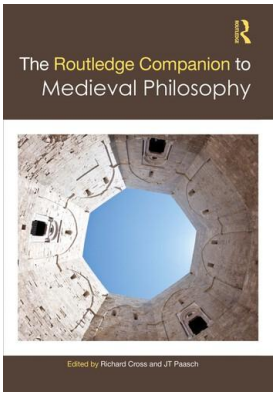

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SPACE AND PLACE

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Space as Incorporeal Extension

The notion of space considered by Aristotle is that of something three-dimensionally extended and incorporeal: a three-dimensional extension that is neither a body nor dependent on a body, but existing unsupported, over and above bodies. The central role of space conceived in this way is that of providing a place or location for bodies by being something able to receive bodies and thus to be occupied by them. With an Aristotelian example, a wooden cube immersed in water would be received, according to this conception, in the region of space coextensive with it and bounded by the inner surface of the water, and it is this region of space that should be identified with the place of the wooden cube. A region of space that is not occupied by any body is also called a void.[1]

Aristotle totally denies the existence of space conceived in this way, arguing that there cannot be an incorporeal extension. He maintains that extension does exist, but only in bodies, so that the only extension there is that of bodies. His most general objections to the existence of space aim to show that space would be a mere duplicate of the extension of bodies, indistinguishable from it, and useless for the purpose of locating bodies.[2]

The vast majority of medieval philosophers follow Aristotle in denying the existence of space and agree with his general motivations against it. Thus, John Buridan, one of the most influential Aristotelian commentators of the fourteenth century, argues that the assumption that incorporeal space is necessary to provide a recipient for corporeal extension is ontologically unsound, since it gives rise to an infinite regress:

> Since that space is nothing else but dimension it would contribute nothing to the located body, because a located body has its own proper dimensions in virtue of which its matter, its form, and all its qualities are dimensioned; therefore, in this respect the located body does not require another kind of dimension. If one says that its own proper dimensions require other dimensions in which they are received, this is absurd, because by the same argument those other dimensions would in turn require other dimensions <in which they are received>, and so on *ad infinitum*, which is false.[3]

Thomas Aquinas raises a more radical objection against space as receptacle: commenting on Aristotle's example of the wooden cube, he argues that there is no way to account for the distinction

between the extension of the wooden cube and that of the incorporeal extension coextensive with it (its alleged place):

> It does not seem that there can be any difference between the body of the cube [i.e., the three-dimensional extension of the wooden cube] and the dimensions of place or void. For just as the dimensions of place or void do not have sensible qualities, so also the dimensions of the cubic body are other than passions of this kind . . . However, two magnitudes of equal quantity cannot differ except with respect to position. For it is impossible to imagine that this line is different from that line equal to it unless we imagine each of them in a different position. Thus, if two magnitudes are posited together in space, one does not see how they can differ. Therefore, if two equally dimensioned bodies exist together, regardless of whether they have sensible passions or not, it follows that the two bodies are one.[4]

Aquinas's point here is that the notion of two coextensive extensions is contradictory because the property of being coextensive removes the only ground for distinguishing between extensions of equal size, namely, a difference in position. That is to say, two totally overlapping extensions are in fact one. Accordingly, corporeal extension, just because it is an extension, regardless of the fact that it belongs to a body, cannot be received in any other extension, be it corporeal or incorporeal. Thus, just as it is impossible that two bodies exist together in space, so it is impossible that a body and an incorporeal extension do.

Corporeal Extension: Its Ontological Status

While the existence of corporeal extension is regarded as self-evident in the Aristotelian tradition, its ontological status becomes a matter of dispute especially in the fourteenth century. The fact that wood, for example, is three-dimensionally extended is regarded as undeniable; what is controversial, however, is whether this is a primitive fact about wood or rather a fact that needs to be accounted for in terms of a thing, "the extension of wood," which is to some extent distinct from wood itself. Is it necessary to posit the extension of wood as a thing distinct from wood itself, although dependent for its existence on wood, in order to account for the wood's being extended? Or is it rather the case that wood has extended parts by its intrinsic nature so that it would be superfluous to posit an additional thing to account for its being extended? In Aristotelian jargon, these questions are formulated in terms of substance and accident. Wood is a substance, and a thing distinct from wood but dependent for its existence on wood as its subject of inherence would be a (real) accident or accidental form of wood. A paradigmatic and uncontroversial example of a real accident of wood is its color: the being brown of some wood is an accidental property of that wood that needs to be accounted for in terms of a thing, "browness," which is a real accident (qualitative form) of the wood. Is the extension of wood a real accident of wood, just as its color is such an accident?

William of Ockham denies that this is the case. He holds that the extension of a substance is ontologically reducible to that substance itself, so that a substance has extended parts by its intrinsic nature and not in virtue of extension as a real accident of it. There is no need to posit an accidental form inhering in a substance that has the role of the formal cause of its being extended. For example, wood "naturally" comes with its parts so that whatever produces wood also produces its parts without having to produce a further thing necessary for wood to have parts.[5]

Ockham's arguments in support of his reductionist view are based on very strong and controversial assumptions about the infinite power of God like, for example, the assumption that not only can God preserve a substance and remove all its accidents, but he can also do this while preserving the extended parts of that substance. If God can do this, then positing extension as

a real accident of a substance becomes superfluous. Indeed, from this assumption, it follows that (i) as a result of this kind of divine action, there would be no change in the extended parts of that substance, (ii) even though any alleged accidental extension of that substance would be removed from it. This shows that it is not the case that extension is a thing that is required to account for the substance's being extended.

Ockham's reductionism about corporeal extension was totally rejected by his fiercest realist opponent Walter Burley, who defends the realist view that extension is a real accident of a substance and objects to Ockham's arguments that it is not possible even for God to remove extension from a substance and preserve its extended parts. According to Burley, this would amount to removing the formal cause of something and preserving the effect of such a cause, like, for example, removing whiteness from a substance and preserving its being white. In his view, there is no ontological difference between the being extended of a substance and its being of a given color in the sense that both properties can only be accounted for by positing real accidents that are formally responsible for these properties.[6]

John Buridan too, who is sympathetic with Ockham's ontological parsimony, is not happy with Ockham's view of corporeal extension. Instead of focusing on the highly elusive question of whether Ockham makes a legitimate use of the principle of the infinite power of God in this context, Buridan turns to the physical phenomena of condensation and rarefaction as the crucial case to test Ockham's position. Both these phenomena involve a change in the extension (volume) of the substance subject to them: when air is condensed, its extension decreases, and when it is rarefied, its extension increases. For a realist about extension, these changes in extension can be easily explained in terms of acquisition and loss of extension-things. What about Ockham? Can he give a satisfactory account of this change in extension? Ockham himself argues that he can give such an account in terms of the local motion of the intrinsically extended parts of a substance. When air is rarefied, its parts become more distant one from the other, and when it is condensed, its parts become closer, but no new extension-thing is added or removed from it. Buridan subjects Ockham's account to an accurate examination. He explores a number of specific ways Ockham's account can be interpreted and considers the empirical evidence in favor of and against it, but he concludes that it does not save the phenomena of condensation and rarefaction. In his view, the only way these phenomena can be saved is by positing that corporeal extension is a thing distinct from the substance that is rarefied or condensed and from the relevant qualities (heat, cold, and the like).[7]

Place without Space

While to many modern readers the notions of place and space may seem intimately connected, this is not so for Aristotle: he strongly denies the existence of space, but he affirms the existence of places or locations. In his view, bodies (that is, material substances) are in a place, but the place of a body cannot be a region of space coextensive with it, since there is not an incorporeal three-dimensional extension in which a body is received. There are, however, other bodies by which a given body is surrounded, and it is to the immediate surroundings of a body that Aristotle turns to define its place. According to Aristotle's definition, the place of a body *A* is the surface or limit of the body *B* that contains body *A* and is in contact with body *A*, that is, the inner boundary of the body *B* that immediately surrounds body *A*.[8] Consider the ideal situation in which a body is surrounded in all directions by only one body: for example, the case of a fish totally immersed in water. Then, the place of the fish is the surface of the water in contact with the fish.[9]

Aristotle takes this definition of place to be a refinement of a common-sense notion of location, illustrated by the paradigmatic example of water contained in a vessel: water is located in the vessel so that the vessel is the place of the water contained in it, and the vessel is something that surrounds the water.

Ontologically, Aristotelian place is a two-dimensional extension, but not a self-subsistent one, since it belongs to a body, the containing or locating body, being its boundary. Thus, Aristotelian place does not violate the restriction imposed by the denial of space that the only relevant ingredients available to build a theory of place are bodies and their intrinsic extension. Aristotelian place also satisfies some basic desiderata for being a place: (i) it is separate from the body located in it, since it is something intrinsic to another body, the locating body; (ii) being separate from the located body, it can be left behind when the located body moves out of it and be occupied by another body (independence from the located body); (iii) being an immediate surrounding of the located body, it is proper to that body in the sense that it cannot at the same time locate within itself another body, namely, it is a proper place and not one common to other bodies.

Aristotelian Place and the Problem of Motion and Rest

While the vast majority of thirteenth- and fourteenth-century philosophers follow Aristotle's theory of place, they also point out that it contains some open problems. A very relevant one is that Aristotelian place seems inadequate to provide a satisfactory account of local motion (change with respect to place) and rest in a place. The nature of the problem is clearly illustrated by the following examples in an anonymous thirteenth-century commentary on Aristotle's *Physics*:

> (i) If place and a surface were the same thing, then something that changes place can remain in the same surface. This is evident as follows: let us imagine that a body is carried about in flowing water in such a way that during all that motion a single part of water is in contact with that body. Then this body always remains in the same surface, and nevertheless it continuously changes place. (ii) Again, if place and surface are substantially the same, then a thing at rest would change place. The proof is that, if they were the same, then that thing which continuously changes its containing surface would also continuously change place; but something can continuously change its surrounding surface and nevertheless be at rest. For example, if a body were fixed in some continuously flowing water, then it would change the surface of its container and therefore a thing at rest would change place.[10]

Thus, Aristotelian place leads to the "paradoxes" of motion and rest: a body in motion can be in the same Aristotelian place and a body at rest can change its Aristotelian place. The obvious reason for this is that Aristotelian place is not "immobile," i.e. absolutely changeless. It is the surface of a body, but bodies are naturally subject to motion, and when they move, they carry their limiting surfaces, as well as all their other accidents, along. Accordingly, the paradoxes of motion and rest arise because of the ontological status of Aristotelian place as something dependent on bodies. They would not arise if place were a region of space understood as something existing over and above bodies. Still, the vast majority of medieval philosophers are not tempted to abandon Aristotle's theory of place in favor of a space-based theory. They rather try to give an account of the required "immobility" of place by introducing some modifications in Aristotle's original notion, but without introducing space.

The Cosmological Frame of Reference

In order to appreciate many medieval attempts to solve these paradoxes, it is important to understand why they are regarded as genuine problems. There seems to be nothing wrong to us in the idea that a body is both in motion and at rest, provided that this happens with respect to different frames of reference. So in the first example, a body carried in water is at

rest relatively to the frame of reference defined by the water immediately surrounding it but is in motion relatively to the frame of reference defined by the banks of the river. Medieval philosophers, however, implicitly assume that the choice of frame of reference is not a matter of convention. In their view, there is a privileged frame of reference such that only with respect to it, we can properly speak of a body being at rest or in motion. This is, so to say, the "cosmological" frame of reference, defined by the center of the universe (the center of the earth) and its celestial poles (north, south, east, and west). This frame of reference is also taken to be fixed, not subject to motion.

The assumption that the cosmological frame of reference is the privileged one entails that a theory of place that provides a good account of motion and rest must be such that a body in motion with respect to the cosmological frame changes its place and a body at rest with respect to that frame remains in the same place. Aristotelian place, however, does not satisfy this requirement, as the two "paradoxes" show. It seems that what is required is a place that is not in motion with respect to the cosmological frame. The problem then becomes how to modify Aristotelian place so that it satisfies this requirement of being fixed with respect to the cosmological frame. In the thirteenth century, the dominant solution to this problem is that of adding to Aristotelian place its cosmological coordinates, so that the place of a body is not simply the surface of the body containing it but this surface together with its distance from the fixed points of the cosmos. In the case of a body at rest, for example, it is because the distance of its containing surfaces from the fixed points of the universe does not change that such a body does not change its place, as an anonymous thirteenth-century commentator explains:

> Therefore, a concave surface, whose centre is at a certain distance from the east pole, a certain distance from the west pole, a certain distance from the north pole and a certain distance from the south pole, can in this way be called place. Therefore, although where now there is air, water may submerge my hand—my hand remaining immobile—nevertheless its place remains the same, because the distance from the extremes of the world always remains one and the same. For the limit of air or water is not called place in an absolute sense, but in comparison to the extremes of the world. And thus, when air recedes and water comes in, the limit of both is said to be numerically the same place by means of the aforesaid respect.[11]

Historically, this solution is already found *in nuce* in Robert Grosseteste and appears in slightly different versions throughout the thirteenth century.[12] The most influential version is that proposed by Giles of Rome, who introduces a distinction between "material" place and "formal" place—more precisely, a material aspect and a formal aspect of place—where material place is the Aristotelian place, that is, the surface of the containing body, whereas formal place is the distance of this surface from the fixed points of the universe. In terms of this distinction, the solution to the problem of the immobility of place is that while the material place of a body at rest may change, its formal place does not change.[13]

This solution, however, contains an obvious problem. In Aristotle's ontology, the distance from the fixed points of the universe is an accident and hence has a subject. A common medieval principle about the identity of an accident is that this is determined by the identity of its subject, so that an accident cannot remain numerically the same if its subject does not remain numerically the same. As medieval philosophers often put this point, accidents do not migrate from one subject to another. In the present case, the subject of the distance from the fixed points of the universe is the containing body or its surface. Therefore, that distance cannot remain numerically the same if the containing body does not remain numerically the same. Thus, contrary to what is claimed in the passage earlier, if my hand is first surrounded by air and then by water, since air and water

are numerically distinct subjects, the distance inhering in them cannot be numerically the same. In terms of Giles of Rome's distinction, when the surroundings of a body at rest change, not only its material place, but also its formal place changes. That is to say, if the Aristotelian place does not persist, its "cosmologically" qualified counterpart does not persist either.

Equivalent Places

In the fourteenth century, the dominant attitude to the question of the immobility of Aristotelian place is a skeptical one. By that time, philosophers have come to acknowledge that the ontological status of Aristotelian place cannot be reconciled with the requirement of its immobility. They also maintain, however, that the admission of places subject to change does not make the "paradoxes" of motion and rest unsolvable. The new strategy to deal with these paradoxes is to provide a more sophisticated account of motion and rest, according to which it is not necessarily the case that a body moves when its surroundings change, and it is not necessarily the case that a body is at rest when its surroundings persist. The idea then is that only a certain class of changes or persistence in the surroundings of a body is relevant for defining its motion and rest. Not surprisingly, the relevant class is identified by appeal to the cosmological frame of reference.

One of the earliest and most influential proponents of this strategy is John Duns Scotus. He claims that the Aristotelian place is changeless, not absolutely but "by equivalence with respect to local motion." This is how he explains what he means by this formula:

> (i) Although place is corrupted when its subject moves locally, so that, when air moves locally, the *ratio* of place in air does not remain the same as before . . . nor can the same *ratio* of place remain in the water that succeeds the air, because the same accident in number cannot remain in two subjects, (ii) nevertheless, the posterior *ratio* of place (which is in truth distinct from the preceding one) is the same as the preceding *ratio* by equivalence with respect to local motion. For, it is just as impossible that a local motion takes place from that preceding place to the posterior place as if these two places were absolutely the same place in number. In fact, no local motion can take place from an *ubi* to another *ubi* unless those two *ubi* correspond to two specifically different places, namely, to places that have a different respect, not only numerically, but also specifically, to the whole universe. Hence, those respects that are only numerically different seem to be one in number, because they are just as indistinct with respect to local motion as if they were just one respect.[14]

In part (i) of this passage, Scotus simply admits that the principle about the numerical identity of accidents makes it impossible for Aristotelian place to be absolutely immobile or incorruptible. In part (ii), he gives his own positive account of the immobility of place "by equivalence with respect to local motion." The general question that Scotus addresses in his account is that of giving an adequate definition of local motion. In particular, given that a local motion occurs from a place *A* to a place *B* (the initial and final terminus), Scotus intends to specify what condition two distinct places must satisfy in order to be the termini of a local motion, that is, in order that a local motion can occur between them. In Scotus's formulation, the condition is that the two places are not only numerically distinct, but also specifically different. The formula "equivalent with respect to local motion" is meant to apply to those places that although numerically distinct cannot constitute the termini of a local motion. The idea here is that two places that differ only in number can be considered equivalent to one and the same place with respect to local motion, because a local motion cannot occur between these two places any more than it can occur from one place to the same place. Specific difference of two places is required for local motion.

Crucially important in this context is how Scotus conceives the specific difference of places relevant to local motion. What makes two places specifically different in the relevant way is not the specific difference of the bodies to which they belong—for example, one place being the surface of air and another the surface of water—but a specific difference in their cosmological coordinates, that is, in their distance (in Scotus's terms, "respect") to the fixed points of the universe. Scotus's solution to the "paradox" of rest is then the following: a body at rest surrounded first by air and then by water is indeed at rest, that is, not subject to local motion, because despite the fact that the surface of air and that of water that successively surround it are numerically distinct and hence also their respective distances from the fixed points of the universe are numerically distinct ("accidents do not migrate from one subject to another"), the places associated with these surfaces are equivalent to just one place with respect to local motion, given that their respective distances from the fixed points of the universe are *equal*. Similarly, for the paradox of local motion: a body carried in water in such a way that it is always surrounded by the same portion of water is subject to local motion because, despite the fact that its Aristotelian place remains numerically the same, its place does not remain specifically the same in the relevant sense, given that the distance of the surface of water in contact with that body from the fixed points of the universe constantly changes.

The Axiom of Containment

The notion of distance to the fixed points of the universe is clearly the key one in most medieval accounts of the "immobility" of place. What is more, as the solutions offered by Scotus and many other fourteenth-century philosophers show, Aristotelian place as the surface of the containing body does not play any positive role in this context and in fact seems to make the explanation of the immobility of place unduly complicated. An account in terms of the distance between the located body itself, by-passing the surface of the body containing it, and the fixed regions of the universe would be much more straightforward. Note, for example, that since a body remains numerically the same subject throughout its rest, if the located body itself rather than the surface of the body containing it were the subject of the "cosmological" distance, the problem of accidents migrating from one subject to another would not arise.

The assumption that place is a container also creates a major problem of its own within Aristotle's theory of place. Aristotle's physical universe is finite and enclosed within the last celestial sphere in such a way that outside this sphere, there is just nothing. Being the outermost body of Aristotle's universe, the last celestial sphere does not have an external container. If being an external container is an essential property of place, then the last celestial sphere is not in a place—as it seems. This negative conclusion is not acceptable by Aristotle and his medieval interpreters, the main reason for this being that the last celestial sphere is subject to rotation, which is a kind of local motion.[15] Accordingly, this serious cosmological problem provides an excellent occasion to challenge Aristotle's assumption that place is an external container. In this case too, the notion of place as distance seems suitable to define the location of the last sphere.

Despite these problems, the vast majority of medieval philosophers resist the temptation of replacing the Aristotelian notion of place with the notion of place as a distance. The idea that being an external container is an essential ingredient of a theory of place without space remains dominant in the Middle Ages.

This general tendency finds an eminent exception in John Buridan, whose interpretation of Aristotle's theory of place seriously undermines the importance of the axiom of containment. Buridan admits that a containing place has a privileged role in the location of bodies, but unlike Aristotle he considers perfectly legitimate many other ways of defining location. To illustrate this point with an example, Aristotle considers only two kinds of answer to the question "Where is

this boat?": the answer in terms of a proper place as something that contains this boat only, for example, the portion of water in contact with the boat, and the answer in terms of a container common also to other bodies, for example, the whole river. In both cases, the answer is given in terms of a containing place. On the contrary, Buridan points out that the answer need not be given in terms of a containing place. In Buridan's examples, to the question "Where is Robert?" we can reply that he is *outside* town or *on* a tree, and to the question "Where is the town of Saint Denis?" we can reply that it is *two miles north of* Paris. Buridan also remarks that the answers to the question about location in terms of a containing place are relatively rare.[16]

Once alternative answers to this question are admitted, the problem of the place of the last sphere becomes a pseudo-problem, as Buridan points out:

> This question was regarded as most difficult, and the reason for this—I believe—is that they fail to distinguish the equivocation of the term "place." For, as has been said above, "place" is said in one way in a proper sense, that is, of something that contains the located body . . . in another way in a non-proper or less proper sense . . . that is, of something by which we judge that a body is in motion in virtue of the fact that that body changes its position relative to it. Therefore, if this definition is conceded, the question is very easy . . . Indeed, if we take the place of a body to be that thing by which that body appears to be in motion or at rest . . . the last sphere has a place, that is, the earth, or a stone or a wall.[17]

Thus, if we abandon the notion of place as a container and replace it with a much wider notion according to which the place of a body is whatsoever thing we use as a reference point to perceive the local motion or rest of that body, we can indeed find a place of the last sphere. Moreover, as the examples of Buridan illustrate, this need not be part of the cosmological frame of reference, like the central earth. It can also be a purely conventional frame of reference, like a stone or a wall. Accordingly, Buridan does not only challenge the idea of place as a container, but also that of a privileged frame of reference for local motion and rest. The result of his "simplification" of Aristotle's theory, however, is that of seriously undermining the physical significance of the notion of place.

Notes

1 Aristotle, *Physics* IV.8 (216a26–b21).
2 Ibid. See Hussey's comments in Aristotle (1983: xxvii–xxxii).
3 Buridan (2016: Book IV, q. 2, 216.17–23). The English translations of the passages from Latin works quoted in this chapter are mine.
4 Aquinas (1964: Book IV, lectio 13, 263).
5 Ockham (1986: 51–85); English translation in (2009: 47–79). On Ockham's reductionism about corporeal extension, see especially Adams (1987: 169–213).
6 Walter Burley (1501: Book I, fol. 15ra–vb).
7 Buridan (2015: Book I, q. 8, 87.22–90.23).
8 Aristotle, *Physics*, IV.4 (212a2–20).
9 On Aristotle's concept of place, see Morison (2002).
10 Quotation from Trifogli (2000: 176).
11 Quotation from Trifogli (2000: 177–178).
12 Grosseteste (1963: Book IV, 80–81).
13 Giles of Rome (1502: Book IV, fol. 81ra–b).
14 Quotation from Trifogli (2000: 185).
15 Aristotle discusses this problem in *Physics* IV.5 (212a31–b21). For an overview of some solutions proposed by Aristotelian commentators, see Trifogli (2000: 186–202).
16 On Buridan's view, see Trifogli (2011).
17 Buridan (2016: Book IV, q. 6, 254.1–5, 17–21).

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