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Uwe Meixner

Angaben zur Veröffentlichung / Publication details:

Meixner, Uwe. 2009. "The non-physicalness of material objects." In *Unity and Time in Metaphysics*, edited by Ludger Honnefelder, Edmund Runggaldier, and Benedikt Schick, 46–66. Berlin: de Gruyter. <https://doi.org/10.1515/9783110212358.46>.

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THE NON-PHYSICALNESS OF MATERIAL OBJECTS

UWE MEIXNER

Abstract

The present paper argues for the partial non-physicalness of material objects at any time of their existence – in the sense that their spatial unity is, at any time of their existence, not of a purely physical nature. The reason for this latter fact is that the place in space of a material object is, at any time of its existence, not determined on purely physical grounds. Nonetheless, the material object's (precise) place in space is determined at any time of its existence, this being so because its place in space is co-determined by human consciousness. The paper explores the consequences of this view and defends it against various objections.

Some material objects exist at some times – this seems unproblematic. But I will argue in this paper that the spatial unity of material objects *is* problematic. I will come to the conclusion *that the spatial unity of any material object is at no time of its existence of a purely physical nature*. It follows that *no material object is at any time of its existence purely physical*.

For assume that some material object is at some time of its existence purely physical. Hence this purely physical material object is at that time spatially unified (since being an existing material object entails spatial unity) and its spatial unity at that time must be of a purely physical nature (since the nature of the spatial unity of what is purely physical must itself be purely physical). But, as I have announced, it will be shown in this paper that the spatial unity of any material object is at no time of its existence of a purely physical nature.

1. The spatial unity of material objects is not of a purely physical nature

This assertion is argued for in the following way:

Assume, for *reductio (ad absurdum)*, that the spatial unity of an arbitrary material object X is at an arbitrary time t of its existence of a purely physical nature. Then this purely physical spatial unity of it requires that it be determined on purely physical grounds where X is at t and where it is not. In what follows I will argue that it is, on the contrary, *not* determined on purely physical grounds where X is at t and where it is not.

It is said to be determined *on purely physical grounds where X is at t and where it is not* (t being a moment of the object's existence) if, and only if, *the place in space at t of X* is determined on purely physical grounds. And this place in space is determined on purely physical grounds if, and only if, X *exactly fills* (or *exactly occupies*) – in the purely physical sense defined below (in the Central Definition) – some place in space at t.

For if X does not exactly fill any place in space at t and *one sticks to purely physical determinants*, then X's place in space at t is *not* determined (*how* could that place be determined if X does not exactly fill any place in space at t *and* one sticks to purely physical determinants?); hence, if X's place in space at t *is* determined even though X does not exactly fill any place in space at t (and it must be determined even though X does not exactly fill any place in space at t: this much is required by the spatial unity of X as an at t existing material object), then this place is not determined on purely physical grounds. Thus, if X's place in space at t is determined on purely physical grounds, then X exactly fills some place in space at t.¹ The converse of this is a matter of course.

And what does it mean that a material object *exactly fills* (*exactly occupies*) a place in space at a moment of time? Philosophers often use this relational predicate without bothering what, precisely, might be meant by it – for example, van Inwagen (1995, 33, 35, and 81), where (on page 81) the reader is asked to entertain the possibility (as antecedent of a conditional) that an immaterial ghost occupies (i.e., exactly fills) the same region of space as a human being. I am not going to leave this predicate undefined – at least not for the cases that interest us here. Let O be any material object – or, indeed, any material being –, and V a localized (coherent) volume of space (in other words, *a place in space*):

¹ The structure of the argument is like this: *First*: If nonA & B, then nonC. *Hence*: If C & nonA, then non(C & B). *Hence*: If C & B, then A. ("If, then" is taken to amount to material implication.)

The Central Definition

O exactly fills V at t if, and only if, (1) there is some material being which is in *O* at *t*,² and (2) every material being that is at *t* in *O* is at *t* in *V*, and (3) there is *no* part of *V* in which there is at *t* no material being that is at *t* in *O*.

Now, the trouble is that there is no material object that exactly fills, in the defined sense, any localized volume of space at any time of its existence. Of course, there is no lack of material objects *O*, existing at a moment of time *t*, and localized volumes of space *V*, which are (1) such that there is some material being which is in *O* at *t*, and such that (2) every material being that is at *t* in *O* is at *t* in *V*. But *O* has at any moment of its existence some material being in it that is spatially isolated (i.e., disconnected by intervening empty space³) from some other material being in it at that time. This is simply a matter of contingent fact, a matter of the way the actual world is like. Therefore, the localized volume of space *V* will have some part in which there is at *t* no material being that is at *t* in *O*. Consequently, condition (3) of the above definition is not fulfilled, and therefore *O* does not exactly fill *V* at *t*.

Since *no* material object exactly fills any localized volume of space at any time of its existence, also the material object *X* of our assumption for *reductio* does not exactly fill any localized volume of space – any place in space – at time *t*. Therefore, the place in space at *t* of *X* is not determined on purely physical grounds, and therefore, it is not determined on purely physical grounds where *X* is at *t* and where it is not – which is precisely what had to be shown.

Clearly, the hub of this argument is the following assertion, expressing a matter of contingent fact:

The Isolation-Assertion

Any material object has at any moment of its existence some material being in it that is (at that moment) spatially isolated from some other material being in it (at that moment).

The following quotation from van Inwagen (1995, 34) states a fact – uncontroversial in physics (at least as van Inwagen presents matters) – which strongly supports the Isolation-Assertion:

2 This condition is tantamount to the condition “*O* exists at *t*” (see Section 4).

3 “Empty space” is to be taken in the sense of “space without any material being in it,” that is, in the sense of “space without anything in it that can be assigned a rest-mass.” Thus empty space can be full of all kinds of non-material physical beings, like photons or fields.

“[I]t is undeniably true that, if there are any composite material objects at all, they are composed of elementary particles and that the elementary particles that compose a given material object are not in contact.”

And this is a consequence of the Isolation-Assertion:

The Denial of Democritean Bodies

There are no material objects which are at some time of their existence Democritean bodies.

A material object that is a *Democritean body* at a time *t* of its existence would be a material object that is completely full at *t*; hence there would not be any lacuna of empty space,⁴ no matter how small, that spatially isolates (spatially disconnects) at *t* some material being in the object from some other material being in it. But this would contradict the Isolation-Assertion. The denial of Democritean bodies seems unproblematic since, apparently, such bodies would have to have infinite mass, and there is no empirical evidence for material beings with infinite mass.

Another important consequence of the Isolation-Assertion is this:

The Denial of Material Atomic Objects

There are no material objects which are at some time of their existence mereological atoms.

A material object that is a *mereological atom* at some time *t* of its existence would be a material object such that there is at *t* no material being in it that differs from it; hence, a fortiori, there would be at *t* no material being in the object that is at *t* spatially isolated from some other material being in it at *t*. But this would contradict the Isolation-Assertion. The denial of material atomic objects seems unproblematic, too.⁵ Since any material object is, as long as it exists, a *three-dimensional space-taker*, it is *in any case* – whether one accepts the Isolation-Assertion or not – hard to see how it could have, at some time of its existence, no material being in it that differs from it. After all, a three-dimensional region of space always has a three-dimensional region of space in it that differs from it. It should be noted that the Isolation-Assertion does not (in itself) exclude that there is a *material being* that has, at some time of its existence, no material being in

⁴ Regarding the notion of empty space, see footnote 3.

⁵ It is *not* denied, of course, that there are atoms in the sense of physics; for the atoms of physics are not *mereological atoms*.

it that differs from it; *however*, given the truth of the Isolation-Assertion, such a *material being* would not be a *material object*.⁶

This is the place to point out that, necessarily, every material object is a material being, but that the reverse of this is not necessarily true: possibly, some individual being that has, as long as it exists, a (non-zero) rest-mass (in short: some material being⁷) is not, as long as it exists, a three-dimensional space-taker, and thus does not fulfill a necessary condition (on conceptual grounds) for being a material object.⁸ In fact, later in this paper, a hypothesis (about the actual world) will be made use of that centrally involves material beings that are not material objects. Given the distinction between *material being* and *material object*, it should also be noted that the Isolation-Assertion does not exclude that there is a material object that has, at some time of its existence, *no material object* in it that differs from it; *however*, if such an object still had *some material being* in it that differs from it, it would not be a mereological atom in the strict (true) sense.

But now, if the Isolation-Assertion is true, as it seems to be, what, then, do material objects ultimately amount to? Take some material object O_0 . Since the Isolation-Assertion is true of it, it has at a given time t of its existence two material beings in it that are spatially isolated from each other, in other words: which are thus that one cannot get from one to the other without crossing empty space (space that is empty in sense of footnote 3). If they are themselves material objects, then the Isolation-Assertion is true of them, too, and they each have at t (which is also a moment at which *they* exist) another two material beings in them that are spatially isolated from each other; and if these latter material beings are in turn material objects, then the Isolation-Assertion is true of them, too, and so on. O_0 thus dissolves at every moment of its existence into ever more fine-grained simultaneously existing material objects that are spatially isolated from each other. For visualizing this schematically, just consider the first four levels of a division-pyramid that the Isolation-Assertion gives rise to:

6 According to van Inwagen (1995, 99), current physics “strongly suggests” that some elementary particles are without proper parts, i.e., that they are mereological atoms (*simples*). To my mind, the mereological status of elementary particles is far from clear, especially if they have, as long as they exist, a (non-zero) rest-mass, that is: if they are material beings.

7 Cf. the preceding footnote.

8 It is true: the term “object” is a very colorless term and is often used as a synonym for “being” or “entity.” But in this paper, the term has a more specific meaning – at least if it occurs in combination with “material.”

O_0
 has in it at t: $O_1 O_2$
 have in them at t: $O_{11} O_{12} O_{21} O_{22}$
 have in them at t: $O_{111} O_{112} O_{121} O_{122} O_{211} O_{212} O_{221} O_{222}$

Given the Isolation-Assertion, the prospects for the *spatial unity on purely physical grounds* of the material object O_0 (or any of its material sub-objects) are even bleaker than one may, perhaps, have been initially inclined to believe. Although O_0 does not exactly fill, at any moment of time, any localized volume of space (according to the Isolation-Assertion), one still may have *hoped* of being able to assign to O_0 on purely physical grounds at each moment of its existence a *spatially distributed region of space as its location*, where “location” or “place in space” now has a wider sense than “localized volume of space.” *Such* a region is not a localized volume of space, but a *set* of spatially separated localized volumes of space. A spatially distributed region of space could be assigned to O_0 on purely physical grounds as its location at a moment t of its existence *if* O_0 were completely divided at t into material beings, spatially isolated from each other, each of which exactly fills (in the sense defined) a certain localized volume of space at t . O_0 ’s location at t would then be the set of the localized volumes of space that are exactly filled at t by the elements in the corresponding complete division-set for O_0 at t . But here’s the catch: Would not the elements in that division-set be *at t existing material objects* (seeing that they are supposed to exactly fill certain spatially separated localized volumes of space)? In fact it seems undeniable that they would be at t existing material objects, and hence the Isolation-Assertion becomes applicable *to them*, too, and the above-mentioned *hope* – of being able to assign to O_0 on purely physical grounds at each moment of its existence a *spatially distributed region of space as its location* – is dashed.

2. The true nature of the spatial unity of material objects

The question of what it is that material objects ultimately amount to, given the truth of the Isolation-Assertion, is still unanswered – and not just by me. However, it is consistent with that assertion to assume that each material object is at every moment of its existence a collection – not *just* a

collection, but *also* a collection⁹ – of precisely located *material points* each of which has unit-mass and is spatially separated from the others (it being impossible that two material points occupy the same spatial point at the same time); the number of material points in such a discrete, discontinuous collection is usually very high, though always finite (otherwise the mass of a material object – that is: the sum of the masses of the material points which go into the object – would sometimes be infinite; but it never is infinite). This speculative hypothesis – which seems to me to be the simplest one consistent with the Isolation-Assertion – stays by and large within the confines of classical physics. Its non-classical element, of course, is the idea that the material points all have the same minimal mass: 1 unit-mass.¹⁰ The justification for assuming that material points all have the same minimal mass is obvious: material points have *no inner structure*, and they all have *no inner structure* in the same way; hence there is no good reason to assign different masses to them.

But, setting aside the non-classical element just described, is not this – by and large – *classical* hypothesis on the nature of material objects wildly unrealistic in view of modern physics, in particular, quantum physics? And is not this a very serious drawback to that hypothesis? The response to this query must be that descriptive realism, or the lack of it, is, as a matter of fact, not a relevant issue here. As I said in the beginning of this section: given the truth of the Isolation-Assertion, the question of what it is that material objects – that is, material beings which are three-dimensional space-takers – ultimately amount to is still unanswered, and modern physics (our, to date, best physics) has certainly not increased our hopes that this question will ever be answered in a way that would satisfy the cravings of the scientific realists. Given the truth of the Isolation-Assertion, the search for a *purely physical, mind-independent solution* to the problem of the spatial unity of material objects seems to me even less promising within the framework of modern physics than within the framework of (by and large) classical physics.¹¹ The right way to regard the hypothesis on the nature of material objects put forward above is, therefore, this: the hypothesis – true or not – states the *best* conditions compatible with the Isolation-Assertion for still achieving – in spite of bleak prospects – a

9 This caveat needs to be added in view of the *Constitution-Statement*, which follows later in the paper. The Constitution-Statement entails that a material object is at any moment of its existence a collection of material points *plus* its (the collection's) *territory* (so to speak).

10 If one measured their masses *in gram*, one would always obtain the same very small value of *m* gram; note the analogy to Planck's constant *h*.

11 Quantum physics has no place for material points (except if they are regarded as package-like concentrations of indefinitely spread-out wavelike entities and are in consequence without a precise location).

purely physical, mind-independent solution to the problem of the spatial unity of material objects. However, *even if* that hypothesis (which, compared to other hypotheses on the nature of material objects, is clear and perspicuous) turned out to be true and those best conditions really obtained, no such solution would be forthcoming – as will become completely evident below. *All the worse* for a purely physical, mind-independent solution to the problem of the spatial unity of material objects if that hypothesis turned out to be *not true* (and, indeed, *very likely* it has already turned out to be not true).

Material points are zero-dimensional material beings that exist at some times and occupy at any moment of their existence some *point in space* (a *point* in the sense of *physical geometry*).¹² It is important to keep in mind that no material point is a material *object*. The simple reason for this is that all material objects are three-dimensional material beings, whereas every material point is a zero-dimensional material being.

If material objects are at each moment of their existence collections of spatially separated material points, it is entirely clear why the Isolation-Assertion is true of them. Moreover, given this hypothesis on the nature of material objects – *the cloud-of-material-points hypothesis* – it is immediately evident that there is no place in space, no localized volume of space that any material object exactly fills at any time of its existence. If $\text{MAP}(t, O)$ – *the material-point-set of O at t* – is the set of all the material points that go into making up the material object *O* at the moment *t* of its existence,¹³ then there corresponds to that set the set $\text{LOC}(t, O)$ – *the location-set of O at t*. This set is defined as the set of every point in space that is occupied at *t* by some material point in $\text{MAP}(t, O)$.¹⁴ But since the elements of $\text{MAP}(t, O)$ are all spatially separated from each other at *t*, the set $\text{LOC}(t, O)$ does not constitute a place in space, a localized volume of space (nor a set of localized volumes of space). There is, indeed no lack of places in space of which $\text{LOC}(t, O)$ is a subset (that is, a part), but, clearly, each place in space of which $\text{LOC}(t, O)$ is a subset also comprises infinitely many points in space that are not elements of $\text{LOC}(t, O)$.

But might one not declare that $\text{LOC}(t, O)$ – the location-set of *O* at *t* – is *the location of O at t*, in another wider sense of “location” or “place in space” (such that not only localized volumes of space are possible locations for material objects)? Would it not, then, be determined on purely

12 The occupation (filling) of a *point in space* by a *material point* can only be *exact occupation (exact filling)*: a material point does not reach beyond the point in space it occupies, nor does the point in space reach beyond the material point by which it is occupied.

13 Since all the elements in $\text{MAP}(t, O)$ go into making up the material object *O* at the moment *t* of its existence, all the elements in $\text{MAP}(t, O)$ must exist at *t*.

14 Necessarily, every material point in $\text{MAP}(t, O)$ occupies *exactly one* point in space at *t*.

physical grounds *after all* (in a different sense than first envisaged, but nevertheless in an entirely adequate sense) where O is at t, and where it is not, giving O *after all* a spatial unity of a purely physical nature? The answer to these questions is a resounding “No.” As a material object, O is a *three-dimensional object*, and therefore LOC(t, O) (which is just a finite set of disconnected points in space) is out of the question as a candidate for being *the location of O at t*. It is only either a localized volume of space or, second-best, a set of spatially separated localized volumes of space that can, in principle, be *the location of O at t*. But, given the truth of the Isolation-Assertion, neither one of these two alternatives is feasible *on purely physical grounds* (as was seen in the previous section). In what follows I will concentrate on the first alternative, since, with regard to the *spatial unity* of a material object, it is clearly preferable to the second (and also because the second alternative can hardly be feasible without the first being feasible at least for some material objects).

The place in space of O at t – the location of O at t – (which is, in the now confirmed preferred sense, a localized volume of space) is not determined on purely physical grounds. Yet, the place in space of O at t is *determined*; this much is required by the spatial unity of O. How, then, *is* the place in space of O at t determined? Not on purely physical grounds, but certainly not without *any* physical grounds. The physical grounds are provided by the location-set of O at t, that is, by LOC(t, O). The place in space of O at t, VOL(t, O), whichever localized volume of space it turns out to be in the end, properly includes LOC(t, O); moreover, VOL(t, O) is related to LOC(t, O), its subset, in the following way: all points in space in LOC(t, O) are occupied (by material points), *whereas* the remainder of the points in VOL(t, O) is unoccupied by any material being (*empty* in the sense of footnote 3). This is how far the contribution of physical grounds to the determination of the place in space of O at t goes, and no further. The rest – the selection of one single place in space as *the* place in space of O at t from an infinite set of candidate places in space – is provided by *us*, by human subjects of consciousness. Phenomenal consciousness presents us with certain objects of phenomenal intentionality: seen and felt wooden spheres, for example. Such objects, certainly, are paradigmatic material objects. Let O be a wooden sphere. The place in space of this sphere, at a time when we experience it, is determined as an objectified upshot of our experience regarding the whereabouts of the sphere’s outer boundaries, that is, ultimately as an objectified upshot of our experience of visual and tactile *local resistance* of a certain – *spherical* and *wooden* – kind. A very important factor in this feat of the human mind is the ability of our consciousnesses to present something as materially continuous and coherent, forming a bounded whole, *which*, in *mindless* reality, is no such thing.

There is no reason not to generalize on the basis of this specific example. Thus, our objectified experiential findings regarding the whereabouts of the outer boundaries of a material object at a certain time are what determines a specific place in space for that material object at that time. *The* localized volume of space (namely, a certain localized solid of physical geometry) that is ipso facto specified by our objectified experiential findings regarding the whereabouts of the outer boundaries of a material object at a certain time – just is *the place in space* of that material object at that time. This is the only way in which the place in space of a material object at a certain time – *where* it is at that time, and *where* it is not – can be determined in the (actual) world; hence it is the only way in which the spatial unity of a material object can come into the world.

3. The true nature of material objects

And it's the only way in which a material object itself can come into the world. How so? We can state for any material object *O* that exists at a time *t*:

The Constitution-Statement

O is constituted at *t* by $\{\text{MAP}(t, O), \text{VOL}(t, O)\}$,¹⁵

where the connection between the two elements of this pair-set is established by $\text{LOC}(t, O)$ – that is, $\{x: x \text{ is a point in space} \ \& \ \exists y(y \in \text{MAP}(t, O) \ \& \ y \text{ occupies } x \text{ at } t)\}$ – on the followings grounds: $\text{LOC}(t, O) \subset^{16} \text{VOL}(t, O)$ and $\text{non}\exists x(x \in \text{VOL}(t, O) \ \& \ x \notin \text{LOC}(t, O) \ \& \ \exists y(y \text{ is a material being} \ \& \ y \text{ occupies } x \text{ at } t))$.¹⁷

As specified earlier, $\text{MAP}(t, O)$ is the material-point-set of *O* at *t*, $\text{LOC}(t, O)$ the location-set of *O* at *t*, and $\text{VOL}(t, O)$ the place in space of *O* at *t*: a certain localized volume of space. The relationship between $\text{MAP}(t, O)$, $\text{LOC}(t, O)$, and $\text{VOL}(t, O)$ has already been described in the preceding

15 Note that *O* need not be constituted at time $t' \neq t$ by the same pair-set $\{\text{MAP}(t, O), \text{VOL}(t, O)\}$: $\{\text{MAP}(t', O), \text{VOL}(t', O)\}$ may well be different from $\{\text{MAP}(t, O), \text{VOL}(t, O)\}$. Note also that *O* may be different from *O'* although $\{\text{MAP}(t, O), \text{VOL}(t, O)\} = \{\text{MAP}(t, O'), \text{VOL}(t, O')\}$ (see Section 5 for more on this).

16 “ \subset ” means “proper subset.”

17 How do some concepts of physics, used for describing material objects, fit into this picture? As follows:

The *mass* of *O* at *t*: the (finite) sum of the unit-masses of all the elements in $\text{MAP}(t, O)$.

The *volume* of *O* at *t*: the quantity of the extension of $\text{VOL}(t, O)$.

The *density* of *O* at *t*: the mass of *O* at *t* divided by the volume of *O* at *t*.

section; that description is here merely restated, using, for brevity's sake, set-theoretical symbolism. To the description, however, there is added, in the Constitution-Statement, the explicit assertion of what it is that a material object, existing at a given time, *amounts to*. (That assertion, by the way, should not be misunderstood as saying that a material object, existing at a given time, coincides at that time with a certain pair-set, an abstract object; I trust that the use of the language of set theory for *conveniently representing* – *not* for literally describing – ontological facts is readily understandable without needing long-winded explanations.)

Given basic physical reality, conceived of in the way described (involving material points in the way described), it is determined on purely physical grounds at a given moment of time *t* which material points exist at that time and where they are located. It is to be assumed that not every finite set of material points that exist at *t* is fit to constitute¹⁸ a material object at *t*: there are bound to be certain restrictions that determine highly selective *criteria of inner material coherence* which must be fulfilled by any set of material points that is fit to constitute a material object at a time.¹⁹ But one may assume that these criteria of coherence relate to matters that are purely physical in nature. Hence, given basic physical reality, it is determined on purely physical grounds at *t* which finite sets of material points that exist at *t* are *fit to constitute* a material object at *t*. But this fact of determination notwithstanding, it is *not* determined on purely physical grounds which objects exactly are the material objects that *are constituted* at *t*. Therefore, the material objects constituted at *t* – that is, existing at *t*²⁰ – *do not supervene* on basic physical reality. And therefore they are not purely physical objects.

For constituting a material object *O* at *t* *two things* are required (in conformance to the Constitution-Statement): (1) a finite set MAP of material points existing at *t* that is *fit to constitute* a material object at *t*; this set will become the material-point-set of *O* at *t*; and (2) a localized volume of space VOL in which all the elements in MAP are located at *t* and which is otherwise empty; this volume of space will become the place in space of *O* at *t*. The trouble is that the first factor of constitution does not determine the *second*; the second factor is largely (though not entirely) independent of the first. As I have argued, it is *we* who determine the second

18 More precisely (in view of the Constitution-Statement): “is fit to be one of the two factors in constituting.”

19 Those criteria are not easy to specify *even though* they are not criteria of inner material coherence which, if fulfilled, are *sufficient* for the constitution (or existence) of a material object – there aren't any such criteria –, but criteria of inner material coherence which, if fulfilled, make the constitution (or existence) of a material object *possible*.

20 If a material object exists at time *t*, it is constituted at time *t*, *and conversely*.

factor in the constitution of a material object at a given time t – and if not every set of material points that is fit to constitute a material object at t *actually constitutes* (i.e., co-constitutes) a material object at t ,²¹ then it seems that it is also *we* who determine the first factor in the constitution of a material object at t ; but I am not going to pursue this line of thought here further.

In determining the second factor of constitution, we more or less automatically observe certain implicit rules regarding the connection between $\text{MAP}(t, O)$, $\text{LOC}(t, O)$, and $\text{VOL}(t, O)$, or, better, *guidelines* (since not all of these rules allow of no exception) – *guidelines* regarding the connection between $\text{MAP}(t, O)$, $\text{LOC}(t, O)$, and $\text{VOL}(t, O)$ which come *in addition* to the absolutely minimal (non-negotiable) strictures specified in the Constitution-Statement itself. For example, the following guidelines – O (and later also O') being a material object, and t a time of its existence:

Guideline 1

$\text{VOL}(t, O)$ should fit $\text{MAP}(t, O)$, or, more properly speaking, $\text{LOC}(t, O)$, *very closely* (by our conscious, or more generally speaking: *cognitive*, lights!).

The surface of $\text{VOL}(t, O)$, in enveloping $\text{LOC}(t, O)$, should not be like a loose gown, but like a tightly fitting one. But we also observe the following guideline that relativizes (to a certain extent) Guideline 1:

Guideline 2

Although $\text{VOL}(t, O)$ should fit $\text{LOC}(t, O)$ very closely, $\text{VOL}(t, O)$ should be a comparatively simple localized solid of physical geometry – unless there are reasons for eschewing simplicity.²²

If a material object is constituted at a time – and, to repeat, it is *we* who constitute it – then all the material objects in it at that time are constituted together with it. In providing the places in space to these material objects, we observe the following guideline:

21 If every set of material points that is fit to constitute a material object at t actually constituted a material object at t , we would be confronted, it seems, with the so-called *problem of the many*. See Unger (1980) and, for further discussion, Lewis (1999). Perhaps this problem is a truly serious problem, perhaps not. (Why not accept that there are 1001 cats sitting on the mat, *given* that they all spatially coincide with each other to more than 99 percent?)

22 Such reasons – to give an important example – are present when living organisms are provided with places in space. What fills a living organism's intestines does not occupy space that belongs to the living organism's place in space (otherwise what fills a living organism's intestines would be a part of the living organism). Hence the place in space of the living organism is not a simple localized solid of physical geometry.

Guideline 3

If O' is a material object that is at t in the material object O , then $VOL(t, O') \subseteq VOL(t, O)$.

It goes without saying that these guidelines leave considerable latitude to our determination of a place in space for a material object, constituted at time t , of which the material-point-set at t is given. Other guidelines can presumably be added to those presented here, but this is not going to change the basic situation.

4. The tying up of some loose ends

Some loose ends need to be tied up. In this paper, the following mereological predicates have played an important role: “(material being) X is in the localized volume of space V at t ,” “(material being) X is in the material object O at t ,” “(localized volume of space) V' is a part of (localized volume of space) V .” All three predicates occur, for example, in the Central Definition, the definition of the predicate “ O exactly fills V at t ” in Section 1. Here follow the definitions of these three predicates:

D1

V' is a part of $V =_{\text{Def}} V'$ and V' are localized volumes of space and $V' \subseteq V$.

D2

X is in the volume of space V at $t =_{\text{Def}} X$ is an at time t existing material being, V a localized volume of space, and $LOC(t, X) \subseteq V$.

D3

X is in [or: a part of] the material object O at $t =_{\text{Def}} X$ is an at time t existing material being, O an at t existing material object, and $LOC(t, X) \subseteq LOC(t, O)$.²³

Two remarks: (1) We have already defined the location-set of a *material object* O at a time. The more general concept of the location-set of a *material being* X at a time t , $LOC(t, X)$, which is employed in the above definitions, is defined in exactly the same way: as $\{x: x \text{ is a point in space} \ \& \ \exists y(y$

²³ According to this definition, the phrases “ O is an at time t existing material object” and “some material being is in the material object O at time t ” are (analytically, or broadly logically) equivalent.

$\in \text{MAP}(t, X) \& y \text{ occupies } x \text{ at } t\}$, *assuming* material-point-sets for material beings in general, and not only for material objects. (2) Since material points must be counted among the *material beings* (though not among the *material objects*), the above definitions of *in-being* apply also to them.²⁴

The important concept of *material part-object* is defined as follows:

D4

O' is at t a material part-object of $O \equiv_{\text{Def}} O'$ and O are at time t existing material objects, and $\text{VOL}(t, O') \subseteq \text{VOL}(t, O)$.

It follows from the definiens of this definition that the material-point-set of O' is included in the material-point-set of O : $\text{MAP}(t, O') \subseteq \text{MAP}(t, O)$, and hence that the location-set of O' is included in the location-set of O : $\text{LOC}(t, O') \subseteq \text{LOC}(t, O)$. This is exactly as it should be.

Suppose that O' and O are at time t existing material objects and $\text{VOL}(t, O') \subseteq \text{VOL}(t, O)$, but that some material point p that is an element of $\text{MAP}(t, O')$ (and hence exists at t) is not an element of $\text{MAP}(t, O)$. Consider the point in space that is occupied at t by p , $s(p)$. $s(p)$ is an element of $\text{LOC}(t, O')$, but it is not an element of $\text{LOC}(t, O)$ (otherwise p would be an element of $\text{MAP}(t, O)$,²⁵ contradicting the assumption). Since $s(p)$ is an element of $\text{LOC}(t, O')$, it is an element of $\text{VOL}(t, O')$, because $\text{LOC}(t, O') \subset \text{VOL}(t, O')$ (according to the Constitution-Statement applied to O'). Hence $s(p)$ is an element of $\text{VOL}(t, O)$ (according to the assumption, $\text{VOL}(t, O') \subseteq \text{VOL}(t, O)$). But according to the Constitution-Statement applied to O : $\text{non}\exists x(x \in \text{VOL}(t, O) \& x \notin \text{LOC}(t, O) \& \exists y(y \text{ is a material being} \& y \text{ occupies } x \text{ at } t))$. Therefore, because of $s(p) \in \text{VOL}(t, O) \& s(p) \notin \text{LOC}(t, O)$, we finally get: $\text{non}\exists y(y \text{ is a material being} \& y \text{ occupies } s(p) \text{ at } t)$. But this is false, since p , which is a material being, occupies $s(p)$ at t .

In view of the result just reached and of Guideline 3, it is apparent that, for material objects O' and O , the phrases “ O' is in the material object O at t ” (*as interpreted by D3*) and “ O' is at t a material part-object of O ” (*as interpreted by D4*) are equivalent statements, which, again, is exactly as it should be.

²⁴ Note that the material-point-set of a material point p at a time t when it exists is $\{p\}$; $\text{LOC}(t, p)$, therefore, turns out to be $\{x: x \text{ is a point in space} \& p \text{ occupies } x \text{ at } t\}$, and this set is identical with the set $\{\text{the point in space occupied by } p \text{ at } t\}$.

²⁵ Remember: it is impossible that two material points occupy the same spatial point at the same time.

5. The identity of material objects

One of the most time-honored principles of metaphysics is the following:

The Location-Principle for the Identity of Material Objects

If O' and O are both material objects that both exist at time t and the place in space of O' at t is identical with the place in space of O at t , then O' is identical with O .

There are certain well-known objections to this principle. Tib is defined as being the cat Tibbles without its tail, and one day Tibbles' tail is destroyed (while Tibbles continues to exist). Then, at time t after that day, the place in space of Tib at t is identical with the place in space of Tibbles at t , and yet Tib and Tibbles are *non-identical* at t existing material objects – because they do not have the same properties, as one notices immediately if one looks at the *history* of Tib and Tibbles. Therefore, the Location-Principle for the Identity of Material Objects cannot be right – at least not in the completely general way in which it has been formulated above.

One might, of course, draw a different moral from the story of Tib and Tibbles – that Tib is not a material object – which, if true, would render the Location-Principle, as formulated above, inapplicable to Tib and Tibbles; *or* that Tib does not exist at t – which, if true, would again make the Location-Principle inapplicable to Tib and Tibbles; *or*, since the example involving Tib, Tibbles, and time t is an entirely arbitrary example, that no “arbitrary undetached part” of any material object ever exists;²⁶ *or* that although Tib and Tibbles are at t existing material objects and do not have the same properties, they are nevertheless identical – as the Location-Principle requires, but contradicting the Leibniz-Principle; *or* that the identity-relation is not transitive – which can be argued for in the following (to my mind: confused) way: if t' is a time before Tibbles lost its tail, then Tibbles at t' is identical with Tibbles at t , and Tib at t is identical with Tib at t' , and Tibbles at t is identical with Tib at t (this is what the Location-Principle requires for the at t existing material objects Tib and Tibbles, isn't it?), but Tibbles at t' just isn't identical with Tib at t' (contradicting the transitivity of identity). None of these reactions, which seek to preserve the Location-Principle for the Identity of Material Objects, seems to me at all attractive. The best reaction to the Tib-and-Tibbles-objection, it seems to me, is to give up the Location-Principle.

The following principle, however, is immune against objections of the Tib-and-Tibbles type:

²⁶ Cf. van Inwagen (1981).

The Fortified Location-Principle for the Identity of Material Objects

If O' and O are material objects that both exist at some time and both exist at the same times, and if the place in space of O' at every time of O' 's existence is identical with the place in space of O at the same time, then O' is identical with O .

But from the point of view of the present position on the places in space of material objects, there seems to be an objection of a different type even to the Fortified Location Principle, and even if one leaves modal considerations quite out of the picture. Let Tibbles-without-Proto be defined as Tibbles *without* a certain subatomic particle – the proton Proto – which, in fact, is in Tibbles at time t . Tibbles-without-Proto and Tibbles both exist at some time²⁷ and both exist at the same times. It also seems that the place in space of Tibbles-without-Proto at every time of this cat's existence is identical with the place in space of Tibbles at that time: there seems to be no reason to assign at any time of their simultaneous existence different places in space to Tibbles-without-Proto and Tibbles – considering that it is *we*, on the basis of our consciousnesses-*cum*-intentionality, who assign these places. But Tibbles-without-Proto is nevertheless non-identical with Tibbles – because their masses at t are non-identical, which, *according to the cloud-of-material-points hypothesis*, is equivalent to saying that their material-point-sets at t are non-identical. For Proto is at t in Tibbles, as we have supposed.

But this objection is, as a matter of fact, ineffectual. Take any moment t at which two material objects, O and O' , exist and which is such that $VOL(t, O') = VOL(t, O)$. On the basis of what has just been shown in the previous section, it follows that $MAP(t, O') = MAP(t, O)$. Therefore, if the material-point-set at t of Tibbles-without-Proto and the material-point-set at t of Tibbles are different – *and they are different* –, then their places in space at t must be different, too, and not identical as has been presumed in the above objection. Although it is indeed *we* who assign the places in space (qua localized volumes of space) to Tibbles-without-Proto and to Tibbles at t , we are bound by the strictures laid down in the Constitution-Statement itself to assign *different* places in space at t to these material objects.

27 Some will contend that the objection can be nipped in the bud by denying existence to Tibbles-without-Proto. But, to my mind, Tibbles-without-Proto exists at some time, since Tibbles exists at some time. For how could Tibbles ever exist without Tibbles-without-Proto existing at the same time?

6. The objection from physicalism

It remains to discuss some objections to the results presented in this paper. Perhaps the most important one of these objections is *the objection from physicalism*.

I have argued that every material object is at any time of its existence not purely physical, since its spatial unity at any time of its existence is not of a purely physical nature. I have argued, moreover, that it is *not* determined on purely physical grounds which objects exactly are the material objects that are constituted at a given time, that, in other words, the material objects that exist (are constituted) at a given time do not supervene on basic physical reality. I have asserted, and made plausible, I hope, that the material objects that are constituted at a given time are, to a considerable extent, products of human consciousness: of the intentionality of human consciousness.

But, one might object, it cannot be true that the material objects that exist at a given time do not supervene on basic physical reality and are to some extent products of human consciousness. It cannot be true, because human consciousness itself supervenes on basic physical reality. Suppose that the material objects constituted at time *t* are to some extent products of human consciousness. Then the only other factor in their production is, certainly, basic physical reality. But human consciousness itself, it is asserted, supervenes on basic physical reality. Hence, since basic physical reality determines human consciousness and is the only factor besides human consciousness in the production of the material objects constituted at *t*, basic physical reality *ultimately determines all by itself* which material objects are constituted at *t*. Therefore, according to this argument, the material objects constituted at *t* *do* supervene on basic physical reality even though they are to some extent products of human consciousness.

The central premise of this counter-argument is that human consciousness supervenes on basic physical reality. On this basis, one can argue that *it is not true* that the material objects existing (constituted) at a given time do not supervene on basic physical reality *and* are to some extent products of human consciousness. But one may just as well – *at least* just as well – take *as premise* the assertion that the material objects existing at a given time do not supervene on basic physical reality *and* are to some extent products of human consciousness, and argue on this basis, contrapositively, that human consciousness does not supervene on basic physical reality. This, in itself, is an important result for the philosophy of mind, which is dominated by materialism in a way that can hardly be considered rational.

7. Is this idealism?

It is not, of course. Neither the mind-independent existence of space nor the mind-independent existence of matter is being denied. It is merely maintained that certain, not unimportant features of physical reality are underdetermined by basic physical reality and are co-determined in their ontological constitution by the human mind. Without the contribution of the human mind *all of physical reality* would just amount to *basic physical reality*, and basic physical reality, as far as its specifically *material* aspect is concerned, is, according to the (by and large) classical picture that was employed in this paper, just the lawfully unified totality of material points in motion. The picture of basic physical reality which is induced by quantum physics is rather less clear than this; but that it is also true from the quantum-physical point of view that *material objects* – three-dimensional material space-takers, in particular, the macroscopic *things* (*living* and *non-living*) that are the immediate intentional objects of our conscious experience of the physical world – neither belong to basic physical reality nor are determined by it *seems undeniable*.

“If it’s not full-fledged idealism,” one might respond, “yet it surely is at least *partial idealism*. And partial idealism is already absurd enough. According to your position, the dinosaurs, existing long before human beings made their first appearance in natural history, must have been constituted, in part, by *us*. And are there not countless material objects which perfectly exist though they are nobody’s intentional object? And what, precisely, is meant if it is said that material objects are constituted by *us*? By all of us? By the experts? By *you*? One answer is as absurd as the other.” My responses, in turn, to these objections are the following:

(1) Truthfully postulated material objects – like the dinosaurs that once existed but do no longer exist, or material objects that exist though they are nobody’s intentional object (it is meant: nobody’s *evidentially given* intentional object) – have at the times of their truthfully postulated existence truthfully postulated places in space. We provide them with these places in space – they do not have them *an sich* –, but of course not in the same manner as a place in space is provided by us for an actually seen and/or felt – hence *to a high degree evidentially given* – individual material object. We provide them with places in space more or less *unspecifically*, corresponding to the manner in which those material objects are objects for us: in the manner of *not being evidentially given to a high degree*, perhaps in the manner of *not being evidentially given at all* (though still truthfully postulated).

(2) The – partial – constitution of material objects is not normally an activity we carry out *in person*; it is normally achieved automatically (except

for tricky cases²⁸) by our – by each one’s – *cognitive life* (that is, one’s stream of consciousness, *plus* the dispositions that are inherent in or come to be attached to it). Hence it would, indeed, be a more proper way of speaking to say that a material object *is constituted* (impersonally) in our – in each one’s – consciousness²⁹ than to say that *we* constitute it. Nevertheless, properly understood, the latter phrase is not objectionable, and in particular, understanding the “we” *truly collectively* is not objectionable. For with regard to our cognitive lives (in which the constituting comes about), we human beings are in some respects – namely, the respects relevant for constituting material objects – rather similar to each other, and it needs to be emphasized (against the accusation of idealism): our cognitive lives interact with a single mind-independent basic physical reality in which we all are similarly rooted; this is what makes our cognitive lives similar to each other in the respects relevant for the constitution of material objects. The result is a common world of material objects – this stone for you is the same stone for me (which is not to say that there is no room for disagreements). However, this common world of material objects is neither a part of basic physical reality nor determined by it. It is, as a matter of fact, not of a purely physical nature, but a partly mind-constituted *Lebenswelt* (to appropriate a famous Husserlian term).

8. Two easy ways out?

There seem to be two easy ways of escaping my argument that material objects are at no time of their existence purely physical because their spatial unity is at not time of their existence of a purely physical nature. What makes these ways seem easy is that they do not deny the Isolation-Assertion; they are reactions to the Isolation-Assertion – accepting its truth – but they are different from the way of dealing with this assertion that I have favored in this paper.

28 Such cases are material objects – for example, orchards – that even to the naked eye have a lot of empty, or at least *airy*, space “to them.” How much of that space belongs to them at a given time – to their place in space at that time –, and how much of it does not? This cannot be decided automatically. (To the extent it is left undecided, the objects fail to be constituted, fail to exist; but, in practice, we often take near-existence as existence-near-enough.)

29 Note that Edmund Husserl, the great 20th-century idealist, often used the reflexive expression “konstituiert sich” for what is intended here by “is constituted.” The German expression can be literally translated as “constitutes itself.” But unfortunately the English equivalent emphasizes agent-reflexivity, which, however, is a meaning component not at all intended by Husserl (quite in accordance with German usage). Thus the impersonal passive expression “is constituted” is the proper rendering of “konstituiert sich.”

I have proceeded on the assumption that some material objects exist at some time and that every material object has at every moment of its existence a *precisely defined* spatial unity (that is, a *spatial unity* in the usual, unqualified sense, which unity requires it to have at every moment of its existence a *precisely defined, determinate* place in space); that unity, however, (as I have argued) is never of a purely physical nature – and therefore: *no material object is at any time of its existence purely physical*.

The *vagueness-reaction*, on the contrary, maintains, vis-à-vis the Isolation-Assertion, that although some material objects exist at some time, no material object has at any moment of its existence a precisely defined spatial unity – but, nevertheless, *all material objects are at all times of their existence purely physical*. There is, according to the vagueness-reaction, no reason to give up this ontological tenet.

The *elimination-reaction*, in turn, maintains, vis-à-vis the Isolation-Assertion, that because no material object has at any (hypothetical) moment of its existence a precisely defined spatial unity, no material object (in fact) exists at any time – and therefore (trivially and vacuously): *all material objects are at all times of their existence purely physical*.

The vagueness-reaction and the elimination-reaction – they are in opposite ways *metaphysically radical* – have, as a matter of fact, nothing to recommend them – except, of course, that they avoid “idealism.” For it seems undeniable that even some *macroscopic* (hence composite) material objects exist at some time (and not just living organisms, as van Inwagen believes,³⁰ but also artifacts – for example, the painting called “Mona Lisa” – and non-living natural objects – for example, the moon). It also seems undeniable that there is no such thing as an at a time *t* existing material object without a precisely defined spatial unity at *t* (or, in other words, with only a fuzzy spatial location at *t*). Lest this seem ontological dogmatism, here is an argument:

There will be, of course, an *appropriate* set of material points M ³¹ and a many-membered set Ω of localized volumes of space, which is such that each member *V* of it is such that all the material points in *M* are at *t* in *V* and such that *V* is otherwise empty at *t*. But the pair-set $\{M, \Omega\}$ does not constitute at *t* a material object with a fuzzy spatial location. For if it con-

30 Van Inwagen (1995) makes an exception for living organisms, but otherwise advocates eliminativism with regard to composite material objects – for reasons that seem to me, on the whole, closely related to the basic ontological assumption of the elimination-reaction: *lack of unity entails lack of existence*. This assumption is quite correct (but note that it is *negated* by the vagueness-reaction). What is incorrect is the other assumption of the elimination-reaction (*shared* by the vagueness-reaction): that all material objects lack unity at any moment at which they exist (though it is true that all material objects *would* lack unity at any moment at which they exist *if* their unity had to be built solely on physical grounds).

31 *M* is “appropriate” in the sense of being fit to *constitute a material object*.

stituted one, would not $\{M, \Pi\}$ constitute at t *another* such object? – where Π is any *proper subset of* Ω with at least two members, *or any proper superset of* Ω which is such that each member of it is a localized volume of space V' such that all the material points in M are at t in V' and such that V' is otherwise empty at t . In other words, once one gets started with spatially vague material objects, there are just too many spatially vague material objects around: infinitely many, all constituted (hence existing) at the same time t , all based on the same set of material points M , some of them spatially vague at t to a high degree (if Π is very much diversified), others to a low degree (if Π is not much diversified). Instead of living with this totally unnecessary infinity of vague material objects, it is certainly better to accept that there is just *no* spatially vague material object *at all* constituted (i.e., existing) at t on the basis of M .

But might one not reduce the flood of infinitely many spatially vague material objects that are *prima facie* constituted at t on the basis of M *to just one* by selecting one of them, *the true one* (so to speak), discarding all the others? But *who* would do the selecting? *We*, of course, and if it is not to be a totally arbitrary choice that we are making, then our consciousness-*cum*-intentionality, hence our experience of material objects, would have a large say in it. In other words, we are back to “idealism” – the very thing that the vagueness-reaction set out to avoid.

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