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Controversy spaces. The dialectical nature of change in the sciences and philosophy

OSCAR NUDLER

RESUMEN: The paper outlines the model of *controversy spaces*. The model of *controversy spaces* integrates two different elements of the dialectical tradition. On the one hand, dialectics in its ancient meaning: the practice of controversial dialogue. On the other hand, the model incorporates dialectics understood as a pattern of change in intellectual history, based on the confrontation between opposite standpoints. I will be argued in this paper, the dialectical tradition was almost completely left aside in modernity and substituted by a *monolectic* approach. The model that will be outlined below aims at overcoming this view by focusing on the emergence, development and transformation of controversy spaces.

PALABRAS CLAVE: Controversies; Science; Philosophy; Epistemology; Kuhn; Wittgenstein.

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What role do controversies play in the advancement of philosophical understanding and the progress of scientific knowledge? In both cases, from the beginnings of modern philosophy, the prevailing responses have been skeptical of such a possible role. At best, it is granted that controversies may occasionally be beneficial, although their value would hardly be more than anecdotal. At worst, they are regarded as a clear sign of the deplorable state of the respective field of inquiry, especially when they continue indefinitely without reaching any consensus, as so often happens in philosophy.

This view began to change only in the second half of last century. A growing corpus of literature has contributed to the reevaluation of the



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cognitive significance of controversies. According to this perspective, whose origins can be traced to the ancient Sophists, the progress of knowledge has an essentially controversial or dialectical nature. However, dialectics, in the sense of “adversarial dialogue”, has not yet become a widely accepted alternative to the monoleptic view adopted by early modern philosophers. One of the main reasons behind this limitation is a hidden assumption according to which controversies may be approached as specific, isolated phenomena. However, at least in most cases any controversy is embedded from its very start in a network of relationships with other controversies. Therefore, a unit of analysis larger than “controversy” is badly needed in intellectual history. In the same way that units larger in scope than “theory”—such as “paradigm”, “research programme”, “research tradition”, etc—have been useful in bringing to light new aspects of the dynamics of scientific change, I am persuaded that the introduction of “controversy space” as a unit of analysis wider than “controversy” will have the same effect. This new notion would turn the dialectical approach into an effective tool for reconstructing the intellectual history of entire fields, not just of isolated episodes.

Before turning in the fourth section of this essay to the concept of “controversy space” and its related notions, we should first ask why a new model of scientific and philosophical change is needed at all. In order to answer, I shall sketch and assess in the next two sections the main positions that have been held on the problem of the epistemic status of controversies. I will start with scientific controversies and take up later philosophical ones.

Some wellknown debates have been the inspiring source of the model that is introduced and illustrated in this book. The first is the confrontation between “classical” and “new” philosophers of science that reached its peak in the 60’s and 70’s (see Nudler 2004). The controversy spaces model offers an alternative answer to some of the main issues at stake in that debate; for instance, whether the progress of scientific knowledge takes the form of a continuous ascending line or moves through revolutionary leaps that give rise to epistemic gaps. The second source of this model has been the confrontation between metaphilosophical views on the possibility of

progress in philosophy. Here, the main disagreement is between those who deny the possibility of philosophical progress (or admit, at best, a sort of negative progress consisting in the dissolution of philosophical problems) and those who assert that philosophical progress is possible only if the “right” philosophical method is applied.

SCIENTIFIC CONTROVERSIES: TWO OPPOSED MODELS

As has been just mentioned, the view that has prevailed since the beginning of modernity is that controversies play no significant role in the development of science. For early modern philosophers such as Descartes or Bacon, science is essentially a twoplayer game (cf. Machamer, Pera, and Baltas 2000): the inquiring mind on one side and nature on the other; the former asking questions and the latter “answering” them. Bacon claimed that the task of the scientific researcher is not to argue with others but to interrogate nature following the right method, and Descartes argued in the same direction. This negative attitude towards dialectics was indeed a reaction against its previous abuse in late scholasticism, yet it would persist largely unchallenged over the next three centuries. Both Descartes and Bacon believed that a universal, context-free Method is the only key to gaining knowledge. For Bacon, intelligence and imagination devoid of method are not only useless but also dangerous: “The understanding must not therefore be supplied with wings, but rather hung with weights, to keep it from leaping and flying” (Bacon 1863, p. 138). Descartes says something very similar at the beginning of his Discourse: “The greatest minds, as they are capable of the highest excellencies, are open likewise to the greatest aberrations; and those who travel very slowly may yet make far greater progress, provided they keep always to the straight road.” (Descartes 2006, p. 1).

A consequence of this methodological (or, more precisely, *methodologist*) stance is that controversies should not even arise. If the available information is sufficient to solve a problem, there is no room for disagreement and, therefore, for controversies. And if the available

information is not sufficient, instead of quarreling about conjectures what is needed is more information. However, if a controversy does nevertheless arise, a widely shared assumption was that the scientific method would provide a secure way to put an end to it by submitting rival theories to the verdict of nature, when possible through an *experimentum crucis*. Though under more sophisticated clothes, the hard core of this methodologist and monolectic approach remained essentially unchanged throughout the development of the philosophy of science in the first half of the 20th century.

In sharp contrast to this modern negative attitude toward controversies, dialectics was highly appreciated in classical Greece. This is apparent not only in the dialogues written by Plato but also in a vast literature in the form of adversarial dialogue that, according to fragments and references to it that survived, flourished along the fourth century in Athens. Plato, for all his love of mathematics, regarded dialectics as being superior to it in the hierarchy of knowledge. Aristotle also esteemed dialectics, though he did not consider it an adequate tool for science. For him, dialectics is the art of reasoning from premises that are the accepted opinions of experts (*endoxa*) in a given field. Thus, while *endoxa* are accepted on authority, scientific reasoning departs from first principles that are “convincing on the strength not of anything else but of themselves” (*Topics* Book I, 100a, 30–31). Thus the truth of principles is immediate and, therefore, superior to *endoxa*, whose truth is not immediate but established as the result of a dialectical procedure.

In Book VIII of the *Topics*, Aristotle describes this dialectical procedure as follows: one of the parties in the dialogue aims at persuading the other to accept a thesis, while the other party tries to avoid to be rationally compelled to do so; to achieve his purpose, the first party seeks the agreement of the second to propositions from which his thesis can be deduced. If a proposition is accepted in this way, it is probably, though not necessarily, true because it is not accepted at face value but *granted* as a result of a dialectical exchange. We may conclude that, while Aristotle appreciated and contributed to the development of dialectics, his conception of science was a

forerunner of the modern monolectic view; in fact, Aristotle declared that solitary research is less prone to deceit than research with others:

[...] the error is effected the more readily when we are inquiring into a problem in company with others than when we do so by ourselves (for an inquiry with another person is carried on by means of speech, whereas an inquiry by oneself is carried on quite as much by means of the object itself) (*Sophistici Elenchi* 169a, 37–41).

In the Middle Ages, the dialectical tradition incorporated a new element inspired in Roman rules for judiciary processes. Thus, a medieval *disputatio* was a sort of trial in which the “proponent” of a thesis faced an “opponent”, in the presence of an audience, and under the authority of a *magister* who at the end of the debate recapitulated the essential points and pronounced his verdict. The procedure had to follow a set of elaborate rules, such as those concerning the burden of proof (*onus probandi*). Rescher (1977) made the interesting suggestion that medieval *disputatio* may be taken as a model for the process leading to the acceptance or rejection of a new hypothesis by a scientific community. When a scientist proposes a hypothesis (the “proponent”), the respective community provides one or more *opponents* who challenge it in order to expose its weaknesses and preclude its acceptance. Finally, the community, playing the role of the arbiter in a *disputatio*, decides whether to accept or reject the proposed hypothesis.

As is well known, after the modern decline of dialectics, Hegel recovered it as a central concept, though endowing it with a new meaning. Besides the traditional meaning, exclusively related to language and argument, Hegelian idealism introduced an ontological or metaphysical sense of dialectics as a law of development of reality. Though leaving aside this allen-compassing scope of the Hegelian sense, we will use the term in a sense inspired by it; namely, dialectics as applied to processes of change in intellectual history. It is in this sense that episodes in the history of science and philosophy (when understood as processes of creation, development, transformation, and disappearance of controversy spaces) may be dubbed *dialectic*.

As has been mentioned, the modern rejection of dialectic was associated with a methodologist view of the advancement of knowledge. It was not until the late fifties that methodologism began to be seriously challenged. N. R. Hanson, P. Feyerabend, T. S. Kuhn, and S. Toulmin questioned the entrenched belief in a universal, context-free scientific method as the key to explain the progress of scientific knowledge. In contrast to this view, the new philosophers of science stressed the changing, historically conditioned character of scientific method as well as the theory-laden nature of scientific observation and its language (Hanson 1958). Kuhn, in turn, emphasized the dependence of epistemic standards on value priorities that may vary from one scientific community to another.

However, all these criticisms of methodologism were not accompanied (with the possible exception of Feyerabend) by a full recognition of the cognitive role of dialectics. Kuhn, for instance, did not assign any substantial role to controversies, neither in what he called the normal phases in the history of science nor in its revolutionary phases. In the former, because the paradigm is not subject to debate, only to further articulation and application; and in the latter because incommensurability between the new and the old paradigm prevents genuine controversies to arise. Only in the phase of crisis, as well as in the prescientific stage, Kuhn admits that controversies may play a role. Nevertheless, it is not clear what epistemic impact, if any, he assigns to them. Laudan (1977), on the contrary, proposed a model that highlights the role of different types of disagreements. However, his model places so much emphasis on the purely rational character of disagreements leading to epistemic progress that, in my view, most real scientific controversies fall outside its scope. As will be argued later, controversies, also in science, include not only rational ingredients but non-rational ones as well.

Especially thanks to the influential contribution of Dascal (1995, 1996a, 1996b, 2006) and other scholars (such as Engelhardt 1987, Pera 1991, and Fuller 1996), the epistemic role of controversies in the history of science began to be clearly recognized and systematically scrutinized. However, as suggested before, most of this work focuses on single, relatively isolated

controversies, thus failing, despite all its usefulness for the study of concrete episodes, to provide a framework to study the historical transformations of science at a larger, more comprehensive scale.

Other fields of inquiry in which the cognitive importance of controversies have also been stressed are the sociology of scientific knowledge and the social studies of science and technology. From the dominant perspective in these fields, the dynamics of scientific controversies is comparable to other types of controversies, particularly political ones. According to this sociologist approach, controversies in science come to an end not through the application of logical or rational standards but through a process of negotiation in which the accumulation of power, prestige and authority plays a decisive role. As is well known, this way of describing decision-making in science has been sharply criticized both by orthodox and historicist philosophers of science, including Kuhn. Although the so-called “science wars” were especially intense in the 80’s, the fire has not entirely died out yet, as exemplified by Boghossian’s recent book (Boghossian 2006).

Critics of sociological externalism often assume that controversies in science are, from the point of view of their rationality, of one and only one kind. Depending on the side of the divide, debates are regarded either as rational, and therefore scientific, or non-rational, and therefore not scientific. But such a naïve dichotomy leaves room for a more complex distinction as soon as we realize that several types of scientific controversies may be distinguished, depending on their particular combination of rational and non-rational ingredients. Rather than divided into clear-cut compartments, controversies are distributed over a *continuum* between two purely ideal extremes, namely, at one end, a “rational” pole in which controversies supposedly develop according to purely rational, internal standards, and, at the other end, a non-rational (or even irrational) pole where the development and outcome of controversies would be exclusively based on external factors such as the interests and relative power of the parties. We consider such opposite poles as ideal because real controversies, no matter how close they might be to either one of these poles, never

coincide totally with any of them. Of course, this does not imply denying that there are controversies whose development and resolution may be accounted for using *almost* exclusively rational epistemic standards (e.g., the controversies over the existence of the ether, the particle or wave nature of light, the continental drift), as well as controversies in which non-rational, extra-epistemic elements play a decisive role (e.g., the controversies between the Copernican and the Aristotelian cosmologies in the 17th century, between evolutionists and creationists in the 19th century, and between behaviorism and psychoanalysis in the 20th century). However, though the dosis of rationality and non-rationality in controversies may widely vary, no component is totally absent. Accordingly, the term “controversy”, as it is used here, does not apply to possible cases in which pure rationality or, conversely, pure irrationality, is the rule. I have proposed the term “primitive conflict” to name this latter case (Nudler 1990).

A controversy does not necessarily remain at the same point of the mentioned continuum throughout its whole historical trajectory. Thus, there are many cases in which a controversy was initially close to the rational pole but later its nature changed so as to become closer to the non-rational end of the spectrum. A clear example in this connection is what happened before and after the intervention of Galileo, about seventy years after the publication of Copernicus’ *De Revolutionibus*, in the controversy between the Copernican and the Ptolemaic views of the planetary system (Blackwell 1991). An interesting, current example of this kind of change is the controversy around the potential risks that genetically modified organisms (GMOs) might pose to human health. In the first phase, prior to the actual use of GMOs in crops, the controversy was confined to the community of molecular biologists. This phase ended when scientists reached an agreement at the Asilomar conference of 1975, which produced a report describing security protocols that would, allegedly, ensure the safe use of GMs. However, a bit later, ecologists began to intervene in the controversy. Their objection to molecular biologists was that their results were exclusively based on laboratory studies that did not take into account the potential risks of introducing GMOs into the environment. Now, when

GM seeds began to be used in cultivation on a large scale, new actors from outside the scientific community began to play an active role, namely, multinational companies supplying GM seeds, environmental groups, politicians, mass media, and public opinion. It is clear that as new voices made themselves heard, the controversy shifted from one place near the rational pole to another close to the non-rational pole of the rational/non-rational continuum. It could be objected that, in this way of reconstructing the history of this controversy, it would be more appropriate to distinguish two different controversies: one involving only scientists and another in which extra-scientific actors intervene. However, in my view, it is more illuminating to reconstruct the course of the debate as parts of the same controversy space whose first stage already implicitly contained the elements that would shape its later character. Such an approach would alert us, from the very start of the heuristic process, to the potential social, political and cultural charge of a controversy. As T. Pinch y C. Leuenberger have pointed out: “[...] during a controversy the social dimensions of science normally hidden can become more explicit” (2006, p. 2).

The power of controversies to reveal hidden dimensions, social or otherwise, is one of the main reasons to attribute a unique epistemic value to them. G. Freüdenenthal has pointed out some of the ways in which controversies may bring about epistemic progress: “[...] in their search for the source of disagreement, the opponents move in the direction of foundations and also toward new consequences” (Freüdenenthal 1998, p. 158).

PHILOSOPHICAL CONTROVERSIES: SCANDAL OF REASON?

A long tradition has denied philosophical controversies any epistemic potential. The ancient Pyrrhonian skeptics regarded philosophical controversies as useless from an epistemic point of view because there is no way to choose between the opposing positions. Worse than that, their only tangible result is the disturbance of inner peace so that the best we can do is to get rid of them. In modern times, philosophical controversies have also

been demoted with the argument that there is no method to put an end to them. That is why philosophical controversies proliferate. Descartes, the founder of modern philosophy, believed that we should leave traditional philosophical controversies aside and start from scratch using the new method he discovered, designed for the solitary thinker.

The devaluation of controversies as a source of epistemic (and, more generally, intellectual) progress continued, and even increased, throughout modernity. Leibniz, for example, called for overcoming controversies and replacing them by a method that would allow the parties to “calculate”, instead of confronting each other, to resolve their disagreements (however, a different reading of Leibniz’s position regarding controversies is argued for in Dascal 2006). Kant, in the second preface to his *Critique of Pure Reason*, claimed that the state of perpetual disagreement (he took as a paradigmatic example the controversy about the existence of “things outside us”) is a “scandal of philosophy and of universal human reason” (Kant KRV, B XXXIX).

It is worth mentioning here that Kant also rejected the skeptical attitude according to which philosophy (or, more precisely, metaphysics) does not admit, as a matter of principle, any method for resolving disagreements. Although agreeing with the rejection of traditional metaphysics as a form of knowledge, he nevertheless proposed a method capable of putting metaphysics “in the sure path of science”. Needless to say, such new metaphysics has nothing to do with the traditional one: it is *transcendental*, focused on the *a priori* conditions which make experience (and hence knowledge) possible, and *not transcendent*, inasmuch as it does not deal with non-empirical objects of speculative metaphysics.

Though differing from the Kantian version, throughout the next two centuries this view of philosophy, either as a science or in an intimate relation with science, remained alive and well. An example of the first alternative is Husserl’s concept of philosophy as “strict science”. An example of the second is the positivist idea of a “scientific philosophy” whose objective is not to obtain knowledge about the world (a task reserved to empirical science) but to analyze the logical structure of scientific language.

A point in common among all the preceding approaches is the confidence in the virtues of method. The shared assumption is that by applying the correct method—whether transcendental, phenomenological, logical, pragmatic, or some other, depending on the philosopher’s loyalty—only legitimate philosophical problems would remain. By the same token, once the illegitimate problems are gone, they will carry along with them all the endless controversies they have generated.

There have been various contemporary versions of what may be called the *para-scientific* view of philosophy, but perhaps none as extreme as that of W. O. Quine, who proposed to reduce epistemology—seen as the core component of philosophy—to an empirical science (Quine 1968). This extreme form of reductionism did not attract many followers; not even philosophers inspired by Quine’s naturalism, such as Kitcher (1992); but the idea of building philosophy taking science as a model is still widely shared. As is well known, however, many philosophers, including analytic philosophers, have rejected the belief in a close proximity between philosophy and science. The most radical among them have also rejected the possibility of reconstructing traditional philosophical problems with the argument that they are not, despite their appearance, legitimate problems. According to the author of the *Tractatus*, the reason for their illegitimacy is that the sentences that state them violate the rules endowing language with meaning and, as a consequence, are meaningless. According to the author of the *Philosophical Investigations*, their illegitimacy stems rather from their lack of roots in a form of life, a lack which manifests itself as grammatical confusion (in the Wittgensteinian sense of “grammar”). The only remaining task for the philosopher would be “to show the fly the way out of the bottle”, that is to say, to disclose the roots of grammatical confusion and thereby to dissolve pseudo-philosophical problems (Wittgenstein 1963, p. 309).

Now, either by reconstructing philosophical problems or by dissolving them, it is clear that both views regard controversies around traditional philosophical problems as devoid of any positive epistemic potential. But this conclusion should be challenged. Taking a closer look at it, two of its assumptions are brought to the surface. The first is that all philosophical

controversies belong to just one type, namely, those that go on endlessly without reaching any consensus. The second is that such a permanent lack of consensus necessarily implies epistemic sterility. Let us examine the former assumption first. When diverse historical examples of philosophical controversies are analyzed and compared, quite significant differences among them, especially in what regards their conceptual and epistemic fruitfulness, are likely to pop up. There are controversies that certainly fit the negative stereotype, such as, generally speaking, late scholastic disputations. Controversies of this kind fail to generate innovations; they are unproductive in epistemic terms. Despite the intensity or vivacity they may exhibit, they remain in a state of conceptual stagnation or, even worse, *conceptual blockage*. They are unable to give rise, not only to new answers to old questions, but also to new questions. However, even a cursory look at the history of philosophy shows that this is not the only sort of philosophical controversies. Take, for example, the controversy among early modern philosophers who adopted mechanism and a mathematical conception of natural philosophy and contemporary Aristotelians, who remained attached to teleological explanation and a purely qualitative natural philosophy. In contrast to the stereotype, this controversy had no doubt an indirect though strong epistemic impact. As Alexander Koyré stressed, it paved the way to the rise of modern science. Actually, Koyré did not limit the influence of philosophy on science to the case of the rise of modern science:

It is, indeed, my contention that the role of this “philosophic background” has always been of utmost importance, and that, in history, the influence of philosophy upon science has been as important as the influence –which everybody admits– of science upon philosophy (Koyré 1955, p. 107).

While the universal scope of Koyré’s claim may be doubted, the impact of certain philosophical developments on science (as well as, of course, the impact of science on philosophy) is in some cases difficult to overestimate.

But let us look at the problem of philosophical progress independently of the impact that philosophy may have on science or other fields.

Extrapolating Lakatos' (1970) distinction between progressive and regressive scientific research programs, we will say that a controversy space is in a *progressive* phase if it generates new questions or discloses new aspects of existing subjects of inquiry. On the contrary, if a controversy space proved an obstacle to such developments, we will say that it is in a *regressive* phase.

Russell (1918, p. 161) already pointed metaphorically to this form of progress attainable in philosophy when he attributed to it the power of *enlarging* our ideas (Nudler 2001). Rescher has described in detail what philosophical progress consists in for him: "In fact, philosophy progresses. Constant innovations supply new perspectives, new questions and problems, new and deeper arguments, subtler distinctions, systems more adequately developed, and so on" (Rescher 1985, p. 295). Turning to the second assumption that lies beneath the negative assessment of philosophical controversies —that persistent disagreement is incompatible with conceptual or intellectual progress—, the reasons invoked by Rescher are in my view enough to show that the contrary is true, i.e., that progress in philosophy is independent of the existence of consensus.

THE MODEL OF CONTROVERSY SPACES

In what follows, I will outline the model of controversy spaces in a rather abstract manner, just mentioning some examples in passing. The rest of this book will provide detailed, concrete examples of its application to the history of science and philosophy.

A controversy space is a structure which usually has as elements, at any given point in time, some controversy which is central and other peripheral controversies related to it. However, since controversy spaces are highly dynamic structures, the relative positions of controversies with respect to each other may change so that a new controversy may become central. Despite these and other possible changes, the *same* controversy space continues to exist if there is some key element that remains stable. Such element is usually a problem, but sometimes it is just a theme. For example,

a main question in Aristotelian physics is why bodies move; but in inertial physics, from Galileo onwards, that question is substituted by another one: why bodies remain at rest, or change their speed while moving. Despite the fact that the central question changed, the controversy space remained the same because its theme – the explanation of the motion of bodies – continued to be the same.

Quite rarely (perhaps never) controversies remain in a state of isolation for a long time. The fact is that controversies have a strong tendency to spread and associate with other controversies. As a first approximation, we could thus define controversy spaces as sets of interrelated controversies. For instance, already at its inception, the debate around Copernicanism and the introduction of a moving earth in the 16th and 17th centuries, was associated with the controversy on the absence of parallax of the fixed stars – which was also a controversy within astronomy. Likewise, Copernicanism was also associated from an early stage with controversies outside astronomy, especially the just mentioned controversy over the motion of bodies on earth, and even controversies completely outside the scope of natural philosophy, such as whether biblical passages should be interpreted literally or metaphorically.

In principle, though the network of relationships established between controversies might potentially be extended indefinitely, in practice a controversy space consists, at any given moment of its historical trajectory, of all the controversies that are in fact interlinked at that moment. The extension of a controversy space —i.e., the number of controversies it contains— is therefore quite variable. Now, when the set of actually interrelated controversies is too large or heterogeneous, the historian is prompted to make a pragmatic decision on where to put a limit to her research object. However, it could also happen that the historian may enlarge her research object when she finds that some relevant connections between controversies were not explicitly made by the parties actually involved.

In contrast to the preliminary definition given before, controversy spaces are *more* than sets of interrelated controversies. A controversy space may

include not only controversies in the usual sense of the term but also what may be called fictional controversies. In this type of controversies, a party enters a debate with a dead or living opponent, imaginary or real, but who never actually intervenes. The importance of these *fictional* controversies for intellectual history has been often underestimated. However, in some cases, real and fictional controversies maintain a close relationship that, if neglected, would deprive us from understanding crucial aspects of the evolution of a given controversy space. It is not important, after all, whether “dialogues” of this kind are called controversies or not; what is important is to take them into account. It is worth quoting what M. Spranzi Zuber has to say in this regard:

While a fictional dialogue erases, or reinterprets, the pragmatic aspects of a real dialectical exchange, it can help highlight its cognitive functions as well as the various strategies employed. While the *idealized* character of the fictional encounter eliminates the unpredictability and contingency of a real exchange, the *constructed* nature of the dialogue permits structural clarity and closure of the controversy it represents. Like rulebound disputations, dialogues are timecondensed, and therefore better reveal the backbone of what can be called a dialectic mode of inquiry (Spranzi Zuber 1998, p. 14).

Spranzi Zuber also provides a clear illustration of the need to take into account fictional dialogues: the controversy between Galileo and the Aristotelian Francesco Ingoli on the motion of earth. This controversy was “real” only to a point, as Galileo did not address his response to Ingoli but to an unknown “lover of truth”. In 1616 Ingoli wrote a public letter in which he invited Galileo to a debate that would be conducted in the manner of a medieval *disputatio*, and in which Galileo would be urged to answer Ingoli’s objections to two main Copernican claims: that the earth occupies a central place in the universe, and that it is in motion. But Galileo only “answered” Ingoli’s letter in 1624. He had been waiting for a better climate to resume his defence of Copernican theory and, eight years after Ingoli’s letter, he thought the time was ripe for testing out the waters. His letter to Ingoli, distributed among some influential people, became the starting point of a process that led to the publication of the *Dialogue* in 1632, after finally

getting the *nihil obstat* from the Roman Church. As is well known, in this work, the Copernican theses are defended in detail against the criticisms of the Aristotelians. The *Dialogue* itself is a fictional controversy between Salviati, a supporter of the Copernican theory that supposedly represents Galileo, and Simplicio, an Aristotelian who criticizes it, while Sagredo plays the role of a learned moderator. On the first day of the *Dialogue*, Galileo clearly takes up again his response to Ingoli. This shows the continuity between the start of a real dialectical exchange and its end as a fictional one.

The history of philosophy is of course full of examples of fictional controversies. To mention one contemporary example, the first part of Wittgenstein's *Philosophical Investigations* may be seen as a long fictional controversy between the author and an imaginary objector who defends a traditional conception of meaning called "Augustinian".

In addition to real and fictional controversies, two other central components of controversy spaces should be mentioned: (1) the problems around which the controversies revolve and (2) the theories, research programmes and traditions of inquiry in dialectical confrontation within the space.

The structure of controversy spaces can be divided into two main regions, one explicit and the other implicit. All the elements mentioned thus far belong to the visible region: the *focus* of the controversy space. In turn, the invisible or mostly invisible region consists of the presuppositions or commitments not subject to discussion within the controversy space. The existence of such a set of underlying shared assumptions —large or small, but never empty— is a necessary condition for the existence of controversy spaces; otherwise, no controversies would be possible. In other words, there should be a basic agreement —a *common ground*— from which disagreements can emerge. In the absence of a common ground there may be conflict, even violent conflict (cf. Nudler 1990), or mutual indifference; but not controversy. Controversies are, thus, exchanges that require a tacit commitment of the participants to certain beliefs and rules. They may be methodological (for instance, what can count as possible evidence and what cannot) or metaphysical (such as the belief in the existence of natural laws

or, more specifically, their mechanical character). The common ground may also occasionally include a whole theory that would then have the status of a *paradigm* in Kuhn's (1962) sense.

There are dependency relationships among all the elements making up a controversy space, whether located at the focus or at the common ground. Such relationships are not symmetrical; for example, a theory change may have no impact on problems or assumptions; but, if any of the latter change, it would provoke significant theoretical changes.

Let us look now more closely at the dynamics of controversy spaces, i.e., the ways in which they change. Not all components of controversy spaces change at the same pace. Thus, problems change at a much slower pace than the theories proposed to solve them, while some background assumptions may change even more slowly. Taking up once more the example of Copernican theory, it is well known that, while Copernicus abandoned the geocentric assumption of the Ptolemaic system, he left another assumption untouched; namely, the circularity of the orbits of celestial bodies. When one or more of the basic assumptions of a controversy space are brought to the surface and discussed in the respective community, this means that a structural change of the space has taken place. Such change consists in the translation of assumptions from the common ground to the focus. Thus I propose to call *refocalization* this kind of structural change. The case studies included in this book illustrate how this notion may contribute to the conceptual reconstruction of certain episodes in the history of diverse sciences, as well as in philosophy. A refocalization process often begins with the intervention in a controversy space of a *third actor*, a party who is not committed to any of the positions at stake, and who is therefore freer to propose a new perspective. Rather than continue playing the same game, she brings to the surface and challenges one or more of the assumptions that had been part of the common ground until that moment. If the challenge is accepted by the respective scientific or philosophical community (and it is not simply ignored or rejected without discussion), a new type of controversy begins that, using Kuhn's term, may be called "extraordinary",

in contrast to normal controversies that do not question the established common ground.

The start of a refocalization process requires indeed innovation, sometimes even a bold creative leap. To this extent it is a phenomenon taking place at the level of individuals or small groups. However, since it also requires the community's willingness to discuss the proposed refocalization, it is also a social phenomenon. Therefore, in the absence of such willingness, refocalization cannot take place. Intellectual history offers examples in which a proposed refocalization – even one that might have led, seen in retrospect, to a breakthrough – was available, but the respective community refused to consider it. Incidentally, this underlies the contingent nature of refocalization processes.

Even in scientific and philosophical revolutions, the challenge and replacement of some basic assumptions coexists with the maintenance of other parts of the common ground. For example, when historicism appeared as a revolutionary alternative in the philosophy of science, questioning several assumptions of the existing common ground (such as the independence of observation with respect to theory), other assumptions remained untouched; for example that the key problem for philosophers of science is to determine the precise nature of the relationship between observation and theory. Only several years later, with the pragmatic turn, this latter assumption was also questioned. In fact, historical research shows that, at least in a significant number of cases, it is more fruitful to leave aside the heuristic assumption of a continuity/rupture dichotomy and replace it with a more nuanced combination of both. However, it would be a mistake to exclude *a priori* the possibility of cases in which, instead of transformation through refocalization, a controversy space is *substituted* by an entirely new one – that is, cases in which an established common ground is abandoned. For example, some of the scientists who created quantum mechanics saw it as the discovery of a “new world” in which almost all of the traditional assumptions of previous science did no longer hold. Another example is Freud's psychoanalytic theory and his claim to have discovered the “new” realm of the Unconscious, in which the absence of logical laws,

time and causality require an entirely new approach. But, even in such episodes of deep change, the possibility of links with previous controversy spaces cannot be discarded. In any case, although the complete substitution of a controversy space by another is admitted, it is often the result of a process of successive refocalizations.

Refocalization should not be seen as just a mechanical translation of some assumptions from the common ground to the focus of a controversy space. On the contrary, it implies the creation of new concepts or the redefinition of already available ones. The Copernican revolution, for example, redefined the concept of “planet”, which no longer meant a celestial body that revolves around the earth. The redefinition of “planet” as a celestial body revolving around the sun made the earth a planet; and this in turn demanded a new physics for a moving earth, with all the momentous consequences that such demand brought for the history of natural science. As may be seen, even this relatively simple case of redefinition had a tremendous transformative potential.

The importance of the introduction of new concepts or the redefinition of old ones in a refocalization process cannot be overemphasized. This process, which might be dubbed *reconceptualization*, contributes to the establishment of a new platform from which to cast a fresh look at the whole controversy space. More often than not, also the past of the controversy space is rewritten in the light of the new perspective. However, the importance of reconceptualization in the evolution of controversy spaces does not provide any grounds to uphold the belief that the introduction of concepts is previous to the construction of the theory that includes them. As C. G. Hempel rightly pointed out, “Theory formation and concept formation go hand in hand; none of them can be performed successfully in isolation from the other” (Hempel 1965, p. 275).

CONCLUDING REMARKS

Let us return to the two senses of “dialectic” distinguished before, namely, its ancient sense as controversial or adversarial dialogue, and the (modified) Hegelian sense as a form of development of a historical reality. Our concept of “controversy space” combines both senses. In the first sense, a controversy space is an agonistic arena in which parties confront with each other within a space which is structured in the way we have just described. As we have also mentioned, such confrontation may have positive or negative epistemic effects. In the case of the latter, controversy spaces remain stagnant or blocked, resulting in conceptual and epistemic sterility. But in the former case, as the parties challenge each other, they may better articulate and refine their respective positions in response to objections and criticisms. Moreover, as has been remarked before, controversies may reveal hidden dimensions and implicit assumptions, thus opening up new directions for scientific or philosophical progress.

In the second sense of “dialectic”, as a mode or pattern of historical development and change, controversy spaces are structures that are formed, may expand or extinguish, and can undergo transformations such as the one here called refocalization. Intellectual history suggests that this pattern is quite widespread. To be sure, science and philosophy have patterns of development and change that are exclusive to each other, but refocalization, as is shown by the cases studies included in this book, is common to both fields.

Finally, let me emphasize that no universality claim for the model outlined in the preceding section is made, as usually is the case with models of scientific or philosophical change. Such claims often lead to the distortion of historical reality in order to make it fit the preferred model. Other possible patterns of change, differing from the pattern proposed here, such as the above mentioned complete substitution of a given controversy space by a new one, may be more adequate in some cases. However, recognizing the limits of this model does not prevent us from claiming that refocalization is a pattern that may be fruitfully applied in the

reconstruction of rather diverse historical cases of scientific and philosophical change.

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