The Semantics of Absolute Space

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Some elementary logical facts are recalled, such as, that growing in space presupposes space, or that the growing of things in space is not at all like the (alleged) growing of space. It is argued that space is not even a thing in the first place (I can take the picture of an object in space; but can I take the picture of space?) It is shown that questions of the type "does space grow" = "what is the extension of space" = "what is the extension of extension", are completely meaningless. Finally, it is proved that Einstein's equation for length contraction, rather than contradicting the existence of a constant space, in actual fact presupposes it.

"There is something very bothersome about the idea of an expanding universe", says Thomas R. Love in the October issue of *Apeiron* (1993). He couldn't be more right. The idea *is* bothersome. My reasons for saying this may hardly stem from sources sharing a great deal with his own, but our final conclusions certainly converge. Our intentions may still be identical, even if our motives are distinct. So I would wish to state my own as a supplement to his, together with our common incredulity:

1. I take it that the assertion that the universe is expanding logically implies or is equivalent with the assertion that "space expands". Not merely because the announcement that "space grows" is frequently stated by various theorists as but an alternative expression of the claim "the universe is expanding" (Bredimas 1988, pp. 218-9, 244, respectively). But chiefly because the two expressions are mutually entailed. "Universe" is an all-inclusive term, so that it would contain "space" by definition. But the reasons for their mutual entailment run far deeper than the mere "unpacking" of the definitions of a term notorious for its vagueness, such as the term "universe" is.

One can (I think) consistently redefine "universe" at the exclusion of empty space, and then restate the initial contention of expansion without necessarily involving the latter concept (*viz*. empty space). But even were it so, still one cannot consistently argue that the universe is expanding, *without* having first established that either space itself is infinite, so that it will make room for such expansion; or, otherwise, postulate that space itself *grows together* with the universe, (which, besides, constitutes the actual practice of expansion theorists), since obviously the latter cannot expand in a *finite* and *non-expanding* space. But to accept the former alternative would entail a tremendous concession; for space *would* be infinite after all, and that, rather than yielding support to finite-universe models, would more likely prepare the ground for their impending collapse. So there remains but the latter alternative; namely, that of treating the expressions "the universe is expanding" and "space grows" as equivalents. So that if the universe expands, space itself must grow.

I will therefore concentrate on the latter claim (one that I feel more at home with) and attempt to show that, in its case, people such as Th. Love (and myself) have a far greater deal to be bothered about than they would with its more 'innocent' looking next of kin.

2. We all have a clear conception of what it is for a *thing* to grow in space. Quite simply, the thing takes up *more of space* now than it did before. But that *presupposes* the existence of space in which the thing can grow. For the thing cannot take up *more* of space now than it did before, unless there is a space to be so taken. But do we have a conception of what it is for *space* to grow?

For to say, similarly, that space itself grows, and were this assertion to be understood in like fashion, it too would *presuppose* the existence of space, in which the putative 'space' is said to grow. Whence, the initial claim would seem to be refuted, since instead of putting forth a theory which *generates* space (from its initial, geometrical-point dimensions to its present ones), it would trivially reduce to a theory which presupposes space and which, as such, fails quite miserably in its promise to *derive* space from other premises.

3. Space *cannot* be so derived. Not ever. Whatever premises are deemed capable of doing so, will subsequently be found to already contain spatial attributes themselves, and so to themselves presuppose the very concept which is allegedly claimed to follow from them. The concept of space logically *predates* all concrete instances of the employment of spatial attributes and relations. From the empirical evidence that "A is a distance from B" (and similar such) the concept of space is not *generated*, as some suppose, but *presupposed*. For the utterance in question is itself based on a prior conception of space in general, exemplified in this case by the distance between A and B. It is not the perception of the distance which generates the perception of space. Perception of the distance *is* the perception of space.

Post-Relativity physicists were too prone to sneer at Kant's repeated claims that "space is a concept warranted a priori" (Kant 1973, B 38, A 24-B 39 ff.) (for it would itself have to participate in all attempts at its derivation), construing "a priori" in a number of silly ways, utterly foreign to Kant's actual contention, associating it with *psychological* connotations, which *could* be disproved by experience, instead of with *logical* ones, which can not.

But if space is really like that, space simply cannot grow. For any such concept, which logically predates all its (relevant) instances, and thus posits itself *in advance* of them, is simply a concept which is *always there*! And therefore wholly unfit for the treatment that expansion-theorists have in store for it, in accordance with which there was (ever) a time, when it wasn't there at all. Space just isn't that sort of a concept. It is because of *this* that we unanimously tend to regard space as *infinite*. Because its *absence is a logical impossibility*, (or, in weaker terms, a logical inconceivability); in other words, because space *necessarily* exists. And the notion of a growing space is but the notion of a space which was smaller once than it is today so that, were one to regress sufficiently far back in time, of a space which was once entirely absent—a possibility which all thinkers prior to so-called recent 'discoveries' unanimously dismissed. It is for the very same reason that we cannot conceptually tolerate even the idea of an (existing but) *bounded* space. For this too would imply an absence of space beyond the specified boundaries.

4. But §3 can at best serve in establishing a conflict between what I claim our general concept of space-proper *should* be, and the contentions of expansion theorists themselves. It has not also established a contradiction within the notion itself, and expansion-theorists need only reject my claim to steer free of all trouble. Perhaps we can do even better.

Having observed in §2 that growing in space presupposes space, we can now proceed to unearth a definite contradiction in the notion of a growing space itself. Apparently, a constantly growing space is a space which has definite *dimensions*, and so definite *boundaries*, at any given instant of time t_1 (and greater dimensions at any later such instant t_2). But if, according to the argument, every growing thing requires an independent space to grow in, it must be *false* to say that space grew at all, to begin with. For if everything growing in space presupposes space to grow in, then obviously the (putative) space itself also does, and then the alleged *boundaries* of space, existing at t_1, were never boundaries of space in the first place; since they were certainly not the boundaries of *actual* space, which was already there all the time, but only the 'boundaries' of a putative space, provisionally assumed. Thus the supposition that space may possess definite boundaries, combined with the remarks of §2 leads to a contradiction.

5. The only way by which conclusions such as the foregoing may be avoided, especially those of §2-4, (§3 is self-contained by and large), is if the following premise is disputed; namely, the supposition that the assertion "space grows" is to be understood in its *ordinary* sense, as is clearly implied in §2. Indeed, insofar as the ordinary sense of "grow" is retained, space *is* presupposed in every instance of growing. However, revolutionary scientific theories do not merely disclose hitherto unsuspected facts. They also entail profound revisions of the *concepts* involved in the disclosure of such facts. Thus, the *meaning* of the assertion "space grows", in the context of post-Relativity physics is no longer to be confused with the meaning of "*X* grows" or, far less, with the meaning of "space grows", as those would emerge in pre-Relativity physics. If the terms "space" and "grow" retained their Newtonian meanings, incoherences of the sort exposed above would indeed follow. But it is simply a semantic error to think that theoretical terms, extrapolated from a certain theory and reintroduced in another, retain their original meanings. In actual fact, in some aspects they may be changed beyond recognition. Elementary semantics proves that the overall logical behaviour, and so the very meaning, of one and the same proposition depends crucially on the *Context* (Feyerabend 1971), in which it appears. Thus, *e.g.* the proposition "Alexander the Great was a Roman" will serve excellently well in a Grammar lesson, if intended as a sample of a subject-predicate sentence. But it will hardly serve at all in a *History* class, where its truth or falsity is the issue. The proposition is perfectly admissible in a certain context but inadmissible in another. All the more so if the contexts involved are as separate and foreign as the conceptual structures of Newtonian Mechanics and Relativity respectively. Whence, the accusations resting on an ordinary understanding of the assertion that "space grows", are wholly misplaced and ill-founded. The very presence of theories such as Relativity theory attest to the inappropriateness and unsuitability of just this sort of an understanding of the assertion. (Feyerabend 1971).

6.

a. §5 condenses the reasons for my personal lifelong dissatisfaction with my own colleagues, philosophers of science, this time. The issue of context-dependence and meaning-variance is an extremely tricky one and demands a transfer of the debate to the domain of semantics *per se*, although its ultimate answer, if there ever is one, will clearly have most definite implications for the status and development of contemporary physics. It goes without saying that, if such violent, essentially *discontinuous* changes of meaning are deemed tenable on the semantic level, (and it is by no means clear what a change of this sort would be), the physical theories which entail them should be proportionally relieved.

Yet as there is no such prospect in view, not even remotely, a defense of this sort is hardly compelling, so hardly prohibitive to the following comments:

b. The shift from fact to meaning, and the attempt to defend the truth and coherence of the former by blindly grasping at what elusive little we know about the latter, is neither a helpful nor a plausible alternative. First of all, this manoeuvre takes it for granted that space *does* grow, whatever new and different that would come to mean in the present context, so that a (discontinuous) change of meaning of the terms "space" and "grow" is thereby inescapable. But prior to deciding whether meanings *have* actually changed in the way demanded by the theory, it seems to me that one should consider first and foremost, whether the theory in question is at all *true*. For then the correlative meaning change *would* be inescapable. But it would certainly not be, were the theory to be proven *false* instead, and this latter we do know to have happened to theories in the past. To take it for *granted* that the theory is true, and thereby proceed on the basis of this to propose whatever semantic rearrangements are deemed necessary, is to exercise a most peculiar sense of priorities. In short, the meaning -change defense of "space grows" is a grossly circular one. For it takes for granted the very point at issue here; *viz*. that the theory which claims this is itself *sufficiently warranted* to enforce and implement the meaning change of the terms "space" and "grows", which is requisite for its coherence. But is it sufficiently warranted?

And, once the question is put thus, *how* do we go about testing its truth and its coherence? For if not yet recorded as "true", the theory will *not yet* have brought about the conceptual change required for *giving* it its claimed coherence and then, in present absence of the required meaning-change, we are as yet left with but the *ordinary* meanings of these terms instead, the analysis of which has already shown the theory to *be* incoherent.

Stated differently, the foregoing considerations disclose another paradox; that, if recourse to the meaning-change defense is attempted, then no physical theory can be charged with incoherence *ever*, provided it is revolutionary enough! For then it would turn up incoherent only on pre-revolutionary standards which, however, according to the meaning-change defense, become themselves automatically *outdated*, upon introduction of the new theory. And therefore unsuitable for its evaluation. I fail to see how *any* physical theory would fail to pass its coherence test in this situation, provided it is revolutionary enough.

c. Finally, such a radical redefinition of the key terms involved in the assertion "space grows" as the one required for safeguarding its coherence is of no use even to expansion-theorists themselves, even were the previous remarks to be as such ignored. For obviously, if the assertion "space grows" is to be taken in a sense so utterly unlike the ordinary one we have thus far been considering, then, even were it true in *that* sense, it still could not have the slightest effect on the ordinary meaning of the *contrary* assertion, "space does not grow". For the contention, "space grows", can act as viable opposite to its contradictory, "space does not grow", if and only if the two assertions differ in nothing save the negation sign itself. If either one has a *different meaning* from the other, it is simply a *different assertion*, and therefore not the assertion required for contesting the truth of "space does not grow".

Just remember that *all* the information I need in order to produce a negation to a statement—any statement—is that I be told what the statement is. Then I have but to repeat it, by adding "not" in front of it (or in the grammatically correct place). Every statement in existence automatically suggests its contradictory.

This simply means that the two statements, the affirmative and the negative, from the point of view of semantics, share *everything* in common except of course the negation sign. If from any statement I can deduce its contradictory, this is simply because there is a single *sentence* underlying both, *e.g.* the sentence "it is raining", which is affirmed or denied by the making of the appropriate *statement*—in other words, a single *meaning*, which is applied or withdrawn, depending on the circumstances. But if "space does not grow" is to have a (sentential) meaning *other* than that of its negation, "space does grow", then the latter would not be its negation in the first place, and thus incapable of opposing or contesting it in any sense. Therefore, the meaning-change defense of "space grows" is completely inoperative and, in failing to provide the requisite opposition, constitutes no reason whatsoever for one to *abandon* one's thesis, that space does not grow.

7. When one speaks about a growing space, one speaks of a space with *definite dimensions* (at any instant of time, as indicated in § 2-4). Yet what is this contention supposed to mean? What else, indeed, than that space itself has a certain *extension*. Now it is the most natural thing to say of an object, that it has a certain extension. But is it equally natural to say so of space itself? For when one says of an object, that it has a certain extension, one simply means that it *takes just so much of space*. So that the question "what is the extension of this object" is but an equivalent of the question "how much of space does this object take". Which shows what hardly any one is (or should be) ignorant of. Namely, that "space" and "extension" are synonymous terms.

Thus, from "space grows" one obtains "space has definite dimensions" and from "space has definite dimensions" one obtains "space has a certain extension". And by putting synonyms for synonyms in "space has a certain extension" one obtains "*extension* has a certain extension". Well, then, what is the extension of extension? The meaning of this 'question' is directly comparable to the meaning of questions such as: 'What is the *length* of "length"?' or, worse, 'what is the *weight* of "weight"?'. In other words, what is the length of the *concept* of length, or the weight of the *concept* of weight. To say that all this is utter nonsense, though certainly true, is not to say everything the case deserves.

8. Space is not a thing [see also (Keys and Martin 1994)]. This much must have been made evident by now. We can touch, hear, smell or taste things. But we cannot touch, hear, smell or taste space. We can stumble across a thing. But we cannot stumble on space. Material objects do interact with our sensory apparatus. Space does not. But surely, one will retort, we can at least *see* space, and sight is the all important sense in this connection.

The fact is that we cannot see space either. No one will deny, I take it, that what can be seen by the naked eye, can also be *photographed*. But can we photograph *space*? Suppose we take the case to an expert photographer. First we ask of him to take the picture of an *object*, any object, in space. He understands this instruction perfectly and complies. We ask him to repeat the process so as to make sure. And then we ask of him the following: 'So far you have been taking the pictures of objects in space. But now we want from you something different. We no longer want you to take the picture of any *object* in space. We just want you to take a picture of space. Not the picture of any object in space But *just* the picture of space'. One is most intrigued to have the film developed.

Space cannot be photographed, because space *lacks* the properties of matter. It is in this sense, I would imagine, that Anaximander declared that "the *apeiron*", from which the elements is something that is *different*", which the present Journal has so appropriately set as its front page motto.

Material objects can and do interact with our sensory apparatus, as they do with one another, their interaction with our sensory apparatus being but an instance of the general case. Space does not. But it nowhere follows that the frame *in* which material objects interact is itself susceptible to a similar interaction, any more than it follows that a *set* itself participates in the propertis of the members of which it is the set. For there are *other* things besides material objects which can be real: *e.g. relations*.)

Thus, matter cannot *curve* space either, regardless of what additional properties we ascribe to it or postulate. Were it true that space grows, or that it can be curved, then it would be true, at least in principle, that space could be *made* to grow or *made* to curve, since anything susceptible to expansion or curvature can be made to expand or curve artificially, that is to say, in laboratory conditions, provided that the technology is available. But not even expansion-theorists themselves have gone that far. Perhaps for the simple reason that first things come first, and so prior to conceiving experiments which would make space grow or curve, they should at least be able to take its picture first.

9. If space cannot be acted upon, space cannot be interfered with. So whatever it is, it is there for good. In other words, space is a *constant*. But has not the Theory of Relativity disproved exactly that type of conclusion? To nearly everyone this is exactly what it has. But the truth is quite different. It is only ignorance of basic semantic rules that can support this supposition. Einstein's equation $l = l_o\sqrt{1 - v^2/c^2}$ for length contraction does anything but contradict the assertion that space is constant, despite the fact that this is *the* interpretation ascribed to this relation, uncontested as it is due to total absence of any contrary suggestion.

Take any rod of a definite rest length l_o and suppose it to be accelerated at various velocities before the eyes of a stationary observer. Then for any velocity $v_2 > v_1$ there will correspond a length $l_2 < l_1$ and so on for all other velocities in the direction parallel to the motion. (At $v = c$ the relation predicts that the rod will be completely flattened out in this direction, but I cannot profess to even begin to understand this. So I will let it rest).

Why is it, indeed, that a phenomenon such as this demands a *relativistic* treatment? Because the successive lengths measured depend on the state of motion of the measured object and thus differ from one another *depending* on the various states of its motion, rather than reflecting a definite length autonomously possessed by the rod in question. Length is *relative* to (state of) motion. And therefore not a constant.

So far so good. But, and the crucial importance of the question following I can hardly overemphasize, *why suppose at all* that the lengths measured, differ due to varying states of motion of a *single* rod, rather than supposing that what has been passing in front of the observer's eyes were *different rods of different lengths* instead? That too would explain the observed differences in length. Is there, in other words, any reason to suppose that it is the *same* rod, only exhibiting different lengths, rather than as many rods as are different lengths involved? Quite clearly, this is a question that can be settled independently, and answered accordingly. For unless we make absolutely certain that it is always *one and the same* rod in possession of one and the same *length* behind all these transformations, the case would trivially reduce to the commonplace fact that different rods moving in front of one possess different lengths. And this possibility would simply eliminate Relativity altogether, since the very *problem* which this theory was constructed to solve in the first place, could not even be posited. It has to be the *same* rod, of the same length, all the time, if there is to be a problem at all of the kind that only Special Relativity can solve. For there is no problem whatsoever, in many rods having many lengths.

The logic of the situation is the logic of *disagreement*, in other words the logic of *Reference*. In order that you and I can at all disagree, and so utter incompatible assertions, we must first fix a reference. For if you say "the car is moving" and I say "the car is at rest" while pointing (referring) to different cars, we anything but disagree. Not unless we point to the *same* car. Thus, if and only if it is independently established that the different lengths measured belong to a *single* rod, possessing a *single* length all the time, (for the rod, unknown to the observer, can be made to change its length by purely mechanical devices, *e.g.* telescopically) will there ever be disagreement of the sort required by Special Relativity. Otherwise, *viz*. if the suspicion that there are as many rods of as many lengths or a single rod of as many lengths mechanically changing is not effectively excluded, the lengths would not be the lengths of a single rod, *relative to its motion*, but different lengths of different rods or different lengths of a single rod, *independent* of its motion. And then the phenomenon would not be subject to a relativistic treatment at all. It would simply make Special Relativity redundant.

There is therefore a single rod, of a *single* length involved in the process, (even if we cannot ever measure it as such). Relativistic arguments cannot even get started without this all too crucial assumption, to be casually dropped and forgotten afterwards in whatever is (erroneously) said to follow from $l = l_o\sqrt{1 - v^2/c^2}$. And the single rod of the single length possesses a length which, by definition, is to remain *constant* throughout the process, during which, the rod's length is acknowledged the status of a thoroughly *self-possessed* property. Thus, Special Relativity, far from having refuted the axiom that space is a universal constant, is proven here to have unreservedly *presupposed* it as part of its foundations, if it is to at all proceed with the formulation and announcement of its own conclusions. (Another time in this note that the word "presuppose" has become inevitable in connection with space). What Special Relativity has disproved, is that *measurements* of space (length) are not universally constant. Which is another matter altogether. For this is not a statement about how things *are*, but one about the way they *appear*, when measured.

10. This concludes my examination of the contention that space grows and of all the assertions explicitly or implicitly connected with it. My findings, not the sort of findings peculiar to the science of physics, but to another discipline by and large, are wholly negative. But I don't see why physics cannot cooperate with this discipline, since their differences notwithstanding, they certainly share a great deal in common, the present cause being no mean example of the frequent intimacy of their bonds. Conceptual issues are far too important to be treated unilaterally and, in a sense, the arguments presented here are but a warning against just that sort of practice, when a group of highly specialized scientists, proficient in handling abstract problems within a narrow field of enquiry, subsequently carry on as if it were a personal affair, negligent, ignorant or, sometimes, even consciously and arrogantly indifferent to the fact that their findings raise a multitude of issues, only a few of which they are by profession equipped to handle. No doubt, when Richard Feynman announced that "positrons are electrons moving backwards(!) in time" (Dingle 1979), he was confident that only men such as himself were authorized to adjudicate on such matters, oblivious of the fact that in saying this, *he was but using words*, words recorded and with definite meanings, which are individually used by all of us, scientists and laymen alike, yet using them in ways entirely foreign to any accepted, actual, or even potential sense. As a consequence, he was not making any sense. He was not making any sense because words are the limits of our conceptual universe, and any one challenging them so profoundly, for whatever reason and by whatever justification, will place oneself beyond these limits at the cost of talking nonsense, *even if transcending these limits were in itself desirable!*

It is so with the idea that space may grow. The idea is simply, utterly, conclusively incoherent. Still, since much of the argument to this end has relied extensively, if not indeed exclusively, on semantic considerations, one might be tempted to turn the table on my approach and point out that according to another, not hitherto mentioned but equally fundamental law of semantics, if any assertion is incoherent or plain meaningless, so must be its *negation*. (This could be even supported by the contents of §6c). Thus, if "space grows" and its correlates (*e.g.* "space is finite") are labeled meaningless or incoherent, so must their contradictories, "space does *not grow*", (or "space is *not* finite") also be. So what has the present analysis accomplished?

It is true that the negation of a meaningless assertion yields but an equally meaningless assertion. But there is a certain class of statements whose status is such that they truly deserve to be treated as exceptions. (Actually, the rule simply does not apply to their case): *necessary* statements. Of these, although the negations will certainly yield meaningless, incoherent or, generally, impossible statements, the affirmations will be perfectly meaningful, coherent and as necessary as ever. For their negations yield meaningless, incoherent and impossible assertions, *because* they are themselves necessary. So it is in this sense of meaningless, that "space grows" or that "space is finite" may be meaningless assertions—*because* their negations are necessary.

It must be this, if anything, which has bothered people like Thomas Love (and myself) right from the start, when we first heard that the universe expands. But, assuming he has read thus far, it is to be hoped that he has begun to wonder whether he should have really bothered after all.

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