Is matter necessary for the existence of space and time? Discuss with reference to two or more thinkers.

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1 Thesis

(**F**) (P1) If an entity is necessary (and sufficient) for the existence of space, then space is relational.

(P2) If space is relational, then matter is necessary (and sufficient) for the existence of space.

(P3) If space is substantival, then it is absolute.

(P4) Space is not absolute.

(C1) Space is not substantival, or in other words, it is relational.

(C2) Matter is necessary for the existence of space.

2 Premise 2

I shall argue that if space is a relational entity, and not a substantival one, then space necessarily depends on matter for its existence. That is to say, a system of material bodies with spatial relation, or "successions of situation", is sufficient and necessary in defining space as a relational entity.

Before starting, I would like to assume the naive substantial distinction between the physical and the mental. The reason being if the latter collapses into the former, then my premise is true by definition. As a caveat, I shall not attempt here to demonstrate why the former cannot collapse into the latter, but I can claim such a view ultimately defeats the point of answering this question.

First, if space, as abstracted from everything, is a relational entity, then the propositional properties derived from a set of sentences describing a system of bodies in space would be relational properties. If "I am next to the computer" is such a system of bodies, then "being next to" is the relational property derived from the system. Now, if I remove the subject and object particles from the sentence, and replace them with X and Y respectively, then we have the sentence "X is next to Y". If I attempt to substitute X and Y with something, then I *prima facie* do so with physical objects—those comprises of matter. I claim that such an action is ostensible proof that only objects of matter can substitute X or Y in this sentence. While such a claim appear terse, consider the opposing case using mental images. If I now sit in park and think of an image of myself being next

to my computer, then while I can utter the sentence "I am next to the computer", such a sentence will make no sense unless I clarify that "the concept of myself is next to the concept of a computer". But even then, such a sentence is meaningless. If two concepts can be said to be next to one another, then they can also be said to be on top, under, in front, etc., without any means to differentiate between them—they are mere utterances. Therefore, while it might be painfully trivial, if spatial relations can be ascribed to both physical or mental bodies, only the first will have any worthwhile propositional content. This proves my first premise.

3 Premise 3

To clarify, by"substantival", I mean a classification of space which considers it as a substance, or in other words, that which exists on its own. Being substantival necessarily entails that matter is independent from space, by definition. If space is not a substance, then it is relational in nature.

A second classification involves absolutism. If space is absolute, and let's take Euclidean three-dimensional geometrical infinite space as a representation, then there exists an immovable and distinct reference point $(x = 0, y = 0, z = 0)$ which determines the origin of all future translated Euclidean space. All points are therefore relative to this origin.

Substantival space is absolute. If space is a substance, then it cannot be determined by other entities, including its origin. However, the reverse does not hold—space can be absolute yet not a substance. Newton brought in the role of God, and likened absolute space to God's sensorium, and hence space cannot be a substance if its existence depends on at least one other entity (a Deity).

4 Premise 4

I shall now take on the task of evaluating Leibniz's use of the Principle of Identity of the Indiscernibles (PII onwards) against absolute space can subsequently. I will claim his attempt as ultimately successful.

PII, in the strong form, which I will utilise, holds that no two indiscernible entities can share all their intrinsic properties.[1] An intrinsic property is one in which entities can have in virtue of they way they are, and not in relation (or lack thereof) to other entities.[2] For PII, the "stronger" its formulation is, the stricter the conditions become for entities to be considered distinct. If A and B share non-identical sets of non-intrinsic properties $N_1 \neq N_2$, but identical sets of intrinsic properties $I_1 = I_2$, no matter how small the intrinsic sets or how large the non-intrinsic sets are, if this latter condition holds, then A and B are indiscernible, hence it follows from PII that a universe with both A and B are not logically possible.

[1]KHAMARA 1988, p. 146.

[2]Ibid., p. 144.

4.1 Two arguments against absolute space

PII was established and used by Leibniz to demonstrate against Newtonian absolute space. Newton, in his *Principia*, espoused for a theory where space is "immovable.." CITE. This was put forth in response to problems found in Descartes' relative space. The biggest problem was that rest and uniform motion were both involved circularly in Descartes' definition of motion, so either they have to be treated as two distinct concepts (from which Newton picked up) or the Cartesian principle of inertia has to be rejected (Leibniz's move in order to defend relative space). For Leibniz, treatment of space and matter cannot be separated because space for him was compared to a genealogical tree CITE (jammer/cushing), and the action of abstraction to space presupposes a system of material bodies. In setting up the scene, Leibniz's proposed two *reductio ad absurdum* to refute absolute space, alongside

Consider space is absolute, and a possible world U1 with finite or infinite material bodies, and possible world U2 with the same finite or infinite material bodies. U2 is numerically distinct from U1, even if all the bodies are relationally identical. Then from PII, U2 is indiscernible from U1. But this leads to a contradiction. Therefore, we must forgo absolute space.

The above argument comes from translating space (like adding a constant amount to the origin), so numerical distinctness but no relational differentation results. In two-dimensional Euclidean space, consider a triangle with base and height both of length 1, with coordinates (0,0), (0,1) and (1,1). If I now translate the origin of this space from (0,0) to (2,2), then the triangle now has coordinates (2,2), (2,3) and (3,3). The numerical relation between the vertices remain unchanged, so are the base and height. Thus, the intrinsic property, a unit right-angled triangle arranged like so, is invariant.

The second argument follows the exact same logical structure, but the translation has been replaced by a reflection along the vertical. The argument is simple, if the entire universe at present is flipped (the universe in the mirror), then would I observe any intra-world difference? Leibniz argued from PII for both translation and reflection that absolute space must be refuted.

4.2 A third argument

With the presence of some bodies then, space is non-absolute. What about the case in which a possible world devoid of matter is considered instead? Here, Leibniz would argue that because absolute space can be divided into arbitrarily small parts, each part identical to one another, then from PII there is only one such arbitrarily small part. So the entire universe is one such small part. From this absurd consequence, Leibniz rejected absolute space. Khamara argued here that the use of PII in this scenario is intra-world (parts of a world) and not inter-world (between worlds, like the two arguments above), and since abusing PII intra-world leads to inconsistencies, Khamara dismissed the validity of this argument. CITE

However, if we consider (P3) of the thesis, then notice that by considering a universe devoid of any matter, we already presuppose it is substantivalist, and hence by *modus tollens* it is absolute. Hence, trying to prove relative space in the case where absolute

space is true is a logical contradiction (since the two are mutually incompatible), so the argument as a whole is unnecessary. The two arguments from translation and reflection are sufficient for the refutation. That is to say, to retain the efficacy of this argument, we would have to refute (P3). I cannot see a way to do so. Space as a substance cannot move into any other "space", thus it is immovable and that is the definition of absolute space.

But if we do not retreat the argument, then it is possible to argue the following. Using PII intra-world leads to absurd consequences, such as the case where a system of N intrinsically identical spheres placed in arbitrary locations is the same as a system of $N + 1$ also identical spheres (and identical to the first system) placed in another arbitrary set of locations. While this may suggest this flavour of PII is too strict—we want *prima facie* a principle capable of capturing the most intrinsic information and PII does not suit this role, it may also suggest that PII happens to *describe* the physical world, where no such ideal system can exist where multiple bodies are considered intrinsically identical (assumed with the hindsight of modern physics). While this boils down to discussing the act of using physically impossible thought experiments to test logic, I will not discuss this further.

My point remains that absolute space is sufficiently refuted from the two arguments from translation and reflection alone.

5 Arriving at the conclusion

From here, it is a matter of logical syllogism; if space is not absolute, or (P4) is true, then space is not substantival (principle of *modus tollens*). If space is not substantival then it is relational, and if it is relational, then applying *modus ponens* on (P2), which I have argued to be true, we can henceforth argue that matter is necessary for the existence of space.

6 What about time?

References

KHAMARA, E. J. (1988). 'Indiscernibles and the Absolute Theory of Space and Time'. In: *Studia Leibnitiana* 20.2, pp. 140–159. ISSN: 00393185. URL: http://www.jstor.org/stable/40694260 (visited on 24/05/2022).