

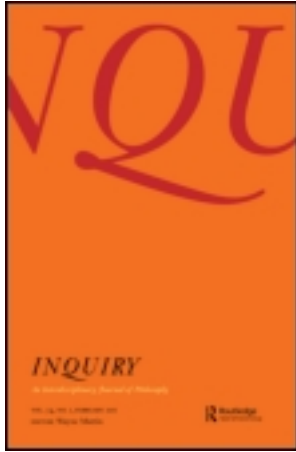
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What is Wrong with Husserl's Scientific Anti-Realism?

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ABSTRACT *Not much scholarly work is needed in order to stumble across many passages where Edmund Husserl seems to advocate an anti-realist attitude towards the natural sciences. This tendency, however, is not well-received within the secondary literature. While some commentators criticize Husserl for his alleged scientific anti-realism, others argue that Husserl's position is much more realist than the first impression indicates. It is against this background that I want to argue for the following theses: a) The basic outlook of Husserl's epistemology as well as his more substantial comments regarding the natural sciences indeed result in a (sophisticated version of) scientific anti-realism which bears certain resemblances to Bas van Fraassen's constructive empiricism; b) This scientific anti-realism can be defended against the two most common objections raised in the secondary literature; c) It is only by means of this sophisticated version of scientific anti-realism that phenomenology can circumvent the problem of "scientific objectivism".*

The language of science is full of references to strange entities. Scientists talk about ions, J/ψ particles, force fields, big bangs and the like. This has puzzled philosophers ever since the advent of modern science. In the meantime, at least with regard to the natural sciences, scientific realism has become for the most part the prevailing view among philosophers and scientists alike. In many cases, scientific realism is substantiated by means of abductive reasoning. Scientific realists usually point out that our best-supported theories yield an enormous amount of predictive success. This is, so the story goes, hard to understand if we were not also willing to accept that these theories somehow mirror the deep structure of the world. Accordingly, to believe in some kind of correspondence between theories and the world and thus to

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favour some sort of scientific realism is frequently presented as the only, or, at least, as the *best* explanation for the success of modern sciences.

However, the realist construal of scientific theories particularly troubles those who find the idea of “knowledge empiricism” attractive (Boyd, 1983, p. 48), i.e., the idea that observation and experiment are the only ways to find out about the truth or falsity of scientific statements. It is easy to see why. Most scientific realists emphasize that theories are truth-valued descriptions of their intended domains of application and that the respective truth values are determined by external reality (cf. e.g., Psillos, 2000, p. 706). Thus, on this view, it is a necessary condition for the truth of a theory that the entities to which the theory refers belong to the stuff of the external world. But how are we able, given the premise of knowledge empiricism, to take theories whose potential truth-makers cannot be observed at face value? Can we really believe in the truth of statements about unobservable entities, if our knowledge about them seems to merely rely on inferences which themselves call for observational grounding? Isn’t the realist construal of theoretical terms such as “ion” or “atom” an unwarranted “leap of faith” (cf. van Fraassen, 1985) that harbors the danger of a metaphysical hypostatization of scientific activity? Following this line of critique, (knowledge) empiricists are likely to arrive at an anti-realist standpoint, be it, for instance, constructive empiricism, reductive empiricism, operationalism or some sort of (eliminative or non-eliminative) instrumentalism.

Although empiricism was and still is one of the main reasons to adopt an anti-realist stance towards science, there certainly are other philosophical traditions that arrive at similar conclusions. This does not only hold true for various constructivist approaches, but, seemingly, also for Husserlian phenomenology. Not much scholarly work is needed in order to stumble across numerous passages where Husserl seems to strike an unmistakably anti-realist tone. On Husserl’s view, the physical sciences “aim at law-like formulae with the purpose of orientation in the world of appearances, and their existential claims have the value of mere auxiliary tools [*Hilfsmittel*] for precisely this purpose” (1979, p. 168; my translation). Elsewhere, Husserl states that “mathematical science [is] a garb of ideas [through which] we take for *true being* what is actually a *method*—a method that is designed for the purpose of progressively improving, *in infinitum*, through ‘scientific’ predictions” (1970, p. 51). To be sure, Husserl grants that “[m]athematical natural science is a wonderful technique for making inductions with an efficiency, a degree of probability, a precision, and a computability that were simply unimaginable in earlier times” (1970, p. 295). However, he insists that “[a]ll the discoveries of the old as well as the new physics are discoveries *in the formula-world which is coordinated . . . with nature*” (1970, p. 48; emphasis added).

Passages such as these suggest a certain anti-realist tendency in Husserl. The secondary literature, however, is inconclusive as to whether this is really the case. Some commentators indeed regard Husserl as an anti-realist

(Belousek, 1998) and thus put him close to verificationism (Smith, 2003, p. 188) and instrumentalism (Harvey, 1986, p. 301; Smith, 2003, p. 194). Some even hold that Husserl's standpoint "resembles that of the logical empiricists, who spent immense energy attempting to reduce the language of scientific theories to a purely empirical language" (Gutting, 1978/79, p. 47). Yet, it is usually the same authors who are quick to relativize this claim by pointing out that there are also "elements in Husserl's thought which are not 'instrumentalistic' in any traditional sense of the term" (Harvey, 1986, p. 309, fn. 48; cf. also Gutting, 1978/79, p. 46, fn. 5; Smith, 2003, p. 197). Other commentators, by contrast, deny outright that Husserl advocated any kind of anti-realism (Heelan, 1989, p. 389). They rather claim "that a consistent development of Husserl's thought [leads] to an epistemically sophisticated version of realism" (Soffer, 1990, p. 68). Most recently, Husserl's original position was even complemented with later insights from Maurice Merleau-Ponty and Patrick Heelan in order to advance a phenomenological defense of Ian Hacking's well-known experimental realism (Vallor, 2009). Finally, it was suggested that Husserlian phenomenology lacks any particular impact on the scientific realism debate and thus at best resembles Arthur Fine's deflationist "Natural Ontological Attitude" (NOA) (Rouse, 1987).

As different as these interpretations are, it is interesting to see that they at least share one common conviction, namely that scientific anti-realism is no option for Husserlian phenomenology. It is against this background that I want to argue for the following: a) The basic outlook of Husserl's epistemology as well as his more substantial comments regarding the natural sciences indeed result in a (sophisticated version of) scientific anti-realism; b) This anti-realism is immune to the two most common objections raised within the secondary literature, namely against the "argument from instrumentation" and the "argument from mutation"; c) It is by means of this anti-realism that phenomenology can circumvent the problem of "scientific objectivism" which troubled Husserl throughout the *Crisis*.

In defending these claims, I wish to contribute to a more complete phenomenological philosophy of science. Husserl neither explicated his respective view in a systematic way; nor did he present a coherent position that corresponds to the complexity of the contemporary scientific realism debate. My contribution is thus to be understood as an answer to the following question: How should today's phenomenologists, who want to be faithful to Husserl's initial program, react to the ongoing scientific realism debate? My answer may sound surprising to some, but I will argue for an alliance with Bas van Fraassen's constructive empiricism.

I. The regulative idea of intuition

One certainly cannot hope to adequately assess Husserl's view of the natural sciences without taking into account the wider context of his philosophy.

I therefore want to begin by outlining the epistemological background of Husserl's thinking in this part of my paper. The best way to do so is to start with a crucial passage of *Ideas I* where Husserl introduces the so-called "principle of principles". There, Husserl states that "[n]o conceivable theory can make us err with respect to the *principle of principles: that every originary presentive intuition is a legitimizing source of cognition, that everything originary* (so to speak, in its 'personal' actuality) *offered to us in 'intuition' is to be accepted simply as what it is presented as being, but also only within the limits in which it is presented there*" (1983, p. 44).

It is nearly impossible to overestimate the importance of this passage for phenomenological philosophy. For with the introduction of the "principle of principles", Husserl commits phenomenology to a method of intuition and thus fortifies the well-known slogan "Back to the things themselves!" However, it is crucial to realize that the Husserlian notion of intuition is a thoroughly technical term that is to be seen in the wider context of phenomenological methodology. Briefly put, X may be said to be intuitively given if an intention towards X is fulfilled by the direct, immediate presence of X. Thus, intuition is an intentional experience in which the reference to X is not mediated by presuppositions that are not part of the intended thing itself.

Let me illustrate this rather abstract description by means of an ordinary every-day situation in which inferential beliefs are perceptually justified.¹ Suppose I am on a bike trip in the Austrian Alps. A map of the area shows that a mountain shelter ought to be somewhere at the end of the path. I am trying to find the location of the mountain shelter and suddenly see smoke rising behind a hill. Since I know that there is no electricity up here and that people are using fireplaces instead, I head for the source of the smoke and eventually arrive at the mountain shelter.

This episode consists of three stages. The first is me picturing the mountain shelter and looking for it. At this stage, I have a mere signitive intention towards the mountain shelter i.e., I am merely thinking about it. At the second stage, I am observing smoke and infer both from the information on my map and from my general background knowledge that the source of the smoke and the mountain shelter ought to be identical. While riding towards the source of the smoke, I am acting on the presupposition that my inferences are correct. To be sure, this "acting on the presupposition that . . ." is no blind guesswork: My actual knowledge of certain objects and states of affairs (the smoke; the information on my map; my knowledge about electricity in the Alps etc.) *motivates* my belief in the not-yet-known reality of the mountain shelter (cf. Husserl, 2001a, §2, §3; Husserl, 1983, §47, §140). However, it is not until the third stage that my signitive intention as well as my motivated expectations are finally fulfilled by the perceptual givenness of the intended thing. This very moment of fulfilment is the moment of intuition; it is the moment of immediate justification where the thing "*itself stands before my eyes*" (Husserl, 1959, p. 32; my translation), where "the 'meant object as meant' is intently

intuited" (Husserl, 1983, p. 327). At this point, "the light of perception and its evidence shines back upon the whole series [of inferences]" (ibid., p. 339).²

This example accentuates a crucial epistemological consequence of the principle of principles. According to the principle, intuition, i.e. the congruence between the thing-intention and the actual givenness of the respective thing, sets the ideal norm for all justificatory enterprises. For it is only in the case of immediate justification i.e., in the case of the thing being intuitively given just as it was intended, that the otherwise indefinite chain of mediate justifications can be legitimately completed (e.g., Husserl, 1980, p. 10). This again becomes apparent in the light of the previous example. As long as I am still riding towards the hill, I may scrutinize every single presupposition on which my belief about the location of the mountain shelter rests. But once I am standing right in front of it, my belief about its location is justified beyond all reasonable doubt. Now, since the legitimacy of my beliefs does no longer depend on presuppositions that are not part of the intended thing itself, it is reasonable to say that I finally *know* about the location of the mountain shelter. "Perception is nothing that can be substantiated. For that reason, it is", as Husserl writes, "itself grounds providing" (2008, p. 9; cf. also 2001c, §22).

Given what has been said so far, however, the following is of utmost importance: To regard intuition as the ideal norm to which all of our justificatory enterprises adhere must not be confused with the claim that knowledge of an object or a state of affairs necessarily requires the actual intuitive givenness of the respective object or state of affairs. Since most of our scientific and extra-scientific knowledge obviously lacks intuition and since there should be a reflective equilibrium between our epistemological principles and our initial stock of knowledge, such a claim would be absurd. It is therefore crucial to stress that Husserl's point is not that knowledge exclusively *is* or *ought to be* intuition. Husserl rather regards intuition as a regulative "Idea (in the Kantian sense)" (1983, p. 342). This is to say that intuition, even if we admit that its actual achievement rarely takes place in the usual course of events, is nevertheless the "ideal limit" (Husserl, 2001b, p. 260) without which all those inferential practices that lack the intuitive givenness of the intended object would not be intelligible. Phenomenologically construed, even to talk about the tentative character of our actual inferential practices only makes sense if there is a norm in relation to which their tentativeness can be asserted (cf. e.g., Husserl, 1970, p. 128; 1983, §141).

Hence, the upshot of Husserl's view is this: There is nothing wrong with accepting judgments as true without actually carrying through to the ideal of direct intuition. However, we have to keep in mind at the same time that "[k]nowing is . . . nothing other than *actual or potential insight*" (Husserl, 2008, p. 13). This is to say that if we accept judgments without actual insight and thus without intuition, we do so on the presupposition that the intuitive givenness of the intended thing or state of affairs *is a possibility* that could be realized *at least in principle*.

II. Planets, ions and the limits of observation

Husserl's concept of intuition has severe consequences for the phenomenological interpretation of the physical sciences. This becomes apparent, for instance, in the crucial paragraph 52 of *Ideas I*. This paragraph is mainly concerned with the question whether or not theoretical terms may be said to refer to unobservable layers of the physical world. With regard to this issue, Husserl declares that "the *perceived physical* thing itself is always and necessarily *precisely the thing which the physicist explores and scientifically determines following the methods of physics*" (1983, p. 119) and that, consequently, "*the physical thing as determined by physics does not signify reaching out beyond the world which is for consciousness, or for every Ego functioning as cognizing subject*" (*ibid.*, p. 121).

What is crucial about this passage is that Husserl's standpoint obviously relies on a distinction between that which is perceivable and that which is not. In Husserl's particular case, this is a consequence of the phenomenological understanding of spatiotemporal thingliness. A real or physical thing is, as Husserl points out at various occasions, defined "as the possible object of a *straightforward* percept" (2001b, p. 285; 1983, p. 341; 1997, p. 297). Thus, in order to count as a physical thing at least potentially, a situation has to be possible in which the respective object could be "given . . . sensuously in sensuous 'modes of appearance'" (1983, p. 120). This is also and especially true of physical things as determined by the natural sciences. To regard something as a physical thing despite the impossibility of situations in which the respective thing could be sensuously given is, according to Husserl, "countersensical in the strictest signification of the word" (1983, p. 118).

It is needless to say that this view is a direct consequence of Husserl's concept of intuition. As I said before, there is nothing wrong with accepting (existential) claims about spatiotemporal objects (e.g., the mountain shelter) even though it may be practically impossible at a certain moment to bring the respective objects to direct intuition (e.g., due to bad weather conditions). This is unproblematic as long as the intuitive givenness of the respective objects could be realized in principle. However, if this realization is ruled out from the outset, the respective existential judgments have to be rejected due to their countersensicality.

Consider the following passage, which illustrates this view by means of a concrete example:

[A]n explanation of the perceptually given processes by hypothetically assumed causative realities, by unknown physical affairs (for example, the explanation of certain planetary disturbances by the assumption of an as-yet-unknown planet, Neptune) is something essentially different from an explanation in the sense of a determining of experienced things in the manner peculiar to physics—an explanation by

such physical–scientific means as atoms, ions, and the like. (Husserl, 1983, p. 119)

The “essential difference” between objects of the Neptune-category and those of the ion-category is this: Initially, both Neptune and ions appear to be on a par with regard to their factual unobservability. Neptune is unobservable due to its relatively low brightness, ions are unobservable due to their exceedingly small size. However, in the case of the former we could at least imagine altering the brightness of Neptune by, for instance, changing our actual position. Following this line of reasoning, Husserl’s standpoint seems to be congenial to Bas van Fraassen’s “principle of observability”:

X is observable if there are circumstances which are such that, if X is present to us under those circumstances, then we observe it. (1980, p. 16)

Since, say, sitting in a spaceship orbiting Neptune would certainly count as a circumstance under which we could directly observe Neptune, and since this circumstance may be relatively unlikely, but certainly not impossible, there are no reasons to deny the potential observability of Neptune. This perfectly matches Husserl’s remark “that something transcendent necessarily must be experienceable not merely by an Ego conceived as an empty logical possibility but by any *actual* Ego as a demonstrable unity relative to its concatenations of experience” (1983, p. 108).

But what are the potential circumstances under which we, as actual Egos, would be able to directly observe ions? There seems to be no answer to this question. Wherever we may go, and whatever we may do, to bring on circumstances under which the exceedingly small size of ions would be altered is impossible. Apparently, this has to do with a fundamental difference between projections in time, projections in space and projections in size. We may *now* be unable to directly observe Neptune; but we, as actual Egos, certainly could within the next hundred years. We may *now* be unable to reach the other side of the hill in order to assure ourselves of the existence of the mountain shelter; but some other actual Ego could already be there. Yet, with regard to ions and other microscopic entities, our inferential practices seem to exceed our epistemic grasp.

Given what has been said so far, Husserl’s standpoint may be recast in terms of the following tripartite differentiation. There are

- (i) Observable entities.
- (ii) Entities that are unobservable *now* but not unobservable *in principle*.
- (iii) Entities that are *in principle* unobservable.

While it is phenomenologically acceptable to regard entities of the first and second category (for instance, mountain shelters on the one hand, planets on

the other) as real parts of the causal chain, it is countersensical to apply the same interpretation in the case of entities of the third category, i.e. in the case of “atoms, ions, and the like”.

Once the distinction between (potential) observability (categories i and ii) and general unobservability (category iii) is fully articulated, it is possible to flesh out a sophisticated version of anti-realism which, I believe, meets the demands of a phenomenological philosophy of the natural sciences. First of all, scientific anti-realism is, as its title suggests, a counter-reaction against scientific realism. This is to say that anti-realism opposes the view “that scientific theory construction aims to give us a literally true story of what the world is like, and that acceptance of a scientific theory involves the belief that it is true” (van Fraassen, 1980, p. 9). For reasons we have already discussed, anti-realism rejects this view with regard to the alleged unobservable layers of reality. Scientific anti-realists such as Bas van Fraassen rather suggest that the aim of scientific theorizing is not literal truth, but only empirical adequacy, and that to accept a theory only means to believe that the theory accords with what is observable.

Two more specifications are needed in order to adequately assess the nature of this sophisticated version of anti-realism. First, unlike its positivist predecessors, the version of anti-realism that I am proposing here implies no reductionist bias with regard to the language of science. Anti-realism rather is the view that there are no sufficient reasons to believe that existential claims about unobservables are true (or false, for that matter) because they cannot be verified or falsified in principle. This leads to the second important aspect: Even if it is correct to claim that there are no sufficient reasons to believe existential claims about unobservables, from this it does not follow that there are sufficient reasons to claim that they *do not exist*. It is crucial to stress that a sophisticated version of anti-realism is not ontological, but epistemological in nature. Hence, the kind of scientific anti-realism I am proposing culminates in an *agnostic* stance with regard to existential claims about unobservable entities such as “atoms, ions, and the like”.

It should be apparent from what I have said so far that I regard van Fraassen’s position as a defensible version of scientific anti-realism that captures Husserl’s sceptical intuitions about unobservable entities, but at the same time avoids the shortcomings of its positivistic predecessors. However, one could wonder whether this brand of anti-realism really is compatible with the whole of Husserl’s position as it is presented in paragraph 52 of *Ideas I* and elsewhere. Let me, in order to answer this question briefly, point out the following. First of all, Husserl explicitly rejects the realist view according to which “[t]he actually perceived (and, in the primary sense, appearing) should, for its part, be regarded as an appearance of, or an instinctive basis for, inferring something else, intrinsically foreign to it and separated from it” (1983, p. 118). As I have already indicated, Husserl opposes this view by pointing out that “[t]he physical thing which he [the physicist] observes . . . , and

no other, becomes the subject of the predicates ascribed in physics, such as weight, temperature, electrical resistance, and so forth" (1983, pp. 120–21). "Likewise, it is", as Husserl adds, "the perceived processes and concatenations themselves which become determined by means of concepts such as force, acceleration, energy, atom, ion, etc." (ibid.). Thus, as becomes very clear from the context of these passages, we should not think of observables as pictures or signs that refer to a hidden, in principle unobservable layer of reality. If anything, we should think of observables as signs *for themselves* (ibid., p. 121).

Given this overtly anti-realistic attitude, I take it that it is phenomenologically consistent to embrace van Fraassen's view that the aim of scientific theorizing, as far as existential claims about unobservable entities are concerned, is empirical adequacy and not truth in a correspondence-theoretical sense. I believe that this interpretation even fits with those passages where Husserl makes use of seemingly realist notions such as truth or unrestricted objectivity. Let me illustrate this claim by means of a concrete example. In his illuminating overview of the phenomenological philosophy of science, A.D. Smith refers to an often-cited passage in the *Crisis*, where Husserl not only contrasts the relativity of different cultural life-worlds with the unrestricted objectivity of the natural sciences, but also characterizes the sciences as aiming for "the goal of a truth about the objects which is unconditionally valid for all subjects" (1970, p. 139). According to Smith, this passage expresses a strong realist intuition which is operative throughout Husserl's oeuvre and which prevents a thoroughly anti-realist reading of his phenomenology (cf. Smith, 2003, pp. 197–200). However, what Smith misses is that Husserl exclusively refers to observable entities and their properties "such as spatial shape, motion, sense-quality, and the like" (Husserl, 1970, p. 139). Thus, as far as claims about spatiotemporal objects and their properties are concerned, Husserl is consistent in restricting the notion of truth exclusively to observables. This is important for obvious reasons: if truth is restricted to the observable layers of reality, nothing prevents the phenomenologist from embracing the notion of empirical adequacy i.e., the claim "that what the theory says *about what is observable* . . . is true" (van Fraassen, 1980, p. 18). It would be a severe misunderstanding to believe that the point of scientific anti-realism is to altogether banish truth from scientific inquiry. The point of anti-realism rather is to know where truth is an in principle attainable goal.³

However, what about my second claim that a defensible anti-realism is merely epistemological in nature and thus implies no ontological consequences with regard to the putative existence or inexistence of unobservable entities? Isn't Husserl actually contrasting the "object of the sensuous imaginatio simpliciter and the physical thing of the *physicist's intellectio*" (1983, p. 121; emphasis added)? Doesn't he actually speak of "the *lack of sensuous intuitability* which is a property of all categorial unities *produced by*

thinking” (1983, p. 123; emphasis added)? Aren’t these quotations clear evidence that Husserl, insofar as he apparently states what unobservable entities *are* (namely, *products of our thinking*), has more in mind than an anti-realism that confines itself to epistemological aspects? Well, at least as far as Husserl’s exemplifications in paragraph 52 go, not necessarily. Except for one particular passage,⁴ the above-cited quotations can be equally plausibly interpreted as being descriptions of how unobservable entities are actually *given to us* within the theoretical attitude. On this construal, then, Husserl can be understood to argue that, since unobservables are merely given by means of inferential reasoning, all we can say for sure is that they are products of our thinking. The decisive anti-realist claim is that there are no sufficient reasons to believe that unobservables are, ontologically speaking, more than that.

III. The argument from instrumentation

As I said in my introductory remarks, scientific anti-realism met with some serious objections both within and outside the phenomenological literature. Let us now turn to the first, namely to the “argument from instrumentation”.

During the last couple of decades, the received view in the philosophy of science was accused of drawing a one-sided picture of the sciences by focussing almost entirely on syntactical aspects of theory formation. Amongst other things, critics pointed out that scientists do not only advance the evolution of new theories, but also spend a considerable amount of their time on the invention of new technical instruments. One could suggest that this aspect of scientific activity is important insofar as technical devices have to be regarded as means to widen the sphere of observability beyond the limits of our unaided senses. It therefore appears by no means accidental that working scientists have no use for fine-grained philosophical distinctions between different forms of (un-)observability but instead simply speak of “data”. Scientists do so because they trust in their ability to technically enhance the human vision almost indefinitely. What is more, as long as a certain theory yields sufficiently good prognostic and explanatory results, scientists seem to be rather unimpressed by the unobservability of the key components of the respective theories. Bacteria indeed may have been unobservable at the time the theory was proclaimed according to which many diseases are spread by very small (and thus unperceivable) “bugs” (cf. Maxwell, 1962, pp. 4–6). But bacteria are observable now due to the invention of microscopes. Somewhat ironically, the same seems to hold true for Husserl’s own example. Ions may have been unobservable in Husserl’s time. But ionized particles are observable now due to the invention of cloud chambers.

Given this line of argumentation, some take it that the distinction between observables and unobservables turns out to be entirely dependent on empirical findings i.e., that the distinction “is relative to the state of scientific knowledge and the technical resources available for observation and detection”

(Laudan & Leplin, 1991, p. 451). “Observable” is thus said to be a highly contextual predicate that cannot be allocated rigidly, even less from the perspective of the philosophical armchair.⁵ Consequently, the “argument of instrumentation” (as I want to call it) is regarded as a definitive blow against all anti-realisms which rely on a viable distinction between observables and unobservables.

The argument from instrumentation has not been unnoticed within the phenomenological secondary literature. However, commentators are not entirely agreed upon the severity of this objection. As, for instance, Charles W. Harvey suggests, at least some parts of the phenomenological wreckage can be salvaged by strictly distinguishing between a logical and a factual aspect of Husserl’s argument. The pattern of Harvey’s strategy is as follows: He admits outright that Husserl’s repudiation of “atoms, ions, and the like” is falsified by the development of technical instruments. However, Harvey instantly adds that this, *per se*, does not endanger the whole of Husserl’s account. For even if we concede that Husserl chose the wrong examples, the argument from instrumentation does not force us to give up the fundamental logic of his overall standpoint (cf. Harvey, 1989, p. 213). This is because we may very well admit that visiting a laboratory that hosts a cloud chamber is nowadays much easier than to fly to Neptune without thereby giving up the claim that any X that is unobservable in principle must not, on pain of counter-sensicality, be treated as a spatiotemporal object. Harvey thus suggests to abandon Husserl’s factual claims about unobservables but to stick to the formal structure of his argument. According to Harvey, this refinement does not only make “Husserl’s ‘instrumentalism’ . . . a moderate or provisional instrumentalism” (1986, p. 303). I also take Harvey to mean that this move is the only way to make sense of Husserl’s position at all (cf. also Harvey, 1989, pp. 212–15).

Yet, Harvey’s suggestion is neither illuminating nor necessary. It is not illuminating because I am unable to see what actually is instrumentalistic about Harvey’s “moderate instrumentalism”. To begin with, contemporary scientific realists certainly are familiar with buzzwords like phlogiston or ether. They would therefore not hold the absurd view that today’s science is infallible with respect to every single existential claim it makes. Accordingly, scientific realists would neither contest the maxim according to which one should take a sceptical stance towards newly introduced theoretical terms until their alleged referential status is supported by sufficient evidence. Scientific realists wouldn’t even challenge the statement that X (say: phlogiston) must not be treated as a real object if X is unobservable in principle. What scientific realists are eager to oppose, however, is the claim that the category of in-principle unobservability can be determined on purely philosophical grounds. This is to say that scientific realists oppose any anti-realistic appeal to certain fixed boundaries of observation that cannot be transgressed either by inferential reasoning or by technical devices. But since the acknowledgment of this

very opposition seems to be the defining characteristic of Harvey's "moderate or provisional instrumentalism", his position inadvertently collapses into a garden-variety realism.

What is even more important, though, is that Harvey's refinements are unnecessary in the first place. This is because there are good reasons to believe that the argument from instrumentation does not force us to abandon any of Husserl's factual claims about the limits of observationability. Thus, the evolution of observation devices is, as I want to stress in the following, no serious threat for those anti-realisms that rely on the distinction between observables and unobservables. Let us, in order to substantiate this claim, take a closer look at what, following van Fraassen (2001, p. 155), could be called the "phenomenology of instrumentation".

It is a pivotal insight of the phenomenology of the positive sciences that scientific thinking necessarily depends on symbolic representations where that which is actually intended is not originally present to us. Undeniably, we are perfectly aware of this fact in many situations, for instance when facing a technical drawing or a computer simulation. But there are other situations where a reflective stance is necessary in order to unveil that something may be intended as actually observed while, in reality, it is merely indirectly given by means of symbolic representations. Technical instruments such as cloud chambers or electron microscopes are prime examples for such a confusion between observational and inferential beliefs. Let me elucidate a bit.

Consider the following analogy from van Fraassen (1980, p. 17): suppose you are watching a vapour trail in the sky and report to your friend that there is an airplane passing by. Your friend retorts that she is only able to see the vapour trail, but not the airplane. What options do you have to convince your friend that your inferential airplane-belief is warranted? Well, you certainly could state all your knowledge about airplanes and the formation of vapour trails as well as your practical ability to identify vapour trails when you see them. In some cases, you could also point to the little dot in front of the trail or simply use binoculars. If you are determined enough, you even could board a second plane in order to prove that there is a relationship between the airplane and the vapour trail. Thus, it is in principle possible to justify your belief about the airplane and the vapour trail by bringing the initially unobservable part of the relation to intuitive givenness.

But now suppose that you are watching the silver-grey lines on the screen of a cloud chamber and report to your friend that there are ionized particles passing by. With regard to this physically similar occurrence, the options to convince your friend of your ionized-particle-belief are severely limited. You certainly could state all your physical knowledge about saturated vapour, decompression and the ionization of particles as well as your practical ability to identify an ionization trail if you see one. However, at this very point the similarities between the case of the airplane and the case of the ionized particles end. If pressed, we would have to concede that what we are actually

observing are artificially produced trails and that we infer the rest according to our theoretical knowledge about cloud chambers, ionized particles and physics in general. Thus, technical devices such as cloud chambers at best give further evidence for our *inferential beliefs* about ionized particles. However, since there is no in-principle observable relationship between the artificially produced trails and the theoretically posited entities, it is evidently clear that cloud chambers do not change the fact that the ionized particles are given to us only inferentially i.e., by means of symbolic representations.

Consider another analogy which again stems from Bas van Fraassen (2001, p. 160): Suppose you are standing in front of a pond looking at a reflection of a tree in the water. Suppose furthermore that, for some reason, you start being unsure whether or not you are really looking at a reflection and not, say, at a picture of a tree that is swimming on the water surface. Is there a way to find out whether you are really looking at a reflection? The answer is obvious: You certainly have the opportunity to raise your head and look to the real tree. If you do so, you are able to gather information about the relation between the reflection and the real tree e.g., information about the relations between your vantage point, the reflection of the tree and the real tree. And it is exactly this information that warrants that you are looking at a reflection of a particular tree that is standing by the pond.

But now suppose that you are looking through the ocular of an electron microscope at a lithium atom that actually has a size of 1.6 Ångstrom. Is this situation comparable to the previous one? Well, it is comparable according to those who claim to actually *observe* a lithium atom with an electron microscope. On this view, here too, some kind of relation between the observer's vantage point, the output of the microscope and a real lithium atom exists. However, how could this belief possibly be justified in a non-inferential way? In the case of the pond and the tree-reflection, you can raise your head and look at the tree. But, evidently, nothing similar is possible in the case of the electron microscope. In the latter case, you are rather *positing* that there exists a relation between you, the output of the microscope and some real lithium atom. Hence, instead of *observing* a lithium atom you are *inferring from your theoretical knowledge* that what actually is observed and what is called "lithium atom" for purely theoretical reasons corresponds to something in the physical world.

Don't get me wrong on this: I certainly do not deny that you are observing *something* in a microscope⁶ or on the screen of a cloud chamber. But I agree with van Fraassen that the correct way to think about technical instruments is to regard them not as "windows into the nether world" (2001, p. 154), but as engines that *produce* new observables for us to apprehend.

If this line of reasoning is sound (and I believe it is), it becomes readily apparent why the argument from instrumentation is fundamentally flawed. The argument relies on the presupposition that the observables which are produced by technical instruments entertain certain relationships with

microscopic entities such as ions, lithium atoms, and the like. The belief that this is so, however, is an inferential belief which, just as Husserl stated, cannot be grounded in principle.

IV. The argument from mutation

Let us now turn to the second counter-argument, namely to the “argument from mutation”. As we have seen, Husserl’s anti-realism presupposes a strong notion of in-principle unobservability which in turn seems to rely on the claim “that something transcendent necessarily must be experienceable not merely by an Ego conceived as an empty logical possibility but by any *actual* Ego as a demonstrable unity relative to its concatenations of experience” (Husserl, 1983, p. 108). However, as Smith remarks (2003, pp. 188–91), there are also other passages where Husserl strikes a much more liberal tone. For instance, Husserl freely admits “that if [a] supposed unknown cause existed at all, it would have to be essentially perceivable and experienceable *if not by us then by other Egos who see better and further*” (Husserl, 1983, p. 119; emphasis added). This raises an obvious question: Does the notion of potential observability demand the potential experienceability by *any actual Ego* (as follows from the first quotation) or do *Egos who see better and further* suffice to regard certain entities as in-principle observable (as follows from the second quotation)?

According to Smith, there is sufficient textual evidence to hold that the second option is the more favourable one. Let me just reprise two passages that seem to corroborate Smith’s reading. On the one hand, Husserl concedes that “there are physical things and worlds of physical things which do not admit of being definitely demonstrated in any *human* experience” (ibid., p. 109). “[B]ut that has”, as Husserl adds, “*purely factual grounds which lie within the factual limits of such experience*” (ibid.; emphasis added). On the other hand, Husserl states that “[n]o one, no species, can say *a priori* that in their system of experience they have the optimal experience, in which *all* physical properties are represented” (1973, p. 135; Smith’s translation). In the light of statements such as these, Smith concludes that the Husserlian notion of potential observability does not imply “that any . . . subject, *given its actual embodied state*, could experience any physical state of affairs whatever, but only . . . that any such subject could be organically transformed so as to be able to enjoy suitable perceptions” (2003, p. 189).

If Smith is right in claiming that the Husserlian notion of potential observability has to be understood in the *Egos-who-see-better-and-further* sense, scientific anti-realism again seems to be in an unfavourable position. For even if we grant that technical instruments do not widen the sphere of observability in a substantial manner, there still is the possibility that our actual embodiment changes in a way that eventually allows for the intuitive givenness of atoms, ions, and the like. Suppose, for instance, that humans are infected with a virus that causes a mutation of our sense organs. At the final stage of this mutation process, we eventually could observe lithium atoms without the need

for any technical aid. Wouldn't it be natural for mutants to be realists with regard to microscopic entities *even if they adopted anti-realist criteria for the acceptance of scientific theories*? Do these examples not show that the distinction between potential observability and in-principle unobservability again turns out to be entirely dependent on certain empirical contingencies, only this time on the contingencies surrounding our physiological make-up?

The argument from mutation appears to be convincing at first glance. However, as a closer look reveals, it fails to meet the requirements of a well-formed argument in at least two respects. First, as Bas van Fraassen rightly points out (1985, pp. 257–58; 2005), the argument from mutation begs the question with regard to the standards of theory acceptance. This becomes apparent if we consider its precise form:

- (i) We could be X.
- (ii) If we were X then we could directly observe Y.
- (iii) In fact, we are under certain realizable conditions like X in all relevant aspects.
- (iv) What we could observe under realizable conditions is observable.
- (v) Therefore: Y is observable.

This argument is certainly valid. But what about its premises? Suppose that X are mutants with electron microscope-like eyes and Y are lithium atoms. Now, premise two states that if we were mutants with electron microscope-like eyes we could directly observe lithium atoms. But what is the basis for this claim? Obviously, it is again a *theory* that tells *us non-mutants* that what we witness in the ocular of an electron microscope *is* a lithium atom. We must therefore conclude that “the argument [from mutation] already assumes, for its polemical success, a different construal of acceptance of scientific theories, thus begging the question against [anti-realism]” (van Fraassen, 2005, p. 114).

Indeed, this simple counter-argument is very forceful. It alone would be enough to show that the argument from mutation does not pose a serious threat to scientific anti-realism. However, I nevertheless want to present a second objection, which sheds some light on the relation between Husserl's interpretation of the physical sciences and his more general meta-philosophical views. Let me, in order to do so, begin by recalling the principle of principles, which was introduced in the second part of this paper. As I indicated there, the principle is not only a particular epistemological thesis about the relations between different forms of justification. The principle rather is part of Husserl's much broader conception of reason and rationality, which lies at the very heart of phenomenological methodology (cf. Husserl, 1983, Ch. 4).

Reason is, in short, the striving towards the intuitive fulfilment of cognitive intentions. Or, in Husserl's own words: “[T]he *posited characteristic* [*Setzungscharakter*] has as its own a specific rational character . . . if and only if it is a position on the basis of a fulfilled, originarily presentive sense and not merely on the basis of just any sense” (1983, p. 327). From our previous

considerations it is clear that this does not amount to the view that to assert X is rational if and only if the intended object or state of affairs is given intuitively. Husserl is merely claiming that the possibility for a judgment to yield any rational weight at all depends on the possibility of situations in which the intended object or state of affairs could be intuitively given. Only if the ideal limiting case of intuitive givenness is ruled out from the outset does the corresponding judgment lack any rational weight and thus cannot be regarded as a serious truth-candidate. According to anti-realism, this is precisely the case with realistic interpretations of theoretical statements containing reference to unobservable entities. Since there is no conceivable scenario in which these statements could be verified or falsified, there are no rational motives either for believing or for denying them. To be sure, Husserl mostly admits that the existence of in-principle unobservable entities is logically possible (cf. 2001a, p. 95; 1983, §48).⁷ But, for reasons I have sufficiently indicated, their existence is no *motivated* possibility i.e., a possibility in regard to which “*something speaks on behalf of the positum*” (Husserl, 1983, p. 334).

Against this, proponents of the argument of mutation claim that the distinction between logical and motivated possibility is entirely dependent on our physiological make-up, which is far from being immutable. What is a logical possibility for us could become a motivated possibility for our evolutionary successors, and vice versa. Now, the reason for my uneasiness about this argument is this: it is arguably the case that mutants and aliens are logical possibilities that could affect the boundaries of unobservability in a substantial manner. Yet, with regard to the property of being logically possible, aliens and mutants on the one hand and ions and lithium atoms on the other are perfectly on par. The reason why scientific anti-realists are sceptical about the latter is the meta-philosophical maxim according to which assertions not only need to be logically possible, but also have to bear a minimum amount of rational weight in order to be regarded as serious truth-candidates. But, if it is this meta-philosophical maxim that results in the repudiation of the realist construal of “atoms, ions, and the like”, there is simply no reason for anti-realists to be too concerned with the logical possibility of mutants and aliens. The assertion of their existence equally lacks any rational weight. Hence, the argument from mutation again begs the question—only this time with regard to the meta-philosophical maxim that motivates scientific anti-realism in the first place.

V. The middle ground of entity realism?

If my previous considerations are sound, it turns out that both arguments rest on dubious presuppositions and thus do not endanger scientific anti-realism. However, one could wonder whether my whole presentation doesn't implicitly depend on a particular understanding of what scientific realism actually amounts to. More precisely, one could wonder whether there is a version of

realism that is less demanding than the full-blown realism I have been dealing with so far and which, therefore, still is an alternative to the anti-realism I am advocating here. According to some, a promising candidate is a selective realism of the kind initially proposed by Ian Hacking. This variant of realism has attracted some attention in the phenomenological literature and was most recently defended by Shannon Vallor (2009).

Let us, in order to get a grip on the kind of realism Vallor is advocating, begin with the seemingly straightforward distinction between judgments concerning the truth of scientific theories and judgments concerning the existence of unobservables. The rationale behind this distinction is this: Entity realists are selective insofar as they accept anti-realism concerning theories and entities whose existential status can only be theoretically inferred. They hold, however, that justified true belief about the existence of unobservable entities can be had without the mediation of theories. While Hacking initially claimed that this is the case when we manipulate entities in a way that allows us to interfere with the causal processes in which the entities are embedded, Vallor begins at a more fundamental level, namely at the level of perceptual experience. This is by no means incidental: according to Vallor, scientific anti-realism is the product of several misguided views about the nature of perception and empirical knowledge. Using Bas van Fraassen as an example, she identifies three major “positivistic distortion[s]” (2009, p. 9): first, the view that perceptual evidence is only about what is actual and is therefore “incapable of revealing any structures beyond those immediately and wholly given” (2009, p. 7); secondly, that this kind of immediate sense-perception is “secure evidential ground” (*ibid.*) upon which our empirical knowledge has to be founded; and thirdly, that “perception [is] an encounter with a thing to which the perceiver’s activity contributes nothing essential” (2009, p. 9).

According to Vallor, it is these three preconceptions that lead the anti-realist to the following line of argument: there are things like planets and mountain shelters that not only can be immediately and wholly given but also manifest themselves without any activity from the perceiving subject. Hence, so the reasoning of the anti-realist allegedly goes, it is things like these that set the standard for what it means to count as an existing thing at all. Since unobservables are by definition incapable of meeting this standard, scientific anti-realism is, according to Vallor, the direct result of this understanding of perception.

However, as Vallor points out, it is especially the phenomenology of perception that contradicts all three “positivistic” preconceptions. Since, as Husserl has shown at numerous occasions, spatiotemporal things manifest themselves always perspectively, their givenness is characterized by a “radical incompleteness” (Husserl, 1997, p. 44). This is to say that whenever we intend a thing in its unity, every particular intention towards the thing “means more” than what is sensuously given. Hence, as Vallor argues quite rightly, perceptual evidence is never exhausted by what is immediately and wholly given. Since

particular acts are always embedded in horizons of potential subsequent acts which ideally would complete what is left indeterminate about a thing as it is intended, perceptual evidence is as much about what is actual as about what is possible. We thus have to conclude that the first “positivistic distortion” is indeed just that, a distortion.

If this is true, however, then the second positivistic tenet isn’t any better off. Immediate sense-perception is no secure evidential ground (in the sense anti-realists allegedly want it to be) precisely because the distinctive mode in which physical things are given is that of a “*presumptive actuality*” (Husserl, 1983, p. 102). This is to say that there is necessarily more to a thing than is contained in a particular act. Accordingly, since the intentional reference to physical things always transcends what is immediately given, “*all evidential disclosures of perception are subject to revision or cancellation upon further experience*” (Vallor, 2009, p. 8).

Thirdly and lastly, physical things are not given in complete passivity. It is a phenomenological commonplace that the concrete givenness of physical things not only depends on kinaesthetically felt movements; the intentional reference to things in their unity also implies a synthesizing activity by which the perceptual givenness of particular perspectives towards the thing is transcended: if all that is immediately and passively given are particular profiles, then the idea of a thing to which these profiles belong relies on the synthesizing capacities of an embodied subject.

In the wider context of her paper, Vallor’s critique of the positivistic view of perception serves a twofold purpose: On the one hand, as I have already indicated, Vallor holds that “[t]he antirealist . . . *relies on the [aforementioned] positivistic distortion[s]*” (ibid., p. 9; emphasis added). If this is true and if, furthermore, the positivistic view of perception is proven to be unacceptable at least from a phenomenological point of view, then anti-realism is clearly not an option for a phenomenological philosophy of science. This, on the other hand, gives room for Vallor’s own realistic account, which draws heavily on the late Merleau-Ponty and his notion of “flesh”.

The central idea of Vallor’s selective realism is this: As we have seen, even the concrete givenness of physical things such as planets or mountain shelters is characterized by a “radical incompleteness” and by a dynamic interplay between embodied actors and empirical reality. Thus, according to Vallor, the bar of what passes for epistemically relevant evidence is substantially altered: While Vallor is ready to admit that “atoms, mesons and baryons revealed by high-energy particle collisions are . . . among the most heavily conditioned appearances”, she nevertheless claims “that such appearances, when they do occur, are no less perceptual for it” (ibid., p. 6). This is because the decisive criterion for what it means to be epistemically relevant is, on her view, not the motivated possibility of the unmediated givenness of (perspectives of) physical things, but the possibility that a “thing can manifest itself to us . . . in a coherent and pregnant manifold of kinaesthetic relations explorable within

our spatiotemporal horizon" (ibid., p. 8). Using the "November Revolution" of 1974 as an example, Vallor argues that mesons as well as mountain shelters meet this criterion and thus have to be regarded as physical things in the fullest sense of the word.

It would lead me too far afield to engage in the details of Merleau-Ponty's late philosophy and thus to do justice to the whole of Vallor's account. However, I nevertheless want to highlight four problems which, as I believe, make her selective realism hard to accept, at least from a Husserlian perspective.

First, in adopting the basic idea of Hacking's selective entity realism, Vallor inherits a number of flaws that are commonly associated with this position. I will confine myself to one critical aspect: selective realism seeks, as we have seen, to strike a balance between anti-realism and a full-blown realism by distinguishing statements about the existence of unobservables and statements about theories. Yet, it has been repeatedly noted that this line is impossible to draw (cf. e.g., Chakravartty, 2007, p. 30–31). Let us suppose for the moment that, in principle, we can know about the existence of unobservables. Now, the problem is that, in order to have this knowledge, one has to know about at least some of the relations in which these unobservables are embedded—for instance, relations between unobservables and instruments such as cloud chambers. However, since unobservables are capable of these relations only because of their properties and since properties are exactly what theories describe, existential claims turn out to be necessarily "infected" by theoretical claims. Hence, while entity realism may present itself as the modest alternative to a full-blown realism, it turns out to be almost equally demanding on closer inspection.

Second, Vallor's presentation is questionable insofar as she overemphasizes the relation between anti-realism on the one hand and a positivistic view of perception on the other. While I agree with her phenomenological critique of the latter, it is simply wrong to maintain that anti-realism *relies* on the aforementioned "positivistic distortions". Like all physical things, mountain shelters and planets may be given perspectivally and their givenness may depend on the synthesizing activity of embodied subjects. But in the case of observables, embodied subjects are able to engage in an infinite series of potential fulfilments which, as I have pointed out, corresponds to the very idea of rational positing. At least at some points of her paper, Vallor also seems to accept this, for instance when she writes that "[p]erceptual evidence of the ongoing fulfillment . . . is the ultimate epistemic authority by which a person may distinguish a genuine percept from an artifact . . ." (2009, p. 5). Yet, the conclusion of the previous sections is that, in the case of unobservables, *a series of potential fulfilments cannot even begin*. This (and not a misguided view of perception) is the reason why an anti-realist stance towards science is not only compatible with, but a natural consequence of phenomenological methodology. Vallor may be right in criticizing van

Fraassen's view of perception. Important for my current purposes is merely that phenomenologists can accept his interpretation of the physical sciences without thereby being committed to his positivism.

Third, Vallor's realism is far too admmissive with regard to questions of demarcation: As noted above, Vallor seems to accept that the intuitive fulfillment of intentions sets the ideal norm for all justificatory enterprises at some points of her paper. On other occasions, however, Vallor strikes a more radical tone: To regard the unmediated givenness of (profiles of) physical things as epistemically crucial is, on her view, nothing but an "apparently empiricist credo of phenomenology" (*ibid.*, p. 10). What counts epistemically is that a "thing can manifest itself to us in a perceptual style, that is, a coherent and pregnant manifold of kinaesthetic relations explorable within our spatiotemporal horizon" (*ibid.*, p. 8). Yet, I doubt that this notion of a "perceptual style" is sufficient to settle the problems that every realist approach to the physical sciences has to face. Let me elucidate by means of an example.

Consider the mythical Sword of Azeroth, which, as we know from the TV show "Big Bang Theory", can be found at the Gates of Elzebub. It takes an experienced group of people about 97 hours to get there. Additionally, a lot of strategic aptness and coordination between the members of the party is necessary because the sword is guarded by heavily armed goblins. The reward, however, is stunning: the sword is not only a powerful weapon and a peculiar rarity. It can also be turned into real cash on eBay within seconds. Now, my question is this: where exactly is the difference between the Sword of Azeroth and, say, mesons, when it comes to their manifestation in the "perceptual style" characterized above? Given the results of the previous sections, the manifestation of both is dependent on technical devices of some sort. Their distinctive "style" of manifestation is, amongst other things, equally characterized by temporal coherence and possible intersubjective consensus on a perceptual level. Both are to be examined by experts who, in order to obtain more and more information about their respective object of investigation, have to follow certain shared rules of conduct. Ultimately, both are linked to the world of everyday experience. However, clearly one crucial difference remains: while we simply know that the Sword of Azeroth is part of a video game and thus does not exist, this kind of external knowledge is not available in the case of mesons.⁸ All we have here is a particular theoretical framework, new observable phenomena that are produced by different technical devices, and the knowledge that these new phenomena fit into the theory. Given all this, the notion of a "perceptual style" appears far too imprecise to draw a meaningful line between all those unobservables that are nowadays posited and those that are singled out from a historically distant perspective.⁹

Fourthly and lastly, Vallor's entity realism, like all realisms, leads to the problem of "scientific objectivism". I shall deal with this important issue in the last section of this paper.

VI. Objectivism and the life-world

It is well-known that, at the end of his career, Husserl came to be more and more concerned with what he regarded as a fundamental “crisis of our culture and the role here ascribed to the sciences” (1970, p. 5). One aspect of the crisis is that science has lost touch with the life of man and thus fails to answer the most burning questions; “questions of the meaning or meaninglessness of the whole of . . . human existence” (ibid., p. 6). However, it would be a severe understatement to reduce Husserl’s critique to a lament about cultural, political and existential–philosophical issues. On Husserl’s view, the crisis of modern scientific culture rather is a consequence of the philosophical inability to reconcile the scientific world-view with the sphere of everyday experience. It is due to this inability that today’s natural science not only seems to estrange itself, but finally even seems to abandon its own epistemological foundation, i.e. the “meaning-fundament [of] the world which gives itself . . . in actual experience, the ‘world of sensibility’” (ibid., p. 347). According to Husserl, this process of abandonment is as if science was to saw off the branch it is sitting on: since all scientific inferences ideally refer back to possible acts of intuitive fulfilment, the abandonment of the “world of sensibility” leads to an “emptying of the meaning of mathematical natural science” (ibid., §9g), and, consequently, to the present scientific crisis.

It would certainly lead me too far afield to enter into a detailed discussion of Husserl’s argumentation. What I would like to emphasize, however, is that the aforementioned process of abandonment of the “world of sensibility” is an inevitable consequence of a realist construal of scientific activity. Moreover, it is an implication of any robust version of scientific realism that it eventually leads to the kind of scientific objectivism Husserl is attacking throughout the *Crisis*. The reason why this is so is as follows. If the aim of the natural sciences really is to tell us (at least approximately) true stories of what the world is like on both sides of the observability/unobservability-divide, the question how to reconcile the scientific world-view with the sphere of everyday experience necessarily arises. To use Sir Arthur Eddington’s famous example: following my ordinary experience, I describe the table in front of me as a solid object made of wood. But physics tells me at the same time that this very table in front of me is mostly emptiness, sparsely occupied by interacting electrons, protons and neutrons. Since, on the realist picture, both descriptions purport to be true, the conclusion that one of the two descriptions has to be false is inevitable. Either it is true to say that the wooden table has the attribute of solidity, or it is true that this mode of speaking does not pick out a “natural kind” and that, consequently, all that exists is scattered electrons, protons and neutrons in mostly empty space.

Once the problem is set up in this way, the dichotomy between the “scientific” and the “manifest image” follows its own inner necessity: if there are two conflicting descriptions of reality, yet one of them is clearly superior in

terms of uniformity, predictive power and pragmatic success, the elimination of the inferior description certainly seems to be the right move. Following this line of reasoning, then, the world of everyday experience turns out to be the sphere of mere appearances, which ultimately will be replaced by the scientific description of objective reality. One even may admit that we are still committed to a certain “folk-theoretical” vocabulary (containing such predicates as “solid”) for purely pragmatic reasons. In reality, however, “in the dimension of describing and explaining the world, science is the measure of all things, of what is that it is, and of what is not that it is not” (Sellars, 1963, p. 173). It is exactly this view which Husserl calls “scientific objectivism” and which he identifies as the origin of the aforementioned crisis of modern science and modern scientific culture. As I have tried to show, this view does not only presuppose, but is also a consequence of a realist understanding of the natural sciences.

Yet, the late Husserl of the *Crisis* goes way beyond the mere diagnosis of the critical condition of modern science. Husserl’s main goal, rather, is to provide a cure that consists in a novel philosophical methodology centred around the phenomenological reduction. Generally speaking, the reduction is a method that allows for the temporary suspension of naïve existential claims about the natural world. In “bracketing” these claims and in focusing instead on the modes of how the world is given to us within certain natural attitudes, the reduction opens up the proper dimension of phenomenological inquiry. However, as Husserl makes clear in the *Crisis*, the method of the phenomenological reduction “is articulated into a multiplicity of steps” (1970, p. 135) of which the first is particularly important in the current context. This first, pre-transcendental step lies in “an epochē in regard to all objective theoretical interests, all aims and activities belonging to us as objective scientists or even simply as [ordinary] people desirous of [this kind of] knowledge” (ibid.).¹⁰

As is the case with any other reduction, the goal of this “first reduction of objective science” is a “shift of interest” or “change of attitude”, allowing for a critical analysis of the assumptions which, in the usual course of events, are presupposed without even being recognized. Thus, in performing the first reduction, one does not actively question or deny the accomplishments of the natural sciences. The sole aim of the reduction is to temporarily put out of action the validity claims that are usually made within the natural-scientific attitude. In doing so, we not only gain access to the sphere of “pre-scientifically intuited nature” (ibid., p. 50) i.e., to the “pre-scientific life-world” (ibid., p. 43) in the mundane sense of the term;¹¹ in performing the reduction, we also become sensitive to the implicit (and sometimes unwarranted) presuppositions on which our traditional scientific world-view rests.

Let me illustrate what I have just said by means of a familiar example: we start from our initial belief that we are actually observing ionized particles or lithium atoms when we are looking at the screen of a cloud chamber or

in the ocular of an electron microscope. Within the natural-scientific attitude, this belief is well-confirmed by our best-supported theories, by their predictive success and by the fact that we seem to manipulate these entities in various experimental settings. However, in performing the first reduction and in thus suspending the validity claims that usually accompany our scientific schooling, our awareness of the implicit presuppositions of this belief is sharpened. We eventually come to realize that our theories indeed may be empirically adequate, but that any further belief in their truth transgresses the realm of what is intuitively justifiable. Hence, the goal of the reduction of the objective sciences is not only to highlight the epistemologically significant discrepancy between the immediate givenness of life-world objects and the unintuitability of the higher-order objects posited by the natural sciences; the first reduction also helps us to set aside certain preconceived interpretations of the world and thus to become aware of a number of metaphysical presuppositions on which our natural-scientific worldview rests. One of these unwarranted presuppositions is, as I have tried to show, scientific realism.

It is crucial to see, however, what exactly it is that the first reduction to the always pre-given life-world does to cure the crisis that plagued Husserl throughout the *Crisis*. As I have said before, the crisis is caused by a seemingly irreconcilable clash between the ordinary and the scientific world-view. But, as I have also said, the belief that this clash actually exists presupposes the belief that the aim of the natural sciences really is to tell us true stories of what the world is like on both sides of the observability/unobservability-divide. Hence, if the first reduction is successful in dismantling this realist prejudice, the clash between science and life-world and thus the problem to which objectivism is intended to be the solution simply vanishes. On this view, then, the phenomenological answer to scientific objectivism does not rest on the naïve ontological presupposition of an asymmetrical relationship between the putative existence of the pre-scientific world and the putative non-existence of the world of the sciences. The phenomenological answer rather lies in the advice to stick to what is actually given and thus to embrace a different, more modest understanding of natural-scientific inquiry.¹²

Notes

1. Yet, it must be stressed that the significance of neither the principle of principles, nor the notion of intuition can be reduced to the sphere of empirical knowledge. Intuition is a thoroughly *functional* concept that correlates with an equally functional object concept. This is to say that, even though the perceptual givenness of a spatiotemporal object may be regarded as the prime example for the intuitive fulfilment of signitive intentions, the concept of intuition concerns the basic structure of givenness as such and thus covers all possible categories of objects and states of affairs.
2. It should be noted that Husserl actually speaks about “the whole series of *memories*” upon which “the light of perception shines back”. But his idea of “reciprocal confirmation” (1983, p. 338) might also be applied to the relations between perceptions and our inferential reasoning about the empirical world.

3. It is exactly for this reason that Husserl doesn't have to deny the truth of the sciences in order to be an anti-realist. A sophisticated version of anti-realism merely states that truth is a property whose application is restricted to observables. However, as we have seen, even that does not mean that judgments about unobservables are to be considered *false*.
4. Husserl states that "[n]ot even a Divine physics can make simply intuited determinations out of those categorial determinations of realities which are produced by thinking, any more than a Divine omnipotence can bring it to pass that someone paints elliptic functions or plays them on the violin" (1983, p. 123). One could wonder whether I dismiss this passage too quickly. Well, in a sense, yes: I indeed think that, for reasons that will be explained below, this passage conflicts with the interpretation I am advocating here and must therefore be dismissed. However, what would it mean to take Husserl's "divine physics" seriously? As the context of this passage makes clear, it would lead to an even more radical version of anti-realism that claims that the intuitive givenness of unobservables is a *logical impossibility*.
5. As Grover Maxwell initially pointed out, there is "a continuous series beginning with looking through a vacuum and containing these as members: looking through a window-pane, looking through glasses, looking through binoculars, looking through a low-power microscope, looking through a high-power microscope, etc., in the order given" (1962, p. 7). This amounts to the claim that, even if the possibility of technical instrumentation is ignored for the moment, the distinction between observability and unobservability cannot be drawn in a sharp way. Hence, since there always remains a grey area, the distinction is said to be highly arbitrary and thus of no use for the philosophical interpretation of the natural sciences. However, as van Fraassen has persuasively argued (1980, p. 16), the vagueness of the predicate "observable" may well be accepted as long as clear cases exist on both ends of the continuum.
6. One even may admit that this argument does not hold true of optical, but only of technically advanced microscopes such as electron, scanning tunnelling or acoustic (sic!) microscopes. However, since, as van Fraassen correctly points out, "optical microscopes don't reveal all that much of the cosmos, not matter how veridical or accurate their images are" (2001, p. 163), this concession does not affect the actual point of the argument.
7. As we have seen in footnote 4, his remarks about a "divine physics" could be interpreted to the effect that the existence of unobservables isn't even logically possible.
8. Presumably, Vallor would counter my claim that there is no external knowledge in the case of mesons with the following line of argument: what counts as external knowledge in the "November Revolution" is the fact that the J/ψ -meson was independently detected at the same time by two different research teams using two detectors of different design. Vallor thus claims that "[t]he experimental particle physicist may need to invoke a malign demon of the accelerator . . . , if she is to disbelieve the appearance of the same [entity]" (2009, p. 18). However, given my previous considerations, I cannot see why a malign Cartesian demon is necessary to account for the November Revolution from an anti-realist perspective: two research groups working, interpreting and constructing their instruments in one and the same theoretical framework produced new observable phenomena which could be equally well implemented in the same theory at the same point within the theory.
9. If realist commitments to science are merely supported by the manifestation of entities in a certain "perceptual style", it appears questionable how to account for the history of science, which is full of theoretically posited entities that eventually were replaced or completely dismissed from the perspective of subsequent theories. Vallor touches on this topic only once by stating that "[t]he data 'confirming' the presence of phlogiston were discontinuous phenomena" and that "a collection of discontinuous data linked *only* by fit with theory do not amount to the perceptual presence of a thing" (2009, p. 19). However, the plausibility of this judgment is highly contingent upon our current scientific status quo. This becomes particularly apparent if one acknowledges that phlogiston was not

only posited in order to explain otherwise unexplainable phenomena; given their state of knowledge, scientists like Joseph Priestley had any right to believe that they did not only predict formerly unknown effects with the help of phlogiston, but that, in carrying out their experiments, phlogiston was actually revealed in experimental praxis (cf. Carrier, 2005, pp. 150–51). Given what Vallor has to say on these issues, it is unclear to me why Priestley should not have regarded the manifestation of phlogiston as, to put it in Vallor's terms, "empirically pregnant".

10. The first reduction of objective science is "pre-transcendental" insofar as it does not affect the "general positing of the natural attitude" (Husserl, 1983, §30), but merely the validity claims that usually accompany our natural scientific theories.
11. As commentators have pointed out, there is not just one, but rather various different (transcendental and pre-transcendental) conceptions of the life-world in the *Crisis* (cf. e.g. Carr, 1970; Steinbock, 1995, pp. 86–122). Here, I am merely referring to the mundane conception of the world of intuitable experience.
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