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PREFACE
BRIDGING A GULF (...OR PERHAPS TWO!)

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This special issue of the European Journal of Analytic Philosophy collects six papers of international authorities in the field of philosophy of physics aiming to tackle a challenge that Sir Michael Dummett has publicly launched from the very pages of this journal in 2007 (Dummett 2007, 21-30; 2012, 15-24).

In our original intention Dummett was meant to respond to each of these papers. But since in the meantime he has unfortunately passed away, here we take the liberty to summarize with some care the target piece, significantly entitled "The Place of Philosophy in European Culture". In this paper, Dummett expressed two main concerns: a) philosophy does not communicate effectively with physics; b) the two main contemporary traditions in western philosophy, the analytic and the synthetic traditions, do not communicate much with each other. Dummett argues that overcoming these two problems is vital to grant philosophy its role and status within high culture; a status that, to make it clear, he thinks that sciences have partially lost because of their specialization. In the following we provide a detailed summary of Dummett's challenges and of the responses that such challenges have found in our six authors' essays; and then we draw a morale from the contributions of our authors.

Dummett's Two Challenges

For Dummett in order to belong to *high culture* (HC) a discipline must satisfy the following three criteria:

1) it requires great skills from the practitioner;
2) it must be capable to elevate the spirit;
3) it must be part of the life of a considerable number of people not just of a community of specialists.

For example music is part of the life of many people and not only of a restricted community of practitioners and it satisfies the other two criteria as well so music is part

of HC. Mathematics is not part of HC since its enjoyment approximately corresponds with being in a broad sense member of the community of mathematicians.

Philosophy, according to Dummett, might still retain the influence proper of disciplines that belong to HC. Philosophical conceptions such as Marxism or Cartesian dualism or mechanistic materialism have had an enduring influence on various aspects of the public life of the western (and not only western) world. Natural sciences have instead shared the destiny of mathematics: they are no longer part of the HC and their knowledge and appreciation is no longer viewed as something constitutive of the profile of a well educated person. The natural sciences are influential in our society but, according to Dummett, they are influential indirectly, through the authority that we attribute to experts. Thus, it is expertise and not direct circulation of specific scientific ideas in the large public that makes science influential. We will see that Lyre will suggest an adjustment even of this view.

To put it in terms of the criteria 1) – 3): sciences surely satisfy 1) and 2) but they do not go beyond the communities of experts that practice them; hence they do not satisfy 3). More specifically, any educated person can read a classic of philosophy without being in need of a particular training. We feel that on this point Dummett is endorsing quite a radical view extremely optimistic in evaluating the accessibility of a classic of philosophy to an untrained audience. Anyway, he believes that a classic of philosophy is also something seen as always open that conveys an irreducible complexity that can and must be appreciated reading it. In this sense philosophical classics are just like literary classics and an education in philosophy as well as in literature involves essentially the direct exposition to them. On the other hand, as Dummett puts it, the education proper of a scientist is based on a certain *residue* that the work of their predecessors leaves behind rather than in the exposition to the original works of such predecessors. A physicist doesn't need to read Einstein's original texts to learn physics.

To this difference corresponds a gulf in communication between natural science, especially physics, and philosophy. Dummett explicitly condemns the paucity of knowledge that the average professional philosopher has of physics. At the same time he complaints that "specialist philosophers of physics speak a technical language among themselves and fail to communicate with other philosophers in the main stream." (Dummett 207, 25; 2012, 19)

This amounts to his first challenge: bridging the gulf between physics and philosophy. The case of the various interpretations of quantum mechanics illustrates – in Dummett's view – that a deeper understanding of the basic concepts of a physical theory – such the one that the philosophers could offer – can have an impact on practicing scientists. As a matter of fact the various interpretations of quantum mechanics constitute – according to Dummett – a case of multiple theories of the relevant quantum phenomena. For the time being they are empirically equivalent but we cannot be sure that they will always be so. After all we have no genuine historical example of proper empirical underdetermination. So a certain philosophical interpretation could at some point turn out to be an alternative theory enjoying empirical support more than other versions of

quantum theory. At that point the situation would be of the utmost importance even for the practicing physicist who is ordinarily uninterested in the philosophical debate and is just interested in the prediction of experimental results.

Here Dummett is actually endorsing two views: 1) that ignorance of physics by philosophers is deplorable; 2) that the adoption of a technical jargon by the philosophers of physics limits or even prevents communication with other philosophers in the main stream. It seems that these positions present a potentially critical tension: Dummett does not seem to consider the possibility that understanding a discipline that has reached a high degree of specialisation and thus has implemented an appropriately technical jargon might require the development of some sort of sub-specialization by philosophers as well. One thing that some of our contributors actually show is that this sub-specialisation can nonetheless be fruitful and can allow for fertile interactions with the main philosophical stream, at least within the analytic tradition.

Let us come to the second concern that Dummett expresses, that of building a robust exchange between the two traditions of philosophical reflection. Here, Dummett goes back to some of the main themes of his intellectual activity. He recalls that the origin of these two styles of philosophising is to be found in the work of Bernard Bolzano. He also insists that Frege, the founding father of the analytic tradition and Husserl, the founding father of Phenomenology, saw each other as working at the same issues and as having similar aims. Looking at the current state of the art Dummett suggests that the gulf could be bridged if the two traditions re-enforce the current tenuous tendency to interact on some issue through some means appropriate to reconstruct a common language for exchange. Here Dummett constructively proposes a journal in which works from one tradition can be commented upon by respondents belonging to the other allowing for an intense cross-tradition debate to flourish. We will see that our authors can show that Dummett's interesting proposal of recovering a common language has been – at least partly – anticipated in the context of the philosophical studies of physics.

The Gulfs and the Philosophy of Physics

Ryckman

Keeping the focus more narrowly on the state of philosophy in philosophy of physics, and in line with Dummett's own view, Ryckman argues that the causes for the gulf between analytic and continental ("synthetic") philosophy are historical since they were rooted in the dramatic European vicissitudes occurred in the first half of the 20th century. Furthermore, he is convinced that the latter gulf persists for sociological rather than for conceptual reasons, and he believes that the current hegemony of scientific realism in the philosophy of science is one of the main reason of separation. In order to justify this thesis, he broaches his case study, centered on the General Theory of Relativity, which was received as a phenomenon of interest for high culture in Dummett's sense from its first successful test in 1919. Philosophical schools explicitly and implicitly shaped themselves around the new theory, which, in particular, was used by Schlick to express

a philosophical condemnation of any kantian-inspired philosophy of natural science. And therefore as a first step toward a realistic philosophy of science. If relativity was correct – Schlick argued – there could not be any genuine role for the human mind in shaping the phenomena. Phenomena admit no shaping because they are given to us with their own mind-independent structure. Kantians just confuse the theory, of course constructed by the human mind, with the facts that are instead mind-independent. According to Ryckman, successive developments in logical empiricism extended and articulated this idea with the rejection of the synthetic *a priori* and the adoption of the conception of theories as a combination of analytic *a priori* and synthetic a posteriori statements.

The refutation of *any* Kantianism by the theory of General Relativity was of course an overstatement and by no means a generally accepted position at the time in which Schlick stated it: important physicists and philosophers of the time disagreed with Schlick's conclusions. Among the scientific figures that well represent such a disagreement Ryckman summons the figure of Hermann Weyl, with his profound philosophical engagement with the mathematics and theoretical physics of his time. Ryckman in particular shows how Weyl's approach to physics was profoundly inspired by his philosophical interest in, and knowledge of, Leibniz and Kant. His main philosophical insight was to argue in favour of a constructivist view of physics driven by the human mind. Weyl's epistemology and metaphysics stand in stark contrast to the default realism of much contemporary philosophy of physics. Given that Weyl popularised part of it in the little book *Symmetry* destined to reach wide educated audiences he indeed constitutes a template for those who seriously wish to further communication between physicists and philosophers and between philosophy and the wider intellectual culture.

Ryckman is correct in individuating in scientific realism a point of separation between analytic and synthetic philosophy, but often this separation – certainly not in the case of Kant or the neokantians or Weyl – is due to an antiscientific attitude on the part of continental philosophy. It might be worth adding that the view that scientific theories are constructed, as Weyl had it, need not deprive them of cognitive value, and therefore of their claim to describe reality, which is exactly the position that is defended by a recent book by Debs and Redhead (Debs and Redhead 2007) and, we take it, also by Ryckman. This might explain why he is surely read more by philosophers of physics of analytic background than by continental philosophers.

Lyre

Lyre's strategy in his paper is to follow Dummett's chain of reasoning, by highlighting points that he either finds inspirational or critical. As a result, the paper appears as a forceful and passionate comment on Dummett's provocative piece.

The major element of disagreement with Dummett's paper revolves around the connection between the sciences, philosophy and high culture. On this point Lyre disagrees thoroughly with Dummett: according to Lyre, scientists are not taken seriously by high culture and by society at large; they are rather ignored and their influence on

society is instead indirect not in terms of expertise as Dummett has it, but in material terms, through the technological outputs that their work makes possible. This is surely quite different from being authoritative. Philosophers follow the same destiny, their work being as highly technical and anyway departed from any common aspect of life. The difference is at most in the public's perception: differently from what happens with physics or neuroscience almost everyone is convinced to have at least something to say that has some philosophical idea associated with it. Given the current state of the art in philosophy, it is not difficult to see how far from realistic such a conviction is.

When it comes to the relationship between physics and philosophy, Lyre and Dummett appear closer in their view. Lyre admits that Dummett's diagnosis is essentially correct and the distance between physics and philosophy has a twofold motivation rooted in both communities:

> a) philosophers, even of analytic orientation, pay only lip service to scientific endeavours;
> b) scientists do not consider philosophical issues, methods and concerns to be fruitful in their work.

Lyre also agrees with Dummett that ontological issues in physics might be the place where a profitable dialogue could begin. Nonetheless, his diagnosis of the divide between philosophers and physicists revolves around a further crucial distinction within the field of physics itself: in physics there are foundational as well as applied studies. The physicists pursuing the latter, however, are the vast majority. In their agenda philosophy simply does not feature at all. Thorough the example of his participation in the project "Epistemology of the LHC" Lyre brings in a very interesting cultural datum: The unusual size of this project, totally unprecedented seems to suggest that a rational examination of scientific methodologies can help to scale them appropriately for the new tasks. The interest is thus not conceptual but pragmatic in nature. Neuroscientists behave no differently. In other terms, the pragmatic attitude of applied science is progressively contaminating even the work of those scientists that might still be concerned with foundational problems. The divide seems thus destined to grow larger and with it the division between physicists and philosophers given that the latter are surely more attracted by foundational issues. After having reviewed the various open issues that making contact with science leaves open for the philosophers and the need for a more acute investigation of disciplines other than physics, Lyre considers the claim that Dummett makes about the need of bridging the gap between analytic and continental – or synthetic – philosophy. A part from agreeing with the idea Lyre makes the conclusive point that in his view this will have a lot to do with the two Schools clarifying their respective relationship to science.

Faye

Of the two gulfs denounced by Dummett (that between physicist and philosophers and that between the analytic and synthetic philosophers), Jan Faye concentrates on the former. In particular, he begins by attacking the discredit in which certain famous scientists throw philosophy by attacking the scientistic view defended in a recent book

by Hawking and Mlodinow (Hawking and Mlodinow 2010).

He brilliantly shows how such a book, as others that like this proclaim that "philosophy is dead", is only apparently uninformed by philosophy, since it simply ends up selling *bad philosophy*. Unfortunately, philosophers are often confused even by famous scientists with radical social constructivists, and therefore with enemies of science tout court (the same has happened to S. Weinberg in one of his latest books). Therefore, the second divide (that between analytic and continental philosophers, if under "continental" we gather also radical constructivists) is partially responsible for the deepening of the first: popular books by great physicists like Hawkins or Weinberg have a great cultural impact, and therefore contribute to the failure of communication between scientists and philosophers of science, and indeed, to the progressive discrediting of philosophy in the high culture, to the extent that the latter is influenced, as it should, by science.

In his paper, Faye argues that "metaphysics begins where science ends", and therefore seems to defend a sharp separation between metaphysics and physics. In a sense, one could attribute him the claim that physics underdetermine metaphysics; and philosophers of physics end up being metaphysicians, as it is often the case today, then the interaction between physics and philosophy is not going to become any deeper. Certainly however, underdetermination is also a phenomenon that occurs in science. Faye distinguishes in particular among three different forms of underdetermination, one ontological/ metaphysical, one semantical, one empirical. Only the latter two, according to him, occur in science.

Global underdetermination: a hypothesis is globally underdetermined by the empirical data if there are two alternative worlds which ascribe differing truth-values to the hypothesis in question, but where the empirical data remain the same irrespective of which world is the actual world"....

"Extensional underdetermination: a hypothesis containing theoretical terms is rendered semantically underdetermined by the language in which the evidence is expressed if the vocabulary of this language is inadequate to fix the extension of the theoretical terms."

Finally, we have a third type of underdetermination..., which Faye calls *"Local underdetermination:* a hypothesis is locally underdetermined by the empirical data in a possible world if every finite set of data is inadequate to determine whether the hypothesis is true or false". While the third type of underdetermination is endemic in inductively based generalizations of all empirical sciences, the distinction between the first and the second type of underdetermination is meant to separate physical interpretations of the formalism of a physical theory from metaphysical interpretations thereof. Not all interpretations of a physical theory are on a par according to Faye, and this view introduces an important and so far neglected distinction in the philosopher of physics community. Notably, since metaphysical interpretations of physical theories according to Faye are going to be always grossly underdetermined by physical theories, we would have in Faye's paper an explanation as of why philosophers of physics engaging in metaphysics and physicists fail to communicate with each other. In closing Fays puts forth a highly reasonable thesis, which somehow offers a brilliant solution to bridge the

gap between analytic and synthetic philosophy lamented by Dummett: "A philosopher should at the same time display special knowledge and general understanding. If philosophers keep cultivating both aspects of their competence by focusing their abilities on both analysis and synthesis, I believe that philosophy will continue to be alive and make new contributions to human understanding. It is Dummett's wish that "Philosophy may give birth to new disciplines which we cannot now imagine." This is my hope too. Nevertheless, it remains to be seen whether analytic philosophers have guts to renew themselves and become creative and unconventional instead of staying conform to common ideas and traditions. Philosophy is the best guarantee for critical thinking. Putting well-established "truths" into their proper perspective is the only way by which we philosophers can gain respect from scientists as well as non-scientists."

Butterfield

Butterfield picks up Dummett's challenge concerning philosophers of physics speaking a technical language among themselves, being thereby incapable of exerting a needed influence on philosophers. Dummett's complaint is that philosophers of physics should mediate between physicists and philosophers, but they fail to do so, because they do not speak to the latter (and often not even to the former!). Butterfield draws upon three connections between the philosophy of physics and Dummett's work. The first of these points regards the philosophy of time, and in particular the reality of temporal becoming, and therefore applies to both classical and quantum physics; the second and the third being, on the contrary are more specific to quantum theory, and are therefore physically more controversial than the first point, as they are interpretable along the lines of Everettian quantum physics. (Butterfield does not defend Everett, but only presents some interesting connections between everettian quantum mechanics and Dummett's philosophy, via the connections between time, modality and semantics).

As to the first point, and by making reference to brilliant previous work of his, Butterfield defends a naturalist, detenserist approach to the philosophy of time, in which the fact that we share a now but not a here (one of the two asymmetries between time and space he discusses), is explained by the thesis that "most of the objects we observe rarely change their observable properties during the time-lag involved in the process of observation". The connection with Dummett's work here is with Chapter 11 ('Thoughts') of Dummett's *Frege: Philosophy of Language* (1973), and the attempt is to show how philosophers of physics are capable of contributing to general topic within philosophy of time, metaphysics, philosophy of language, etc. In fact, since the time needed to perceive the state of object is much shorter than the time needed for objects around us to change, we can say that we observe the present of these objects, even though, strictly speaking we observe their past. Since we take as real what we observe, we can also explain why we tend to think that only the present is real.

The second topic involves the essential indexical, and relates Dummett's belief that an indexical-free, detenserist description of reality is necessarily incomplete to the indexical nature of branches in an everettian interpretation of quantum mechanics, and, in particular, to the subjective uncertainty before an Everettian `splitting' of the multiverse.

This subjective uncertainty is due to the fact that since the results of a measurement in an everettian framework will all realize, any observer before measurement will not know what "she" (indexical) will observe, even though she knows that her successors (also indexical) will observe one of the outcomes in the different branches (indexical), and not two or more outcomes simultaneously. Here Butterfield's overarching purpose is to show, against Dummett's first complaint, how the principle of charity in interpreting one's assertions within everettian quantum mechanics, and therefore questions in the philosophy of language may be relevant for the philosophy of physics, and conversely.

Finally, the third topic, broached in section 4, connects Barbour's (1999) denial that time is real to Dummett's suggestion that statements about the past are not determinately true or false, because they are not effectively decidable whenever we do not have traces of the past in the present. Butterfield notes some analogies and also some disanalogies between Dummett and Barbour's antirealism about time. In short Dummett is antirealist about most of the past (and he does not want to be), while Barbour is antirealist about time past present and future. (and he wants to be antirealist, since the basic stuff the universe is made of is instantaneous configuration space).

French and McKenzie

The aim of the paper is to defend the thesis that the engagement between physics and metaphysics is to be pursued because

> a) Metaphysics can offer a set of conceptual resources to treat metaphysical issues raised by current physical theories (to the benefit of the philosopher of physics)
> b) Insofar as metaphysics is concerned with the ultimate foundation of reality and physicalism is a taken as a basic tenet, physics is to be taken into consideration in order to develop an appropriate understanding of reality as well as of necessity and of possibility (to the benefit of the metaphysician).

Thus French and McKenzie agree with Dummett that the interaction between philosophy and physics should be enforced and made more substantial than it actually is. In arguing for this view they focus on the interaction (or better the lamented lack of interaction) between analytic metaphysics and physics. The kind of enterprise in which Ontic Structural Rrealism (OSR) is engaged because of its quest for an alternative metaphysics is a good example of what the authors have in mind. Ultimately OSR is committed to offering its own account of themes such like dependence, fundamentality, truth-makers and so on. The availability of a variety of metaphysical answers to those issues is an advantage. The relationship between philosophy of physics and metaphysics is akin to that between physics and maths. Hence, contra Ladyman and Ross 2007, *a priori* analytic metaphysics *should not* be discontinued.
On the other hand even assuming that metaphysics is the study of necessity and possibility it can be shown that philosophy of physics can play a fundamental role in regulating and constraining the answers that the metaphysician can find. As an example in favour of this point, the authors insist on the regulatory role that physics can play in the context

of the discussion about the nature of laws. French and McKenzie pick as an example of the troubles that a physics-free metaphysics experiences the quest for a notion of natural law. They appropriately divide the field between the reductionist and antireductionist accounts and take Lewis and Lange to respectively champion each of the fields. Both views are heavily criticised, convincingly showing that they are undermined by their distance from current physics. Lange's view is rejected because it revolves around the idea that it is possible to build a world with just one proton in which the laws of our world hold good. This appears untenable in the light of what follows from the Standard Model regarding the very nature of protons.

Similarly the Lewisian account insofar as it is based on the idea that intrinsicality and fundamentality are the same thing and on the assumption that is physics that tells what is fundamental, turns out to be untenable. Lewis conceives of intrinsic properties as those enjoyed by a particular even if it were the only inhabitant of a world. Gauge theories characterise fundamentality in such a way that the Lewisian idea of intrinsic is inapplicable to fundamental properties of matter.

Interestingly, French and McKenzie maintain that the rejection of these projects does not correspond to the rejection of metaphysics *tout-court*. It is due to a metaphysical mistake: it is their insistence on the notion of non-nomic facts that leads them astray. Rather they reassert the preferability of structuralist perspectives on this matters that in their view grows out of a tradition that is much more sensitive to science.

Dieks

Like Butterfield's first case study, also Dieks reviews a chapter in the philosophy of time to take issue against Dummett's complaint that philosophers of physics speak too technical a language to be able to interact with philosophers working in other fields. According to Dieks, it is indeed true that "examples exist to which this characterization of the philosophy of physics applies". Still, as a general claim it is unjust; and one may even wonder whether it is not more appropriate to complain that many mainstream philosophers take uneducated intuition more seriously than the results of modern science. According to Dieks, the philosophy of time illustrates quite well that the problem does not lie so much in technicalities but rather in the fact that "what physics, or science in general, tells us is prima facie in conflict with common sense and intuition". His paper shows that many intuitions leading to presentists' or A-theoretical metaphysical views (only present events exists) on closer inspection are untenable. The scientific-based B-theory of time (according to which past present and future exist on a par) "may explain our intuition better than the A-theory, even though the latter at first sight seems to completely mirror our direct experience.

In the first part, Dieks reviews the way physics deals with time in both classical mechanics and relativity theory, so as to explain in what sense it relies on B-theory. Then he uses the explanatory tool-box of physics supplemented with the B-theory of time in order to account for our temporal experience, in particular our experience of the passage of time. As a comment to Dieks' essay, we may add that it would be wrong to surmise

that continental philosophy is a re-elaboration of our experience of time, since much analytic metaphysics of time is nowadays devoted to defend the A theory of time from the perceived threats of relativitistic physics. His essay, together with Butterfield's piece illustrate why the threat is illusory.

Concluding Remarks

All in all, these essays confront from different perspectives Dummett's challenge of bridging the two gulfs. At the same time they provide a good sampling of the variety of forms of philosophical engagement with physics currently pursued. Butterfield and Dieks have tackled the challenge by offering examples of how current philosophy of physics in the analytic tradition is engaging physics at the foundational level and at the same time offering interesting contributions for the metaphysics of time and/or philosophy of language. French and McKenzie have shown how an appropriate understanding of physics can play a role in constraining our metaphysical frameworks. Finally, Faye and Lyre have engaged more closely Dummett's diagnosis of the current state of philosophy in wider culture offering alternative readings of some of the problems that motivates Dummett's challenge. Their position is somewhat more pessimistic than Dummett's one but it is interestingly based on a deeper understanding of the way physics works in present day society. Ryckman's piece represents the current openness of philosophy of physics: through his emphasis on the work of Weyl he has offered a case that shows how philosophy of physics can be the terrain for philosophers not only for making progress in communicating with scientists but also with philosophers of the other tradition. An element that as we have stressed above is surely more common in the philosophy of physics than in other areas.

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