

# Heterogeneities<sub>DOT</sub>net

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# Objects and Spaces

## John Law

### Introduction

#### What is an object?

In its original form actor-network theory (ANT) has a specific and distinctive answer to this question. It proposes that *objects are an effect of stable arrays or networks of relations*. The suggestion is that objects hold together so long as those relations also hold together and do not change their shape. This approach is inspired by a post-structuralist version of semiotics. Semiotics, in the European de Saussurian version of synchronic linguistics, argues that the significance of a term depends on its relations, and specifically the relations of difference between a term and its neighbours. 'Dog' and 'cat', each of these terms achieves its significance by virtue of its difference from the other – and other related but different terms: 'dog', 'cat', 'wolf', 'puppy', and so on. So the significance of the term is arbitrary, though highly determined by the network of relations of difference. It is indeed a relational effect.

Structuralists usually argue that the arbitrary nature of language reveals something universal about the operations of the human mind. Humans, it is said, structure relations in the ways that they do by virtue of the machinery in their heads – which means that all languages have the same deep structure. By contrast, post-structuralism argues that there are different and incomplete deep structures underpinning and being enacted in different social locations. Each makes different kinds of objects and different knowledges of those objects, an approach visible in Michel Foucault's analysis of the body. In the classical epistémé the body is a site for the enactment of symbolic power relations (for instance in the form of torture), while in the modern epistémé it is turned into a functional and (self) disciplined machine, a structured set of ordered and productive

relations. Foucault thus identifies several different ‘deep strategies’ for ordering relations (e.g. Foucault, 1979).

ANT is similar in its commitment to materiality. Speech, bodies and their gestures, subjectivities, and materials such as architectures, ships, aircraft or firearms, all are treated as enactments of strategic logics. All participate in holding everything together. All are made in, and help to produce, those relations. But it is different because it is less concerned – in some versions even unconcerned – with the limits to the conditions of possibility set by modernity. Instead it explores the different strategies recursively and productively embedded in the relations that make up objects, organizations, subjects, and all the rest. In ANT there are many possible ‘modes of ordering’ in modernity, not just one.

What should we make of the difference between Foucault and ANT? If we say that in ANT objects are simply relational contingencies, then it follows that how they grow up and how the relations which produce them stabilize themselves is primarily an empirical matter. This in turn means that in ANT the possibilities of the world are constrained, but contingently so, and that since the world may produce a variety of things their orderings do not come in big epistemic blocks. But is this a good way of thinking? One option is to see it as a liberation from a dark concern with the limits to the conditions of modern possibility.<sup>1</sup> Alternatively, it can be seen as a form of blindness, in which case ANT is arguably involved in an intellectual and political refusal to try to squint beyond the possible. It is refusing to find and to make the undiscovered continent, refusing to discover the shady and heterotopic places, the places of Otherness, that lie beyond the limits of the current conditions of possibility.<sup>2</sup>

In this article I consider the absence of alterity. My question is: *what is an object if we start to think seriously about alterity?* I choose to tackle this topic spatially, and more particularly topologically. First, I argue that the making of objects has spatial implications and that spaces are not self-evident and singular, but that there are *multiple forms of spatiality*. Second, I suggest that to enact objects is also to enact *spatial conditions of im/possibility* – and (following the first point) that these spatial im/possibilities are multiple. I also argue that there are various possibilities, but these include regions, networks and fluids. And third, I suggest that these *spatialities and the objects which inhabit and enact them are unconformable*, that they are Other to one another, and that that objectness is a reflection and enactment of that unconformity, a shift between different spatial im/possibilities.

## The Portuguese

It is usual in the discipline of science, technology and society (STS) to work through the medium of empirical examples, and I follow this practice. So my first data come from a large-scale and significant case, the technologies of the Portuguese imperialist expansion.<sup>3</sup>

As is well-known, Iberian maritime technologies – new vessels and new navigational techniques – played a crucial role in the early history of

European colonial domination. Christopher Columbus arrived in central America in 1492, and Vasco da Gama reached the coast of India in 1498. Descriptions of their vessels point to a number of significant features. They: were adaptable (small vessels could be rapidly re-rigged); had substantial carrying capacity; were relatively impregnable to attack by boarding (in part because of the castles fore and aft); carried relatively small crews (which meant that they could stay at sea for months); and they could navigate far from land (which meant that they could take best advantage of prevailing winds and currents) using astrological and astronomical techniques transferred from land to sea. So in the early Portuguese and Spanish expansion the great vessels – carracks – set out to sea, returning, if they did, up to 18 months later. ‘If they did’ because, whatever the success of this new maritime technology, often the vessels foundered along the way, got lost, or their crews died of scurvy and tropical diseases. As the Portuguese put it, ‘If you want to learn how to pray, go to sea.’

## ANT on Objects

ANT treats this technology as a *network*, and this is an analysis that can be applied to different levels of scale. For instance, a vessel can be imagined as a network: hull, spars, sails, ropes, guns, food stores, sleeping quarters and crew. In more detail the navigational system – Ephemerides, astrolabe or quadrant, slates for calculations, charts, navigators and stars – can also be treated as a network. And on a larger scale, the Portuguese imperial system as a whole, with its ports, vessels, military dispositions, markets, and merchants can also be thought of in the same terms.<sup>4</sup>

There are many objects here, but ANT suggests that an object (for instance a vessel) remains an object while everything stays in place and the relations between it and its neighbouring entities hold steady. Navigators, Arab competitors, winds and currents, crew, stores, guns: if this network holds steady then the vessel doesn’t founder, it doesn’t get seized by pirates and it doesn’t sail on, lost, until the crew are broken by disease and hunger. The vessel is an effect of its relations with other entities, and the job of ANT is to explore the strategies which generate – and are in turn generated by – its object-ness, the syntaxes or the discourses which hold it in place.

Bruno Latour offers an interesting version of this story. He talks of *immutable mobiles* (Latour, 1990). Mobile, yes, because there is movement, from Lisbon to Calicut. And immutable because the objects hold their shape as a network. Here, then, the network-ness of the metaphor works in two ways, at two of the scale levels mentioned above. The immutable mobiles are themselves a network, an array. They are objects. But they also pass down or through a network, held in an array of secure and stable surroundings. If the circuit is broken then the ship starts to degrade, loses its form, and turns into something else.

## Introducing Topology

All of this is worked out in the classic versions of ANT. Less classic is the idea that when objects are constituted then this means that spatial relations are also being enacted at the same time. Latour's term 'immutable mobiles' introduces the notion of movement, and therefore of movement through space. I return to this below. But for the moment I want to argue that the notion of network – or the creation of objects in network terms – is not spatially neutral, but also implies the production of a particular kind of space.<sup>5</sup> To make this argument I make a brief detour into topology.

Topology is a branch of mathematics which explores the character of objects in space. So how does this work? A non-mathematical answer is that topologists think about spatiality by asking questions about the continuity deformed. In topology, for instance, a shape is said to hold its form while it is being squeezed, bent, or stretched out – but only so long as it is not also broken or torn. If it is broken or torn, then it changes, it is no longer *homeomorphic*. Topologically, for instance, a cube is equivalent to a sphere, they are homeomorphic, but not the same as a donut which can only be made by piercing a hole through the surface of the ball (or cube). Or, to give a two-dimensional example, circles and squares are homeomorphic, but not arcs where the line making the circles (or squares) needs to be cut in order to produce that arc.

These examples fit with what we tend to think of as 'space' in Euro- American common-sense, which is geographical or Euclidean in character. But this is a bit misleading, because Euclideanism is only one spatial possibility. Instead, topologists invent and explore different possible spaces or (this amounts to the same thing) different possible circumstances in which objects may be deformed without being broken. The conventional character of this inquiry is revealed if we look at the two shapes in Figure 1.

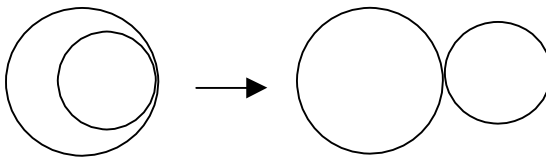


Figure 1 Homeomorphic or Non-Homeomorphic Transformation?

Topologically these do not seem to be equivalent. This is because if we want to move from the shape on the left to the shape on the right then deformation is not enough. We also need to cut the larger circle to let the smaller circle out. This means that homeomorphism is lost. But this is only true if we stick to two dimensions and restrict ourselves to working on a surface. If, instead, we work in three dimensions and imagine that the point where the two circles join is a hinge, then we can rotate the small circle up and over the larger circle and move homeomorphically from one shape to

the other. This means that there is deformation without rupture, and object continuity is sustained.

This example suggests both that spatiality is a convention, and that the spatial possibilities are not exhausted by Euclideanism.<sup>6</sup> It also, and crucially, suggests that questions of spatiality and object continuity are settled together. Under what circumstances can an object be deformed (for instance moved through space in relation to other objects) without changing its shape? This is precisely what is at stake in topology, which is a mathematics that explores the possibilities and properties of different forms of continuous transformation – and the different spaces which express or allow these. So there is an indefinite number of ways of defining what will count as homeomorphism, of deforming objects whilst securing their continuity, just as there is an indefinite number of corresponding spaces.

## Euclidean and Non-Euclidean Spaces: Or What is a Ship?

As I noted above, in Euro-American common-sense the most obvious form of space is Euclidean. One version of this defines shape in terms of three orthogonal dimensions, and then says that objects are undeformed if their relative three-dimensional co-ordinates remain stable. Deformations – for instance involving displacement through three-dimensional space in relation to other objects – are not ruptures if the relative co-ordinates hold. For instance: a vessel remains the same vessel if it holds together physically as it moves around the seas. But ANT plays with a second and less obvious version of spatiality. For, if we ask what it is that secures a homeomorphic shape within a network, the answer is as I have described above: *it is unbroken if it is sustained within a stable network of relations with other entities*. It is the stability of the syntax of those relations that is crucial. Hull, spars, sails, stays, stores, rudder, crew, water, winds, all of these (and many others) have to hold in place *functionally* if we are to be able to point to an object and call it a (properly working) ship.<sup>7</sup> All these bits and pieces have to do their jobs. All have (as ANT sometimes puts it) to be enrolled and stay enrolled. So a properly working ship has to borrow the force of the wind, the flow of the current, the position of the stars, the energy of the members of the crew, it has to borrow all these and include them (so to speak) within itself.

Now notice this. In Euclidean space a working ship is a constant set of *orthogonal co-ordinates* – for the relative positions of the prow, the keel, the stern, the masts and the spars are held fixed as it moves through geographical space and do not change all that much. In addition, however, it is also a constant and continuous *network* object, a ‘network shape’ where the relative syntactical positions of relevant entities are held constant and contribute to object-stability of the vessel. This means that vessels are *spatially or topologically multiple*, inhabiting both Euclidean and network spaces. They are also homeomorphic within each of the forms of space, holding together physically in the one, and functionally or syntactically in the other. However, they *move only within Euclidean space*, remaining

immobile within network space. (If there is rupture in the relations between the components in network space then they are no longer a network object.). At the same time it is this *immobility within network space which affords their displacement within Euclidean space*, that allows them to sail successfully from Calicut to Lisbon.

Such is an anatomy of Bruno Latour's notion of 'immutable mobile'. We have learned that *immobility* belongs to network space while the *mobility*, a Euclidean attribute, becomes possible because of network immutability. A quick version of the lesson, then, is that if objects displace themselves then this may be *because* they are topologically complex. Because they exist within different spatial systems, or because they are produced in intersections between different spatialities. Indeed, though I risk trying to run before I can walk, I want to suggest that objects may be defined as *intersections between homeomorphic enactments produced within different topologies*.<sup>8</sup>

## Spatialities are Enacted

In Euro-American common-sense there is, I guess, a tendency to want to say that objects exist *within* pre-existing Euclidean space, and that the latter simply sets the conditions of possibility for objects. We sense, that is, that space comes before us, that it is a neutral container within which our bodies (or Portuguese vessels) happen to exist. This is not exactly wrong. No doubt there are Euclidean spatial configurations which pre-date particular objects in that space. But I noted above that in topology issues of spatiality and homeomorphism are settled together. Indeed, in topology *the two are made together*. Thus as topology invents objects and defines what will count as avoiding rupture it simultaneously invents or defines spatial conditions of im/possibility. Perhaps, however, we can apply this argument beyond topology. If this is so, then we might say that the enactment of a 'real life' object that is deformed without rupture in Euclidean space *also* enacts the Euclidean space within which it is located. Or, to put it both more concisely and more generally, *spaces are made with objects*.

In Euro-American common sense this is indigestible primarily, I think, because we do not see the *work* of producing that space. Spatiality has become reified in a series of sedimented enactments. If Euclidean spatiality has been enacted in the past then a sense of space as a pre-existing container is indeed appropriate, and it is understandable that we lose sight of the possibility that it is also enacted. But here, more by luck than good judgement, ANT is particularly helpful. This is because it is easier to sense the enactment of network than Euclidean space because this involves much more or less visible engineering. Indeed this is old ANT territory, arguably what it is best adapted to do, with its studies of the heterogeneous engineering of networks, the circulation of immutable mobiles, and the creation of structures of relations which will precariously ensure, for instance, that the laws of Newton will (as Bruno Latour notes) stay the same shape in both London and the Gabon (Latour, 1988a: 227). The ANT argument, then, is

that when a (network) object is enacted, so, too, a (network) world is being created with its own spatiality and its own versions of homeomorphism and rupture.<sup>9</sup>

## Networks Make Regions Make Networks

But this is just the first step, for it is also more complicated because the making of network spaces also intersects with the formation of Euclidean spatiality.<sup>10</sup> Part of this argument is relatively straightforward. It is that volumes (for instance vessels), regions (for instance countries) and measurements of distance (for instance from Lisbon to Calicut) *get made by network means*. For instance, boundaries and distances are generated by surveyors who know how to use theodolites, to measure angles between trig points, to take accurate records of the angles between those points and who are able to transport records back to a cartographic centre where they can be arrayed on a two-dimensional surface where they can be set against the known distance of some base-line. At which point it becomes possible to draw a map.<sup>11</sup>

Annemarie Mol has observed that ANT is a machine for doing war on regions. More precisely, it strips self-evidence from regions by showing that Euclidean conditions of spatial im/possibility are not given in the order of things. Instead, it reveals that not only network objects and spaces get enacted, but also, by analogy, that Euclidean space is also a performance. This too is a series of enactments of stable objects secured by the parallel creation and reaffirmation of a homeomorphism, which rests on invariant relative and orthogonal co-ordinates, enactments which take place at least partially in network space.

But if networks help to enact regional spaces then do networks subsist in and of themselves? Are they, as the ANT theorists have sometimes appeared to assume, spatially autonomous? There are several reasons why the answer is 'no'. It is, for instance, possible to argue that network-objects depend on enactments in additional and different topological systems. I will come to this in a moment. But more straightforwardly, it is also possible to see that the creation of network-objects often depends on homeomorphism in Euclidean space. Think again of the Portuguese vessels. As we have seen, these are network-objects, made by the invariances defined by syntax. But they are *also* objects within Euclidean space. Give or take, *a vessel is only an unbroken network shape if it is also an unbroken Euclidean shape*. And here is the rub. *To generate network homeomorphism it is also necessary to work in Euclidean space* and make an object, a vessel-shape, whose relative Euclidean co-ordinates are constant.

But what are the implications of this? Two initial suggestions. First, the old unspoken hierarchical ANT view – that network-objects and network-spatiality *underpin* Euclidean-objects and spatiality – is misleading. Instead, interaction between the two is reciprocal. And second, as I intimated earlier, in order to make an object in one space, it may be necessary to work in another. Or, perhaps even more strongly, it may be (as I



suggested above) that *objects are always enacted in a multi-topological manner*, and are dependent for their constancy on the intersection of different spaces.

## The Bush-pump is a Fluid Technology

So far I have talked of Euclidean and network spaces, but there are other possibilities.<sup>12</sup> In exploring one of these I again work through empirical example, that of the Zimbabwe bush pump, which is described in an exemplary paper by Marianne de Laet and Annemarie Mol (2000) as a *fluid technology*.<sup>13</sup> They say this because the bush pump is not very stable. For instance, its boundaries seem pretty fluid:

For what *is* the Zimbabwe Bush Pump? A water-producing device, defined by the mechanics that make it work as a pump. Or a type of hydraulics that produces water in specific quantities and from particular sources? But then again, maybe it is a sanitation device – in which case the concrete slab, mould, casing, and gravel are also essential parts [to keep out contaminated water JL]. And while it *may* provide water and health, the pump can only do so with the Vonder Rig [for drilling wells JL] . . . and accompanied by manuals, measurements, and tests. Without these it is nothing, so maybe they belong to it too. And what about the village community? Is it to be included in the Pump – because a pump has to be set up by a community and cannot be maintained without one? But then again: perhaps the boundaries of the Bush Pump coincide with those of the Zimbabwean nation. For in its modest way this national bush pump helps to make Zimbabwe as much as Zimbabwe makes it. (de Laet and Mol, 2000: 237)

If the boundaries of the pump are fluid, then so too is what makes it work. For instance, bolts which link the pump to its mounting, or the handle to the pump, turn out to be unnecessary. There are pumps that work perfectly well in their absence. Leather seals are replaced with bits of old tyre which work just fine. Perhaps there *is* a core to the pump – some parts that are essential – but if so then what that core is constantly being undermined. The ‘essential’ mechanics often turn out not to be essential.

And if we think of the pump as a device for supplying pure water? This, again, is a fluid matter. Sometimes it has to do with an *E.coli* count, less than 2.5 micro-organisms per 100 ml of water, but not always. For instance there may be 10 times the level of *E.coli* without any signs of disease. It depends on who uses the pump. Or water from the pump may be contaminated, but much less so than alternatives – in which case it is also a working pump in a less than trivial sense. Then again there may be no facilities for measuring the bacterial contamination of water, in which case the relative absence of disease is the only indicator of purity left.

The arguments about the fluid nature of the pump go on. If it is a device for building village communities (part of Zimbabwe government policy), then is this a stability? The answer is: no. Often village communities are mobilized to create and maintain a pump, but sometimes they aren’t

and the relevant unit is a smaller collectivity such as a group of families, in which case the pump is no longer involved in the version of social engineering initially preferred by the Zimbabwean state. And, more dramatically, the fluidity of the pump, its variability, also contributes to its success as it shifts and adapts to local circumstances. There is no fixed structure, no basic agenda. As it is installed and used it changes shape and works in different ways, which indeed reflects its originator who resolutely refuses to accept authorship for the device:

Morgan, as a promoter of *distributed action* . . . is firm about the necessity of abandoning control. Implementation, he maintains, depends on involving those who will use the pump. It therefore requires room for their methods and insights. Without this, any pump is bound to fail. For, as he says, in water development it is all too common that the new and the foreign does not work, and that 'all that glitters . . . end[s] up as a rusty heap of useless technology'. (de Laet and Mol, 2000: 251)

## Fluid Continuity

So in Euclidean and network space the bush pump is a variable object. Arguably it is broken while it is being deformed. But putting it this way sets the alarm-bells ringing. For the question is, is it 'really' a broken object, or is it homeomorphic but in some other space? And de Laet and Mol suggest, as I have already hinted, that it is an object that holds its shape in a fluid manner. It is part of – it helps to enact – a fluid form of space.

So what would the rules of fluid space look like? How would an object hold its shape while sustaining itself in a fluid world? We can extract four suggestions from the bush pump example:

- First, *no particular structure of relations is privileged*. This means that in a fluid, objects hold themselves constant in a process in which new relations come into being because they are reconfigurations of existing elements, or because they include new elements. But this suggests a strong claim: in fluid space *change* is necessary if homeomorphism is to be achieved. Objects that get fixed in (for instance) network space get broken in fluid space. They are Other to it.
- But continuity is needed too. So the second point is that *relations need to change bit by bit rather than all at once*. In fluidity topological cutting and tearing take the form not only of being frozen, but also of abrupt or large-scale disruptive changes. These also undo homeomorphism. If everything is taken apart at the same time the result is rupture, the loss of shape-continuity, the loss of identity. The result is more likely to be the creation of an alternative object – no longer a bush pump but some- thing different.
- Third, it also follows that *no particular boundary around an object is privileged*. Bits may fall off the while new bits join on. This means that it is not possible to draw a line in the sand – a regional metaphor, a regional

enactment of space – and say that homeomorphism depends upon that boundary. Indeed, a stronger version of the point, to draw a fixed boundary is precisely to break a fluid object. Homeomorphism depends on mobile boundaries. Rigid enactments of inside and outside are Other to fluid objects.

- Finally, however, *mobile boundaries are needed for objects to exist in fluid space*. At some point differences indeed become important. Without them homeomorphism is disrupted. The object has simply changed too much and the bush pump has become (for instance) a bucket pump. Or it has dissolved into some kind of larger object, no longer being anything distinct in its own right. So in fluid space it is not that anything goes. Fluid objects are enacted in practices which also recognize rupture. It is just that they do not coincide with those of Euclidean or network space.

De Laet and Mol observe that the idea of fluidity extends from the bush pump to its (non) author, Morgan, who refuses to say that he invented it, refuses to patent it, and in general insists that it was invented and adapted in all sorts of distributed locations.

Morgan creates a non-creator subject, a dissolved self. Not so he will fade away, but in order to get clean water flowing everywhere. Perhaps all this is so appealing to us because it is so far removed from the control-drive of the modern subject – and even further from the shape this subject takes in soldiers, generals, conquerors, and other exemplars of strong and solid authority. Serving the people, abandoning control, listening to *ngangas* [water diviners], going out to watch and see what has happened to your pump: this is not a line taken by a sovereign master. Here we have, instead, a feminist dream of an ideal man. (de Laet and Mol, 2000: 251–2)<sup>14</sup>

But this suggests an important point. The distinction between the modern subject (one might add the modern object) and the non-modern subject/object reveals that many flows do not belong to fluid space at all. Think, for instance, of immutable mobiles such as vessels: they are immutable because they retain their shape in network and Euclidean space – but at the same time they also move or ‘flow’ in Euclidean space. They have nothing to do with fluid space. But then many ‘global flows’ – information, capital, people – also belong to networks<sup>15</sup> and have equally little to do with fluid space. Indeed, as we have seen, fluid objects precisely lose their homeomorphism if they are fixed in this way: fluid objects lie beyond the conditions of network possibility.<sup>16</sup> And the same is true for centres. A brief empirical excursion. In late 19th-century France if you wanted to save your cows from anthrax you needed to make a detour through Louis Pasteur’s laboratory, its procedures and its products (e.g. Latour, 1999). As a result the laboratory accumulated resources which further strengthened its pre-eminence. So L’Institut Pasteur was a centre of accumulation because its relations with other locations were fixed: because it was *an object in network space*. But this is quite unlike Morgan. Indeed, it is precisely what he is

trying to *avoid*. Which is not to say that the bush pump is not a success. Quite to the contrary. But it is not a success that brings special rewards to one particular location. There is no strategic location where there is accumulation: there is no centre or periphery.<sup>17</sup> Morgan is a fluid subject: like fluid objects, he lies beyond the conditions of network possibility. He is more or less inconceivable. Other.

## Intersections

Flows, then, are not necessarily about fluid spatiality. But these examples take us beyond the description of specific spatialities to the issue of their intersection. Thus I have suggested that objects exist and achieve homeomorphism in several different spatial systems, and it is clear from the above examples that fluidity is often Othered in network space. But how to think about intersections? To treat with this fully is beyond the scope of the present article. Accordingly, here I offer only four brief suggestions about the intersection between fluid and network spaces:

1. While networks tend to Other fluid objects, it also seems important to avoid becoming too committed to the romance of fluidity. It is not easy (or even possible?) to do away with network objects. Working objects sometimes need to take network shapes: Portuguese vessels come to mind, and perhaps even in the bush pump there is a core of stable network relations, something to do with vertical pipes, levers, valves and connecting rods. And the bush pump also exists in and enacts Euclidean space. Like other objects it arises out of an intersection of homeomorphisms enacted in several topological systems. In short, arguably even in a fluid world *network space remains crucial*.
2. Even so and conversely, it appears that network objects and realities *depend on fluid work*. For instance, the network description of the Portuguese vessels described above is certainly incomplete, effacing the fluid ad-hocery necessary to keep a vessel at sea and afloat for an 18-month return trip to India. More generally, the network homeomorphism implied in any centre of accumulation effaces endless analogously fluid ad-hocery.
3. It follows that often such fluid work is *invisible*: it is simply not homeomorphic in the network space created by accountability. The latter recursively produces (and is produced by) immutable mobiles, objects such as goods, well-disciplined persons, and most especially representations such as figures that can be faithfully drawn together at a centre of accumulation. Network spatiality produces and depends on such network-objects, objects which secure their constancy in a syntax of consistent functionality. This means that what cannot be made into an invariant functional syntax *cannot be represented at the centre at all*. Unstrategically, it flows, as we might say, through the meshes of the network.
4. Finally, when fluid objects or subjects do become visible in network space

they tend to look dangerously *elusive, vague and sloppy*. Unlike Pasteur, Morgan looks as if he is not getting his act together. Or health service professionals, or accountants, or architects, or lay people look as if they are failing to follow appropriate protocols: nurses are participating in operations; mothers are not putting their children to sleep on their backs; cervical screen laboratories are not following the appropriate guidelines; or railway signallers are sloppy and lax in the way they follow the rules.<sup>18</sup>

The hypothesis, then, is that networks tend to panic when they fail to secure network homeomorphism – at which point what I am claiming to be the hidden but necessary fluidity of objects to networks becomes both visible and Other, represented as a failure and therefore as a threat.

## Conclusion

Topology generates spaces by creating rules about what will count as homeomorphic objects – and there is no limit to the possible rules and spaces. Actor-network theory sets spatial limits to its understanding of objects – and to the space that these inhabit and enact. It undermines the reifications of Euclidean space, revealing the latter and its objects to be enactments. But in some versions it sets limits to the conditions of spatial (and political) possibility.<sup>19</sup> The analysis of fluid objects suggests, to the contrary, that undeformed objects in fluid space both defy and support the conditions of network spatiality. They may do this in ways which look unregulated, sloppy and sub-optimal – but only from the point of view of network space. So the argument is that it is often, perhaps usually, wrong to imagine fluid forms as failing networks, and to imagine that if only they were turned into networks with the possibility of central accumulation then things would be better.

The aim of this article has been to denaturalize network-space and network-objects by showing that these too are enacted, and to move the agenda on by proposing that objects are topologically multiple, existing as intersections or interferences between different spaces including regions, networks, and fluids. As a part of this I have argued that objects may be understood as an intersection between different versions of shape invariance, Euclidean, network, and fluid.

Finally, I have also sought to interfere in favour of a spatial understanding of alterity. Contrary to what is often told and enacted, there are spaces and objects that lie outside networks. So it is that I end with this proposition: that spatial systems are *political*. They are political because they make objects and subjects with particular shapes and versions of the homeomorphic. Because they set limits to the conditions of object possibility. Because they generate forbidden spatial alterities. And because – at least in the case of networks – they tend to delete those alterities. Networks, then, embody and enact a politics, a politics linked to and dressed up as functionality. Though network spatiality is not to be abandoned, it deserves to be cut down to size. For the implication is that fluids embody and enact an alternative politics of object-constancy that does not link functionality

to centring, syntactical stability or capitalization. And as we have seen, this politics – this reality – is necessarily Other to network spatiality. Which is why it is right, as a matter of political choice to interfere, to discover objects in their spatial multiplicity and alterity, to make and articulate alternative spatialities and, in particular, to rehabilitate fluidity.

## Notes

This paper is part of a joint project on spatiality with Annemarie Mol and arises out of nearly a decade of conversation, debate and joint work. I am also most grateful to Claudia Castañeda, Kevin Hetherington, Duncan Law, Doreen Massey, Ingunn Moser, Vicky Singleton, John Urry and Helen Verran for discussion, support, encouragement, and resistance.

1. For a particularly interesting analysis of the heterotopic, beyond the limits of the epistémé, see Kevin Hetherington (1997).
2. A criticism made one way or another by various writers including Lee and Brown (1994) and Star (1991).
3. This case study was explored in Law (1986, 1987).
4. The notion of scale also raises important questions. For discussion see Law (2001).
5. I draw this argument from joint work with Annemarie Mol. See Mol and Law (1994).
6. Readers who doubt this are invited to imagine the analogous example of spheres instead of circles. Can the smaller sphere escape from the interior of the larger sphere without deforming the latter? The answer is yes, but only if it is rotated through a fourth dimension!
7. A sense of the importance of the functional in certain explanatory schemes – here actor network theory – arose for me in conversation with Claudia Castañeda. I am most grateful to her.
8. This moves the argument several steps forward into speculation. I will shortly make one of those steps slightly less speculative, by arguing that spaces are made together with objects. A second step in the argument would be to say that objects can only be detected in inter-topological interferences.
9. This, to be sure, is why the actor-network theorists sometimes say that nothing exists outside the network – a form of colonialism if ever there was, a way of limiting the conditions of possibility, but if one is confined within a network topology it is also a claim that is nevertheless quite right. For definitionally, network stabilities can only, indeed, exist within a topos of network.
10. This is an argument that has also been developed outside ANT. See, for instance, Harvey (1989) and Thrift (1996).
11. All of which is explored in Latour (1990).
12. I talk here of fluidity. For a discussion of a further possibility, that of fire space, see Law and Mol (2001).

13. The argument outlined here was developed in Mol and Law (1994), and the empirical case is described in greater detail in de Laet and Mol (2000). An analogous multi-topological argument is developed in Law and Mol (1998).
14. De Laet and Mol suggest that Morgan is the ideal man, a fluid man – and contrast his unwillingness to capitalize himself with the ruthless centring performed by Louis Pasteur as described by Latour (1988b).
15. For the most obvious example of the genre see Castells (1996).
16. The argument was originally developed in Mol and Law (1994).
17. There is much more that might be said about this. No doubt strategies of flexible accumulation represent an intersection between objects that exist both in network and fluid spatialities: it is not simply a matter of the movement of immutable mobiles. But the beast of capitalism needs, no doubt, to accumulate somewhere, even if that somewhere moves around through Euclidean (and even network) space. For further discussion see Law and Hetherington (2000) and Law (2001).
18. The health care examples are drawn from the work of Vicky Singleton. See Singleton (1998, 2000). The case of the signallers comes from Law and Mol (2002).
19. For further commentary see Haraway (1994), Strathern (1996), and the papers collected in Law and Hassard (1999).

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