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PUTNAM ON TIME AND SPECIAL RELATIVITY: A LONG JOURNEY FROM ONTOLOGY TO ETHICS

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ABSTRACT

In this paper I discuss Putnam's view on time and the special theory of relativity. I first locate Putnam's philosophical approach within a more general framework, essentially making reference to Sellars' distinction between the scientific image and the manifest image of the world. I then reconstruct Putnam's argument in favour of the reality of the future and the determinateness of truth-value for future tense sentences (Putnam 1967) by showing that it is based on three premises that generate a contradiction. In the second part of the paper I discuss Putnam's argument both by using later results belonging to the foundations of STR and quantum mechanics (Putnam 2005), and by invoking some conceptual analysis on the pseudo-predicate "is real". Since I will show that the presentists/eternalists debate is ill-founded if regarded as *ontological*, I will conclude that it boils down to our different *practical* attitudes towards past, present and future.

Keywords: special theory of relativity, presentism, eternalism, becoming, ontology, pragmatism

Introduction

Putnam's work on the philosophy of physics has been wide-ranging and highly original, both in the philosophy of physics (space and time and quantum mechanics) and in the philosophy of science in general. However, here I will concentrate mostly on a famous paper published forty years ago (Putnam 1967), not only because it has been very influential on the philosophical literature on relativistic time, but also because – from the moment in which I was captured in its gravitational field while writing my PhD thesis at the Johns Hopkins University – I have worked on some of its topics extensively.[1] Eventually, I will also bring to bear a more recent paper on quantum mechanics (Putnam 2005), which could be regarded as a sequel not only to his previous paper on quantum mechanics (Putnam 1965) but also to Putnam 1967. I am aware that by discussing just these two papers, I will be looking like a fly

[1] See for instance Dorato 1995, Dorato 1996 and Dorato 2000.

bothering a horse who has been (and still is) galloping in a free field, actually in many fields of philosophy. But discussing in depth a great philosopher is the best tribute that I can pay to honour him.

In a nutshell, in 1967 Putnam argued that the Special Theory of Relativity (STR from now on) implies that "any future event *X* is *already* real" (Putnam 1967, p. 243). Of course, this potentially misleading conclusion is not meant to entail the absurd view that *X*, which has not yet occurred *qua* event that is *future* relative to some coordinate frame's "here-now", *is now already* real or *was already* real relative to that very same frame. More charitably, Putnam's claim entails that after STR, reality ought to be understood *tenselessly*, so that existence is coextensive with what "has occurred, what is occurring now, and what will occur", a disjunction that can be regarded as a definition of tenseless existence. Correspondingly, also from a semantical viewpoint, according to Putnam STR implies that all propositions possess a well-defined truth-value independently of the time of assertion, and don't "become true" when (and only when) the event that they purport to describe occurs.

Here I will argue that the opposition between *presentism* – only the presently existing event exist – and *eternalism* – past present and future events are equally real – which is somewhat presupposed in Putnam 1967, is misguided.[2] Consequently, rather than an ontological or semantical debate, the true problem raised by Putnam's argument concerns the compatibility of a correctly defined notion of temporal becoming with the structure of Minkowski spacetime. Considering the fact that the paper I am referring to was written so long ago, one ought not to assume that Putnam would now disagree with my conclusion.[3]

However, before describing in more details why, according to Putnam, STR entails the semantic determinateness and the ontic reality of the future, it is important to locate his argument in a wider philosophical perspective. This will be done in the next section (1), by introducing Sellars' fundamental distinction between the manifest and the scientific image of the world (Sellars 1962). In the second section I will then offer a synthetic reconstruction of Putnam's argument, and discuss some possible ways-out from its conclusion, involving either raising doubts on the transitivity of a "reality" relation (or of a becoming relation), or the existence of events at a distance (or better, their "spacelike" kind of becoming). In the third section, I will connect this latter premise in the context of Stein's criticism to Putnam (Stein 1991), by synthetically bringing in some considerations from quantum mechanics that have been advanced also in "A philosopher looks at quantum mechanics (again)" (Putnam 2005), and that seem to re-establish Putnam's 1967 conclusion against Stein's. In the last section of the

[2] See Dolev 2006, who independently argued for a similar conclusion.

[3] This comment should not be regarded as a joke on his tendency to change his philosophical views rather frequently, but is rather meant to take into account the decisive influence that Yuval Dolev, a Ph.D student of his, had on him (personal communication by Putnam). On Dolev, see *infra*.

paper, I will finally evaluate the dispute between eternalists and presentists, so as to show that the ontological aspect of the dispute – much more than the semantical one, which is epistemically-driven – really dissolves into our different *pragmatic attitudes* toward past, present and future.

1. The background of Putnam argument: Sellars' influence and three different views on time and reality

I thought that it was quite fortunate that in the paper presented in Rome on November 6th 2007, Putnam explicitly quoted Sellars, since it confirmed my deep conviction that Putnam's approach to philosophy of science is closely related to his: "The aim of philosophy is to understand how things in the broadest possible sense of the term hang together in the broadest possible sense of the term" (Sellars 1962, p. 37). Of course, a crucial question is whether things hang together at all, and for Sellars this meant asking what is the relationship between the *scientific image* of the world with the *manifest image* that we have of it, where by "manifest" we should mean, roughly, "the world as it appears to us" and is re-elaborated by philosophical thought.

As I see it, Putnam's method was (and still is) to start taking the *scientific image* at face value: essentially, this means asking what physical reality must be like for our theories to be as predictively successful as they are. In our case, the scientific image specializes to the scientific image of time as it emerges from STR. On the other hand, he considered the manifest image of the world from the point of view of our phenomenology of time, and asked whether the two images can be regarded as compatible. In a word, I take it that one of Putnam's main aim in his 1967 paper was to inquire into the compatibility of the time of physics as it emerges from STR with the so-called "man in the street" view of time, to which he explicitly refers at the beginning of the article (1967, p. 240). Quite correctly, the main tenet of the manifest image of time that he considers is what is currently known as *presentism*, that is, the view that "All (and only) things that exist *now* are real" (Putnam 1967, p. 240).

While conflicts between the scientific image and the manifest image are a splendid occasion for serious and deep philosophical work, and possibly philosophy's most important vocation, I think that today's Putnam (and plausibly also his older self) would correctly warn us to steer away from two easy "ways out". The first would consist in resolving the above conflict by going instrumentalist about physics (or science), while taking the manifest image of the world as unchallengeable and unrevisable. By adopting this solution *a priori* and for all possible cases of conflict, it would be the scientific image that should always yield to the manifest image. The second easy solution is opposite but similar to the first in its radicalism, and would consist in claiming that mature physical theories are an infallible guide to ontology, so that whenever they are in conflict with the manifest image, it is the latter that should always yield *qua illusory*.

In his 2006 contribution to *The Ontology of Spacetime*, Dolev has also warned against what he calls "the exclusivity dogma", namely the view that "if something is not part of the ontology of physics, then it is not part of the world" (Dolev 2006, p.189).[4]

These two opposite attitudes, if taken aprioristically, would be wrong, and not just because we cannot exclude that sometimes the conflict ought to be resolved in favour of science, and some other times in favour of the manifest image. This invitation to a case by case analysis would of course be sound. But more importantly, one should bear in mind that it is possible to be both a scientific realist *and* a defender of the view that colours are, for example, *real, mind-independent* properties of objects. Such a third possibility is, in fact, given by the possibility that, on closer analysis, some conflicts between the scientific image and the manifest image might turn out to be only *apparent*, as it was the case with the Copernican revolution. The Copernican natural philosophers had to *explain* why the Earth may truly and absolute move – as absolutists about motion like Galileo and Newton had it – even though in our manifest image everything looks *as if* the Earth is at rest. Once we realized the features of inertial motion, and the fact that the Earth is approximately an inertially moving body, we came to realize why our perceptions cannot inform us of the Earth's traslational motion, since the latter is indistinguishable from a state of rest. In cases of this kind, we can maintain a realist understanding of the import of the physical theory as well as the accuracy of our manifest image of the world.

In light of Putnam's more recent work (Putnam 2005), I think that he would agree that conflicts between the manifest image and the scientific image cannot be overcome by slogans invoking "the unavoidable pluralism of our descriptions of the world": the ontology posited by a physical theory should in principle be capable of establishing connections with the world of our experience, since the latter world is the source of *the empirical tests of the theory*. If a physical theory were in radical conflict with our experience of the world, and it could not give any explanation of the origin of such contrast, we should not invoke the illusoriness of our experience, but we would rather have good reasons to reformulate or even abandon the physical theory.

According to Sellars, the manifest image is often the very source and object of philosophical analysis and explications. The reader will excuse this rather long quotation: "Now the manifest image … defines one of the poles to which philosophical reflection has been drawn. It is not only the great speculative systems of ancient and medieval philosophy which are built around the manifest image, but also many systems and quasi-systems in recent and contemporary thought, some of which seem at first sight to have little if anything in common with the great classical systems … For all these

[4] The view that physics is an infallible guide to ontology has been authoritatively defended, among others, by Reichenbach and Grünbaum – "If nowness were a fundamental property of physical events themselves, then it would be very strange indeed that it could go unrecognized in all extant physical theories *without detriment to their explanatory success.* And I hold with Reichenbach that "If there is Becoming (independently of awareness) the physicist must know it" (Grünbaum 1967, p. 20) – and is frequently defended also today.

philosophies can, I believe, be fruitfully construed as more or less adequate accounts of the manifest image of man-in-the-world, which accounts are then taken to be an adequate and full description in general terms of what man and the world really are." (Sellars 1962, pp. 37-38).

Attempts at conceptualising the manifest image of time in different ways can be traced in the history of philosophy quite easily. For instance, presentism has been defended by many philosophers of the past as an *ontological* hypothesis directly suggested by the manifest image of time, together with a less ontologically parsimonious view, allowing also the past to be real together with the present, a view that I will be referring to as possibilism, or the empty-future view of time.

Here are a couple of quotations showing how entrenched presentism has been in the history of philosophy.[5] Augustine, in the *Confessions* clearly defends the idea of the single time (the present) in which we live and think as the only real time: "Nor is it properly said, 'there are three times: past, present, and future'. Yet it might possibly be properly said, 'there are three times: a present of things past, a present of things present, and a present of things future.' For these three do exist in some way in the mind, and I do not find them elsewhere. The present of things past is memory. The present of things present, sight. The present of things future, expectation" (Augustine 1853, p. 239).[6]

Another famous quotation from the modern times will suffice to convince us that presentism has indeed enjoyed a special role in the philosophical explications of the manifest image of time: "The *Present* onely has a being in nature; things *Past* have a being in the memory onely, but things to come have no being at all, the *Future* being but a fiction of the mind applying the sequels of actions Past to the actions that are Present" (Hobbes 1988, p. 10). Notice that the semantical counterpart of this view would be a form of radical scepticism, as it would amount to claiming that only present tense sentences have a definite truth-value, while all past- and future-tense sentences would be deprived of a definite truth value.

[5] Possibly already Parmenides was a quasi-presentist, where "quasi" here means that reality according to him is an "eternal now". He was convinced of the unreality of time and becoming on the following grounds: the passage from the non-being of future events (future events are *not* yet) into their being real in the present was as absurd as the passage from the being of present events into a state of non-being, when they become past (past events are no longer). "Nor was [it] once, nor will [it] be, since [it] is, now, all together, / One, continuous; for what coming-to-be of it will you seek? / In what way, whence, did [it] grow? Neither from what-is-not shall I allow / You to say or think; for it is not to be said or thought / That [it] is not. And what need could have impelled it to grow / Later or sooner, if it began from nothing? Thus [it] must either be completely or not at all.
[What exists] is now, all at once, one and continuous..." (Parmenides, *On Nature*)

[6] Here is the original text: "Nec proprie dicitur Tempora sunt tria: praeteritum, praesens et futurum; sed fortasse proprie diceretur: Tempora sunt tria, praesens de praeteritis, praesens de praesentibus, praesens de futuris. Sunt enim haec in anima tria qaedam et alibi ea non video: praesens de praeteritis memoria, praesens de praesentibus contuitus, praesens de futuris expectation" (Augustine, *Confessiones*, XI, 26).

Many other quotations from contemporary authors could be provided, but I prefer to begin illustrating a second ontological/semantical view, also quite close to the manifest image of time: possibilism: "Nothing has happened to the present by becoming past except that fresh slices of existence have been added to the total history of the world. The past is thus as real as the present. On the other hand, the essence of a present event is, not that it precedes future events, but that there is quite literally *nothing* to which it has the relation of precedence. The sum total of existence is always increasing" (Broad 1923, pp. 66-67). The main thought here seems to be that by leaving the future wholly *empty*, we make sense *both* of the fact that our actions can give a (cosmically negligible) contribution to bring it about, *and* of our closely related intuition, hard to explicate in a clear way, that at any instant of time, there is a part of the history of the universe that is "fixed" and "definite", and a part that isn't.

The third view, certainly more remote from common sense, and often referred to as *eternalism*, can be illustrated by the following quotation: "There 'exists' an eternal world total in which past and future events are as determinately located, characterized and truly describable as are southern events and western events" (Williams 1966, p. 287). In the following, last quotation, supposing that Einstein is referring to an *ontological* distinction, we could have another illustration of eternalism: "For us believing physicists the distinction between past present and future amounts to an illusion, albeit stubborn" (Einstein and Besso, 1979, p. 312, letter dated, May 21, 1955).

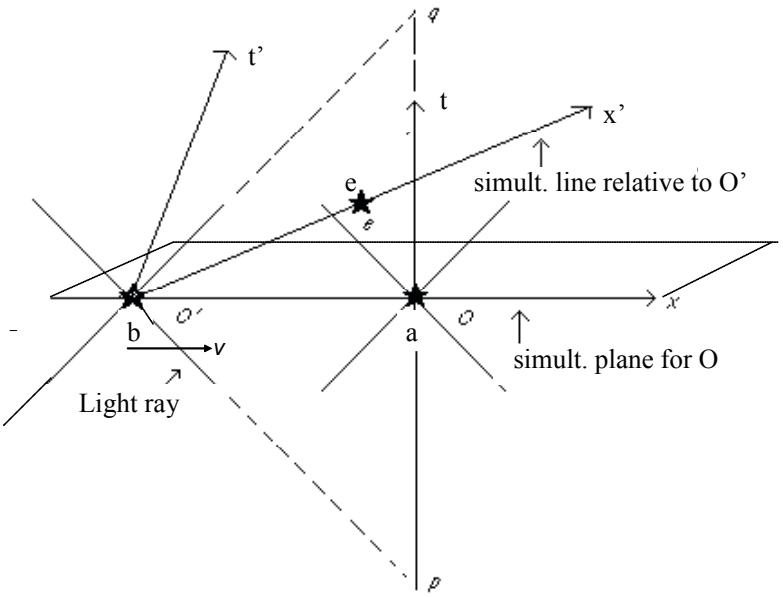
Which of these views, in decreasing order of closeness to our manifest image of time, is compatible with special relativistic time? Which of these seems to be mandated by the theory? These, I take it, were the main questions lying behind Putnam's 1967 paper.

2. Putnam's argument reconstructed

Putnam has been one of the first, if not the first, philosopher/scientist to notice an amazingly counterintuitive consequence of the special theory of relativity: events in someone's future light cone can be in someone else's *relative present* or even *relative past*! There are actually two ways to obtain these effects, which are rigorously obtainable from the mathematical/physical structure of the theory.

The first is assume two observers in relative inertial motion zooming past each other at speeds close to that of light: the spatio-temporal closeness of the two observers requires great speeds for these weird effects to be noticeable. The second way is to assume observers that are very far away from each other, but still in relative inertial motion. For example, one can calculate that if someone, simultaneous with our here-now, but located 10 billions light years away from us, were to *recede* from us at 16 km/h, her "instantaneous now", different from ours due to the relativity of simultaneity, would include events that in *our* frame happened 150 years ago! Analogously, if

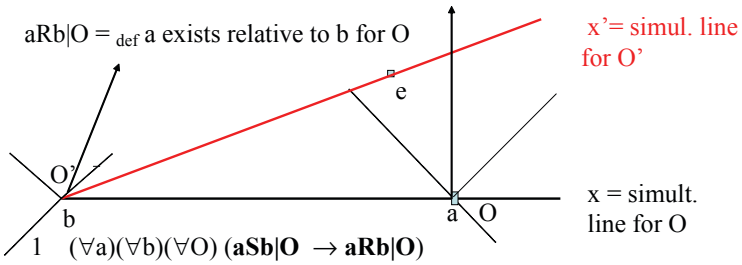
she approached us with the constant speed $v = 12$ km/h, her "simultaneity hyperplane" would include the first day of the year in XXII century, say the event *e* marked with a star in the figure below.[7]



Suppose the observer *O* is either a presentist or a possibilist, believing, that is, that the future "is unreal". Putnam's 1967 simple but brilliant argument is a consequence of the relativity of simultaneity, one of the pillars of STR: relative to the two inertially moving observers *O* and *O'*, there are two different simultaneity "three-spaces", which in the picture are indicated by *x* and *x'* respectively.[8] The event *e*, which is in the absolute future of the observer *O*, and therefore unreal relative to her here-now centered in *a*, *is simultaneous to observer O'*, since it is intersected by the latter's simultaneity space. If we assume that a presentist is committed just to the reality of whatever is simultaneous with her "here-now", then *e* is real relative to *O'* and *b*, while *b*, the here-now of *O'*, is real relative to *O*. *Transitivity* of the reality relation across different inertial frames concludes the argument, because anything *e* that is real relative to *b*, conjoined to the hypothesis that *b* is real relative to *a*, gives us that also *e* is real relative to *a*, contrary to our preliminary assumption about the unreality of the future event *e* relative to *a*! In the following diagram I schematised the whole argument, and in particular the premises leading to the contradiction contained in the box.

[7] These figures are taken from Greene 2005, ch. 5.

[8] Of course, one spatial dimension is suppressed for *O* and two for *O'*.



1 $(\forall a)(\forall b)(\forall O)$ (**aSb|O** $\rightarrow$ **aRb|O**)

(if two events co-occur for O, they coexist for O)

2 $(\forall a)(\forall e)(\forall O)$ **(**$\neg$**eSa|O** $\rightarrow$ $\neg$**eRa|O**) (if two events don't co-occur rel.to O, they don't coexist rel. to O: presentism)

3 R is **transitive** across different reference frames

Since eSb|O' then (for 1) eRb|O', and since bSa|O then bRa|O

But (eRb|O' $\wedge$ bRa |O) $\Rightarrow$ eRa|O for 3), against premise 2)

eRa|O $\wedge$ $\neg$**eRa|O**

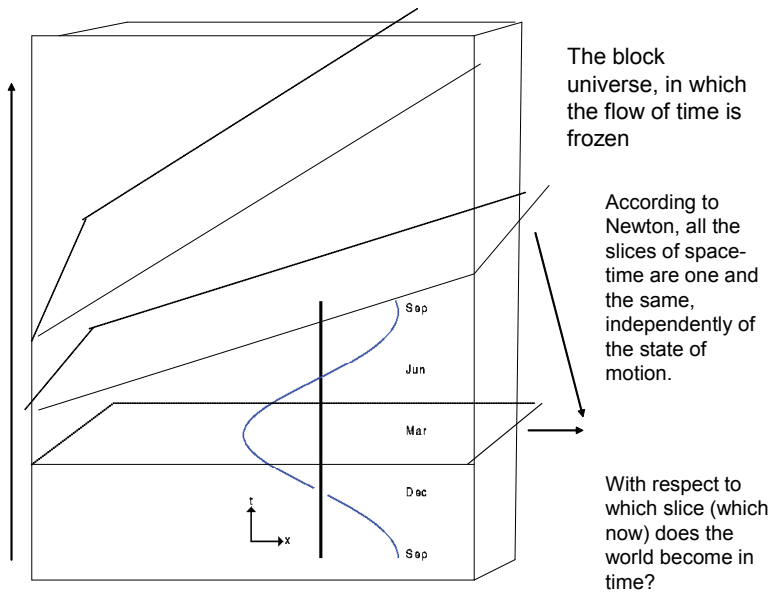
Note the crucial role played by the ternary relation denoted above by *aRb/O*, and defined as "event *a* exist (or is real) as of event *b* relative to observer *O*. While such a relation plays a crucial role in Putnam's argument, *the sceptic may observe that it has nothing to do with physics*! The relation is in fact *not* a physical relation, and it plays no role whatsoever in any physical theory I know of, unlike the other ternary relation of simultaneity, denoted above by S.

Putnam could of course rebut that *if* we want to judge the compatibility of presentism or possibilism as metaphysical/ontological reconstructions of two assumptions of the manifest image of time, we need to supplement STR with an additional metaphysical/ontological hypothesis, and see whether such an addition is consistent with the structure of the theory.

Since the question of the role of physics in metaphysical debates will be examined more thoroughly in the last section, here I will conclude my presentation of Putnam's argument with the following, crucial question: *which of the above premises should be abandoned?* Denying *transitivity* (3) would imply that what exists at a distance depends on a state of motion: a position that we could call "ontic protagoreanism". It seems reasonable to assume that the relation of existence as defined above *ought to be* transitive. Denying (1) does not seem palatable either: if *b* occurs simultaneously with *a* (relative to *O*), *b* and *a* coexist for *O*, *even if b is epistemically inaccessible for a* due to their being spacelike-separated. Among the three premises, Putnam concluded that it seems more plausible to deny "presentism": past, present and future events all coexist *tenselessly*, even though we should not express this conclusion, as he did, by claiming that future events and things "are *already* real", since, for reasons specified above, we would be mixing in the same statement the tensed (conveyed by the adverb "already") and the tenseless sense of existence, implied by "are".

If this is Putnam's conclusion *vis à vis* the ontological side of the debate, its *semantic* side was the second but not minor target of his paper. His opinion is that STR settles once and for all the Aristotelian question of the indefiniteness of the truth-value of future tense statements, which calls into question the view I called possibilism. "Aristotle would have added that there is a fundamental difference between the past and the future, viz., that past events are now determined, the relevant statements about them have now acquired truth values which will stick for all time; but future events are undetermined, and at least some statements about them are not yet either true or false … Aristotle was wrong. At least he was wrong if Relativity is right" (1967, p. 244). The old issue of the sea battle mentioned in the IX book of *De Interpretatione* is then settled once and for all: all past and future tense statements are either true or false independently of the time of assertion. This is how he wraps things up: "I conclude that the problem of the reality and the determinateness of future events is now solved. We have learned that we live in a four-dimensional world and not in a three dimensional world … Indeed I do not believe that there are any longer any *philosophical* problem about Time" (1967, p. 247).

Another remarkable consequence of Putnam's article was not addressed by its author, however, and it is worth mentioning for the sequel of this paper. To the extent that the notion of *temporal becoming* presupposes the unreality of future events as its necessary condition, STR seems to rule out also temporal becoming. In the picture below, there is no privileged time (or no separation in cosmically extended past and future events) relative to which the world "unfolds": the universe is like a *block* or a big loaf of bread that can be "sliced" by hyperplanes of simultaneity in different, equally legimate ways. Relative to which of these "slices" does the universe *become* in time? If none of the slices can be regarded as privileged, there is a sense in which none of them can represent the unfolding of the universe in time, and the river of time seems to freeze.



3. Stein's criticism of Putnam's theorem: quantum mechanics to Putnam's rescue?

It could be argued that our endorsement of some of the premises of the argument was too quick. However, transitivity should be granted, despite the fact that defining reality in terms of simultaneity might induce one to reject it, especially since STR has rejected the transitivity of simultaneity across different reference frames.[9] If it makes sense at all to introduce a notion of *reality* in a philosophical reconstruction of the ontological consequences of a physical theory, such a notion calls for transitivity *as a matter of meaning*. Furthermore, by denying transitivity, two observers zooming past each other would share the same present without sharing what is real at a distance, and by simply changing reference frame (getting off a bus or jumping on an airplane), we would change what counts as real for us at a distance. Rejecting the transitivity of the relation *R* seems to be a much less palatable option than denying presentism.

Could we not deny that what occurs at a distance and is simultaneous with an event *a* in a frame is *ipso facto* real for *a*? (premise 1). This move could be justified on a verificationist ground (if event *y* does not register on *x*' worldline, *y* does not exist for *x*) and would seem *prima facie* admissible, given the original empiricist foundations of the theory of special relativity. After all, the theory is founded upon a very successful verificationist move, the epistemic inaccessibility of distant simultaneity (Einstein 1905), and the relativity of simultaneity may justify one to believe that the present moment, relative to an event, coincides with the event itself. By introducing a binary relation between spacetime points ("being determinate as of"), and by imposing upon it some plausible axioms, Stein (1991) could in some sense be interpreted as trying to justify the pointlike nature of "being present", since the upshot of his theorem is that for any point *p* in Minkowski spacetime, only the points in the causal past of *p* are *definite*.

In order to try to tackle the decisive question "what does *definite* mean?", I will briefly review the premises of his theorem, which might be viewed as implicitly defining the notion in question. Working with a beefed up model of Minkowski spacetime, $M = < R^4 , \eta_{ab} , \Uparrow >$, where $\Uparrow$ is a temporal orientation, Stein proves that

if

1) "Being definite" is a binary *relation* between pointlike events: $xBy =_{def}$ "*y* is definite as of *x*";

2) Such a relation is *non-universal*: for all events *x* of spacetime, there are events *y* such that *–xBy*;

3) *B* is reflexive and transitive;

4) *B* is invariant under automorphisms of M preserving the temporal orientation $\Uparrow$;

[9] See Sklar 1985 for a defence of this claim and Dolev 2006, p. 183 for a new vindication of it.

5) for any pair of events such that the vector *ab* is past pointing, *b* is definite as of *a:* $\forall a \forall b(aK_p\, b \rightarrow aBb)$;

then

being definite is co-extensional with the relation of past causal connectibility: for all *x* and *y, xK_py* iff *xBy*, so that the relation *B* can be uniquely defined in terms of the causal structure of Minkowski spacetime.

If being definite meant "being real", and the premises of the theorem were acceptable, its conclusion would amount to a vindication of a special relativistic version of possibilism, since only the points in the causal past of any event are real as of that event!

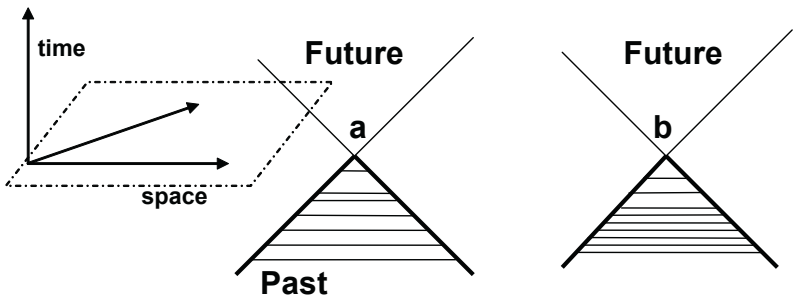
Well, there are no doubts that this is the intended interpretation, since Stein was responding, among other things, to Nick Maxwell's claim that special relativity and quantum probabilism were incompatible, based on reasons similar to those already given by Putnam in 1967 (Maxwell 1985). The question, for Stein, is to show that "at each stage, the entire history of the world is separated into a part that has already become – 'is ontologically fixed and definite', as Maxwell puts it (1985, 24) – and a part that is not yet settled" (Stein 1991, p. 148).

While Stein brings in the issue of becoming,[10] not explicit in Putnam's paper, and tries to prove its compatibility (and therefore the compatibility of the time of our experience) with the temporal structure of STR, his conclusion and Putnam's are clearly at odds. According to Putnam, eternalism is the only view compatible with STR, while for Stein, if we accept his premises as reasonable, possibilism turns out to be implementable (and uniquely so) in the structure of Minkowski spacetime. Which of the two philosophers is correct?

While in the next section I will try to argue – along with Savitt (2006) and Dolev (2006) – that the *ontological* dispute between presentists, possibilists and eternalists is devoid of a clear meaning, so that there is no real disagreement between Putnam and Stein from this viewpoint, in the remainder of this section I will try to defend the claim that, *if the ontological dispute were genuine*, introducing *quantum* phenomena in a world characterized by relativistic becoming *à la* Stein would vindicate Putnam's eternalism.

Crucial to this argument is a simple corollary to Stein's theorem: since all and only the events that are in the causal past of events *a* and *b* are definite relative to *a* and *b* respectively, it trivially follows that *a* and *b* aren't definite as of each other: *-aBb* & *-bBa* relative to any observer whose here-now coincides with *a* and *b*.

[10] This is why he presupposes an asymmetric notion of causal connectibility.



Imagine an Aspect type of experiment in which *a* and *b* are spacelike-related measurement outcomes. Either there is causal influence between the two wings of the experiment or there isn't. Let us assume the first alternative: if some sort of causal influence between the two wings of the experiment were admissible,[11] we would have *both aBb and bBa* on the basis of a modification of Stein's premise 5). In fact, the reason for assuming that premise is that whatever causes *b* needs to be regarded as definite as of *b* (alternatively, as having become with respect to it). This, however, would contradict the corollary that *-aBb* & *-bBa*. If we interpreted quantum non-locality in a causal way that implies action at a distance, we would violate the condition of relativistic becoming because the corollary would be violated.[12] STR conjoined to quantum physics would imply eternalism and Putnam's argument would be vindicated. Suppose now that the correlations were non-causally interpretable, an issue that is interpretation-dependent and might be regarded as still open. Also in this second alternative, however, it would still follow that the nonseparability between the two measurement outcomes *a* and *b* would be *sufficient* to rule out Stein's type of becoming, since *a* and *b* ought to be regarded as mutually definite (see Dorato 1995 and Dorato 1996, and for a contrary view, Myrvold 2003).

Bringing quantum mechanics into the picture might be regarded as equivalent to changing the rules of the game, though, given the lack of a shared interpretation of the quantum formalism. In Bohmian mechanics, for instance, for which there is no developed relativistic form yet, an absolute time is needed, and likewise in the GRW theory invoking a collapse of "density of stuff". Currently, only Tumulka's version of the flash-theory of GRW is relativistic invariant (Tumulka 2006). In other words, it is still unclear whether quantum mechanics and special relativity are really compatible, so that it might be too soon to try to learn lessons about time from their conjunction.

[11] This causal interpretation of non-locality is favoured by Bohmian mechanics.

[12] On the basis of an extension of Stein's theorem due to Clifton and Hogarth (1995), "spacelike" forms of becoming are ruled out, i.e., no two spacelike-separated event can become as of each other unless becoming is the universal relation (all events have become as of any event). Clearly, if the becoming relation is universal relation, there is no becoming at all.

The fact that we can assume their compatibility **F**or **A**ll **P**ractical **P**urposes (FAPP) can be interpreted in a dual way. On the one hand, "practical purpose" might mean, in Bell's sense, "lack of an accepted ontology", and therefore a prohibition to draw metaphysical lessons about quantum mechanics and special relativity. On the other hand, the fact that any empirically adequate future extension of quantum mechanics will have to incorporate the quantum non-local correlations might mean that the hypotheses required by Stein, Clifton and Hogarth are incompatible with quantum mechanics.

Be that as it may, if one wants to find out about becoming in the real physical universe one should consider cosmological models in which a cosmic time *is* definable. For example, isotropic and homogenous cosmological models in stably causal spacetimes (no closed timelike curves) reinstate a complete temporal order. And finally, one should open one's perspective to the current attempts at unifying quantum mechanics with general relativity, in which one finds some timeless and changeless models *vis à vis* some other attempts admitting a cosmic time. In this respect, I cannot resist quoting an interesting speculation contained in Putnam (2005), a must-read by anyone interested in the philosophy of quantum mechanics:

> … what relieves my initial distress at the idea of an absolute time coming back into the picture is the following thought: it might not be quite as bad a contradiction of Einstein's vision as it first seems. It might be that, before we 'superimpose', each space-time is perfectly Einsteinian—each space-time is a Minkowski space-time which knows nothing about any 'simultaneity'. And it may be that the time parameter that both GRW and Bohm need is just the absolute time parameter that quantum cosmology seems to need. Of course, this is just a speculation. But it would mean that, although Einstein would have to admit that there is such a thing as simultaneity, it comes from 'outside' any one well-defined space-time, it comes from the quantum mechanical 'interference' between whole space-times. (Putnam 2005, p. 632)[13]

If enlarging our perspective is certainly needed if we want to know whether there is becoming in the physical world, here I will have to restrict myself to these scanty remarks, given that Putnam has not explicitly dealt with this question in print.

In a word, while *a propos* of the question "which is the best ontology for Minkowski spacetime?" I want to suspend judgment until the next section, for now I would defend a revised version of Stein's local becoming, where the revision entails that Stein's result should be deprived of any ontological significance. More precisely, this means that his relation of "being definite" should be dropped altogether, and replaced by a time-asymmetric relation of becoming, so that his theorem would not involve the attempt at

[13] For a discussion of some philosophical problems (among which the changelessness of the universe) in classical general relativity, see Dorato year, Pauri 2004.

establishing what is "ontologically fixed at a spacetime point", but rather what has and what has not become relative to any event in Minkowski spacetime. Interpreted in this way, and not as a contribution to ontology, Stein's result is interesting, because, by confining the *physical* present of any event to the event itself, and relativizing becoming to worldlines and worldtubes, it helps us to see how it is that *the manifest image of time came to contain the false belief that the now extends at cosmic distances*.

The psychological present is spatially extended in proportion to the duration of the specious present and to the immense speed of light. Consider 30 msec as the threshold under which *two* distinct, temporally separated light signals are perceived by humans as being *one and the same signal*. Multiplying 30 msec by 300.000 km/sec gives a practically immense distance (9000 km): our eartly experience (i.e., when we don't look at the night sky or the Sun) takes place within a spherical "bubble" of psychical simultaneity (presentness) whose radius is approximately 9000 km. Within this "bubble" we cannot discriminate a light signal *L* coming from objects lying on the surface of the bubble (that are 9000 km away from the center of the sphere where we are located), from light signals *L'* emitted 30 ms later just around us, since *L* and *L'* are perceived as *one* signal, and therefore as being "at the same time". This remark helps reconciling the manifest image of time, entailing a belief in a cosmically extended present, and the physical image of time, relying on the relativity of simultaneity, and implying that there is no fact of the matter as to what is occurring right now on Andromeda independently of a particular inertial frame.[14] This claim in particular is addressed to Dolev's criticism of Stein result (Dolev 2006), given that also within Stein's picture, it is possible to claim that each event is either past, present or future, even though the notion of being present clearly turns out to be *mind-dependent*. What we regard as present is strictly speaking *past*, and is impinging on our senses from the past light cone centered on our bodies. When I look at the moon, I see it as it was approximately half a second before. The further question whether in STR there is something objectively occurring "right now" on Andromeda seems to be not only relative to a given frame, but also purely conventional, and this result holds simply as a consequence of the relativity of simultaneity.

In any case, as far as this particular debate in the foundations of physics is concerned, for better or for worse it still goes on, and has been inspired, as many other things in other fields of philosophy, by Hilary Putnam's decisive contributions.

[14] For more details, see Stein 1991, Dorato 2006a, Arthur 2006, Savitt 2007.

4. Presentism and eternalism, or how to dissolve an ontological issue into a practical one

In the literature on the compatibility between relativistic time and the manifest image of time, there are at least *three* different senses of "a real or unreal future" that are frequently confused, to the detriment of clarity. The first is "the real as *the determined*", an epistemic or metaphysical sense, depending on how determinism is construed (predictability/retrodictability *versus* metaphysical relations of "events + laws fixing other events"). In this first sense, laws and initial conditions uniquely fix past and future events, and a future (past) event is real if and only if it is determined by laws and initial conditions. This is not the sense that is relevant in evaluating the metaphysical consequences of STR, since the geometrical structure of Minkowski spacetime by itself is clearly *not* sufficient to enforce determinism or indeterminism, despite the fact that special relativity is somewhat friendlier to the requirements of determinism.[15] And Putnam did in fact correctly concentrate on the other two senses, namely, "the real as *the determinate*" (a *semantical* sense, having to do with the definiteness of truth-value of future contingents) and the real as *the existing* (an *ontological* sense). The argument to be presented shortly have been independently supported by Dolev (2006) and Savitt (2006), and will just touch upon the ontic side of the dispute, and will therefore ignore (implausible) epistemic theories of truth, in which truth does not transcend the assertability conditions.

Let us begin by carefully distinguishing between two different uses of the copula "is" or of the verb exist, the *tensed* and the *tenseless* one.

DEF$_1$ An event *e* "exists" in the tensed sense of "existence" iff *e* exists now.

The above definition *is contrasted* with the following definition of tenseless existence:

DEF$_2$ *An event e "exists" in a tenseless sense of "existence" iff e existed, or exists now or will exist.*

Note that DEF$_2$ *is* useful because it can be *contrasted* with the abstract sense of existence of numbers, classes and mathematical objects, whether one believes that such an existence is needed in one's ontology or not.

I can now state the Dilemma of Presentism, which is committed to the view that

"Any future (past) event *F* (*P*), as of the present time *t*, doesn't *exist*" (*is* unreal).

The italicized copula "*is*" or the verb "*existence*" in the above sentence is either (i) tensed or (ii) tenseless, *tertium non datur* (*abstract* atemporal existence is irrelevant here).

[15] Earman noted that the claim (often associated to the special theory) that there is an upper limit to the velocity of propagations of signals prevents the existence of "infinitely fast invaders" coming from infinity and intersecting future time slices without having registered in the present (Earman 1986).

(i) In the former case, presentism becomes a triviality (*F* does not exist or is not real means that *F does not exist now* or is not real now). Both presentists and eternalists must agree that whatever occurs in the future (past) does not exist *now*!

(ii) In the latter case, presentism runs into a contradiction: supposing that at least *some event F will occur* (*has occurred*), *that something is* (tenselessly) real or existent in virtue of DEF_2, and it cannot be (tenselessly) unreal, as presentism has it. Of course, a presentist will not want to deny that something will occur, or that something has occurred, unless presentism turns into the apocalyptic view that the world will come to an end after the present moment (or, to explain the disappearance of past events, is created anew every moment, as in occasionalistic metaphysics).

In a word, presentism seems to be caught between the Scylla of a triviality or the Charybdis of a contradiction. Is this a refutation of presentism and an endorsement of eternalism? No, because if it is not clear what it means to claim that the future (the past) is *not* real, it is not very informative to claim that it is real either (it amounts to the trivial claim that something will occur after the present moment).

As a matter of fact, other attempts to defend the genuine character of the dispute between presentists and eternalists often charge eternalism with absurd consequences attached to DEF_2. What does it mean to affirm that past, present and future events *are* equally *real*, or *exist* on a par, or tenselessly coexist? First of all, tenseless coexistence ("existence on a par") does not entail coexistence in a *Totum Simul*: timelike-related events in Minkowski spacetime (or any classical relativistic spacetime) are *temporally separated* and do not coexist in the sense that they are simultaneous. Since *the reality of the future does not mean its simultaneous coexistence with the present events*, there cannot be any possible disagreement with presentism about this point. Analogously, even though it is always true to assert that "event *F* occurs at its own spatiotemporal location", such an *eternal truth* about *F* in no way implies the *eternal existence* of *F* (existence at all times of single, localized events is absurd). Since the reality of future events does not imply their eternal coexistence, there is no possible disagreement here either! Other philosophers have insisted that the dispute is about the truth makers of claims like "there *exist* dinosaurs", or "there *exist* human outposts on Mars".[16] While presentists claim that there *are* no truth-makers for these claims, eternalist disagree. But note that this reformulation is subject to the same dilemma between triviality and contradiction noted above, since the italicised copula is either tensed or tenseless. So where does the alleged disagreement lies?

I want to advance the claim that the debate between eternalists and presentists is a pseudo-debate for at least four reasons.

[16] This point was suggested to me by Barry Lower in a personal communication.

1) The pseudo-predicate "is real" should only be used in cases where there is a clear contrast class between what is real and what isn't (think of "a real coffee" *versus* a surrogate coffee or a "real team" versus a disorganized assembly of players).[17] The presentist/eternalist debate lacks such a contrast class, because it is not clear at all how to make sense of the claim that the future (the past) *is* not real (the copula here *is* understood in a tenseless sense, the only one about which there could be some disagreement). As we will see below, the lack of what I refer to as "a contrast class" has been particularly stressed by Dolev (2006).
2) Once tensed and tenseless existence are clearly distinguished, we have seen that it is difficult to state a single ontological claim about the past and the future about which there could be a genuine disagreement: presentists and eternalists do not disagree about the fact that "the future will exist but it does not exist now".
3) Ruling out the legitimacy of the tenseless "is" or the tenseless "exist"—a presentist's possible but desperate move—would amount to denying oneself the possibility of distinguishing concretely existing entities from merely possible or abstract entities.
4) The fact that the tensed sense of existence might be regarded as more entrenched or more fundamental in our language – a claim which looks highly reasonable – does not entail by itself an ontological bias toward tensed existence over tenseless existence, once the latter is purified from some frequent misunderstandings.[18]

In conclusion, I would like to state a claim about which I think Putnam would not disagree at all these days: sometimes, according to our different purposes, we rely on the tensed sense of existence, and then we take a *perspectival* attitude toward reality; some other times, for different purposes, we rely on a tenseless sense of existence, and we look at reality from "nowhen". If reality is spoken about in many ways, both senses are well-grounded and useful in our language. *Such a pragmatic difference commands only a linguistic choice, one that, however, can make no difference about ontological commitments.*

The need to drop ontology in our context has been forcefully argued also by Dolev, who refers to the widespread claim that the difference between past, present and future is to be analyzed in ontological terms as the "*ontological assumption*" (2006, p. 178). He correctly (in my view) rejects such an assumption as unintelligible, by developing Austin's remark that in the case of "real" it is the negative sense that "wears the trouser".[19]

[17] "The function of the word real is not to contribute positively to the characterization of anything, but to exclude possibly ways of being not real" (Austin 1962, p. 70). This reference to Austin was reminded to me by Dolev in his presentation in Montreal, for which I thank him (see Dolev 2006). I had made reference to the emptyness of the predicate "is real" (along kantian lines) already in my Ph.D thesis in 1992 (see Dorato 1995), where I tried to establish whether relativity rules out "the becoming determinate" and the "becoming determined" of previously undetermined and indeterminate events.

[18] For a fuller articulation of arguments 2, 3, 4, I must refer to Dorato 2006b, Dolev 2006 and Savitt (2006). Argument 1 is spelled out in some more details in the following.

[19] "Next, 'real' is what we may call a trouser-word. It is usually thought, and I dare say usually rightly thought, that what one might call the affirmative use of a term is basic—that, to understand 'x,' we need to know what it is to

Dolev writes: "in general, assertions that something is (or is not) real are meaninful only when they can be used to rule out concrete ways in which the thing spoken of coulod be not real (or real). Accordingly, the question "Real or not?" can be meaningfully raised on a given occasion only if, on that occasion, a definite and relevant way in which the thing in question can be real, and a definite and relevant way in which it can be not real, are specifiable" (Dolev 2006, p. 180).

Suppose that we affirm, along with the presentists, that "only and all present events *are* real". This is the positive sense of "real": consequently, if Austin is right, for presentism to make sense there has to be a way for present events *not* to be real. At this point Dolev rhetorically asks what is the contrast class of what presentism asserts, that is, "what form of being *not* real is excluded by such an assertion?... To say that they are real in the way that past and future events are not real begs the question twice." (Dolev 2006, p.181). As he explains, we beg the question in a first sense, because we are trying to establish whether past and present evens are real or not, and cannot presuppose lack of reality for non-present events with a *petitio principii*. In the second sense, we beg the question because we are assuming (in a vicious circle) that is makes sense to claim that past and future events are *not* real just to make sense of the claim that only present events *are* real (Dolev 2006, *ibid*.)

It might be tought that we can evade Austin's and Dolev's challenge by avoiding the pseudopredicate "is real" and talking instead about a temporally unqualified sense of *existence*. This move however can be countered by the remark that in the expression "all and only present events *exist*", the verb "exist" is either *tensed* or *tenseless*, so that the point raised in 2 above applies: we are either peddling tautologies or selling contradictions. In reply it could be argued that the verb "exist" is neither tensed nor tenseless (tertium datur) but simply *used* in a more general sense, one that can be made true by the existence or non existence (in this general sense) of the relevant truth makers. However, there is, once again, a problem of lack of contrast class: it is not clear (to me, at least) what it *means* to claim that future events do not exist in this general, temporally unqualified way, if we thereby don't mean that they do not exist now"!

The dissolution of the ontological side of the debate does not entail that the disputed issues are devoid of practical consequences. Leaving aside theories in which truth does not transcend assertability conditions as implausible, one might want to look at the ethical existential "interpretations" of the various pseudo-ontological positions at stake. Claiming that only the present exists really should be regarded as meaning that we should only worry about the present: *carpe diem*, or seize the day, the famous motto advocated by many hellenistic philosophers influenced by Epicureanism.[20] Much later, we find different readings of the motto. According to Kierkegaard for instance, don Juan – the symbol of the aesthetic life – tries to transform the present experience into something provid-

be x, or to be an x, and that knowing this apprises us of what it is not to be x, not to be an x. But with 'real' (as we briefly noted earlier) it is the negative use that wears the trousers" (Austin 1962, p.70).

[20] See the beautiful reconstruction of the hellenistic ethical outlooks by Pierre Hadot (2002).

ing value to his whole life, but escapes from any sort of *commitment* that would keep together his past and his future together with the present moment.[21] On the other hand, the figure of the judge, or the married man – the symbol of the ethical life – considers the future as real as the present and the past, and it is such a ("Rawlsian") concept of a *life plan* that keeps together his life by binding his past to his future.

If I am right in claiming that the ontic debate between presentists and eternalists dissolves, such human practical attitudes toward the present and the non-present are the only aspect of the debate that survives and that really matters.

Living only in the present (presentism), *versus* keeping faithful to one's past commitments (the past is as real as the present, or possibilism), *versus* considering each present action and past commitment as a step toward the realization of a future goal (eternalism) are the different practical options that we have and that "correspond" to the ontological positions sketched above. We might endorse these attitudes in different ways at different stages of our life (the personal future might be more important at younger ages, thought not the collective one), and different persons might have different attitudes. Of course, much more would need to be said about these different pragmatic attitudes and the role that they play in our lives and here I can simply name them. But considering that also the recent Putnam insisted on having "ethics without ontology" (Putnam 2004), the dissolution of an ontological debate into a pragmatic attitude might not find him on an unsympathetic position.

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REPLY TO MAURO DORATO

HILARY PUTNAM

(1) I believe that Yuval Dolev, Mauro Dorato, and Steven Savitt are absolutely right, and that the question whether the past and the future are "real" is a pseudo-question. In my view, what still survives of my 1967 "Time and Physical Geometry", after their criticisms, is that the philosophical position that statements about the present and the past have determinate truth values, whereas statements about the future do not, is incoherent. But, like these three authors, I am *not* convinced by a well known criticism due to Howard Stein. Stein's objection to my argument was that I overlooked the possibility of *relativizing the notion of reality* (or "having become", in his terminology). On his proposal, what "has become" relative to an observer at a time is what is in the "here-now" of that observer or else lies in the past light cone of that observer, and this is a relativistically invariant notion. In my view, Stein simply misses the issue I was addressing, which is whether future events are real *in the standard metaphysical understanding of "real"*, on which what is "real" is precisely supposed to be *mind-and-observer-independent*. At best, Stein's view, like Dorato's, rejects my question, but if one is going to reject the question, I prefer to be up front about that rejection, in the way Dorato is.

Let me mention that, as an immediate consequence of the Lorentz formulas, the time displacement of events at a distance depends not only on their relative speeds, but also on their relative distance, and the effect is significant even when the relative velocities of the observers is small relative to the speed of light. In fact, if we choose a star system that is only ten light years from here, then if I am in Singapore (roughly on the Equator), and my friend Jack Smart is at the antipodal point from me (also near the Equator), so that our relative velocities due to the Earth's rotation are of the order of 3200 km per hour, and each of us chooses a rest system in which he himself is at rest, we will differ about when an event in that distant system took place by *several minutes*!

(2) As to what Mauro Dorato says about the relationship between the manifest image and the scientific image, I want to say that the manifest image can certainly be corrected by science—but not only by science: philosophical reflection has long been a major source of correction.

Let us begin with the original form of the idea of two incompatible "images"—Eddington's celebrated "two tables". According to Eddington, there is a table that physics has shown to not really be solid because it is mainly empty space, and therefore the table of the manifest image is not identical with the table of the scientific image. That argument depends on assuming that the ordinary language term "solid" has a semantics which

makes almost all of its descriptive occurrences false. But what kind of linguistic methodology is that? Doesn't it make more sense to claim that there is a sense of "solid" in which to say that something is solid *isn't* to say anything about its microstructure? In fact there is a field of physics called "solid state physics"—but if physics has really shown there are no solids, how can there be a solid state physics? Physics may have shown there are no ghosts, but it doesn't go on to create a field of physics called "ghost state physics", or "ectoplasm physics"!

Similarly, there are exaggerated claims sometimes made by psychologists about the alleged falsity of "folk psychology" (another part of the "manifest image"). It is very easy to construct clever experiments to show that people sometimes rationalize and invent a reason why they did something, which wasn't actually the cause of their behavior. But to conclude that we don't really *eat because we are hungry*, we don't really *turn on the water in the bathtub because we want to take a bath*, we don't really *take an unpleasant job because we need money*, we don't really *try to impress that person because we are in love with them*, etc., is nonsense.

Nevertheless, I do expect that science will *sometimes* correct folk psychology. In fact, it already has. Here is an example: I know that there are a lot of mistakes in Freud. He had the typical Viennese *Gelehrter's* arrogant sureness about his own opinions, *plus* the great psychologists' over-ambitiousness (recall that in the *Treatise of Human Nature,* Hume claimed to have done for psychology what Newton did for physics!). Freud vastly overgeneralized from a small number of cases, he was overly reductionist, and so on. *But the unconscious is still importa*nt. And I think folk psychology did undergo a correction as a result of psychoanalysis. Theophrastus, the head of the Lyceum after Aristotle, is the author of a book called *The Characters*. Reading it, I was struck by his sketch of what we would call a "neurotic behavior", a sketch of someone who has a compulsion to spread rumors, and even misses the trial of a civil suit he himself has brought, being so busy with his irrational behavior. Theophrastus's *description* of this behavior was marvelous, but when it comes to *explanation* he just threw up his hands, saying, as it were, "utterly inexplicable, utterly irrational behavior". But even the man on the street now appeals to unconscious motivation in such a case. In fact, any branch of psychology may lead to some *corrections* in so-called "folk psychology". But notions from folk psychology, including the central notions of *belief* and *desire*, remain indispensable.

The specialized perspectives of the sciences can be overly "reductionist" at times, to be sure, but they are also the perspectives from which we demolish, for instance, the pseudo-science of racism. In fact, the most powerful destructive criticisms of so-called "racial science" came from the modern synthesis of genetics and evolutionary theory. So, I am opposed to any view which sets science and ordinary language in opposition to each other. There are times in which ordinary language *does* need corrections—from science, and, as I said before, also sometimes from philosophy. Forgive now what may look like a digression.

When Ernst Gombrich was 26 years old, he had a friend, a publisher, who said to him "I had someone lined up to write a short history of the world for children, and he quit on me—it has to be written in six weeks". Gombrich replied "I'll do it". (He needed the money, was in love with a girl he wanted to marry, had a PhD in art history and no job.) And he wrote his amazing *A Little History of the World*. His short account of what was good about Enlightenment is particularly important. Gombrich begins by listing things that everyone thought they "knew" in the years before the Enlightenment—things like "of course" you have to beat children, "of course" it is all right to beat your wife, "of course" you have to burn witches, and so on. The point Gombrich wished to make is that the central virtue of Enlightenment was *tolerance*.

So, here is a case of ordinary language being corrected—the use of the term "witch" got "corrected", for example. But the Enlightenment's attack on superstition required also support from science. In this case the philosophy and the science worked together. One needed both philosophical arguments and a new view of the facts. So, it is not that the whole job can be done by science, because science can be used by anybody. Late capitalism has developed a technology of manipulating public opinion—which is a *scientific* technology. So, there's nothing intrinsically good or bad about science. But there is a moral duty to fight pernicious errors. Michele Moody-Adams wrote a book in 1997 called *Fieldwork in Familiar Places: Morality, Culture and Philosophy* in which she does a beautiful job describing what she calls "affected ignorance"—the deliberate "not knowing" the things that you have a moral obligation to know. I think that this is a tremendously important notion: the prevalence of *affected ignorance*. And of course the evil person would then try to make other people *affectedly ignorant*.

So, science can be enlisted in bad causes, and exposing that it is *bad* science is very important. We should show that those negative stereotypes are wrong, and wickedly wrong, and combat affected ignorance of the facts that refute those stereotypes. I would say that destroying those stereotypes is itself a moral obligation, since the presence of a stereotype which is factually nonsense in the majority of the population, or even in a significant minority, is itself a significant form of oppression. I think that (and in this I agree with Habermas) it is a feature of discriminatory oppressive positions—those of the racists, the oppressors of women, the defenders of cruelty to children and so on—that they always invent facts that are not facts. They encourage affected ignorance of the truth, and here truth is on the side of justice.

I sum, I think that when the so-called "manifest image" is wrong, it can and must be corrected, but there is no principled incompatibility between the scientific image and the manifest image. Sellars and Eddington were just wrong about that.