis of concrete examples, the two determinants of *CA* (CA_1) and *IR* — that seemed at the beginning of his presentation, at the general and abstract level, well defined and separated — often interfere in practice. Let us give some illustrations.

A. Here are some examples in which MC is claiming to deal with *CA* (my CA_1) but in which *IR* surreptitiously enter into play, leading the reader to feel, at first sight at least, that the situation should be (or could be) characterized in terms of *IR*.

Ex1. When MC gives the list of the celestial objects falling under the concept of “geocentric planet” (Moon, Mercury, etc.) as an exemplification of what it means to specify the *CA* of “geocentric planet”, we are at first sight surprised: in so doing, aren’t we typically spelling out the *IR* (or theoretical integration) of the considered concept?

Now I would characterize the situation as a case of restricted $CA_{1_{obj}}$:

- *Restricted*, because the reasons why the Moon, Mercury etc. are assumed to be geocentric planets are not articulated (the way the linguistic item “geocentric planet” applies₁ to the celestial bodies named “Moon”, “Mercury” etc. is not made explicit);
- *Objective*, because the (descriptions of the) *Eis* here involved, that is, the (descriptions of the) considered celestial bodies as they appear from the earth, may be viewed as (descriptions of) objective given phenomena that astronomical theories have to explain, (rather than produced *Eis* identified with reliable means performed in order to show that the Moon, Mercury etc. indeed are geocentric planets).

Ex.2. MC claims that the *CA* (CA_1) of “mass” in *ED* and *SR* are the same, because “mass is evaluated in the same way in the two accounts in question. They both endorse determining mass values using a balance or collision processes (*thereby drawing on momentum conservation*)” (84, emphasis added). Reading this passage we can see (since this is here explicitly pointed out by MC) that the empirical evaluations under consideration are *not* independent of something, namely the momentum conservation, which is a highly theoretical principle holistically linked — according to the adopted contextual theory of meaning — to many other theoretical pieces, and which is then on the side of the *IR* (theoretical integration).

Now, I would characterize the situation as a case of enlarged $CA_{1_{mes}}$:

- *Enlarged*, because, with the allusion to the principle of momentum conservation, there is a (admittedly quite embryonic) specification of the way the linguistic item “mass” applies₁ to empirical situations involving balances or collision processes;
- *Measuring*, because the (description of the) *Eis* under scrutiny are, here, (descriptions of) basic instruments and basic manipulations corresponding to procedures intended to measure the magnitude named “mass”.

Ex3. When “impetus” and “momentum” are said to have the same CA (CA_1) because “both quantities are estimated by the product of a body’s velocity and its weight or mass”, this sounds again at first sight strange: in specifying the relation between velocity and mass underlying the two incommensurable concepts, aren’t we typically deploying their theoretical *IR*?

In this example it is not easy to qualify the situations in terms of our distinctions, because it is not very clear if MC’s verb “estimated” intends to refer to measures of impetus and momentum via measurements of velocity and mass, or if it intends to refer to a theoretical explanation of the links assumed by both theories between the concepts involved. At least our distinctions allow us to identify promptly what we need to clarify in order to be able to specify the situation.

By the way, the example illustrates how complex the situation is. Indeed, suppose that the first of the two possibilities listed holds¹⁹. Admitting MC’s characterization, two different experimental measurements are required in order to determine each quantity (impetus and momentum), so that the linguistic item “momentum” (for ex.) applies_{1 $_{mes}$} to two different Ei_{mes} — these Ei_{mes} corresponding to (the description of) the two basic experimental procedures. Now, these Ei_{mes} need to be related one to the other in a certain way if the momentum is to be determined. Yet, how are we going to characterise such a relation? If we want to equate the corresponding *IR* with a component of the specification of the CA_1 of “momentum”, we can consider it as specifying the way “momentum” applies₁ to the two *Eis taken together*. But this is a more complex case than the configuration considered above in (iii), in which the condition ‘the way a linguistic item L applies₁’ named the relation

¹⁹This is probably what MC has in mind; if the second possibility held, I think we should better describe the situation in terms of ‘pure *IR*’ instead of *CA*.

between L and one *single* class of empirical situation Ei .

B. Here is, now, an example in which, reciprocally, MC claims to deal with IR , whereas we are at first sight inclined to qualify what is at issue as CA_1 .

Just after saying that “phlogiston escape” and “oxygen bounding” have (roughly) the same CA (CA_1), MC continues: “the drawback is that the inferential relations fail to be preserved. A case in point is that the presence of phlogiston is connected with the colour and the nature [oily-fatty nature for ex.] of the pertinent substance” [Carrier 2001, 76]. He goes on explaining that the adherents of the phlogiston theory see a substantial connexion between the presence of phlogiston on the one hand, and the colour and oily-fatty aspects of the bodies on the other, whereas such relation is no longer accepted by the adherents of the oxygen theory; he adds that phenomena like colour or oily-fatty aspect are no longer, for many lavoisians, relevant phenomena with respect to the task of a chemical theory.

Yet, why does MC describe such a situation in terms of ‘different IR ’? Aren’t we here typically in the presence of a case of ‘different CA_1 ’? That is, a case in which each rival incommensurable theory assumes different sets of phenomena as relevant (here, very basic naked-eye observable phenomena like the colour or the fatty aspect of bodies)? Or else, if we consider those scientists that assume colour and oily-fatty nature to be relevant, aren’t we typically in the presence of a case in which the linguistic items under scrutiny differently apply₁ to the same empirical situations?²⁰ In brief, aren’t we typically in the presence of a case in which key concepts of each rival theory either apply to different sets of situations, or differently apply to the same restricted situations²¹?

Personally I am inclined to subsume the present example under the category of $CA_{1_{obj}}$, and to describe it as a case of difference of CA_1 (i.e. the two linguistic items under scrutiny, ‘phlogiston’ and ‘oxygen’, do not have the same CA_1 for the empirical situations examined — either because they do not apply to the same Eis , or because they apply

²⁰The way ‘phlogiston’ applies₁ — is linked by the phlogistician — to these Eis (for ex.: fatty-nature means a high quantity of a principle, phlogiston) is not the way in which ‘oxygen’ applies₁ to the same Eis (lavoisians do not explain what this link is).

²¹In the judgments concerning CA_1 , we can focus on a single restricted class of empirical situations, or enlarge the object of focus, up to a — of course idealized — clause corresponding to ‘all the phenomena that the theory has to explain’ or ‘all relevant phenomena’. This can of course modify the decisions about CA_1 (the conclusion that we have the same or different CA_1). The point will be examined in section 8 below.

differently to the same *Eis*). The reason for this choice is that unproblematically very ‘observational’ ‘given’ observations are involved here (the colour of the bodies, their fatty aspect...). Yet, as we will see in a more detailed way in section 7 below, such unproblematically intuitive observational character is one of the only way we have, in practice, to differentiate the CA_1 from the ‘pure’ *IR*. If cases involving items that are so observational are not counted as *CA*, what will be?

At least, we can experience, through the consideration of these examples, how the application of the distinction between the two determinants *CA* and *IR* can be problematic in practice. I will come back later to this problem and try, in section 7, to identify at a more general level the fundamental reasons for such interferences between CA_1 and *IR*. For the moment, let us keep in mind the central conclusion: *we cannot avoid to rely on some IR in order to specify the CA₁ of any scientific linguistic item.*

6. Exploring the substantial relations between CA_1 and CA_2

Let us now come back, as promised at the end of section 4, to the substantial common points and relations between CA_1 and CA_2 , the ones that may justify the appeal to a common generic expression in order to label the two operations involved.

As already noticed in section 4, in current usages we employ one and the same verb ‘to apply’ to mean CA_2 in some occurrences, and to mean CA_1 in some others. Yet, this fact is not at all gratuitous. Indeed, CA_1 and CA_2 are two distinct *but related* senses, and it is not useless, for the analysis of our present problem, to clarify the nature of these relations.

The fundamental common point between CA_1 and CA_2 is obvious: both concern the relation between the linguistic and the non linguistic, the connection between the words and the world.

The differences come from the sort of relation involved. This last point has been already sketched in section 4, but it can now be restated relying on the analysis of CA_1 provided in section 5.

A. ‘The relation of *L* to the physical world’, *understood in the CA₁-sense*, names:

- either (if we consider the restricted CA_1) simply a no further specified relation of *relevance* (for $CA_{1_{obj}}$) or of *reliability* (for CA_2);

- or (if we consider the enlarged CA_1) some specified connexions (my IR_B) that a given scientific theory T assumes between L and some observational situations Eis taken as given.

At this level, two remarks can be done.

First, a physical (or more generally scientific) concept will always have CA in this sense. Indeed, a *physical* concept cannot completely fail to apply₁²²; otherwise it would reduce to a purely metaphysical concept (in the logical positivist sense).

Second, to recognize that an expression applies₁, and eventually to spell out moreover some of the precise relations IR_B that are responsible for this application in a given framework T , is in principle *completely independent* of any ontological presupposition or commitment about the real/fictitious character of the theoretical states of affairs involved. Once the links between L and some empirical situations according to T have been stated (for ex. once explained that — or in what way — the words ‘phlogiston’ or ‘oxygen’ are related — apply₁ — to experiences of combustion in their original framework), we still have to decide if these relations are sufficiently adequate, objective or true of the world.

It is at this point that CA_2 eventually come into play, as higher-level judgments *about* lower level relations (the later lower-level relation being possibly relations involved in the specification of CA_1 — in my notations, IR_B).

B. The relation of L to the physical world’, understood in the *in the* CA_2 -sense, names, as we explained section 4, a *modal* judgment (a judgment of sufficient empirical adequacy or of independent existence) *about* some previously specified first level assumptions.

Now, the object of such modal judgment, that is, the previously specified first level assumptions can, in principle, be identified with any selected part of the T -framework:

- with some IR_B ;
- or with some IR_{DL} .

Hence, as a particular case, the object of such modal judgment can be something previously characterized under the category of ‘ CA_1 ’. In such cases, previously specified CA_1 are a required condition of the possibility

²²Even if the connections of this concept to empirical situations are complex and indirect. I will come back to this point below.

of CA_2 -judgments, and there is a *generative link* between judgments of CA_1 and judgments of CA_2 . This is especially striking if we understand CA_1 in the enlarged sense, that is, if we include in CA_1 of L some specification of the way L is linked to the relevant empirical situations *Eis*. In that case, determined CA_2 -judgments depend on the number and on the success of the (often predictive) bridge statements that constitute the CA_1 's network and that link L to observational/experimental situations. CA_2 -judgments (= 'the linguistic item L , understood according to theoretical context T , applies₂, or fails to apply₂') are therefore largely rooted in (if not univocally determined on the basis of) *an evaluation* of the way L applies₁ (or fails to apply₁).

For our purpose, the point is better considered in a comparative perspective: the verdicts ' L_2 of T_2 applies₂ / L_1 of T_1 fails to apply₂' are largely grounded in a comparative analysis of the way L_1 and L_2 respectively apply₁ (or fail to apply₁) within their original (different, eventually incommensurable) frameworks T_1 and T_2 . True, on the whole, the balance is not always easy to make, and in real historical situations, it is not necessarily consensual. The more the theoretical change is revolutionary, the more incommensurability will increase, and the more the judgments about the empirical global superiority of one theory on the other will become increasingly delicate, and possibly, in actual revolutionary periods, not homogeneous in the community of specialists²³. Nevertheless, from the overhanging perspective of the historian of science, there is no doubt that einsteinian relativity is empirically superior to Newtonian physics, or that the oxygen theory is, by far, more empirically adequate than the phlogiston theory. This is true in the minimal sense that the post-revolutionary theory is largely more apt, on the whole, to account for (*that is: to apply₁* to) known empirical situations (and this, despite of some possible marginal cases of kuhnian losses).

Admittedly, in actual historical controversies, other factors than quantitative considerations concerning the set of empirical situation explained come into play in theory comparison (such as estimations of simplicity, or conformity to other aesthetical or thematic requirements...). But considering the net result of the historical process, we can claim that the recent theory T_2 is indeed supported by a larger number of empirical situations than T_1 , and that T_2 is able to predict more exactly some empirical situations also predicted by T_1 : in other words, T_2 *applies₁ better than its rival* T_1 . Yet from this fact, one commonly tends to conclude that T_2 is a better description of reality than T_1 , which is equivalent

²³Cf. [Soler 2004a].

to say, in our technical vocabulary, that T_2 *applies₂* whereas T_1 *fails to apply₂* — or more cautiously: that *if* one of the two theories T_1 and T_2 refers to real states of affairs (= *applies₂*), it has to be T_2 and not T_1 .

In brief, the judgments about the success/failure of the associations assumed, inside of each rival framework T_1 and T_2 , between L and some observable experimental results (i.e. the judgments about the quality of CA_1), indeed influence deeply the modal comparative judgments about the comparative adequacy of each theory (i.e. the judgments about the ability/failure to *apply₂*). In most cases²⁴, at least from the point of view of the historian, it is because L_2 is thought to *apply₁* better than it's correlate L_1 of T_1 , that L_2 is assumed to *apply₂* whereas its correlate L_1 of T_1 is assumed to fail to *apply₂*.

On the basis of these considerations, developed with the intention to clarify the relations between CA_1 and CA_2 , I want to reaffirm a previous conclusion and make a remark.

At the end of section 4, I concluded that, although CA_1 and CA_2 correspond to different operations that have to be distinguished in the context of the incommensurability problem, it is legitimate to use one and the same generic expression to label both operations. I maintain that conclusion and hope that the arguments in its favour are now clear.

The remark is the following. As noticed above, first we need, in order to perform modal judgments corresponding to CA_2 , to specify and to take for given some aspects of the theories T_1 and T_2 under scrutiny, and second, modal judgments of the application₂-type can in principle be directed toward any *part* of the T -framework. In particular, the later judgments can be directed either toward highly large networks of assumptions held by the adherents of T , or toward very circumscribed propositions (for ex. toward the following one — say (p) –, ascribed to a phlogiston world-view's adherent: 'one and the same substance is exchanged in all reactions of combustion').

Yet, it is important to stress the interdependence between, on the one hand, the choice to focus on this or that (more or less extended, more or less observational) network of relations surrounding a given term L in a given context, and on the other hand, the judgments in favour or

²⁴In most cases only, for two reasons: first this holds on the whole, concerning several important concepts of the theories under comparison, but it could fail to hold for some particular marginal concepts; and second, we can imagine some peculiar situations, for example periods during which a new theory is proposed, in which some practitioners of physics believe that this theory is the good one (i.e. that this theory is the most accurate as to its fundamental ontological assumptions), even if it has not yet proved its empirical superiority with respect to the existing alternatives.

against the conclusion that a term applies₂.

In MC's *second try*, the modal judgments involved in the examples are most of the time directed toward broad networks of theoretical relations — eventually including our statement (*p*) but in association with many other theoretical claims about phlogiston that the oxygen-theory T_2 rejects. On the basis of this choice, MC is led to conclude, at the end of his second try, that the linguistic item 'phlogiston' under scrutiny fails to apply₂. Now, if one had chosen to focus on more restricted parts of the phlogiston theory involving the same linguistic item 'phlogiston' (for ex., if one has focussed on our (*p*) in isolation), the conclusion relative to the possibility for the term to apply₂ would have been the opposite, since (*p*) is maintained by T_2 .

This remark, and many other previous ones concerning the necessity to cut within the whole network of assumptions constituting a scientific paradigm, points to a cluster of important difficulties that we will discuss in the next section.

7. Some intrinsic difficulties of the holistic-contextual framework

Many of these difficulties do not concern specifically MC's approach and arise inevitably in any approach committed to the holistic-contextual framework. They represent therefore difficulties that are essentially constitutive of the incommensurability problem for anyone who thinks, like so many people today, including me, that the holistic-contextual framework is not a free methodological choice but a deep feature of human scientific practices. However, they remain relatively hidden in MC's presentation, and sometimes take a particular form in MC's model of translation, which I will try to make explicit in the course of the reflection.

Globally considered, the difficulties referred to have, I think, two sources.

- What I will call the *global/local dilemma*: the problem that although we recognize that our scientific theories work *holistically* (that our concepts are *systems* of correlated concepts, some of them possibly equated with observational ones), we also have to consider them in isolation and cannot use them without, up to a point, disconnecting them from the whole linguistic structure and from the whole set of empirical situations to which they owe their meaning.

- What I will call the *theory/observation dilemma*: the problem of reconciling the today well-known fact that there is no sharp demarcation line between the observable and the theoretical levels (this is the famous thesis of the theory-ladenness of any observation), with the epistemological necessity to maintain the distinction, to admit, at a pragmatic level and in a given historical context, that certain areas of our linguistic systems can be considered as direct descriptions of empirical basic states of affairs.

We need fundamental distinctions of these types. But at the same time, we have to recognize that such distinctions are pragmatic and most of the time not very sharp. This poses special difficulties when we try to compare two deeply different frameworks.

7.1. Indeterminations at the level of judgments concerning *IR*

Consider, first, judgments about *IR*. In order to characterize incommensurability precisely, we have to discuss as carefully as possible if (and why) two given linguistic items either have sufficiently similar *IR* (so as to be said translatable according to the clause ‘same *IR*’), or have too different *IR* (so that they must be considered as *untranslatable* according to the clause ‘same *IR*’).

In the framework of a contextual holistic theory of meaning and in the light of the global/local dilemma, we can anticipate that many difficulties will hinder such discussions, and we can understand their cause. A holistic theory holds that the use of a term is determined by its relations to other words and to empirical situations. If holism is drastically global, each linguistic item will have to be determined with reference to the *totality* of its original framework: that is, each linguistic item *L* will, in a way, contain the whole theory *T*, where *T* includes all the connections to empirical situations that hold for an adherent of *T*. Under such assumption, the only situation in which it would be impossible to conclude that L_1 of T_1 and L_2 of T_2 have the same *IR*, would be the case in which $T_1 = T_2$, and the criteria of *IR* would be deprived of any operativity. Yet, as previously noticed, for epistemological and practical reasons, holism cannot be drastically global: we must assume *local* holism. The consequence is that we have to *cut* the linguistic system into parts. And the problem is to decide *where* the cut is to be made.

With respect to the task of comparing rival concepts L_1/L_2 involved in rival theories T_1/T_2 , we have to decide, considering the whole frameworks 1 and 2, which part of the integral inferential network associated

to L_1 in T_1 , and which part of the integral inferential network associated to L_2 in T_2 , are really important/anecdotic, essential/secondary, considering the aim that is being pursued. We encounter here a new version of a traditional philosophical problem, namely that of the essential/secondary properties.

Yet this kind of decision is far from being trivial, since nothing imposes one unique and consensually evident cut: there is, at this level, a fundamental indeterminacy. And the more the theories are incommensurable, the more the decisions of different subjects will be heterogeneous [Soler 2004a].

In MC's presentation this difficulty is hidden, relegated in the background: although what constitutes the ground for the judgments 'same IR ' or 'different IR ' is clearly specified or identifiable, the reasons for underlying cuts, and a fortiori the very fact that these judgments need to rely on a non trivial cut, are not explicit. Yet the indeterminacy becomes palpable to the reader, in cases where he would have himself cut differently and thus would have come to different conclusions about sameness/differences of the IR associated to two linguistic items.

The above considerations about statement (p) 'there is one and the same substance exchanged in all reactions of combustion' can provide an illustration in principle. If we operate a very circumscribed cut within the inferential networks surrounding 'phlogiston' in T_1 and 'oxygen' in T_2 — for example if we extract the particular statement (p) and focus on it only —, we will conclude that L_1 and L_2 have the same IR . But if we enlarge the inferential network associated with L_1 and L_2 , the conclusion will be the opposite.

The case will maybe not appear very convincing, because of the common intuition that 'phlogiston' cannot be essentially reduced to the (p) characterization. But take the much discussed case of 'mass' in Newtonian and Einsteinian physics. Here the intuitions of the speakers are not so uniform. Some are ready to grant that a sufficient core of Newtonian assumptions about mass are conserved in Einsteinian special relativity, so that we can conclude that 'Newtonian mass' indeed refers, or in our vocabulary applies₂. But others do not agree at all with this analysis and believe that it is illegitimate to separate the shared and unshared assumptions of Newtonian and Einsteinian scientists about mass, and thus tend to conclude that Newtonian mass fails to apply₂.

We can also appeal to the example of mass analysed in MC's paper (section 4). The very fact that "the dependence of total mass on real mass and velocity is mathematically identical to the dependence of relativistic

mass on rest mass and velocity” could be taken as a sound argument in favour of the conclusion — which is not MC’s one — that “total mass” and “relativistic mass” indeed (roughly) satisfy the criteria ‘sameness of *IR*’. The adjective ‘roughly’ is here crucial. But since the criteria are never exactly satisfied, we face a real problem in cases where intuitions of the speakers do not coincide.

7.2. The ‘observational status’, as the central discriminative pragmatic criteria in order to distinguish CA_1 and *IR* in practice

The previous difficulty overlaps with another one, already briefly introduced section 5, related to the fact that the distinction between *CA* and *IR* is not so sharp, or more exactly, that the CA_1 criterion is not independent of the *IR* criterion (and hence inherits all the difficulties pertaining to the latter). Indeed, to specify the *CA* of a term can *not* be done *without* specifying *some of its IR* in a given framework.

Let us recall briefly why and explain the point a little bit more.

A. What does the philosopher of science have to do, when asked to specify the CA_1 of a given linguistic item *L* in the theoretical context *T*?

In the restricted sense of CA_1 , he has to specify:

- (i) The relevant empirical situation(s) *Ei*s to which the linguistic item *L* is assumed to be applied according to the adherents of *T*;

In the enlarged sense he has moreover to specify the way *L* applies to each *Ei*, that is:

- (ii) Some relations holding between *L* and each relevant empirical situation *Ei* according to the adherents of *T*.

The first element (i) *points to a non* linguistic, empirically given component, and it is precisely what leads one to talk about ‘*CA*’ instead of ‘pure *IR*’. So it is clear from the beginning that the very difference between the two constraints upon translation, CA_1 and *IR*, will at the end have to be located around this point.

But this being said, a network of *IR* underlie both components (i) and (ii).

This is explicit in the very definition of (ii): to specify the CA_1 in the enlarged sense inevitably implies to spell out some inferential relations, labelled IR_B section 5. And this holds too for (i), although maybe less obviously (cf. section 5, B). Indeed, the empirical situation E1 (resp. E2, E3, ..., E_i) targeted in (i) is never — at least from an overhanging historical perspective — a *single* situation that could be identified *here and now by ostension*. It is a constituted (in principle infinite) *class* of situations *assumed to be* of the *same kind*. To identify and circumscribe this kind of situation, the philosopher of science *has to* rely on a *description* of it, formulated in a specific language associated with a specific taxonomy. Even if such a description may be labelled ‘observational’ and considered, at a given developmental stage of knowledge, as a sort of ineluctable double of a piece of observation — so that we can say, in an intuitive and pragmatic sense, that the specification of CA_1 have to include *observational* linguistic items —, it remains, just as every description, questionable in principle (as questionable as the ‘theoretical’ assumptions that constitute it) and deconstructible. Hence, strictly speaking, to specify the (i)-component of CA_1 amounts, from the perspective of the historian of science, to rely on a (‘observational’ or ‘empirically given’) network of IR (labelled IR_{E_i} section 5).

B. But then the question arises: *which* inferential relations? If the CA_1 includes some IR , which part of the total inferential relations of an item L have to be counted as pertaining to its CA_1 , and which part have correlatively to be counted as ‘pure IR ’?

The ‘grammar’ (in a wittgensteinian sense) of the verb ‘to apply’ requires an artificial separation between at least two but more often three different parts corresponding to two or three fragments of taxonomies and levels of descriptions²⁵:

For the CA_1 in the restricted sense we have:

- A (relatively) higher level (or more theoretical, general level), intimately linked with the subject of the application L , in which an IR_{D_L} is selected;
- A (relatively) lower level (or less theoretical, more particular level),

²⁵In doing this we go back to a formulation of epistemological problems that is structurally very close to the one that the logical positivists assumed, the main difference being that in the framework of the contextual-holistic theory of meaning all distinguishing determinants (observational/theoretical, etc.) are assumed to be pragmatically and contextually determined features, rather than absolute properties of the states of affairs.

intimately linked with the point of application, within which some *Eis* are selected, and to which L is said to apply.

For the CA_1 in the enlarged sense we have moreover:

- A (relatively) intermediate level, within which some IR_B are selected and by the medium of which L (that is, IR_{D_L}) is connected to the *Eis*.

Now, what tells us how to cut within the total inferential network at the heart of which L lies, so as to isolate the IR (IR_{E_i} and IR_B) contributing to the CA_1 of L ? The demarcation line between the D_L - and the B -levels is neither sharper nor more objective than the one between the observational and the theoretical, or between the lower level and the two other ones.

Moreover, the situation is complicated, as already noticed section 5.3. C, by the fact that the point of application of the verb ‘to apply’ is *not*, in current usages, restricted to unproblematic ‘direct observations’, but commonly includes highly theoretical and idealized models. We saw that the ‘grammar’ of the verb ‘to apply’ requires an artificial separation between two or three networks of IR corresponding to three levels of descriptions positioned on a scale of ‘theoreticity’. Yet, this does *not* imply the assumption that the lower level is *observational* in the common intuitive sense. And there are many current usages of the verb ‘to apply’ that presuppose the contrary (see the example note 16).

However, leaving the reference to current usages and focusing on the task to make the CA_1 and IR determinants as operant as possible *in the practice of the philosopher*, I think we should try to avoid to subsume under the CA_1 category configurations in which the *Eis* involved coincide with too theoretical idealized models. In other words, I am inclined to consider the ‘observational’ status of the *Eis* as the *central discriminative pragmatical criteria* when having to choose between a characterization in terms of CA_1 and a characterization in terms of IR .

Of course, there is, once more, no absolute demarcation involved here, and we have to rely on intuition. However, one thing has to be stressed: from the viewpoint of the historian of science comparing two incommensurable paradigms from the vintage point of the overhanging perspective, the ‘given-observational’ status can be legitimately ascribed only to statements or assumptions that have indeed been (or would have been according of the historian) unproblematically taken as ‘observational’ by the adherents of both incommensurable traditions. In this

way we can give a sense to the clauses ‘ T_1 and T_2 have the same *Eis*’, ‘ T_1 and T_2 target a common set of relevant *Eis*’²⁶.

Let us recapitulate. We are left, when wanting to use the CA_1 and IR determinants, with the necessity to cut within the inferential network involving L in order to extract the CA_1 of L , together with the difficulty that nothing imposes a sharp dividing line between what has to be counted as pertaining to the CA_1 ’s network of L , and what has to be counted as pertaining to the theoretical integration network of L .

Ambiguities may arise, and in fact do arise, in the analysis of historical case studies. We sometimes hesitate to characterize the situation in terms of CA_1 or in terms of IR , to conclude that we have a case of ‘sameness/difference of CA_1 ’ or a case of ‘sameness/difference of IR ’, and we are sometimes astonished by the characterizations given by others (cf. as an illustration the discussion of MC’s examples at the end of section 5). Even when no ambiguity arises in practice — when everybody is intuitively inclined to uphold the same conclusions about CA_1 and IR —, I think it is important to make explicit that the two characteristics CA_1 and IR are *not mutually independent* characteristics.

7.3. Coming back to the analytical characterization of the differences between CA_1 and IR

I tried to clarify the relations of CA_1 and IR and to analyse the reasons of the difficulties related to the demarcation. But now, I want to repeat that from an epistemological point of view, the distinction between CA and IR seems to me as required as the distinction between the observational and the theoretical —, although no less problematic. It is therefore worth restating in what the difference between CA_1 and IR consists, in principle at the analytical level, independently of the possible ambiguities related to the application of the distinction.

- To specify the ‘ IR of L ’ requires to extract, within the whole linguistic network involving L in a given historical context, a single unitary fragment encapsulating *only theoretical* linguistic items, covering only inter-conceptual links *detached from any connexion to anything playing the role of ‘direct observation’*.
- Whereas to specify the ‘ CA_1 of L ’ requires moreover, in the restricted sense to extract the IR_{Ei} corresponding to the lowest ‘observational’ linguistic level, and in the enlarged sense, to clarify in

²⁶See [Soler 2003].

addition the $IR_{B_{[L-Ei]}}$ corresponding to the intermediate linguistic level.

Hence, from an analytical perspective, the difference between the two operations ‘to specify the IR ’ and ‘to specify the CA_1 ’ lies in two facts.

- There is in the second case, but not in the first, a division of the whole linguistic network encapsulating the whole system of beliefs of scientists in *several* areas understood as *hierarchical* levels.
- The lowest level encapsulates descriptions *targeting* taken-for-given perceptual situations, and the highest one encapsulates theoretical descriptions targeting unobservable states of affairs whose existence is supposed to account for the known experimental results. Thus we find in the second case, but not in the first, some ‘*observational*’ linguistic items (at least as targeted, sometimes in an indirect way), or some linguistic items having the same function in a given context (that is, being in this context unproblematically taken-for-granted descriptions of empirical situations).

All this encourages us to prefer, when having to name the ‘pure IR ’ of a linguistic item L (by contrast with the IR involved in the CA_1 of L), the systematic use of the expression ‘theoretical integration of L ’ (often employed by MC as an alternative to ‘ IR ’), instead of the more generic one ‘ IR ’. The former label has the advantage to underline that it is a peculiar kind of IR that is involved in the case of ‘pure IR ’: namely, a network that can be negatively characterized as exempt from any observational linguistic item.

However, the label does not have to be understood as signifying that the IR involved in the specification of the CA_1 of L are, by contrast, not theoretical and have nothing to do with theoretical integration. Indeed, it is worth repeating that although the IR involved in the specification of the CA_1 of L *target observations* and thus inevitably comprise *some* observational linguistic items, they cannot themselves be seen as ‘purely’ observational. The corresponding network will, inevitably, contain *theoretical* terms. Indeed, if L is a high-level theoretical terms of T , it will be impossible to specify its relations to empirical situations Eis (the way it applies₁) *without using, in addition* of L , some other very theoretical signifiers $L', L'' \dots$ In Kuhn’s words, theories involve interrelated terms that work holistically and apply together to nature. We encounter here the indeed delicate but inescapable problem of evaluating the “empirical import” [Carrier 2002, 134] of a single concept in the framework of a contextual-holistic account of language.

8. Some additional reflections about comparative judgments involving CA_1

Let us consider now *comparative* judgements involving CA_1 .

Such judgments have to estimate the similarities/differences between the CA_1 of two linguistic items L_1 and L_2 , in order to conclude that L_1 and L_2 possess the same/different CA_1 . Yet, it follows from the preceding analysis that to compare the CA_1 of two linguistic items L_1 and L_2 means to contrast each of the two elements (i) and (ii) specified section 7:

- on the one hand the empirical situations Eis to which each of our items apply;
- and on the other hand, the network of relations $IR_{B_{[L-Ei]}}$ spelling out the way each of them apply to its Eis (with the limiting case where IR_B = the simple claim *that* L_1 and L_2 indeed apply to their Eis with no further specification as to the 'how').

This being admitted, there are, at the most general level, four possible combinations:

L_1 and L_2 may be:

- (a) Similarly related to the same empirical situations; ($IR_{B_1} = IR_{B_2} = IR_B$) and ($Eis_1 = Eis_2 = Eis$);
- (b) Differently related to the same empirical situations; ($IR_{B_1} \neq IR_{B_2}$) and ($Eis_1 = Eis_2 = Eis$);
- (c) Similarly related to different empirical situations; ($IR_{B_1} = IR_{B_2} = IR_B$) and ($Eis_1 \neq Eis_2$);
- (d) Differently related to different empirical situations; ($IR_{B_1} \neq IR_{B_2}$) and ($Eis_1 \neq Eis_2$).

In the limiting case (= for CA_1 in the restricted sense), the verdicts of the type 'similarly/differently related to...' reduce to a disagreement concerning the relevance of a given class of Eis with respect to a given linguistic item L (for ex., if Ei = the fact of coloured bodies, T_1 = the phlogiston theory and T_2 = the oxygen theory, we can say that T_1 and T_2 are differently linked, in this minimal sense, to the same empirical situation Ei).

Outside of the limiting case, the difficulties of the verdicts of the type ‘similarly/differently related to...’ have already been discussed. They are difficulties inherent to judgments about sameness/differences of *IR*, generated by the necessity to make cuts within each of the whole linguistic structure involving respectively L_1 and L_2 , joined to the fact that nothing imposes this or that element as constitutive/secondary and that the choice to focus on certain units instead of others may lead to antagonist verdicts (cf. sections 5 and 7).

It remains now, first to consider the clause ‘same/different empirical situations’; and second, to analyse the relation between each of the four cases (a) to (d) on the one hand, and *global* verdicts of ‘same/different CA_1 ’ on the other hand.

8.1. Comparative judgments involving the CA_1 , discussed in reference to a circumscribed kind of empirical situation

With respect to the first point, it is important to stress, as MC rightly points out, that in comparing two rival incommensurable theories, it will always be possible to identify *some* empirical situations for which *both* T_1 and T_2 claim responsibility (situations that both the adherents of T_1 and T_2 think they *have to* explain). In other words, there will always be some L_1 of T_1 and L_2 of T_2 that will apply *to the same empirical situations* (in the minimal sense of being relevant in order to describe such common *Eis*).

Such identical empirical situations jointly targeted by T_1 and T_2 may be described, at least by an historian of science having the advantage of an overhanging perspective and mastering both T_1 and T_2 , by means of a unique ‘observational’ description.

Of course such a description would not be completely theoretically neutral. It would be neutral *only* with respect to both T_1 and T_2 . In other words it would be a description that is sufficiently independent of the *divergent* assumptions of T_1 and T_2 . (Such a description is not necessarily a statement that has been actually used by the real practitioners of science associated with the two studied incommensurable traditions. It may well be a statement formulated in a meta-language especially elaborated by the historian for the purpose, a statement that has never been actually used by scientists but that is nevertheless imputed to them in the name of the assumption that they *would have* accepted it) ²⁷.

²⁷I elaborated a similar thesis in [Soler 2003].

Thus there will always be some pairs of L_1 - L_2 , about which it is possible to say that they are linked to the same empirical situation picked out by one single actually available observational common description (like ‘situations of combustion’, ‘movements relative to specified concrete frames of reference’, etc.).

At first sight this seems to be a necessary condition to conclude that L_1 and L_2 do have the same CA_1 (with respect to a specified class of empirical situations). However, the possibility of case (c) incites us to examine this conclusion a little bit more. Indeed, case (c) could correspond:

- Either to an extension to *newly discovered* phenomena of an already available explanatory scheme (an extension of the domain of application of the theory, as one commonly says);
- Or to a displacement of an already available explanatory scheme on phenomena *already known*, but to which the sketch in question was not applied until now, and to which other (possibly incompatible) explanations were previously applied.

Given the flexibility and the polysemy of the verb ‘to apply’, we could be tempted to say, without going against current usages, that in such a case, L_1 and L_2 do have the *same* CA_1 (= *similarly apply*₁), although the requirement ‘to be linked to the *same* empirical situation’, that seemed at first sight to be a pre-condition of the verdict ‘same CA_1 ’, is *not* fulfilled (L_1 and L_2 are here linked to *different* specified empirical situations).

However, my position is that case (c) is better described under the label ‘different CA_1 ’. This is because of the fact, already emphasized, that if we want to be able to maintain a distinction between CA and IR despite of the circumstance that to specify the CA_1 of L requires to specify some IR of L , then, we have to confer a *primary role* to the factual (extra-linguistic, empirical, non-inferential) component targeted in the CA_1 ’s clause (primary compared with the IR component). Thus in cases in which L_2 is related to empirical situations E_2 s unknown or unexplained by T_1 , and related to these E_2 in the same way that L_1 is already related to other empirical situations E_1 , it seems better to say:

- *On the negative side*, that L_1 and L_2 *do not have the same* CA_1 (with respect to the restricted class of the E_2 s. It of course remains, on the basis of the multiplicity of such *local* verdicts, to enounce a *global* judgment covering the whole body of the empirical situations relevant for the adherents of T_1 and T_2 , cf. below).

- And *on the positive side*, that L_1 and L_2 do have similar IR but different CA_1 with respect to the E_2 s.

Let us admit that the requirement ‘to be related to the same kind of empirical situation’ is a necessary condition to the judgment ‘to have the same CA_1 ’. It is, however, of course not a sufficient one. Otherwise we would have to say that all concepts related in one or in an other respect to a given isolated empirical situation have the same conditions of application! (for ex., mass and length in the Michelson-Morley experiment²⁸). We need more than this, because L_1 and L_2 could be related to the same empirical situations in very different ways (=situation (b)). We need, furthermore, that L_1 and L_2 be related to the same empirical situation *in a sufficient similar way* — and here we are back to the problem to decide when we are ready to consider that the two underlying networks of IR as ‘sufficiently similar’.

On the whole and at a general level I conclude, concerning the relations between the verdicts of the ‘same/different CA_1 ’-type on the one hand, and cases (a) to (d) on the other hand, that:

For two linguistic items L_1 and L_2 :

- Cases (a) and (d) obviously correspond, respectively, to judgments of ‘same CA_1 ’ and ‘different CA_1 ’;
- And cases (b) and (c), at first sight less obvious, are finally better described as two cases of ‘different CA_1 ’.

8.2. Comparative judgments involving the CA_1 , discussed in reference to ‘the whole set of relevant empirical situations’

All this holds in reference to a circumscribed kind of empirical situation. But let us now consider the judgments of CA_1 in reference to the *whole set* of the empirical situations that the adherents of T_1 and the adherents of T_2 consider to be scientifically relevant.

The relation between the set associated with T_1 and the set associated with T_2 is rarely (and probably never for incommensurable theories) a relation of strict inclusion, let alone one of an identity. There are, in most

²⁸Note that it is precisely in order to avoid such an absurd way of describing the epistemological situation, that one cannot reduce the relation of application constitutive of CA_1 simply to a relation of *relevance* without any further specifications, and that one is correlatively almost inescapably inclined, in the analysis of concrete cases, to understand the CA_1 -clause in the enlarged sense, namely, to specify, up to a point, *how* L is related to the relevant *Eis* according to T .

cases, empirical situations *Eis* to which one of the two incommensurable theories is related but not the other (where the 'is related' may mean either 'actually explains' or 'has in principle to explain but is not yet able to do it').

Let us develop briefly the point.

It seems obvious if we take the later theory T_2 as the frame of reference. Indeed, nobody denies that T_2 possesses, at least when considered on the whole and a long time after its victory on its rival T_1 , a broader scope than the earlier theory T_1 . The theory T_2 accounts for empirical situations and experiences that were either unexplained or even completely unknown at the time T_1 was holding sway.

Yet, although less immediately obvious, the point holds too, at least locally, if we take T_1 as the frame of reference. It corresponds to what is nowadays commonly referred to as 'kuhnian losses': phenomena for which T_1 claims responsibility (and eventually, phenomena that T_1 was believed to explain well), but that the adherents of T_2 consider without any relevance (for instance: the colour and the oily-fatty nature of bodies, with T_1 = the phlogiston theory and T_2 = the oxygen theory).

If we focus on a particular kind of empirical situation to which L_1 of T_1 is linked but no L_2 of T_2 is linked (for ex.: the coloured aspect of the bodies), we will of course conclude that L_1 and L_2 do not have the same CA_1 . However, judgments of 'same/different CA_1 ' are not in general referred to a *single circumscribed class* of empirical situations of the same kind (for example, combustions/coloured aspect of the bodies). They are, most of the time, *global* judgments corresponding to a *balance* based on a *large set of different kind of* experiences and observations (combustions, coloured aspect of the body, *plus many other kinds of experiences* for which either T_1 and T_2 claims responsibility, or only T_2 , or only T_1).

This introduced a sort of second order difficulty (the first order one corresponds to the previously analysed ambiguities of the judgments based on a *restricted* specified class of empirical situations). Judgments that L_1 and L_2 *do* have (resp. *do not* have) 'the same CA_1 ' rely on an evaluation of their being grounded on a *sufficiently important* common empirical basis (resp. in a *too narrow* common empirical basis). Yet, the balance may be delicate, especially for incommensurable theories. One will of course not be ready to conclude that L_1 and L_2 have similar conditions of application, on the grounds that L_1 and L_2 have the same CA_1 for a given specifiable restricted class of empirical situations, if the class in question *is too poor* (is reduced to a few empirical situations,

or to empirical situations considered by both T_1 and T_2 as anecdotic or of secondary importance). But once again, such evaluations engage an intuitive and inevitably pragmatic component. As a result, their conclusions are often not consensual, and the arguments underlying them not uniformly convincing.

Conclusion

MC's central characterization of incommensurability corresponds to the following thesis. Kuhn has been right, in his last work, to identify incommensurability with untranslatability. Yet such identification needs to be clarified, and this can be done in the framework of the contextual theory of meaning. Incommensurable concepts appear then to be defined as concepts translatable with respect to *only one or the other*, but *never* to one *and* the other, of the two conditions that must be satisfied in order to obtain a good translation, namely, 'same CA ' and 'same IR '.

However, I conclude from the above reflections that MC's thesis cannot, unfortunately, be maintained as such. I say 'unfortunately', because the symmetry of MC's thesis was indeed attractive. But this symmetry actually lies on a too flexible and permissive usage of the expressions 'conditions of application' and 'preservation of the inferential relations'. Once having distinguished the CA_1 from the CA_2 , and once having examined what should be a proper translation according to inferential relations (= a TIR), this nice symmetry does not resist, and we feel the need for more fine-grained distinctions in order to grasp the complex and diverse situations under study.

I have tried to suggest some solutions in this direction, but a lot of work remains to be done. In the framework of a holistic and contextual account of the scientific activity, and under the assumption that there is nothing that can be identified with certainty to absolute and irrefutable data independent of any way of talking, I think we — historians and philosophers of science — have to begin with what we have, that is, with inferential relations underlying statements assumed by each of the scientific traditions under study. In other words, the IR determinant is, from the methodological point of view, of primary importance relatively to the CA (my CA_1) determinant. It is only once having exhibited the two inferential structures (and the two coordinated taxonomies) associated with each of the two compared theories T_1 and T_2 , that one can begin to ascribe to certain structural fragments the status of being 'observational' or 'protocolar', that one can then characterize the situations either in terms of CA (CA_1) or in terms of 'pure IR ', and that one can

ask questions about the preservation of such determinants for key terms — with all the difficulties and ambiguities emphasized above.

This being admitted, I think that Kuhn's characterization of (semantic) incommensurability is the good one and the most fundamental one: incommensurability names the relation between structures and taxonomies that are not superimposable and that are for this reason not mutually translatable.

If we want to go further, relying on the CA_1 and IR determinants, it seems that something like the following holds:

- Incommensurable concepts are *never* translatable according to the criteria 'sameness of IR ' (are never TIR) — and here is the main point of disagreement between MC and me, at least at the level of general formulations²⁹. The incommensurable concepts are the ones corresponding to two (*on the whole*) very different networks of inferential relations, and as a result, the ones that possess no good correlate in the rival theory according to the criteria '(*on the whole*) sufficiently similar IR '.
- As a consequence, incommensurable concepts cannot both apply₂ (since they point to incompatible realities).
- However, incommensurable concepts must have some non negligible *fragments* of IR in common (otherwise they would not appear

²⁹I say 'at the level of general formulation', in the sense that it is only considering nominal formulations that we find two contradictory claims (my claim that a translation preserving the IR (=my TIR) is always impossible / MC's claims that a translation preserving the IR is sometimes possible). If we go under the nominal formulations, it is not really a contradiction that we find. What we find is, rather, that MC actually never performs what I consider as a genuine translation preserving the IR , that is, a TIR .

The way MC frames the problem of incommensurability, joined to the awareness that in his second try one is actually not looking for linguistic items satisfying the clause 'sameness of IR ', strongly suggests the need of something like a 'third try' corresponding to the search for a TIR .

Had MC seriously attempted to follow such a third try, he would certainly have been led to the difficulties, examined above, constitutive of any comparative judgment of IR in the framework of an holistic theory. True, MC mentions, in his analysis of the historical examples, similar patterns of theoretical relations between L_1 of T_1 and L_2 of T_2 (for instance, the fact that 'velocity_{ED}' and 'velocity_{SR}' are involved in some identical mathematical formulas). But such remarks are not exploited as the starting point of a general methodological discussion concerning the pretension that linguistic items are analogues with respect to IR ; neither are they exploited as premises of the conclusion according to which certain linguistic items (the non-incommensurable ones) indeed possess homologue IR (are TIR).

at first sight as potential candidates for mutual translation, as MC underlines too — and this is an important point of agreement between us).

- Moreover, some incommensurable concepts of the so-called incommensurable theories must have the same CA_1 (at least in the restricted sense): there must be concepts of T_1 and T_2 that are similarly linked with — in the minimal sense of ‘being relevant for the characterization of’ — a non negligible number of identical empirical situations. Otherwise, the two theories T_1 and T_2 would not appear as *rival* incommensurable theories, but as theories about different separated regions of reality — like for instance hydrodynamics and botany. And in that case the claim that T_1 and T_2 are incommensurable is neither scandalous nor interesting, and the comparison between T_1 and T_2 no longer appears as a crucial epistemological problem linked to realism and relativism).

With such (indeed incomplete but already far too long) characterization of incommensurability, we lose the nice symmetry of MC’s conclusion. But we gain, I hope, in precision.

Notations

T	=	any theory.
T_1/T_2	=	old/new competing theories.
L	=	any linguistic item (signifier or group of signifiers forming an expression or a sentence).
L_1/L_2	=	a linguistic item used in the theoretical context T_1/T_2 .
ED	=	electrodynamics.
SR	=	Special Relativity.
t_1/t_2	=	MC’s first/second try.
t_{1a}/t_{2a}	=	first step of MC’s first/second try.
t_{1b}/t_{2b}	=	second step of MC’s first/second try.
CA	=	conditions of application.
IR	=	inferential relations.
‘ CA_1 of L ’ (or	=	conditions of application in the first sense)
	=	‘empirical situations to which L is linked in the theoretical context T ’.

- L applies₁ (or applies₁ to this or that particular empirical situation)
 = L indeed has links to empirical situations (or is indeed linked to this or that particular empirical situation) in the theoretical context T .
- ‘ CA_2 of L ’ (or conditions of application in the second sense)
 = ‘empirical adequacy of the description named L ’, ‘existence of the state of affairs named L ’, or ‘truth of the statement L ’ from the viewpoint of a given subject (most of the time a scientific community in the context of our discussion).
- L applies₂
 = L has an empirical objective counterpart, L is not an empty concept (from the viewpoint of a specified subject).
- $TIR_1(= TIR)$
 = to look for, within two theories T_1 and T_2 , two linguistic items having the same inferential relations (items associated with superimposable structures)
 = the operation attempted in t_{1b}
 = a genuine ‘translation satisfying the condition same inferential relations’, that can thus be noted TIR .
- $TIR_2(= G)$
 = to graft, on a linguistic item L_1 of T_1 , a foreign network of IR usually associated with an item L_2 in the theoretical context T_2
 = the operation attempted in t_{2a} , inadequately described as a translation according to IR . What is done in t_{2a} is not an operation of translation. It can be better described as a graft (= G).
- Ei = an empirical situation.
 Sa = the subject of an application₁ (= a linguistic item).
 Pa = the point of an application₁ (= a set of empirical situations Eis).
 Ra = the relation constitutive of an application₁; the kind of link holding between Sa and Pa .
 Ei_{obj} = the objective Eis = empirical situations taken to be manifestations of the reality under study.
 Ei_{mes} = the measuring Eis = experimental situations conceived and performed in order to measure some theoretical variables.

- $CA_{1_{obj}}$ = CA_1 such that Pa = some Ei_{obj} (and correlatively such that Ra = 'to be relevant in order to achieve a sound characterization of the objective situation under study').
- $CA_{1_{mes}}$ = CA_1 such that Pa = some Ei_{mes} (and correlatively such that Ra = 'to be relevant and reliable in order to determine the magnitudes involved in some theory').
- IR_{Ei} = network of the inferential relations underlying the descriptions of the Eis .
- IR_{DL} = network of the inferential relations underlying the definition (D) or the sense of a theoretical linguistic item L .
- $IR_{B[L-Ei]}$ or IR_B
= network of the inferential relations underlying the description of the way L is linked to the Eis ; bridge relations between theoretical assumptions and observational states of affairs.
- CA_1 of L in the restricted/enlarged sense
= CA_1 restricted to the specification of the Eis ($=IR_{Ei}$) to which L ($=IR_{DL}$) applies₁ / CA_1 understood as including the *additional* specification of *the way* L is linked to the Eis ($=$ additional specification of $IR_{B[L-Ei]}$).