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On making infrastructure visible: putting the non-humans to rights

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Using the author's own experiences in local politics, the paper examines several cases in which pieces of mundane infrastructure are contested. The cases include *eruvs*, traffic-calming technologies, and invisible dog fences. The argument is that in contra distinction to abstract philosophical approaches to technology, the social construction of technology (SCOT) needs to return to the examination of the mundane embeddedness of technologies in everyday life. It is argued that an adequate approach to the role of the human and the non-human should not buy into a distinction between ontology and epistemology but instead should focus upon the contested interaction of humans and non-humans in everyday life and thereby restore the analysis of intentionality and meaning to its rightful place at the core of the sociology of technology.

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"Don't ever take a fence down until you know the reason it was put up."

- C. K. Chesterton

1. Introduction

I have to come clean. I am not a philosopher, neither am I a rabbi. I have recently been mistaken for both. But I am a president. Let me explain.

I find myself writing here about the weighty matter of 'Ontology of Technology'. My earlier writings on technology (e.g., Pinch and Bjker, 1984) may have influenced philosophy of technology to take an 'empirical turn' (Verbeek, 2005). But, dear reader, I am no philosopher. Before you turn with better expectations to, say, the paper of Andy Feenberg, who is a real philosopher, let me give you two reasons to stay here a while longer. I really am a president and I really was recently mistaken for a rabbi.

I am a very humble form of president. Unlike the US President, who commands Air Force One and the whole might of the US Military, I command a small non-human—a gavel. When I was elected president of my local housing association, the Forest Home

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Improvement Association (FHIA), this little wooden mallet was ceremonially passed on to me at the annual meeting with some humour; this pathetic non-human signifies the almost impossible task the president has of controlling the unruly humans at our meetings. Being president of my local housing association in the hamlet of Forest Home, which is part of Ithaca, New York, generates more email than my job as a professor at Cornell University.

2. Making visible an invisible wall

Now let me tell you about the rabbi. At a recent meeting of the Ithaca Town Planning Committee, which I was attending for only the second time, I was asked whether I was the rabbi from Cornell University the Committee was expecting. Alas my rabbi credentials are even less impressive than my philosophical ones. But then the real rabbi appeared and what he came to tell us was extraordinary. He wanted our town to be surrounded by an invisible wall—a very special form of wall known in Jewish Law as an *eruv* (the Hebrew word for mixing or blending). An *eruv* surrounds a space with a series of symbolic gates (as to a temple) and enables a blending of the public and private space within. Once in existence this invisible wall gives the space within it special religious significance, a form of virtual temple, and allows Orthodox Jewish religious observances to be carried out in an easier way. It would permit an Orthodox Jew, say, to take property from his home that would not normally be allowed on the Sabbath. The example the rabbi gave, well chosen to appeal to our better nature no doubt, was of someone in a wheelchair who, with the help of an *eruv*, could be permitted to leave his house on the Sabbath, while strict observance would not allow this. There are many Orthodox Jews living in Ithaca who would benefit.

Sitting at the meeting, I pricked up my ears. I was familiar with walls and how they figure in the philosophy of technology. John Searle, unquestionably a real philosopher, had once told a parable about walls to illustrate the difference between material boundaries and processes of social signification (Searle, 1995). In Searle's parable we are asked, with the typical armchair example beloved of by philosophers, to imagine a tribe who build a stone wall around their village 'big enough to keep intruders out and the tribe members in' (Searle, 1995, p. 39). The wall works by a physical property of walls known for an eternity—humans cannot pass unaided through thick, rigid, solid substances.[1] Eventually everyone gets used to the wall and how it works. Over time the wall gradually evolves from being a physical barrier to being a symbolic boundary, say, a line of stones. The symbolic wall serves the same function as the physical wall. In short, collective processes of signification have replaced 'sheer physics' (Searle, 1995, p. 39). It is this collective process of signification in the 'construction of social reality' that Searle is most interested in.

Real walls (and wheelchairs one might add) are much more fascinating than armchair walls, as became evident when the Town of Ithaca got down to considering the rabbi's request. The first problem is that building an invisible wall turns out to be a non-trivial matter. The *eruv*, the rabbi explained, must consist of a continuous wire around the space with columns hanging from it at certain fixed intervals to symbolise the gates. An immense stroke of good fortune is, however, on the side of the modern *eruv* builders. Most cities and towns are already surrounded by wires with columns attached to them—telephone poles and power lines! The rabbi pointed out that the necessary wires and poles could be cleverly adapted for *eruv* purposes. There was one problem. Jewish Law stipulates that the poles

[1] That is unless they build a door or gate, but that is another whole story in technology studies (Latour, 1992).

should be placed precisely under the wires—a position to be determined exactly using laser measurements. Unfortunately, and as might be expected given the lack of interest of most upstate utility workers in Jewish law, the poles in Ithaca were not quite lined up right. An ingenious retrofitting of the wrongly-positioned poles with the addition of plastic housing columns would, however, save the day and would mean that all poles could be made to comply. Furthermore most citizens would never be able to tell the difference between the original poles and the new *eruv* retrofitted poles and could pass through the *eruv* totally unaware of its existence.

The rabbi had done his homework and lined up the two key social groups to carry his plan forward: the two major utilities, Verizon (formerly AT&T) and NYSEG (the power company). After some initial resistance and after being told that the new poles would look identical and could be modified without any damage, these companies had agreed to cooperate. A contractor had been found to do the necessary retrofitting, and now the Town of Ithaca was being asked to sign off on the project.

Part of the job of town planning committees is to make the normally invisible infrastructure of towns visible. The first issue to be addressed at any such gathering is money. How much will this cost? The Town Supervisor clarified with the rabbi that it would not cost the Town of Ithaca anything as all costs were to be born by the Cornell Jewish community. But members of the committee were worried about other aspects. Wasn't there meant to be a strict separation of church and state? The Town clerk had diligently gone online and circulated a case of a *eruv* in Palo Alto, which had been opposed on exactly these grounds. 'What if a less benign religious group wanted to nail crosses to every telephone pole in Ithaca?', asked one member of the committee, who prefaced his remarks by stating that he had been brought up Jewish and 'to be frank I find the whole idea of a *eruv* silly'. The rabbi had his reply ready. He understood where the criticism was coming from but the *eruv* demanded no precedent because it was simply allowing religious people to do what secular people did all the time—such as cavort around Ithaca in their wheelchairs. In short it permitted something secular to happen rather than prescribing something as religious.

The Town lawyer then spoke. She had researched other cases and felt that the town could maintain its discretion in the future to ban any less benign walls. But members of the planning committee still felt uncomfortable because the request came from a specific religious group with a specific religious purpose in mind. The discussion wandered over the exact wording of the request and whether other religious groups would tolerate the wall. The lawyer questioned whether the wall would break local signage ordinances—Ithaca has strict rules about signs being posted on telephone poles and this looked like a sign. No, argued the rabbi, it was not a sign because it was invisible to most people. The lawyer came back: the definition of a sign is something that conveys information and since the wall will convey information to some people it could potentially be a sign. The committee decided further investigation was required. Someone whispered in my ear after the rabbi had left: 'If God was really omnipotent he wouldn't be fooled by this fake wall anyway!'. The last word, as always, was with God.

In the ten-minute discussion the Planning Committee had ranged over some of the most salient issues in technology studies. The real wall was actually far more interesting than Searle's armchair wall. For one thing it demonstrated that technologies carry no intrinsic meanings. Their meanings are always to be found amongst social groups who interact with the technology and share a meaning of the technology (Pinch and Bijker, 1984; Bijker, 1995). Most people share the meaning of poles and wires as carriers of part of our

technological infrastructure—power lines and telephone lines. Now a new meaning of the poles and wires was being asserted—that they also carried religious significance. This meaning was shared amongst a specific social group, namely Orthodox Jews.

This case is interesting because the new meaning does *not* challenge the predominant meaning as with more familiar cases where there is a struggle over a technology and one meaning wins out. A familiar example of this type is the transition in the history of the bicycle from the high-wheeled ordinaries to the safety bicycle (Pinch and Bijker, 1984; Bijker, 1995). There the 'interpretative flexibility' [taken over from the sociology of science where the term describes interpretative battles over scientific facts (Collins, 1992 [1985]; Pinch, 1986)] associated with the high-wheel bicycle (namely contested meanings) amongst different social groups soon vanishes. In the case of the *eruv* the two meanings of the wires and pipes could coexist together, albeit with some expensive modifications to the existing infrastructure.

This points to another important set of issues in technology studies to do with infrastructure. Most new infrastructure is built upon older preexisting infrastructure (Bowker and Star, 1999; Star, 1999). The role of older technologies coexisting with new technologies is gaining increasing attention amongst historians of technology (Edgerton, 2006). This is all part of the move within technology studies from an innovation-centred to a use-centred account. The fascinating thing about the *eruv* case is that it piggy backs upon a comparatively *new* infrastructure to establish a very *old* meaning. Also it further reaffirms the importance of new meanings of technology being created by users. Scholars in technology studies argue today that the key to understanding technology is to understand use and users and how users are 'scripted' or 'configured' with technologies and how in some circumstances users can act as 'agents of technological change' and 'repurpose' technologies for completely new uses (Akrich, 1992; Faulkner and Runde, 2009; Kline and Pinch, 1996; Oudshoorn and Pinch, 2003; von Hippel, 1988; Woolgar, 1991). The rabbi and his fellow users had imaginatively developed a new use for an old technology.[1]

In the case of the *eruv* it is important to note that, although the meaning of the technology is mainly symbolic, materiality is involved. The wires and pipes need to be precisely aligned. In short 'religious functionality' requires its own non-trivial material alignment.[2] Measuring each pole with laser equipment and retrofitting if necessary is a huge investment in time, technique and money. This is what is missing from Searle's discussion of walls. For Searle the 'brute physics' of the wall and acts of signification are analytically separated. The deep insight of recent social studies of technology is to show that signification and materiality always form an interactive process (Bijker *et al.*, 1987; Latour, 1987; MacKenzie, 1993). Furthermore technologies and their meanings do not exist detached from the rest of society, its institutions, culture and the vast assemblages of technologies and humans we have already built. This point is nicely illustrated by the Planning Committee's discussion, which ranged over economy, law, religion and the nature of signifiers.

The fate of the new addition to Jewish infrastructure lies in the balance and lies, in the end, with the very human powers of the Town Planning Committee to decide whether to approve the project. This case also tells us something about the neglected politics of

[1] Or one could equally say an 'old' use for a 'new' technology.

[2] Which technologies can be used on the Sabbath and exactly how and in what form are closely debated in Orthodox circles. The pros and cons of new technologies designed specifically for the Sabbath (that, for instance, offer computer control of mechanical actions not permitted by humans) are also much debated (see Woodruff *et al.*, 2007).

technology. Often analysts look for the politics of technology in big issues such as racist bridges, or authoritarian states built around nuclear power stations (Winner, 1999) or the megamachines of modernity (Mumford, 1934). But there are politics too in our everyday interaction with the infrastructure and material fabric of life. In most communities it is entities like planning committees that make these issues visible, and which decide on which infrastructure to maintain and which to change, and where these politics are played out (Bijker and Bijsterveld, 2000).[1]

I should mention one last thing about the *eruv*. When I got home I skyped my wife who is a sociologist currently in Israel studying the 'Separation Barrier' being built in the Middle East. She was surprised to hear about the prospective *eruv* in Ithaca, and even more surprised that I would sit there at the meeting taking notes for an academic paper rather than opposing this political wall that served conservative religious sentiments. Her own experiences of living in a country where Jewish Law dictates so many aspects of everyday life had given her a renewed dedication to the firm principle of the separation of church and state. A new meaning of the *eruv* and my actions was about to be scripted.

3. Non-humans and the social studies of technology

It might be argued that the above case, although interesting, is rather atypical for technologies because it deals with a form of what I have called 'religious functionality'. In other words, the ability of the *eruv* to affect people directly is a matter of whether you believe in the powers of God and what sort of God. But there are many cases discussed at forums such as planning committees where the powers ascribed to the technologies at stake are straightforwardly accepted as having a direct impact on people (as we shall see below). Indeed most, if not all, technologies have material consequences for human activities. The desk I am using prevents my computer falling to the floor, the smooth asphalt road enables my bicycle to go faster, the appalling potholes in the roads around Ithaca force my car (and me) to go slower.

The most controversial issue in technology studies today, and indeed a foundational issue for the ontology of technology, is how analytically to deal with these effects of non-humans upon humans. Some approaches, such as advocated by Bruno Latour (1992) and Peter-Paul Verbeek (2005), argue for symmetry between humans and non-humans. In other words for analytical purposes the humans and non-humans are to be treated as equivalent.[2] The impetus for this sort of work is to move 'beyond' the social shaping or social construction of technology by humans and to take account of the effects of technology on social formations. I have no problem with new social groups coming into existence with new technologies. Obviously social groups are not stable for ever and new ones have to emerge from something. For example, in studying the history and social construction of the electronic music synthesiser—a whole new class of instruments that start to appear in 1964—all sorts of new social groups including synthesiser players, manufacturers and salesmen come into existence (Pinch and Trocco, 2002). The

[1] The contested nature of *eruv* in other planning committees can be gleamed from a web search, e.g. http://www.eruv.net/. *Eruv* is interestingly contested within Israel where in Jerusalem (which is surrounded by *eruv* poles) secular Jews fight the powers of the religious Jews who try to encircle specific communities with a localised *eruv* in case the outer eruv is breached or damaged. Secular Jews worry about the takeover of their communities by the orthodox Jews and pull down the *eruv* poles and oppose the *eruv* on grounds of safety and aesthetics. See, for instance, Madzini (2009).

[2] The general issues around Latour's work for science studies have been much debated before. See Collins and Yearley (1992), Callon and Latour (1992), Bloor (1999) and Latour (1999).

psychedelic movement of the 1960s is also partly shaped by the synthesiser, which allows the exploration of new washes of sound, unusual timbres, spacey effects and so on. The mutual interaction between social groups and technologies such as with the formation of a new social group around a new technology does not, however, necessarily lead to the more radical position that humans and non-humans are equivalent or that every effect of technology on humans needs to be brought into the analysis. Indeed, I will argue below that approaches which call for the symmetry of humans and non-humans miss the more important issue, which is to think about how and under what circumstances non-humans and their impact are made visible in the first place. Let us now go into these arguments in more depth.

Peter-Paul Verbeek (2005), in calling for a new postphenomenological philosophy of technology, dismisses the approach towards technology and meaning outlined above (known as Social Construction of Technology, or SCOT). He says this approach ignores the effects of technology on humans. He gives the example of how a microwave oven—a non-human device—has transformed eating. He writes: 'the factors that determine whether human beings take their meals together include not just human beings but the microwave itself. Reducing technology to social interactions fails to do justice to the active role played by technologies themselves' (Verbeek, 2005, p. 102).

The phrase 'reducing technology to social interactions' mischaracterises SCOT. The SCOT approach is a way of understanding technological development that emphasises the role played by social groups. It does not claim that there are no effects or impacts of technologies upon humans. It would have been very strange indeed if Bijker and I could have said anything at all interesting about bicycles and their history if we ignored the effects of non-humans on humans. Clearly bicycles depend on roads (non-humans) and being able to steer your bicycle around a bend is an example of a human responding to a non-human—a bend in the road. If you think of the non-human effects in even describing how a bicycle works there are clearly many: the frame must be rigid enough to support riders; the handle bars must turn freely such that riders can not only steer but also react to bumps on the road; the chain must be tight enough to enable a hill to impact on riders such that they feel the need to pump their legs harder; the tyres must be inflated and of the correct material to lessen impacts of bumps in the road and so on. Add in all the laws of physics and balance so that upright riding can be maintained under different conditions and you have vast numbers of non-human effects. In writing about the bicycle Bijker and I were, of course, quite aware of the many ways that bicycles, roads, and so on, impact humans. We saw no need to lay stress on such effects, but neither does our form of analysis deny such effects. Rather our analysis is selective in the aspects of the non-human world it chooses to focus upon.

There is an enormous amount of stability in how the non-human world impacts upon humans, which is shared across all social groups.[1] Walls impact humans but no one seriously thinks this always needs to be stated, unless you are analysing new architectural practices or an earthquake. Likewise, in the analysis of the bicycle all cyclists whether 'young men of means of nerve' or elderly men or women respond to non-humans, namely roads, every time a bend is taken. Sometimes, though, in the development of a technology, what goes on in the non-human world becomes much more visible as engineers and others contest the exact properties and performance of the non-humans. Such contested

[1] One way of talking about material effects is through the language of 'affordances'. For an attempt to develop a social constructivist account of affordances see David and Pinch (2008).

meanings of the non-humans and their attributes are exactly what SCOT tries to make visible. In the bicycle example we showed that air under pressure can be a problem for tyre construction and this directly affects the adoption of the new safety bicycle; we discuss the impact of roads upon bodies directly as in 'doing a header'; we show that bicycles with big wheels go faster and this leads to developments of extraordinarily large-wheel bicycles like the Rudge Ordinary, and so on (Pinch and Bijker, 1984). In other words, we have a methodology for making certain non-humans visible. If the non-humans are relevant to social groups then they are relevant to the analysis.

If there are indeed many effects of a technology on humans why settle on just one social effect of the microwave as Verbeek does—that eating patterns may change? The number of potential effects of the microwave upon humans is enormous: it uses power you pay for, it uses part of your hard-earned cash when you buy one, you can start a fire unintentionally if you forget to remove the silver foil around the food being microwaved, it can lead to domestic fights over the role of new technology in the kitchen, it makes an unpleasant humming noise, it takes up space where other appliances might go, it allows you to reheat your kid's school snack much faster, it requires you to own more plastic containers, it enables many restaurants to stay in business and it boosts sales of deep freezes. Then think in detail how it impacts the different sorts of food we cook—it allows you to cook baked potatoes faster, is wonderful for popcorn, reheats a mug of coffee quickly (but unfortunately also burns your hand on the mug), destroys croissants, is OK to defrost frozen bagels with, and so on. The list is vast, and food is such an important part of social life that its cooking (perhaps also invisible work in some households) affects humans on a daily basis. So why pick out just one effect on humans and make this the crucial one? How do we know which non-human effect to focus attention upon?

4. The cobbled shoulder

Let us now examine a much more famous example in technology studies—the sleeping policeman or speed bumps introduced by Latour (1992). Again we will turn away from the armchair to a real example. The Forest Home Improvement Association, as it name suggests, is in the business of making improvements. One of the improvements we are trying to make in our little hamlet is to deal with one of the pressing problems of modern life—traffic. The traffic problem we face in Forest Home comes from living next to what we call the Big Bear—Cornell University. With an income bigger than many nations, Cornell is by far the biggest employer in the area. As professors, staff and students from the surrounding area join the fevered daily rush to and from work, they also rush through our hamlet threatening our air quality and our safety. If only we could calm them down! After seven years of taking data, modelling, meetings, consultations with relevant stake holders and so on we have developed no less than a plan to calm the cars, buses and trucks on our roads. The Forest Home Traffic Calming Plan, as it is called, is currently being considered by the Town of Ithaca and it is my job as president to lead these negotiations.

The best way to calm traffic, as Bruno Latour knows only too well, is to use non-humans. Mid-block 'speed tables' (which differ in subtle ways from 'speed bumps' and 'sleeping policeman', but which work on the same sorts of principles) and 'entrance features' are the main tools at our disposal. The mid-block speed tables are sections of gently ramped raised road placed in the middle of a straight length of road ('mid-block'). The motorists encounter the ramps leading to the raised section of road and slow down because they fear damaging their cars. The entrance features are a narrowing of the road accompanied by

some recognisable 'historic' features (e.g. stone pedestals with lampposts) so that drivers know they are entering our specially designated 'historic' hamlet. The entrance features, recommended to us by our traffic calming consultant (a leading US authority on such matters), are a much debated part of the plan. They are expensive and residents wonder whether they really will work—in other words speed tables that directly impact motorists give better 'bang for the buck' and are likely to be more reliable and effective in calming traffic than the largely symbolic entrance features. The debate over entrance features, however, has recently been resolved by the availability of economic stimulus funding (in response to the credit crisis), which enables us to pay for both speed tables and entrance features. Lucre in sufficient quantities can go a long way to resolve some infrastructural issues.

Where our community is really divided, however, is over 'cobbled shoulders'. I have more email in my inbox pro and con cobbled shoulders than anything else to do with the traffic plan. The shoulder is the section of road between the sidewalk and the main road. The idea is to keep cars away from the sidewalk and pedestrians. But then, citizens ask, where will the cyclists go? Our neighbourhood is full of cyclists and many ride through it on their way to work. Suddenly with all the talk of 'sustainability' in the air the bicycle on the ground has achieved a new prominence in traffic planning. But there is a big constraint on our tiny hamlet and its narrow streets—lack of space. Our already narrow roads and crammed together houses have no room for Dutch or Danish style specially-designated bicycle paths. The bicycles will have to share the road with the rest of the traffic. It is ugly.

But how can they best do this in safety? Our traffic consultant tells us that most serious bicycle accidents are caused by cyclists leaving bicycle lanes placed on the right of roads to turn left across the path of the traffic. It is actually safer, the argument goes, for the cyclists to ride in the newly calmed traffic. But how do you prevent cyclists riding in the shoulder (which, for them, seems like the next best thing to a bicycle path)? The answer our plan calls for is to make the shoulder of a specially textured material (cobbled stone), which will give the cyclists a 'buzz' that is sufficiently uncomfortable that it will force them to ride in the main road. Cyclists are unhappy, for this is to assume that the traffic is already sufficiently calmed that they can ride in safety. Supposing the cars get that fever again and speed up between the speed tables? As one cyclist put it at a recent meeting, 'It sounds as if you want to use cyclists as speed bumps!'. Parents worry about children on their bicycles who will not feel confident enough to ride in traffic. The proponents of cobbled shoulders point out that the cobbled material itself is not a safety issue and that in emergencies cyclists can ride on the shoulder—it will just be uncomfortable.

This is real technological politics in action. Our community is divided over 'cobbled shoulders'. Neighbours threaten to no longer talk to each other, and allegations of ill-will are in the air. The poor president must use all his good humour and negotiating skills to bring about compromises.

The problem we face is a classic but neglected one (Edgerton, 2006)—how do older technologies, bicycles, fit in with newer systems with greater capacities such as cars? A pertinent example is from shipping. Sailing boats, which are obviously less manoeuverable and speedy than the more modern motorised boats, in most circumstances have the right of way over power boats on rivers and the high seas (although it would be a foolish sailor who relied on this when a tanker is bearing down upon her boat!). Even if not sanctioned by law, custom also plays an important part in dealing with how the old and new coexist. Thus, to this day it is customary when driving in the countryside to slow down your motor vehicle when passing a horse. These laws, rules and customs change depending on how well

entrenched the new and the old technologies are or become. Early on when the horse and carriage system was changing to the motor car system it was usual for cars to be accompanied by someone waving a flag to warn horses and pedestrians of the approaching car.

But the law is hard to enforce and speed signs can, as Latour points out, be replaced by physical technologies such as speed bumps that 'force' cars to slow down. Latour talks about this as a process of delegating to non-humans a form of morality formally carried out by humans. The sign 'Slow down' is replaced by the speed bump, which does the job more reliably. But all that is at stake is the point known since the dawn of eternity that non-humans can directly impact humans—try walking into a wall. The only little twist in the speed bump example is that the interaction with the non-human is mediated by another non-human—the car—which the human will want to avoid getting damaged or risk an accident (the economic incentive to save your car from an expensive repair and safety here combine). The decision to slow down is of course made by the human and even if that decision were delegated to a machine (say a special detector on the car that notices a speed bump approaching) it will still be a human who has programmed the machine and made the decision to tell the car to slow down. People understand this all too well. They also understand that material technologies are better at getting people to slow down than symbolic ones. Thus they are suspicious of the soft argument about motorists attending to the signs designating the 'historic' nature of our hamlet and thereby respectfully slowing down. Won't today's young men and women of means and nerve, namely students, simply see this as a reason to drive faster with their expensive SUVs and further shock the old professors living there?

The case of the cobbled shoulder is even more interesting. Again it is the use of a non-human—the textured material—which is used to do the 'forcing'. But this material has become visible because in this case people want to resist the forcing aspect of the technology because for them it does not obviously increase safety. Indeed for some users it may make the roads more dangerous. The way to think about this issue is to realise that 'forcing', 'guiding', 'steering' and so on is being done to us all the time by non-humans but for the most part goes unnoticed. Every time you walk on the pavement you are being 'guided' by the non-humans that make up its physical structure. Every time you drive your car, take a bend in the road, avoid a pothole and so on non-humans are constraining what you do. Normally this role played by the non-humans is so taken for granted it is invisible. Think about driving your car or bicycle round a bend in the road. Perhaps you have a desire or intention to get from A to B quicker by following a straight line and ignoring the bend. What keeps you on the road is just like the speed bump—the fear of damaging your vehicle.

The issue of delegation is one that we now need to address. Talk of delegation mystifies the issue unnecessarily. Delegation of morality depends upon imputing a form of intentionality—which is always tricky. In Latour's analysis the intention, to get cars to slow down, is delegated to the speed bumps. The example seems convincing because the intention is first spelt out in a sign—'Slow Down'—that has now been replaced by a non-human—the speed bump. But let us take an example that works the other way—where a sign replaces a non-human. Consider the case of the 'invisible fence', which many people use these days around their properties to control their dogs. A buried wire and special dog collar will trigger an audible warning signal followed by an electric shock as the dog gets nearer and nearer the now invisible fence. My neighbour has installed such a device enabling him to replace his old wooden fence. On the ground between our properties he erected a warning sign that says 'Invisible Fence'. It is as if non-human action was not

strong enough alone and needed to be accompanied by weak signification to fully accomplish the job the old fence did.

At first I was puzzled by this sign; why did I need to know that an invisible fence was present? Was it a satirical joke? Instead of telling humans 'Beware of the Dog' it was perhaps telling the dog 'Beware of the Fence'! Then I thought some more. One of the advantages of the new invisible fence that replaced the old wooden one was that it opened up my neighbour's property so that my kids and his could now play unimpeded. But this introduced a new problem; his dog now was clearly visible (and audible) as she barked at passing strangers. What if the strangers did not realise there was an invisible fence keeping them safe from the dog? Because the new fence is invisible to human senses (not to the dog's of course) an old-fashioned sign is needed, perhaps to help reassure everyone that the dog owner is not being negligent and that the dog really is under control. If this is the case it points to the important signification work that the old wooden fence did in telling people that the dog was under control. But then why should my neighbour care about what strangers might think? Perhaps there is a legal or insurance stipulation that advises invisible fence owners to display a sign to prevent themselves getting sued from passers-by suffering heart attacks at the sight of an unrestrained dog? In this case rather than morality it is prudence and compliance with the law that is the intent behind the sign. The more I thought about and investigated this case, the more complex it became to infer what, if any, the intentionality in the sign was. Someone told me that the sign was merely an advertisement for the Invisible Fence Company, even though the Invisible Fence Company itself proclaims at its website that the sign is to be erected to alert people that the dog actually is under control. Another person who had erected the sign assured me that it was needed during the training phase where smaller flags marked the hidden wire and that neighbours would worry about what these smaller flags meant. In other words it was a sign about other signs that in turn served some doggy signification purpose. What if I bought in another hidden actor as Donna Haraway (2003) would want me to do—the dog. Suppose my neighbour's dog was a cute little chihuaha as opposed to a snarling Rotweiller? That too would change how the sign could be read and my actions in attending to it.

Depending on how the sign was read different effects would follow. It could mean more revenue to the Invisible Fence Company, it could mean the difference between a heart attack or not, it could mean making a complicated risk calculation depending on the size of the dog, the state of its training, and so on.

Think about this example in terms of delegation. Is a human delegating an intention first to the wooden fence, then to the invisible fence and then to a sign? What does it mean for a non-human to delegate to a sign? And which particular intention is being delegated? And even if we are to accept some sort of postphenomenological ontology of technology whereby humans and non-humans both do delegation (not to mention dogs and cats),[1] we cannot escape from the problem that reading intentionality into the sign depends on humans.[2] There is of course no straightforward meaning of signs—as the Ithaca Town Planning Committee reminds us. The irony is that while the Planning Committee debates whether or not an invisible fence is really a sign, we debate what the sign 'Invisible fence' means! There is no escape from the contested world of human signification.

[1] The complex agency that can be read into a catflap is investigated by Ashmore (1993).

[2] Verbeek (2005) advocates such a position and criticises Latour for his tendency to do only one-way delegation (from humans to non-humans) and not be fully symmetrical.

Even if we buy into the notion of delegation from humans to non-humans we run into the problem that such delegation is everywhere. The delegation/intentionality argument can be made, in principle, every time that a purposely built non-human artefact 'forces' a human to do something. Think of all the myriad bends the road takes. We can say the road engineers constructed *that* bend *there* intentionally and that they delegated their intention to the non-human bank of the road, and so on. Now it may be argued that the bend in the road involves no intentionality on the part of the designers because they are just following the natural terrain of an encroaching hill. But there is no 'natural' in road building. We just have to be reminded of how Napoleon III rebuilt Paris in the 1850s at huge cost so as to maintain straight boulevards. Hills were tunnelled through and buildings raised and lowered to ensure that the road was straight.[1] In other words a road builder who opts for a curve can be said to have intentionally avoided the straight option and delegated this intent to the bend in the road. The road itself, in that it supports the car, can be thought of as a delegation by the road designer to the road to support cars. But with this way of thinking delegation quickly becomes trivial because it is happening nearly everywhere all the time.

The beauty of the cobbled shoulder example is that it makes visible or audible[2] part of the vast, normally invisible, world of non-humans we live with. In this case the human contestation makes visible what is at stake because humans do not want to accept the 'forcing' aspect of the non-humans. Now suppose the cobbled shoulder advocates win the debate. In years to come the cobbled shoulder will again become invisible (except to those cyclists who curse it)—another aspect of our infrastructure of roads. It will not be realised that the non-human forcing comes from a human decision made many years earlier. Latour and Verbeek, and others who advocate an ontological turn, need a means of sifting through all the myriad non-humans and their countless interactions with humans so that we can see the significant choices made by humans. It is returning to the politics of technology and the forums in which they are manifest which reminds us of how this can be done.

In summary, there is no ontology without epistemology or rather where there appears to be so it is humans who have achieved the split. Intentionality can only be determined in context. The job of the sociologist of technology is to try and recover that intentionality and in a non-human saturated world we need some sort of methodological guidance as to which non-humans to focus upon.

When the non-humans are contested such as at planning meetings and the like the participants do a form of SCOT analysis for us. In SCOT we are the opposite of magicians who make things and people disappear. Our goal is to make things and the humans who interact with them reappear. The citizens of my hamlet remind us about the non-humans we need to focus upon. It is in this carrying out of the mundane politics of infrastructure where the non-humans are finally put to right.

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[1] I am grateful to discussion with Park Doing and Peter Dear over this point. On Parisian road-building see Pinkney (1958).

[2] My friends in sound studies will notice the overuse of visual metaphors in this paper. Listening for the buzz of the cobbled stones and the crunch of your suspension on the speed tables, is an alternative way of conceptualising the same problems through another sense.

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