3. Questions of Theory and Purpose

Like the four other learning histories, the Merton learning history draws in theories that, at the time of writing, I was engaged with and that seemed to be particularly well illuminated by that case. The theories I refer to here could be broadly termed 'theories of change' and do not include methodology. They are theories that in some way suggest understandings of processes of change at an individual, organisational or sociological level. The sketch below locates very roughly, using stars, the theories I drew into the Merton learning history.

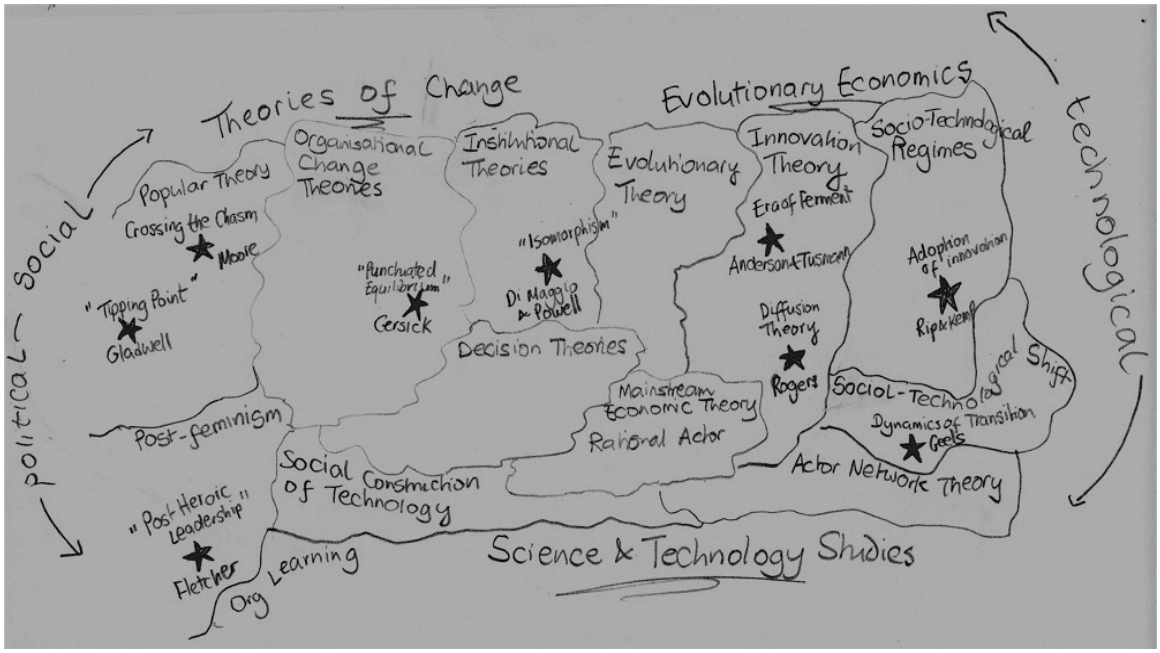

Figure 10: Rough sketch of theory points used in Merton

The use of theory in this way might well raise questions. Why those theories? How was I working with them? What purpose did they serve – for the research and for participants? In this section I reflect on such questions of theory and purpose trying to draw out as I go the different purposes these theories have served in the research that include: drawing out my own position on change; creating a rationale for the research approach I took; setting a theoretical platform which I would develop in the research; and finally providing

a base of theory that I would use to enrich the learning histories.

The above sketch might well be tidied up and categorised more neatly. It includes a span of theories that work with different units of analysis: the individual, the organisation, the institution, the sociotechnical system and so on. But instead of tabulating these, they are all jumbled together in this messy sketch. I show this because it seems a truer representation of how I carry these theories in my mind. There is a rough order in it too. It flows temporally from left to right. On the far left are theories I brought into the work with me. Postfeminist theories that included Joyce Fletcher's ideas about relational practice were an area that had been important to me during my MSc work. So too had been the popular ideas of complexity theory. Moving in from the left my PhD literature survey started with organisationally located 'change theory'. I branched from there into institutional theory, touching at times into interesting sociological theories of collective behaviour, some of which were building on evolutionary theories of economics. I rooted right down into individual decision making theory too. I then moved to the set of theories on the right hand side of the diagram. These have a different feel as they are more strongly built on science and technology studies and economics. With these theories technology and its relationship with the social world is the focus.

This chapter will follow the sweep of the sketch from left to right. First I start back with the purpose of the research, as it was introduced in the first chapter. I will explain how it was the attempt to connect this purpose to theory that guided the flow of my theoretical survey.

Theory and the 'Big Issue'

The 'big issue' of climate change and the need for a rapid decarbonisation of our society was the cold fact at the centre of the Lowcarbonworks project and by extension at the centre of my work. One way of describing the Lowcarbonworks project and my research work in particular, might be as an attempt to find some cogent way to take the 'big issue' of climate change and convert it into meaningful and appropriate action. During the first year of my studies, in a search for what is cogent, I spanned a range of literatures that were connected in some way to 'change' and 'technology'. The choices of where to start with the literature were driven by the framing of the project which centred on the idea of

'lock-in'.

> There is a systemic interplay between technological, economic, and human factors which creates a form of systemic conservatism. Theories of complementarities in economics and organisational change show that attempting to change one factor alone may be of limited impact; it may even be damaging if it causes the whole system to **'lock in'** to a suboptimal path. However, addressing several of these at the same time, can result in a virtuous cycle of change
>
> **--- From the Lowcarbonworks research proposal**

The thinking behind the project was that as a society we are "locked-in" to our use of fossil fuel based technologies and that this "lock-in" is held in place by a variety of psychological, organisational and sociological factors. Only by addressing these factors simultaneously might change be enabled. On the project we wanted to explore this idea. This meant looking at change as it occurred across different levels from the individual to the collective and embedded in a cultural, technological, economic and legislative context. David Ballard, who was instrumental in initiating the Lowcarbonworks project, proposed a tool to help us test this view in practice. "The Wilber/Ballard Matrix" (Ballard 2006) draws on Wilber's 'all-quadrant, all level' integral conception (Wilber 2000) and integrates it with complementarities theory (Sanchez-Runde, Pettigrew et al. 2003) to suggest a way of taking a multi-levelled, contextualised view of change.

Barrier/Opportunity Mapping Tool	
Person *Individual subjective factors* (values, worldview etc.)	**Job** *Individual objective factors* (socio-demographics, knowledge etc.)
Company *Collective subjective factors* (culture, shared norms etc.)	**Industry** *Collective objective factors* (Political, economic, technological, etc.)

Figure 11 Ballard/Wilber 4 quadrant model (based on (Ballard 2005 p.5))

The figure above shows how the matrix orders the factors enabling or inhibiting change into four quadrants defined by two axes. The vertical axis runs from the individual to the collective and the horizontal axis runs from the subjective and objective. The matrix tool proposes that by looking at factors across the four quadrants and seeing how they line up and/or complement each other, a more comprehensive view of change or 'lock-in' might be reached. For example an individual might be subjectively committed to a

change agenda, and he/she might be empowered in her job to do so. However if collectively the regulatory context for that change is difficult and/or the organisational culture is one that is not encouraging of it, change may still not occur; the situation may be locked in. The Wilber/Ballard Matrix was a tool offered to be of practical use in the project, and I also found it useful to guide my literature survey so that I too would have theory of change that made sense quite comprehensively and that would link to the project goals.

Using this framing I started to pick a pathway through the various literatures on organisational and technological change. This chapter will describe how it was in this way that I could slowly uncover and develop my own position with respect to these ephemerous terms: ‘change’ and ‘technology’. And as I did this idea of ‘lock-in’, and to an extent the Wilber/Ballard Matrix that had been so engaging at first gradually became less important as I started to adopt a more flowing, less instrumental view of change. So I introduce the project framing and assumptions here not because they became central but because they oriented me well into my theoretical inquiry. From there I could build a piece of research that connected to the ultimate purpose of addressing ‘the big issue’ in a way that made sense to me.

The remainder of this chapter relates to that gradual unfolding of position. It divides loosely into three parts delineated by the sketch: the left side, the middle and the right hand side.

In this chapter, in keeping with what I am striving for overall in this thesis, I am attempting to present a multi-layered account of my work with theory. I will present the destination of my literature survey – the position this reading has led me - but I will also be giving some sense of the journey. Some sections and reflections will be more personally toned as I explain how I engaged and reacted to some of the ideas and tested them against my own experience.

The Left Side

Organisational change theories

I started with organisational change theory seeking insight and integration. Though much of the organisational literature is set within a frame where business success and longevity is the ultimate aim, I thought there may well be insights from that literature that would integrate well in a project that at its heart was trying to understand why organisations are not changing. What I found there was insight but also confusion and frustration.

Insights

One key insight was into the nature of organisational routines. Organisational routines are repeating patterns of behaviour that reflect a collectively held wisdom of how things are done. Routines are embodied in procedures, standards and taken for granted cultural norms. They express a dynamic stability that has been described appreciatively as a source of capability for change (Feldman 2003). However, more commonly the change literature describes them as degenerative linking them to rigidity and organisational inertia. There is the threat-rigidity hypothesis (Staw, Sandelands et al. 1981; Gladstein and Reilly 1985) that claims that groups, under threat, will seek recourse in existing routines. Or there is routine rigidity (Gilbert 2005) which has been defined as a key source of inertia. Finally there is success rigidity (Miller 1994) where fearful of breaking a running system, organisations daren't change existing patterns of operation and so fail to recognise and respond appropriately to changes in their surrounding environment . These perspectives do give an insight, albeit a depressing one, into why 'business as usual' is a cycle that is hard to escape despite growing awareness of the environmental crisis.

This depressing insight was to be repeated as I moved upwards from the organisation to the level of the institutional field where the field is defined as a set of organisations that:

> In the aggregate constitute a recognized area of institutional life
>
> (DiMaggio and Powell 1983)

DiMaggio & Powell propose that in a field of organisations there is much less variation in how organisations operate and do business than might be expected. They propose that organisations rapidly become like each other – they term this isomorphism - because there are homogenising mechanisms that tend to push out diversity in the field. As a result organisations change in directions that are convergent with each other. The mechanisms that cause this to happen are: *coercive* – organisations might be different but they share the same formal and informal pressures including regulatory structures and cultural norms. Secondly there are *mimetic* mechanisms – organisations will tend to look at how their competitors do things and evolve their practices and processes in relation to each other. Finally there are *normative* mechanisms – as work becomes increasingly professionalised, organisational boundaries are made more fluid by the mobility of the professional who identifies as much with the network of professionals to which he/she belongs as to the organisation of which he/she is currently a part. The result is, that at the institutional level, there is also rigidity and resistance to change.

> Highly structured organizational fields provide a context in which individual efforts to deal rationally with uncertainty and constraint often lead, in the aggregate, to homogeneity in structure, culture and output
>
> (DiMaggio and Powell 1983 p.147)

Institutional theory is highly relevant to my work as it offers a perspective on the processes that exist at the inter-organisational level. Note that here I use the terms ‘inter-organisational’ and ‘institutional’ interchangeable. Later, in the method chapter, I will distinguish these terms. As the Merton history shows I reflected on how these mimetic and coercive processes worked in favour of the spreading of the Merton Rule across the institution of local government. In setting the context of local government in the last chapter I noted how organisations are connected to local issues giving rise to a distinctive federalist feel that can stimulate an entrepreneurial spirit. ‘Mimetic’ forces in this context will be dampened. ‘Competitive’ forces are different to those seen in the market driven private sector. So institutional theory is supporting two important points in this thesis: the first is that that the field of possibility for organisations and sets of organisations can be very curtailed. Taken together with the theory on organisational routines it would seem that organisational and individual social processes can interlock

quite quickly to limit further explorations of how things might be done differently. If possibility is diminished, then so too is exploration and vice-versa. ‘Lock-in’ could be described as the inevitable result of this vicious cycle. Secondly, as an institutional field, it would seem that the distinctive nature of the local government makes it less subject to homogeneity than other organisational fields that are more directly market driven. This supports what this research has observed: the conditions in this field have led to breakthrough projects occurring.

Returning to the unfolding literature review, what I was finding quite early on from these various literatures on change was substantial evidence for the view that ‘change is difficult’. This would later be greatly boosted by the sociotechnical theory I covered. But already I was starting to build the following argument.

Insights: Business as usual is the norm.

Forces within and across organisations do exist to perpetuate practices of ‘how things are done’. Though the lack of organisational and societal change toward decarbonisation might be frustrating it should be viewed more realistically as the norm rather than as the anomaly. So projects and organisations that that have successfully managed to reduce carbon are anomalous and worthy of study.

Confusions

As much as I found insight in this part of the literature survey I also felt critical of it for a number of reasons. Where theories were being offered as analytical aids to thinking about or describing organisational life, I found them helpful. Institutional theory is one such example I have cited above. What I found less helpful - and this occurred in several places in the organisationally centred literature - was when the theories then moved from being descriptive to prescriptive. This shift would occur when helpful descriptions of relevant aspects of organisational life might be further and further broken down and defined and with this continued application of the logical lens would come a more deterministic message. This message implied, it seemed to me, that if these factors were addressed then ‘change might be achieved’ or ‘inertia might be overcome’ or ‘better decisions might be made’. To give an illustration: in one paper ‘organisational inertia’ was proposed as resulting from the dual effect of an organisation being rigid in its

organisational processes (‘routine rigidity’) and rigid in its investment patterns (‘resource rigidity’) (Gilbert 2005). This seemed a helpful way of looking at inertia. However in the paper these rigidities were then further characterised in relation to each other and mechanisms to overcome these rigidities were discussed as though, if they were, inertia itself might be overcome

And at the level of the individual - in organisationally-situated decision theory- I also found this tendency toward recursive definition going beyond a point that was helpful. So for example one conceptualisation of decision-making emphasises how the diagnosis of an issue is crucial to the final decision relating to it (Mintzberg 1976). And prospect theory goes on to propose that individuals often classify issues according to risks but they do not properly accord those risks with an appropriate probability. Hence decision-making can seem irrational and inconsistent (Kahneman and Tversky 1979). So far, so good. Here a helpful and accessible picture of some organisational decision-making is being painted. However later literature then builds on for this with more abstraction that seems to break the link with any real experience of making decisions. One paper for example proposes a further nine determinants of how individuals classify issues (Sitkin and Pablo 1992). This just did not seem realistic or even helpful to the way I made decisions and I will return to this point in the middle section of this chapter.

This continuous naming and definition of ‘factors’ and ‘dimensions’ seems to be a trend throughout the organisational literature and I resisted it as being overly mechanistic. Whilst it felt helpful to put a name on different dimensions of change, these definitions sometimes carried an assumption, sometimes implicit, that by addressing one dimension ‘in real life’ change might somehow be controlled. This just didn’t make human sense to me. I started to term this a logical view of change: one that was helpful but ultimately unsatisfactory in that it assumed change to be quite defined, tangible and controllable.

Insights from confusion

The logical conceptualisation of change sees it as a defined and controllable process. It can be executed as a series of logical steps. It does not pay particular attention to the start or end point of the change. Change in these terms is an end in itself.

I see now that my irritable reactions to this literature were helping to reveal where I actually stood: I was uncovering my ontological position on change where I understand ontology to mean the assumptions that underlie my reality. The next section narrates an early exploration of this ontology of 'change' and introduces one overarching theory of organisational change that felt more compatible with my disparate reactions.

Exploring the meaning of 'change'

With my reactions to 'change' I had bumped up against a fault line within the academy that had been identified by Weick and Quinn. They proposed that change theory builds on one of two opposing conceptualisations of change and this had been a source of "*ongoing tension and energy in recent change research*" (Weick and Quinn 1999). Many theories of change, said Weick and Quinn, can be traced back to Lewin's description of change as an episode that occurs when a normally stable system is perturbed (Lewin 1951). The change episode is conceptualised as a disruptive sequence of 'unfreeze-change-refreeze' that can be quite radical. On the other hand, another set of organisational change theories suggest the opposing view that change is not a discrete or controllable episode but is a process that is ongoing at all times. Within this view '*change never starts because it never stops'* (Weick and Quinn 1999 p.381). Weick and Quinn sometimes referred to this second view as Confucian to indicate its ongoing, cyclical nature. They contrast it with the Newtonian cause-effect view of episodic change.

I explored this fault line of organisational change for some time in the first year of my studies. I found myself quite actively involved in the debate, taking sides, catching myself being seduced by some theories and incredulous of others. By noticing my reactions I could further tease out my views on change and, to add spice to the pot, my

responses did not land neatly along the faultline defined by Weick and Quinn.

Whereas I was drawn by the project aspirations, and perhaps by my own desperate hopes, to the idea of rapid, episodic transformation, I could not accept the Lewinian notion of change that suggested an organisation as a machine that can be taken down, reprogrammed and set running again. I agreed with those who pointed out that there is a fallacy in the belief that change can be programmed to happen in this way (Beer, Eisenstat et al. 1990). I was uncomfortable too with the characterisation of radical change that it was just one 'prime mover' or change agent who could see it through (Weick and Quinn 1999 p.373).

On the other hand I was drawn, pragmatically and by my postfeminist roots to the counter definition of change as an ongoing and continuous process evolved through collaborative relational ties, through conversation and through networks (Fonseca 2002; Shaw 2002). This was however a more incremental view of change; emotionally I wondered how incrementalism alone might bring about the kind of change needed for a shift on the scale of that required by rapid decarbonisation.

One theory of change, classed as "episodic" but incorporating a more Confucian ongoing view of change was punctuated equilibrium. Originating in the field of evolutionary biology, Gould and Eldredge had suggested that new species emerge from a rapid transformative episode of 'speciation' that punctuates a backdrop of more gradual evolution (Gould and Eldredge 1977). Connie Gersick had taken the theory into the social domain and had looked at how this same model of change was echoed in a diverse set of theories across the literature. Her examples – and these were drawn from literatures that ranged from adult development, to teams, to organisations and on the field of scientific knowledge – all suggested change occurring as a pattern of stable, continuous evolution interspersed with revolutionary episodes of sudden transformation. Gersick posed and explored 'deep structure' as the stable guiding patterns that knit a system together:

> Deep structure is a network of fundamental, interdependent "choices", of the basic configuration into which a system's units are organized and the activities that maintain both this configuration and the system's resource

> exchange with the environment. Deep structure in human systems is largely implicit
>
> (Gersick 1991 p.15)

This was a very scientific definition but within that language lay a suggestion that could not be more relevant to the 'big issue' humanity faces: Gersick's theory suggests that when a system is pushed significantly out of tune with its environment, a revolutionary episode of transformation can occur. Such episodes are radical, and, in their breaking down of the deep structure can take the form of a collapse. Gersick's survey suggested that episodes of collapse can be precipitated by incoming 'prime movers' who are attracted to a system - be it an organisation or a system of thought – when it is in a state of impending crisis. Or, as in the case of teamwork, by the arrival of an unavoidable temporal milestone making previous patterns of performance no longer tenable. Though I found this analysis of the triggers at best incomplete, the theory itself was thus far the most resonant to the research subject and aspiration. It linked to notions of 'tipping point' change that are very popular in discussions of social change: where a social epidemic can cause a system to rapidly transform (Gladwell 2000). And it chimed with complexity ideas that I had explored during my MSc (Gearty 2006) and in the early days of my PhD. In complexity theory a system transformation arises not necessarily from radical action but from a cumulative tampering with its deeper structures. I felt emotionally drawn to the idea that chipping away might bring on the seismic shift society needed to address climate change. A repeated theme in my work has been the search for meaningful individual action in the face of 'the big issue'. Tampering that contributed to a big shift sounded appealing. In Chapter 14, I'll talk more about this tampering as a process of faithful rather than controlled action. For now, suffice it to say, Gersick with her bringing together of system transformation with humble human action had practical resonance for me and it oriented me out of the intellectual cul-de-sac into which Weick and Quinn had led me.

Overall my study of organisational change theory taught me as much about myself as it did about change. With its tendency to classify and define, it had provoked me. It was a lens that offered helpful explanations as to why organisations might not change but I found these explanations partial and, in their lack of context, somewhat abstract. The external political, technological and economic factors that would surely interact with any

organisational change program were often not discussed. And change itself was often discussed as an end in itself stripped bare of intention and not considered in relation to its shadow – the question of what to keep. Finally much of the theory was riddled with the idea of change as something that can be shaped and mastered. This was seductive but ultimately a view I could not accept. I was much more drawn to the evolutionary notion that we are swimming along in change not distanced from it: in a world that has a material reality. We live with technology; there are melting icecaps; realities such as these need to be included in any discussion of change. It is this involved, evolutionary yet purposeful, constructed yet material view of change that underpins the discussion in this thesis. I call it a 'visionary' view of change and I came away from this literature looking for theories that would support it.

Insights: A visionary view of change

Change has a quality of 'just happening'. It is not wholly controllable but it is purposeful. It needs to be considered in relation to human systems but also the material and the natural world. Change on its own is a meaningless term – it needs to be associated with a vision of where it is going and also in relation to what is remaining the same.

The Middle – Practice and Choice

This section zooms right into the experience of the human decision-maker that underlies any social theory. As a section it builds a bridge between the two main sections of this chapter by honing in on the piece of territory in the middle of my theory sketch. This is a territory that links to practice and experience and it is one I explored not only theoretically but also quite personally. In this section I will look more closely at individual processes of decision-making and explain why it was important to do this.

> The possibility of human choice, albeit constrained underlies all [discussions of climate change],
>
> (Rayner and Malone 1998 p.xiv)

In their excellent discussion of climate change from a social sciences point of view, Rayner and Malone suggest that in responding to climate change humans can chose to do nothing, act to mitigate it, or anticipate and adapt to it. This is a macro-level view of the choice facing humanity. What does this mean in practice? The above quote and many discussions of climate change are somehow distant from the micro experience of individual choice in the here and now. Sustainability policy in the UK also reflects this distance. It polarises into two main areas of policy: one oriented at technological innovation, the other on changing human behaviour (Steward 2008). In both cases human choice is still distantly inferred through users and consumers. It is expressed in how people use technology or how they consume the energy and services of the market. This section is built on the premise that to support the research that I have been doing a micro view of choice and decision-making is necessary. In this section I zoom into this micro view, I explain why it is of relevance to the research and what it has meant to me in practice.

The left hand side of my theory sketch refers to theories of change at an organisational and system's level. In this territory the individual is presented as an idealised component of a collective. Where individual decision-making is discussed it is following an organisationally-referenced logic and it is often, though not always, presumed to be a rational process. Classical economic theory has likewise been built on an idealised view

of human behaviour. It assumes humans to be entirely rational. When faced with a decision, an individual is presumed to find the available relevant information, process it rationally and act accordingly. The question for me has been what are the implications of these idealisations? After all, theories, depending on what it is they wish to explore, be it an organisation, a society or a political system, need to make simplifications. But on the other hand, I feel that theory if it fails to account in any real way for the phenomenon of human behaviour runs a risk of building an edifice on shaky foundations. At a minimum such a theory runs a risk of becoming hermetically sealed into itself and difficult to translate into practice, an observation that, for an action researcher, has to be taken seriously.

And it is not only action researchers who have taken this disconnect with human behaviour seriously. Scholars from across economic, political and other social science disciplines have long suggested that the rational actor view limits the applicability of any theory that is built on it. This is a big statement, one that would warrant a chapter of its own, so I cannot fully set it out but can at least illustrate it. In 1956, the influential social scientist Herbert Simon argued that rational models of decision-making were a helpful but insufficient underpinning to much of economic and management theory. Adding a psychological perspective he coined the term ‘bounded rationality’ to imply that decision-makers were subject to the limits of their cognitive processes as well as the circumstances of their environment (Simon 1956; Gigerenzer and Selten 2002). So in reality they simply may not have time or the mental capacity to process all the information at hand. Or indeed their environment may be such that they cannot or will not seek that information out. Simon’s approach is quite formalistic – it still presumes a degree of rationality is at work with human choice – but his argument is that this rationality will never be optimum. It feels faintly ridiculous to be dwelling on this careful argument when a quick check-in to my personal experience of making decisions as a mish-mash of logic and intuition would at a stroke refute the rational actor view of decisions. Perhaps it was a similar common sense that drove complexity theorist Dave Snowden to write in frustration that there is a ‘general error in idealistic approaches’ (Snowden 2006) to decision theory that renders many theories built on this error pretty meaningless. Humans are ‘pattern-based intelligences’ he argues who

> evolved for a complex world in which prediction is dangerous, and hedging against uncertainty a sensible strategy…… We need to build our own patterns, in order to act

ibid. p.87

The alternative to an idealised approach is a naturalistic approach that works back from how human behaviour is and then proposes why it might be that way. Research psychologist Gary Klein pioneered naturalistic decision-making in just this way (Klein 1998). Having set out to explore how firemen made decisions under pressure, he was at first surprised to find that when he interviewed them on their return from the field, firemen couldn't remember making any decisions at all. From here Klein embarked on the study of understanding why the choices humans made in natural settings differed considerably from lab experiments. Through interviewing experts who make decisions under pressure he found that the choices in such settings were not made using deductive logic as much of cognitive psychology would suggest – so they were not rational - but they were made nonetheless effectively and drew instead on what Klein came to call 'sources of power'. These sources of power that typify naturalistic decision-making reside between human experience and the imagination. They are built on two pillars of human thought processes: pattern matching and mental simulation. Through pattern matching one's awareness of a situation can be heightened. Then it is by simulating, one after the other, a series of possible scenarios representing choices that the expert decides. It was in this way that Klein's firemen made their choices under pressure. They do not deliberate on and weigh up different options simultaneously.

The above discussion is relevant in several ways to the research. First it casts a question mark over the scope of theories that build on abstracted models of human action. This question mark lays the foundation for a recurring argument in this thesis that says: at certain points in dealing with practice and theory, a move to a narrative approach is necessary in order to rehumanise action in a way that is practical and accessible. This argument will be fully presented much later in Chapter 13. However I am drawing attention to it here because it also supports the choice of narrative approaches that will be described in the next chapter on method. If human choice relies on pattern and imagination rather than rationality then narrative has an important place in creating images and patterns that might link to choices.

Second the ideas of 'bounded rationality' or 'naturalistic decision-making' are necessary to have floating around if only to explain that when the obvious choice appears not to be made there is some reason for it. Throughout the learning histories there are examples of where an obvious choice to reduce carbon emissions is just not made. In the Southampton learning history, one company who stood to save money and emissions by connecting to the cost-saving district energy scheme did not do so because they had procurement policies for wall-mounted radiators. Such a decision, or in this case a non-decision, is well explained by Klein's model. Decision-makers in this case were clearly unable to move away from an internal mental image of 'how heating is done'. When an image of a district energy scheme with its big pipes and missing radiators and boilers was presented, it may well have been an image that simply didn't match.

Finally this section is very relevant to the practice of my research and its quality. Later I will write that quality in my research relied on my being watchful of the choices I was making. Having read Klein I started to explore just what the micro-processes of my choice making actually were. By the end of my first year of study I had developed a practice of taking a daily walk in the woods near me. I often saw these walks as an opportunity to let thoughts tumble through unchecked but at the same time observed. Sometimes I would then write about these thoughts trying to catch a sense of this jumble and one day, not long after I had read Klein's book, I wrote this:

March 27th, 2007

Reflections & Choices on a woodland walk

After a morning spent, not unpleasantly, but worthily slogging through to the end of the Nottingham case I strike up into the woods. Spring has sprung at last and perhaps reflecting this my head seems to be teeming with growth and new thoughts. Soon I'm lost in a stream of consciousness that goes something like this…..

I start thinking about where I ended up this morning with the Nottingham Declaration being not unlike a learning history itself. I don't know whether to be excited by this or take it as a sign that I am now completely lost in reflexivity. Next I hear myself mentally rehearsing explaining to Peter tomorrow that my learning history work needs to be maybe more multileveled than I originally described – that it's increasingly evident that I need to engage the different levels of the system – not only the apparent innovators. For example it'd

be most interesting to run the case of Merton by people perhaps in my local council – Bristol or Bath - and see what they make of it. I relax when I think like this because it de-pressurises getting these dratted learning history documents right – and indeed getting them done at all. One year in and I've only done two of them. They take a lot of effort.

I think about the learning history workshop and again I find I'm mentally simulating – well not so much simulating as imagining. In addition to the more conventional plans, I imagine working with a storyteller and deliberately creating a mythical story related to say Merton or Nottingham. And then I imagine a Merlin character coming on and telling the story in a short interlude in between conference sessions. Hmmmm. I like it – but it scares me.

In the woods now and the path has levelled out. I notice how teeming with ideas I am and I ruefully reflect on how last Sunday I could barely string a sentence together. What is it with this energy? It comes and goes. I find myself thinking again about these polarities. Between energy and no energy, doubt and conviction. It's like I'm always on a high wire between one place and the next I think – even this life and the end of it. Well I've somehow got to learn to dance on that wire I think – and then I'm back to thinking about risk and fear and wondering is these are going to hold me back?

As I head toward home I wonder what I'll do now. I start to think of this as a micro-choice – wondering if the way I decide this is indicative of other more important research choices I make. Since my MPhil transfer I've been thinking a lot about being more conscious of the choices and decisions I am making so perhaps even this micro-decision of what to do now says something about those processes.

I've got the energy to write in my blog. I could nail the ending to the Nottingham case. I could write in my journal. I could go to bed and listen to the Archers. It doesn't really matter what I do. I think of all the 'decisions' I've made with the research and how many have held (like keeping a blog, a journal) and how many have not (like tracking choices weekly, or reviewing my working title monthly).

Sitting outside now with the warm sun on my cheek I think about theory. I must work up that theory map and work out how to be more discriminating. Discriminating the literature and what it may mean for my research seems quite an interesting thing to do and classification mechanisms start dancing across my mind. I know - I'll go in quickly and write those down. And I quickly finish eating my sandwich and go back inside before I forget to do just that….

And I sit down and write this……(**End of diary piece)**

Reflecting on the writing of this piece at the time I was amused by how apparently

random my final choice of writing the piece seemed. I had meant to write about theory but the intention evaporated by the time I reached my computer. Reflecting on it now whilst I write this chapter I note that my choices weren't completely random either. The reflective process was rich and was tossing around ideas that eventually did lead to significant action. Later I did work with the local council at Bath. And at the workshop we did include a mythic element though it was not Merlin. The themes and ideas mentioned in the journal piece recurred and deepened throughout the research process though each time they recurred it was as though for the first time. Choices and decisions seemed to result then from ideas that were tossed, turned and thrashed about over time. These ideas were simulated over and again - the actual point of decision-making was not always overt.

This piece really gives a fair sense of what my thought processes were. It represents the experiential dimension to Klein's ideas that helped me gain a greater awareness of my decision-making processes.

Revisiting it again now, with the thesis in draft, I recognise this piece illustrates a difficulty I have been trying to address in the presentation with my storied fragments. It highlights that any account of decisions I claim to have made here must be both true and untrue. True in that actions described throughout did result from decisions carefully made; untrue in the suggestion that at particular points decisions transitioned so clearly into being made. Some did, but by no means all.

The next section will range across to sociotechnical theories. These will offer a whole systems view of change that encompasses context and technology. In this territory the individual is not a rational automaton but a social actor involved in shaping and being shaped by the society in which he/she participates. However this actor will need to again become a faceless one who is described at a distance. This section has set out to illuminate in theory, and a little in practice, what these faceless actors might be like.

The Right Side

Arriving in sociotechnical theory

Whilst I was reading the various organisational literatures, a chance recommendation brought me right across my theory diagram to the field of innovation and sociotechnical theory. The emphasis, tone and purpose of this literature stood in contrast to the other literature I was reading. My brow immediately unfurrowed.

The very first paper I read used sociotechnical theory to consider reasons why two carbon-reducing technologies – gas heat pumps and biogas production from manure – had not been successfully introduced in the Netherlands (Raven and Verbong 2004). In this paper technology was proposed as being embedded in complex human processes that shaped its success or not as the case might be. The breakthrough of low carbon technologies was suggested as a process outside any one actor's control and yet one from which lessons could be learnt. I had parachuted into the territory of sociotechnical theory and I felt as though my feet had landed firmly on the ground! Here the discussion was framed clearly within the context of sustainability; it described change as a complex, uncontrollable process; its view of technology was that it was central, relevant and intertwined with social processes. All this responded well to the struggles with which I had concluded my organisational literature survey.

Parachuting now….

Even now as I write I relive a sense of escape or, put more positively, jubilant homecoming about arriving in this literature. My energy picks up as I write in comparison to the earlier piece on the left hand side of the diagram. I wonder will the reader have felt a deadness in it? I pause and ask myself frankly: was that organisational change literature a complete waste of time? But I have to say no. I don't think I would have known my home if I hadn't been somewhere else.

The Raven and Verbong paper I read represented what I now know to be current sociotechnical theory. This set of ideas has emerged over the past decade from a largely Dutch school of thinkers who have successfully brought together ideas from several streams of literature that discuss technology and its relationship to human society. My

literature survey now started to look at those streams. The sketch below gives a rough idea of where they stand in relation to each other.

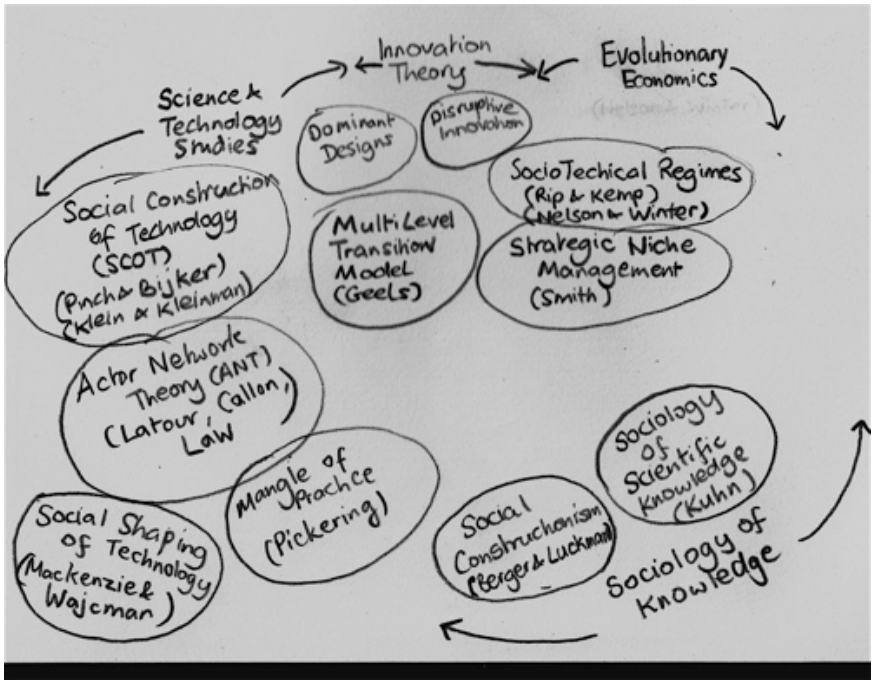

Figure 12: A sketch of some of the sociotechnical theories I covered

This survey centred on the question of how, having accepted technology could not be ignored, might its place in society and its role in processes of change be understood? Technology is a slippery term that is difficult to pin down. To help unpack it I found Rip and Kemp's distinction of four views of technology very helpful (Rip and Kemp 1998):

(1) as a tool or externalised **object**,

(2) as a process of production, (**transformer** view)

(3) as a **symbol** or

(4) as a key aspect of the **sociotechnical** landscape of society

These views are not mutually exclusive – they blur into each other and apply in different situations. The first three views contribute to a static view of technology whereas the fourth is taking a more dynamic view. By static I do not mean unmoving but rather that is in place already and the first three lenses are concerned then with explaining how it came to be so. I will start with the static view of technology before turning to the dynamic view that is more concerned with how technology shifts and changes rather than with

what fixes it in place.

The static view of technology

Technology is often equated with material concrete things, with edges and substance. It is this very hardness that can lure us into Rip and Kemp's first conceptualisation – the object view. The word technology also carries with it a sense of newness and excitement. After a time, a technology that has been accepted ceases to be technology and becomes an artefact. Yesterday's technology is today's stuff (think of roads, lightbulbs, telephones and bicycles). Life without today's stuff is hard to imagine; it takes on an air of inevitability. Yet this inevitability is illusory. The path-dependent view of economic and technological change accepts that *"historical accidents"* cannot be ignored and allows that *"temporally remote events"* have a part to play in the path that leads to today's stuff (David 1985). Take the now famous example of how keys are arranged on a QWERTY keyboard. This sub-optimal arrangement for typing reflects an earlier need to slow typists down so that their mechanical typewriters would not jam. By the time the mechanics had improved, typists were already trained on QWERTY keyboards and it was too late to shift. The example was used by the economist Paul David to illustrate the idea of 'path dependence' that suggests how each fresh decision narrows the field of possibility (David 1985).

But technology is not always an object like a typewriter. It can manifest as a configuration, an interconnection of many different bits of technology together with a set of engineering and user practices like software and applications. This description fits more with the **transformer** view of technology (2 above): a network of parts that transforms inputs to outputs. At its most complex, such interconnected configurations of technology become large technical systems (LTS) (Mayntz and Hughes 1988). Such systems also become today's stuff; often a mysterious functioning black-box (Rosenberg 1982). In this case black-boxing is an uneasy necessity. The understanding is distributed across so many agencies that no-one has a complete picture of how the inputs are transformed to outputs. Large technical systems

> …evolve behind the backs of the system builders, as it were
>
> Joerges quoted in (Rip and Kemp 1998 p.333)

This black-boxing of technology, like the object view is a dangerous shorthand falsely implying that the technology we have is inevitable. This is technological determinism – a view that is insidious because it abdicates a responsibility to reflect on how today's processes are leading to the stuff of tomorrow.

From Science and Technology Studies (STS) come two important sets of ideas that reject technological determinism. The first of these, the Social Construction of Technology (SCOT) framework, puts forward the view that technological development is a highly contingent process. A technological artefact is not inevitable and fixed but represents instead the culmination of ad-hoc processes of negotiations on meaning between groupings with different understandings of what that technology might represent. In a seminal paper, authors Pinch and Bijker first offered a framework for understanding this process (Pinch and Bijker 1984). To illustrate their ideas they described how today's taken-for-granted bicycle was but one artefact from a sea of many possibilities (penny farthings, tricycles, safety low wheelers). Though the penny farthing had at first been much preferred for its speed, the safety low-wheeler ultimately was chosen as a result of the interactions of various **social groupings** (lady cyclists, men of means and nerve…) who were around at that time. These different groupings exhibited **interpretive flexibility** over the purpose of the artefact (transport, sport…) and the problems that need solving (comfort, safety, ..). The variation of the design led eventually, through social processes of **closure** to a point at which the safety bicycle was selected from the variety of different options (Pinch and Bijker 1984). In this way the safety bicycle of that time started to become embedded symbolically as the bike we know today. Closure processes can be explicit or implicit, ad-hoc or time-bound. There is no *best* design in this framework. Echoing the earlier ideas about path-dependence, the key message of SCOT is that

> whatever the design that finally results from the process, it could've been different
>
> (Klein and Kleinman 2002 p.29)

Early conceptualisations of SCOT were criticised for failing to place its individuals and social groupings into a social and political context in which structural influences might be

properly reflected. A technological artefact will represent social contexts and power asymmetries of the past that go beyond the original groups involved in its creation (Klein and Kleinman 2002). For example the low-hanging overpasses that we see on Long Island today symbolise past social exclusion. The designer wished to exclude busses - the primary mode of transport for poor people and blacks – from reaching Jones' beach (Winner 1993). Yet when someone looks at these overpasses now it will most likely be in relation to the cultural norms of the present.

So the SCOT framework makes the powerful suggestion that technology is not only symbolic, but it is multiply symbolic over time. Even past the point of 'closure' the meaning of technology will continue to shift in accordance with the times. SCOT looks inside the black box of technology and finds there a reflection of human society. Using SCOT to discuss the modern-day freezer, Shove and Southerton note that it is the symbolic adaptability of this device that has led to its success. A freezer supports many different conflicting modern lifestyles: a financially constrained life (bulk-buying) a time-constrained life (convenience foods) and even an ideologically-led life where organic or locally sourced food can be bought in bulk and frozen (Shove and Southerton 2000). Such symbolic adaptability has helped it embed quickly as part of the 'stuff' of modern life.

> by opening up the 'white box' of the freezer we have been able to capture aspects of ordinary consumption which would otherwise have slipped the net. In particular, we have been able to follow the transformation of sociotechnical regimes and systems of consumption and practice from the perspective of one ever-changing device.
>
> (Shove and Southerton 2000 p.316)

The quote above evokes Hughes' well-known metaphor of the 'seamless web' to evoke technology's inseparable relationship with society (Hughes 1986). It suggests too that the fixedness of technology comes not from its hard material edges but from the social processes that fix it in place.

A second important framework of ideas from Science & Technology studies, actor network theory (ANT), looks more closely at those relationships within the seamless web of society and technology. Within SCOT the view of these relationships is human-centric. Technology, though indeterminate, is still presented as the result of human activity rather than having itself a role that might shape that activity. Actor network theory suggests instead that sociotechnical systems are constantly being produced and reproduced by networks of elements that can be material, symbolic or human.

Actor network theory is attributed mainly to the work of Callon, Law and Bruno Latour (Law 1986; Callon 1995; Latour 2005). Actor network theory accepts the differences between the human and non-human elements of the seamless web but doesn't privilege one over the other. Instead it abstracts both onto an equal level where the interactions between them can be considered on the same footing. At the core of this theory is a poststructuralist view that society is, in a sense, an effect generated by patterned, heterogeneous networks of what are sometimes called 'actants' (Law 1992). An actant is a broadening of the notion of 'actor' to include non-humans: machines, materials, ideas, animals or any collection of these. Relationships between actants can be material (e.g. a wire) or semiotic (e.g. symbolic - the idea that freezers provide bulk buying service) or, simultaneously, both. The elements in an actor network are in dynamic tension with each other and when elements change the whole network can change or be reconstituted.

A theory that has the material world interacting with the human world in this way has not surprisingly led to some moral debate and resistance as the sociologist and historian of science Andrew Pickering describes (Pickering 1995). He has redressed some of this controversy by arguing that human agency *is* different from material agency and human intentionality is something that has no analog in the material world. In attempting to capture the semi-symmetrical relationship between human and material agency he describes how they are '*constitutively intertwined'.* Using the metaphor of '*a mangle of practice*' he describes how, in practice, agency moves back and forth between human and machine. (Pickering 1995). Whilst humans have agency though, he argues, technology has affordance. The web then is not woven in all the same silk.
Both the Social Construction of Technology (SCOT) and Actor Network Theory (ANT) give a subtle insight into the mutual shaping relationship between the social and the

technical. This section has highlighted how today's technologies - be they artefacts or complex systems - carry within them stratified layerings of human process across time. The implications for this research are significant. SCOT illuminates some of the learning histories where projects such as Kirklees, Barnsley and Southampton might well be framed as examples of how the meaning of what it is to heat a home is being negotiated. And all projects featured in the learning history could well be described as action networks of technology, symbols and people that interact in complex ways over time. The debunking of technological determinism present in both SCOT and ANT implies a responsibility to look closely at how human action and technology are interacting in the present day to produce a sociotechnical future that is anything but determined. Part of the challenge in this research has been to keep a nuanced view of technology on the table so that the social processes under study can be explored in the context of their mutually influencing relationship with technology. This is a recurrent theme in the thesis, one that is discussed in the practical accounts of the workshop (Chapter 5) and the small group work with B&NES (Chapter 12).

The SCOT framework has been critiqued for not going far enough in explaining the processes that lead to the embedding of a technology (Winner 1993). It explains well how an artefact has come into being, but tends after that to revert to a more static *'object'* technology viewpoint. This is not surprising. Though it draws on evolutionary theory, the roots of SCOT lie in the more static traditions of the study of knowledge such as Berger and Luckman's theory of social constructionism (Berger and Luckmann 1967). On the other hand ANT starts to really get inside the seamless web and by considering what action and agency might look like in there it is exploring dynamic effects at the micro-level. However it often lacks a macro view of the broader societal and social structures and how these are interacting over time with agents in the network. The foundations of ANT lie within empirical science and the title of Latour's 1980s book "Science in Action" that first outlined ANT conveys this emphasis (Latour and Biezunski 1987). Perhaps this empirical bias explains why, unlike SCOT, I never did get into a full depth with ANT. Though its ideas were influential I never found myself drawing on them directly whilst writing the learning histories.

In the next section I will look at some of the literature relating to the dynamics of sociotechnical change at a macro level. The roots of these theories lie more in

evolutionary economics a field that underpins innovation studies and sociotechnical theory. From this reading have come some key ideas on which I built the strategy for my research ("The era of ferment"). From it has also come a 'good enough' theory of change to describe and underpin the research (diffusion theory). And finally it has led to the Dutch school of sociotechnical theory. These influential and very current set of ideas have guided and been developed in this research.

The dynamic view of technology

If the static view helps to understand technology in terms of what it has become, then the dynamic view is more concerned with technology in terms of how it is continually becoming. The former settles around objects, the latter around processes. The field of evolutionary economics is the school of thought that underpins this dynamic view of sociotechnical change.

Drawing inspiration from Darwin, evolutionary economics sees industrial society as developing in terms of constant processes of variation, selection and adoption among firms, technologies and industries. Its origins go back to the well-known economist Schumpeter who rejected static economic models proposing instead that economic progress relies on a continuous process of technological development that unfolds along trajectories and results in competition between new firms and technologies (Schumpeter and Opie 1934). Through processes of 'creative destruction' the weaker firms are weeded out in ways akin to weaker species failing to survive in nature (Scherer and Schumpeter 1984). Also influential in this field are Nelson and Winter who looked closely at the processes of variation and selection (Nelson and Winter 1982). They were the first to propose the importance of cognitive and organisational routines in guiding the trajectory of technological development suggesting that the variation space was limited. They coined the term "*Technological Regime*" to refer to "*a frontier of achievable capabilities*", defined within certain constraints that lead to "*a broadly defined way of doing things*" (p258). With these ideas, progress is not linearly forward going. It is cyclical with periods of stability and periods of chaotic change and destruction.

And echoing the discussion in the middle section on 'bounded rationality', evolutionary

economists also started out with a flat rejection of the rational actor suggesting too that at an organisational level, it is again routines rather than rationality that guide decision-making. The following quote from Nelson illustrates this:

> organisational decision processes often display features that seem to defy basic principles of rationality and sometimes border on the bizarre.

(Nelson and Winter 2002 p.29).

These underpinning assumptions of evolutionary economics: first, that change is an unfolding, uncontrollable process of variation and selection; second, that the notion of progress is questionable; and third that human agents and organisations are not rational were at one with the assumptions my reflective literature survey was surfacing. It is not surprising therefore that it was from these sets of ideas that I took some of the key ideas for the research. The first of these, the era of ferment, came from innovation theory.

Innovation studies: The 'era of ferment'

Innovation theory builds on evolutionary economics with a particular focus on new technology. Its language is militaristic and competitive and oriented particularly around selection: dominant designs are selected and these are ultimately toppled by discontinuities and breakthrough technologies (Utterback and Abernathy 1975). This theory echoes insights from SCOT in its suggestion that the 'dominant design' is not necessarily the best design but rather one that is the result of complex social, economic and technical interactions (Clark 1985). The dominant design then sets the forward development within the guiding trajectory of Nelson and Winter's technological regime. Again this echoes earlier writing about routines and the sense that business as usual can be very entrenched.

Observing several examples of where new technologies had broken through across entirely different industries (e.g. microcomputer, cement and glass) Anderson and Tushmann looked more closely at the dynamic nature of these breakthroughs – they called them discontinuities – and considered how these related to 'dominant designs' (Anderson and Tushman 1990). In a way they were putting a temporal lens on processes of variation and selection

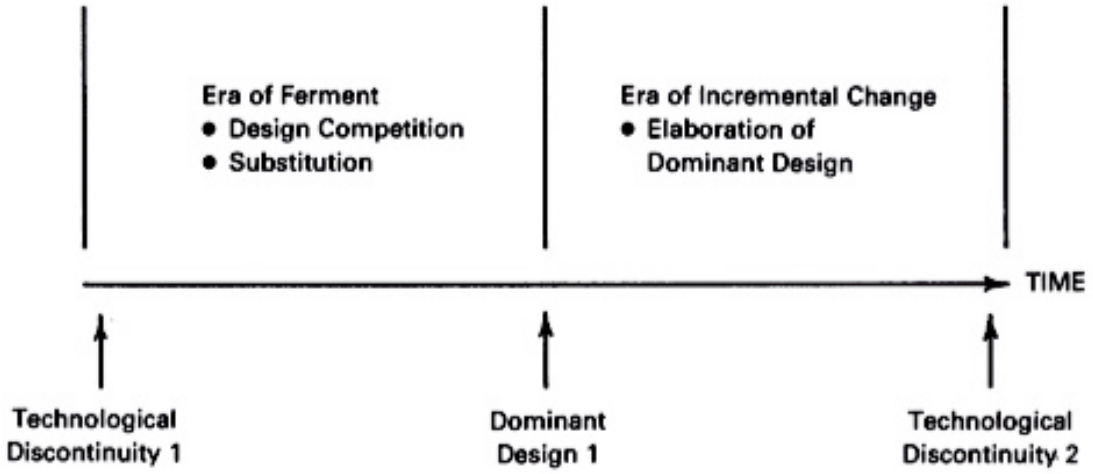

Figure 13: The era of ferment – from (Anderson and Tushman 1990 p.606)

What they proposed was that technological change is indeed an evolutionary process but one with distinct phases that are punctuated by 'discontinuities' and 'dominant designs'. A discontinuity occurs when a new technology emerges that is distinctly different and challenging to the incumbent technology. Influenced by this new breakthrough the field is then thrown into a state of diverse response – what the authors call "the era of ferment". During this era new variations of the design emerge, new solutions are considered and are in competition to each other. Eventually a new industry standard emerges – a dominant design – that is *not* the original discontinuity but has been informed by it. Subsequently a period of incremental improvement is ushered in.

This was a very technology-centred theory, and yet I found it to have a wider resonance with the 'big issue' and the research in general. At the time of reading I'd been in the field gathering potential examples of breakthrough projects. I have written how I kept hearing about the iconic example of Woking Borough Council who, through the use of different low carbon technologies, had slashed their emissions by over 70%. When I went to other sites of innovation in local government they always mentioned Woking. Was Woking then a discontinuity in its way that had ushered local government into "an era of ferment" as to how to respond on the carbon issue?

And even more broadly I wondered if our whole society might be in ferment as the 'discontinuity' of our unsustainable way of life becomes ever clearer. Sometimes things

really seemed to be shifting in response. I heard of communities joining together to install solar panels; wind turbines were starting to appear in local DIY stores; woodchip boilers, geothermal heat exchangers and hydropower renewal schemes were increasingly on the radar. And policies were engaging the system too. Recent changes to the Building Regulations in the UK had caused a noticeable upsurge in the use of efficient condensing boilers (Watson, Sauter et al. 2006). And I heard of previously reluctant financiers were now knocking on local authority's doors asking if they can get involved in their district heat and power schemes. The list went on. New policies, business models, community groupings and low carbon technologies seemed to be sloshing around – or was this just wishful thinking? Other environmental campaigners I met felt that nothing was changing[8]. It was still unusual or 'forward looking' to install heat recovery compressors that would pay for themselves in just two years time and would save substantial amounts of energy and money[9].

Metaphorically at least my sense was that we are a generation, if not in the era of ferment, then poised on the brink of it[10]. And practically it seemed to me that local government was indeed springing pockets of innovation. It helped my thinking to call this 'ferment' and to ask how might we act constructively and learn quickly from each other in such a phase. By the end of my first year I had started to title my research "joined up learning in an era of ferment".

The importance of adoption

The 'era of ferment' is not just about variation. Enduring change only occurs via processes of selection and adoption. The Merton learning history split clearly into two acts. The first act described the processes that led to the breakthrough of this new piece of policy. The second described how that idea then started to be adopted across the institutional field. The acts were bridged by this quote:

---

[8] this based on formal phonecall discussion with Greenpeace policy adviser

[9] this based on informal conversation with steam engineer in local playground who told of oil rigs leaving expensive valves that cost £2K / year to run in standby.

[10] I revisit this the day after the UK government put up £500bn in a desperate move to restart the economy – the sense of the credit crunch as a 'discontinuity' is one I would hold and the sense that as a society we are in ferment seems even stronger now.

> The introduction of novelty has been studied in great detail. However, the adoption of novelty is decisive for society, not its introduction. Adoption is an active process, and has elements of innovation itself. Individual behaviour, organisations, and society have to rearrange themselves to adopt, and adapt to, innovation. In this sense, the introduction of a new technology is an unstructured social experiment
>
> (Rip and Kemp 1998 p.338)

There is a palpable switch in energy of the ideas with the move from selection to adoption. Adoption shifts away from the excitement of novelty to the mundanity of what that novelty implies. There are uninformed and capricious users, untrained field engineers, unsympathetic regulatory structures. The adoption of novelty relies on how well it can embed in a field that is not naturally set up to receive it. A move to consider the adoption of technology is essential if the dynamics of sociotechnical change are to be fully understood. Yet as the Dutch researchers observed above, adoption has not generally been considered to be part of the innovation process.

The above quote helps place this research within the context of adoption. This work is very much exploring that as an active and innovative process. None of the low carbon technologies described in the later learning histories are brand new. The action centres on the deployment of old technologies in a new socio-economic configuration. A wider argument would be that an over-concern with new technology, exciting though it may be, distracts thinking from the context into which it must fit where these include consumptions patterns, user behaviours and deep-seated cultural interpretations of how things are done. The next two sections highlight two theories that relate to adoption and as such underpin the research.

Diffusion theory

The first theory of adoption is a simple and well-known one. Rogers' diffusion theory (Rogers 1962) is an influential sociological theory that describes the mechanisms and patterns observable in how innovations move through society. Starting by studying farming practices in the Midwest of the US Rogers identified different social groupings

that respond to innovations – from early adopters to laggards – and even suggested percentages for their distribution in society. This results in a bell curve pattern – shown in the figure below - that has modelled well the spread of many innovative developments that range from the adoption of products like ketchup, new technologies like Ipods and even ideas like Feminism.

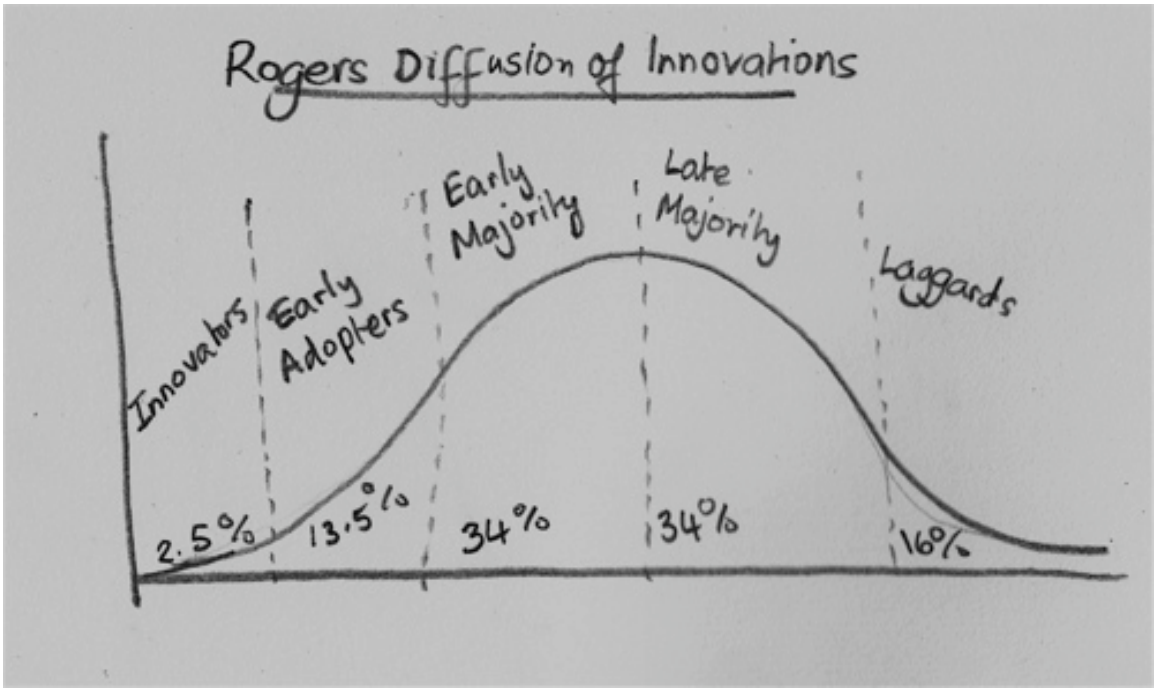

Figure 14 Rogers' diffusion curve

Yet this view is idealised. It sees the innovation as an object that is being cleanly transferred between social groups. It doesn't offer much explanation of failed diffusion or chasms that sometimes appear between constituencies (Moore 1998). Nor does it acknowledge that diffusion of an innovation is a process that itself shapes the technology. From actor network theory, the notion of technology **'**translation' has been offered as an alternative to the idea of technology 'transfer' (McMaster, Vidgen et al. 1997). At each stage of technology diffusion, 'translation' of its meaning and use occurs within heterogeneous networks of actants. Such a view is helpful in explaining the messiness of technology adoption and its location within a complex social structure.

Yet it was the very simplicity of Rogers' diffusion graph that made it a powerful theory to use in the research. I found it a helpful way to explain the research to participants. I

would show it –often people were already familiar with some of the terms - and describe the research as a process of trying to speed up “innovation for carbon reductions” from the innovators in the long tail through to the early majority and on. Where the learning history examples of Merton and Nottingham showed how ideas had spread across local authority organisations I applied the theory to enrich the account.

It also helped me to think about the research strategically. I could classify where on the curve I was engaging and why. For instance the February learning history workshop brought mainly early adopters from across local authority together. My B&NES work on the other hand was located, quite deliberately in an early/late majority constituency. Recognising all the time the limitations of this model I still found it very useful to work with and notice now while writing how, in contrast to my earlier wranglings with organisational change theory, I embraced rather than strained against the abstractions.

Bringing it all together: the Dutch school

The final sociotechnical theory is a dynamic one and brings many disparate streams together. Returning to consider my starting question of theory might connect to ‘the big issue’ of climate change:

What does theory say about organisational change processes and innovation for carbon reduction?

My survey had yielded several useful theories: theories to help explain the research, theories to help build a strategy for the research that would be consistent with my emerging view of change and theories that would be illuminated by the learning histories themselves. Mostly these theories were partial and emphasised particular dimensions more than others: for example the collective over the individual; the micro- over the macro, technological over the sociological; or temporally the period of ferment (variation and adoption) over the period of incrementalism (selection). In looking at the question of whole-system’s change of the scale necessary to address climate change, Frank Geels surveyed a wide range of technological and economic literature and noted:

> Literature provides bits and pieces which can be used for a more integrative perspective

(Geels 2004b p.20)

The integrative perspective to which he is referring is the sociotechnical approach that has been developed by several, mainly Dutch, scholars over the past decade who have been particularly concerned with the transition to environmental sustainability. Their multi-level transition perspective is the result of a detailed working and integration of ideas from across economics, technology and sociology (Kemp and Soete 1992; Kemp 1994; Rip and Kemp 1998; Geels 2002). The suggestion is that it is through the complex interaction of three levels of sociotechnical activity that transition occurs. These three levels are the regime, the niche and the landscape. I will give an overview of the multi-level perspective now, starting with the concept of the regime.

The multi-level transition perspective

Taking Nelson & Winter's idea of a 'technological regime', Rip and Kemp tightened its grip on trajectories of innovation and change by calling it an underlying rule-set. They also widened it to include a sociological context:

> A technological-regime is a grammar or rule-set embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artefacts and persons, ways of defining problems all of them embedded in institutions and infrastructures

(Rip and Kemp 1998 p.340)

This definition was to form the basis for what Geels later would term a sociotechnical regime that he referred to as a:

> semi-coherent set of rules carried by different social groups. By providing orientation and co-ordination to the activities of relevant actor groups [they] account for the stability socio-technical configurations

(Geels 2002 p.1260)

Frank Geels' became particularly well known for his compelling visualisation of the multi-level transition model that is shown overleaf on Figure **15**. His work had started out by analysing historical sociotechnical transitions such as the shift from sail to steam and the shift from horse-drawn carriage to automobile (Geels 2002; Geels 2005). He drew SCOT and Evolutionary Economics together to paint engaging, complex pictures of how these

major shifts in transportation had come about. In keeping with SCOT, he emphasised the interaction of different social groupings at regime level noting that these were broader than the more engineering-centric definitions of Rip & Kemp whose regime actors were still focussed on the production and use of technology. Geels' meso-level sociotechnical regime brought groupings from different dimensions together (e.g. policy, market, science, technological, cultural…) suggesting that these interlock at an institutional or societal level to create a dynamic stability. On the figure below the sociotechnical regime is the pentagon moving through time in the centre. Each point on the pentagon represents one of these overlapping dimensions.

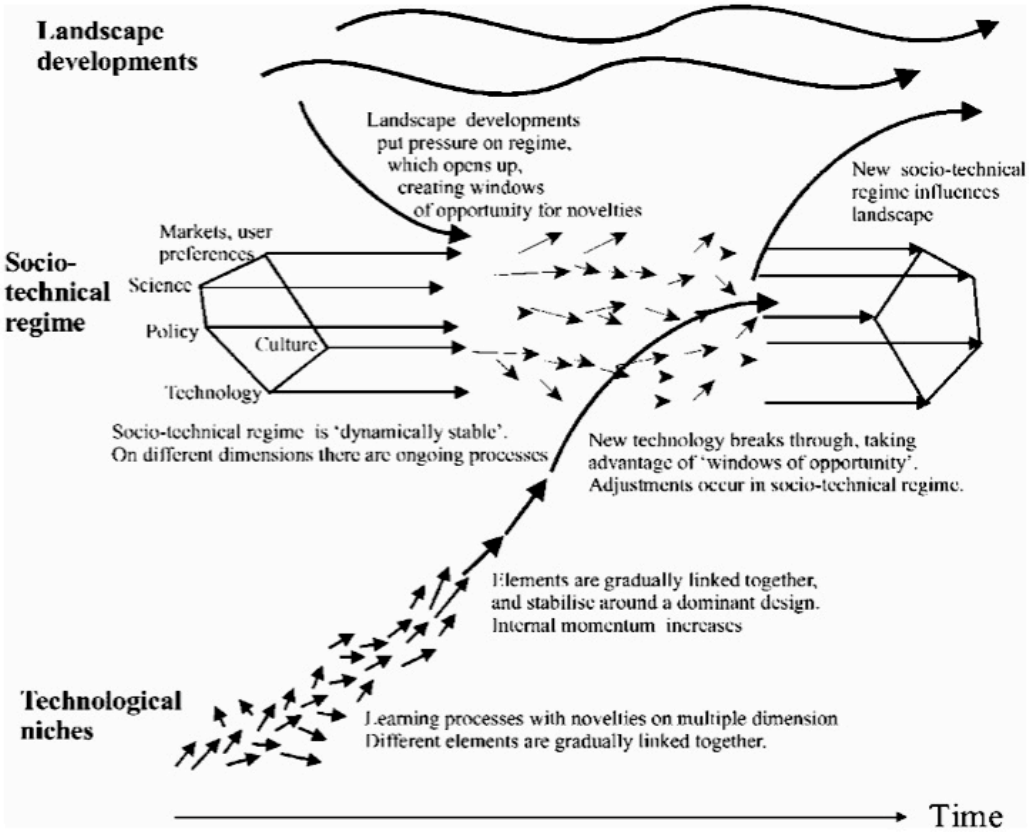

Figure 15 Geels' Multi-level perspective on transitions. Source: (Geels 2005 p.452)

These dynamically stable regimes are then subject to upward pressure from new technological niches. Niches follow ideas from innovation theory. They are the petri-dishes of innovation and as such represent sites of 'ferment' and 'variation' of radical new technologies that then push for 'selection' by the incumbent regime. However the definition of 'niches' has increasingly been broadened in sociotechnical theory to include not only new technologies but also new rules and the necessary re-configurations of the

social groupings (suppliers, producers, users etc.) that these imply. A part of sociotechnical theory, strategic niche management, has particularly looked at how social processes within these niches might be cultivated in a way that supports their breakthrough in the regime (Kemp, Rip et al. 2001; Smith 2004). The titling of the 'niche' as technological is unfortunate as it represents a lapse back into a technologically centric language and is inconsistent with Geels and Schot's more recent sociotechnical definition of what happens in the niche:

> Both niches and regimes have the character of organisational fields (community of interacting groups). For regimes, the communities are large and stable, while for niches they are small and unstable. Both niche and regime communities share certain rules that coordinate action. For regimes these rules are stable and well articulated; for niche innovations, they are unstable and 'in the making'.
>
> (Geels and Schot 2007 p.402)

The multi-level model, as visualised by Geels, sees niches nested within regimes and these in turn are nested within a slower-moving sociotechnical landscape. The landscape might be likened to the macro actor network that fulfils societal needs. It includes material things like road networks and cities, but it also includes cultural, macro-political and economic ideas like growth, oil prices and democracy that have deep-seated symbolic meaning in our society. The landscape has been described by Geels and Schot as:

> the exogenous environment beyond the direct influence of niche and regime actors (macro-economics, deep cultural patterns, macro-political developments). Changes at this level take place slowly (decades)
>
> (Geels and Schot 2007 p.402)

The landscape exerts pressure on the regime over time. Describing dynamics very similar to those described in Gersick's theory of punctuated equilibrium, the Dutch sociotechnical school proposes that a sociotechnical transition occurs when changes in

landscape exert pressure downwards on a sociotechnical regime in tandem with upward pressure from increasingly competitive niche innovations. This instability creates windows of opportunity for niche innovations to start to breakthrough into the regime where realignment of the existing regime is then forced to occur. What is important to recognise is that in this model, all three levels are in a state of flux though the rate of change is different at each level. Niches do not break into static sociotechnical regimes. Rather they are reinforced by an alignment of pressures and timescales in the regime and landscape:

> It is the alignment of developments (successful processes within the niche reinforced by changes at regime level and at the level of the sociotechnical landscape) which determines if a regime shift will occur
>
> Kemp quoted in (Geels 2002 p.1261)

Inquiring into Geels

I found the multi-level perspective in general and Geels' diagram in particular immediately appealing. It offered a theory of transition that linked closely to my work and to the purposes of the project. It managed to answer many concerns I had with other theories too. We started discussing it on the project and colleagues found it similarly engaging. Gradually it became quite a central theory. We started to question it, to apply in our work and to inquire into it. On the project we were questioning the role of theory in general. And I found myself particularly looking at Geels – his name came to represent this theory for me. I started gathering critiques from within the project and outside of it. I noticed quickly just how much influence it had.

It had been the underpinning theory of a UK ESRC program: "The Sustainable Technologies Program (STP)" that was just completing as Lowcarbonworks started. I attended their dissemination seminar in December 2006 and enjoyed the lively discussion about the model – its benefits and its shortcomings. At about the same time I contacted a British academic Adrian Smith from STP who had been looking at how these ideas were or might be applied in practice to policy-making (Smith 2004; Smith and Kern 2007). When we spoke he shared his own questions about these ideas. In 2007, Tim Foxon, also from STP visited Bath and gave a seminar to a large audience to present his perspective on how transition pathways to a low carbon future within a Geels framework

might be created (Foxon, Hammond et al. 2008). This presentation of Geels raised yet more questions and critiques to add to the comments and questions I already had. These are summarised in the table below:

Nr	Critique
1	Doesn't explain everything – for example sudden ideas driven change e.g. liberalisation of markets under Thatcher; French push for Nuclear power
2	There is a connotation that new is 'good' and 'old' is bad
3	It is too uni-directional with the influence moving from niche to landscape. What about forces of influence in the other direction
4	The Niche is overly characterised as technological when it should overtly include the incubation of new social, biological and ecological practices
5	The model itself serves a particular 'regime of thought'. The notion of one dominant regime is itself a way of thinking. What about pluralities?
6	It is too functionalistic – there is a neglect of the micro level of individual agency
7	The nesting of levels makes clarity difficult: a regime shift at one level might be incremental at another
8	It is hard to understand. When we show it to research participants they don't get it – it is quite abstract.
9	Across the model the action takes place at the socially constructed level. It obscures our natural world.

Figure 16 A summary of various critiques and questions stimulated by the Geels model

As the table above shows, the critiques I gathered were varied. Some challenged its scope and explanatory power. For example critiques 1,6,7,8 suggest it doesn't explain certain things well implying that the model might need to be expanded and/or improved upon. Other critiques were more fundamental, see for example critique 5 that questions the use of this kind of meta-theoretical model altogether. I will not reflect in detail here on these critiques but will return to them later. Here they are introduced, much as they were to me, quite early in my thinking. The overall effect of this early inquiry cycle into Geels was to temper my embrace of the theory and make me more ready to recognise its limits. I continued to work with Geels but did so carrying quite a demanding question as to what was the use of it. I continued to think about how it might be developed but also to

notice where it might better be put aside. This then was a question of purpose.
In Chapter 13, with the benefit of the research process, I will revisit Geels. I will reflect then on these critiques and this question of purpose.

One further thread of inquiry resulted from this engagement with these ideas. It related to the final critique listed in the table namely that the model seemed to have no place in it for the natural world. The next section will describe this inquiry and show how it raised an important question for me.

Geels and the natural world

In mid-September 2007 the Lowcarbonworks action researchers met to discuss theory. It was in this meeting that we first discussed how Geels' model seemed to be located exclusively in a socio-economic-technical world. That no direct mention was made of the natural world seemed ironic to us considering that the transition that this model is trying to explain is one to a more sustainable world. The most obvious absence was in the definition of the landscape where societal needs are described as being fulfilled by its material culture with no mention being made of the services supplied to us by our ecosystems.

> the linkages between elements necessary to fulfill societal functions
>
> (Geels 2004a p.900)

Elements in this landscape particularly relate to transport and energy needs and are described as comprising our road systems and energy networks together with the social fabric and deeper cultural patterns that fix such networks in place (Geels 2002). There is no mention of the services of our ecosystem: the natural world is at a step removed.

In a later 2007 paper Geels and Schot start to make reference to this abstraction:

> Philosophers see modern man living in a 'technotope' rather than a 'biotope'
>
> (Geels and Schot 2007 p.403)

But they seem to accept our technotopic landscape as inevitable supporting the view of:

> Rip and Kemp [who] saw sociotechnical landscapes as something we can travel through and metaphorically and as something that we are part of, that sustains us….[] the technical, physical and material backdrop that sustains society
>
> p.403

Though it sustains us it only does so in a sociotechnical way. Again no mention of our habitats, climate systems, the forests, the oceans, and the air we breathe. The natural world is referred to only by analogy. Static elements of this sociotechnical landscape are likened to static elements of the natural world:

> soil conditions, rivers, lakes and mountains in biological evolution
>
> p403

And similarly, when responding to critiques that the sociotechnical landscape is not always as slow moving as originally proposed, Geels and Schot make analogies to the climate. Again in their 2007 paper they start to explore the dynamic effects – sudden war, fluctuating oil prices, the credit crunch, the fall of communism - that have hitherto not been accounted for at the landscape level (Geels and Schot 2007). These sudden occurrences they liken to the weather. They are like

> rainfall patterns, storms and lightning
>
> p.403

Though it is like them it is interesting to note that the weather itself appears to have no actual place in this technotopic landscape.

Eco-blindness and evolution

I remember voicing a chilling question that surfaced for me during that project meeting that was to remain significant for me. My question was: if we were talking about evolutionary change in the context of a constructed socio-economic world – where things like ‘bank account’, ‘career appraisal’ and ‘the economy’ seem realer to us than the earth we stand on – then didn’t that imply that any transition we might hope to evolve would be in relation to these constructs rather than to our natural world? If that was the case the

whole notion of a sociotechnical transition was just another constructed wheeze. Whereas before I held a gentle assumption that evolution was not necessarily always progressive, my thinking now was becoming more depressive. Maybe we humans just don't have it in us to evolve in tune with our natural world – at least at this stage.

"Let me get it right, what if we got it wrong

what if we weakened ourselves getting strong

what if we found in the ground a vial of proof

what if the foundations missed a vital truth"

Lemn Sissay[11], Poet

I called this eco-blindness and took the depressing idea of it away with me. I wrote about it in my blog[12]. I noticed it in myself. One day not long after the meeting I was driving quickly to be on time for a medical appointment in nearby Bristol. On the radio was a conversation about how CO_2 emissions could be greatly reduced if people dropped their motorway speed by a certain amount. I remember listening to this, mentally pausing, but not dropping my speed, feeling uncomfortable and noticing that too. All this was going on as I continued speeding along, eco-blindly to the appointment.

My questioning as to how I might take action when I hold a systemic, evolutionary view of change was tinged now with deeper questions over where the evolutionary process itself was taking us. And with the current financial meltdown and celebrations of Darwin it seems to me these questions are around more than ever as the short verse by Lemn Sissay that I have included above might illustrate. A new perspective on what it is like to be acting within an evolutionary process of change is what the learning histories are essentially exploring. And at the end of the thesis I will return, in quite a personal way, to the question of what meaningful action might look like within that when the outcome cannot be known and progress is not assured.

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[11] Broadcast on 9th Feb, 2009 on Channel 4 as part of the Darwin 200th birthday short films.

[12] http://academicmum.typepad.com/academic_mum/2007/09/ecoblind-stick-.html

Concluding

This chapter has covered a lot of ground. The ideas of ‘change’ and ‘technology’ have been discussed as they appear in the related literature. As they are such broad terms, the survey has itself been broad and has ranged from micro-detail of individual decision-making to macro-level sociotechnical change. Theories and concepts have been explored that formed a basis for the learning history work as well as the overall positioning of my research as an experiment in facilitating ‘change’ at a systems level.

By noting my reactions and following my rejections of aspects of organisational change theory I gradually started to tease out my view of change as ‘visionary’ rather than ‘logical’. By contrast, my enthusiastic embrace of sociotechnical theories helped me further articulate my position on change as being an evolutionary one where actors within that it are non-rational, naturalistic intelligences subject to getting fixed in entrained patterns of thought. The ‘visionary’ view of change links directly to the narrative approach of learning history which, as the next chapter will describe, recounts change as a story of messy human endeavour with highs and lows and unknowable outcomes.

By exploring the literature around ‘technology’ in a social context I noted tendencies, even in this literature, to collapse into a view of technology as a separate and immutable object once it has emerged. This concentration on selection with a particular focus in the innovation literature on ‘newness’ helped me to better identify the territory of this research as relatively fresh. This territory is concentrating on the adoption and reconfiguration of existing technologies rather than on the emergence of new ones. The contention is that there is much innovative work to be done and it is here I am hoping to contribute.

Finally the chapter culminated appropriately with a discussion of Geels’ model of sociotechnical transition that brings many of the disparate streams of theory together. As such it is an important and currently influential model of system’s change and one that is very relevant in this research. A first cycle of inquiry into this theory resulted in a loosening of my embrace of this theory and this lays the ground for a deeper discussion in Chapter 13. Again the discussion of Geels lays the ground open for narrative which

zooms into this abstracted evolutionary theory of transition, puts faces on the actors and describes what change is like for them. This cycle also raised some more deep-seated questions as to how I might live and work meaningfully with the view of change that I have been discussing and these questions will be taken up again at the end of the thesis in Chapter 14. In this way the role of theory and its relationship to the purpose of this research is being explored ever more deeply.

A final reflection

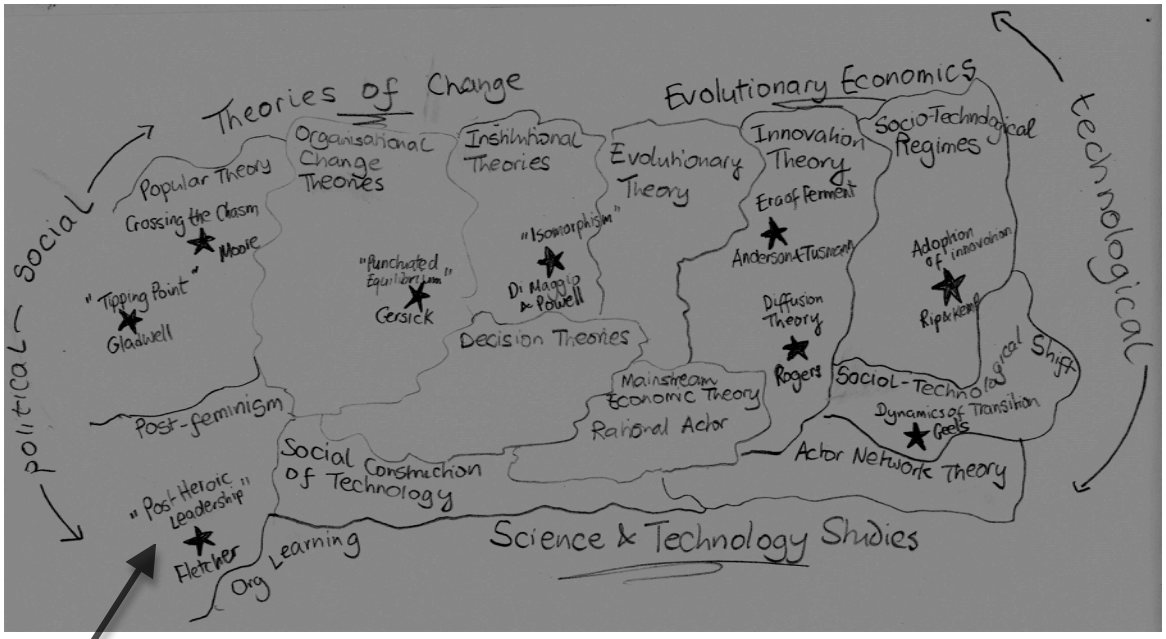

Figure 17: Rough Sketch of Theory points used in Merton

Fletcher's posthero has been 'disappeared' from the narrative

On the disappearing dynamic…..

More deeply I reflect on how masculine a place I have been. Apart from Connie Gersick and Elizabeth Shove, all the writers I have quoted are, I think, men. The sociotechnical world is undoubtedly masculine. It feels quite familiar to me from my engineering days. But my feminist funny bone is tickled – in an unfunny way - at the end of a piece like this. What about Fletcher and her paradox of 'postheroic' leadership? Fletchers postheroic paradox comes from noting first how the new thinking on leadership increasingly reject the notion of a single prime mover (hero) acting on the back of his (yes his for they are masculine) special qualities. This new postheroic leadership is defined instead by networks rather than

individuals and the qualities it calls for increasingly demand relational skill; however, and this is Fletcher's main argument, the gendered nature of the workplace has been overlooked in such writing (Fletcher 2004). Its tendency to re-privatise the feminine will tend to disappear those very skills that are theoretically valued as postheroic. The idea of postheroic leadership as something inherently feminine is something I carried into the work and was with me the whole way through – how come it got bumped out of this chapter? Ironic really considering Fletcher's relational practice is all about the tendency to 'disappear' skills and practices associated with the feminine: team work, empathetic communication, collaborative working and so on (Fletcher 1999). Some of my work has intuitively been oriented at inquiring into who and what postheroism might look like and how might I help it to 're-appear'.

This final reflection refers to what is important but has not been covered in this chapter. It is deliberately presented on the limb of a reflection. It has to do with the tendency to make things disappear and introduces the notion of postheroism which was mentioned in the Merton learning history. These perspectives on what can be 'disappeared' from even the most thorough exploration have become increasingly important both for this thesis and the Lowcarbonworks project as a whole. The reader will find this thread running through the thesis; it will be revisited more fully in Chapter 14.