Smarter cities:

Socio-technical innovation towards sustainable urban transport futures

The case of re-establishing utility cycling as a mainstream mode in London

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DECLARATION

I certify that the work contained in this thesis, or any part of it, has not been accepted in substance for any previous degree awarded to me, and is not concurrently being submitted for any degree other than that of Doctor of Philosophy being studied at the University of Greenwich. I also declare that this work is the result of my own investigations, except where otherwise identified by references and that the contents are not the outcome of any form of research misconduct.

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ABSTRACT

Cities globally face pressing sustainability challenges. This is particularly evident in the urban transport sector, where increasing and increasingly frictionless mobility continues to be promoted as a key driver of local economic growth and development. There is, therefore, increasing pressure to mitigate against arising externalities through technological innovation. Evidence, however, suggests that technologically-induced efficiency gains in the transport sector are likely to be short-lived in the absence of simultaneous changes in mobility cultures and transport practices.

This thesis, therefore, argues that innovation towards more sustainable urban transport futures must take the form of strategic socio-technical innovation to foster transitions from dominant, yet unsustainable, urban transport systems to more sustainable ones. In doing so the thesis contributes to existing literatures on socio-technical innovation and sustainability transitions. Specifically, it articulates a crossover to a second literature, that of cultural political economy, to enable more coherent theorisation and empirical analysis of the role micro-level structure-agency interactions play in mediating socio-technical change or inertia observed at the macro-level.

Empirically, the thesis presents a case study of the ongoing efforts to re-establish utility cycling as a mainstream mode within the road transport system of London, UK. Analysis of the case proceeds in two steps. Findings suggest that, while the transition appears to be progressing well, as indicated by the rise of cycling on mainstream transport policy-making and practice agendas, prospects for a radical transition to more cycling in London are mixed: the mode remains perceived primarily as auxiliary, tasked with remedying the externalities of the motorised regime. The analysis further finds that cycling advocates, from campaigners to transport practitioners, continue to face strategic barriers impeding their efforts to press for more and better provision for cycling, though the thesis also presents compelling evidence of cycling advocates exercising agency to strategically exploit or subvert these barriers.

CONTENTS

INTRODUCTION

Chapter 1   Overview of thesis

Chapter 2   Situating the research

LITERATURE REVIEW

Chapter 3   Sustainability transition studies

FIGURES

All figures by the author unless otherwise stated.

TABLES

All tables by the author unless otherwise stated.

BOXES

All boxes by the author unless otherwise stated.

Box 1   Insights from transport economics, the Jevons Paradox and rebound effects

Box 2   Wicked social problems

Box 3   Basic concepts for understanding transitions as multi-level processes
(Source: Schot et al., 2016)

ABBREVIATIONS

A-S-I	Avoid-Shift-Improve
CIHT	Chartered Institute of Highways and Transport
CILT	Chartered Institute for Logistics and Transport
CPE	Cultural Political Economy
CR	Critical Realism
CSA	Critical semiotic analysis
CWIS	Cycling and Walking Investment Strategy
DETR	Department of Environment, Transport and the Regions (1997-2001)
DfT	Department for Transport (2002-present)
DoT	Department of Transport (1976-1997)
GLA	Greater London Authority (2000-present)
GLC	Greater London Council (1965-1986)
ICT/ICTs	Information and communication technology/ technologies
IEPE	Institutional-evolutionary political economy
IHE	Institute of Highway Engineers
LBL	London Borough of Lambeth
LBS	London Borough of Southwark
LCN	London cycle network
LIP	Local implementation plan
LTP	Local transport plan
MLP	Multi-level perspective
MTS	Mayor's Transport Strategy
NCN	National Cycle Network
NCS	National cycling strategy
PAR/AR	Participatory action research/ action research
RAC	Royal Automobile Club
RBG	Royal Borough of Greenwich
SNM/SPNM	Strategic (policy) niche management
SRA	Strategic-relational approach
SRN	Strategic Road Network
TDM	Transition management
TfL	Transport for London
TIS	Technological innovation systems
TLRN	Transport for London Road Network
TM	Transition management
WebTAG	Web-based Transport Analysis Guidance

PUBLICATIONS

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INTRODUCTION

1. OVERVIEW OF THESIS

1.1.   Smarter innovation for more sustainable urban transport futures

Sustainability research is facing a new frontier with the arrival of the "urban age", a term coined in recognition of recent statistical trends, which locate more than 50 per cent of the world's population as living in cities (World Bank, 2016). This urbanisation trend is significant from a sustainability perspective as it is made possible by, as well as amplifying, the increasing concentration of human productive and consumptive activity in cities. Adapting to accommodate these growing populations while mitigating and building resilience to the environmental degradation, resource scarcity and social pressures accompanying these trends is a complex challenge facing cities worldwide. The scope of this challenge varies in line with cities' geographic location, their existing environmental footprint and adaptive capacity, as partially contingent on their institutional as well as infrastructural histories.

Academic research on *systems innovation* echoes these concerns and has long emphasised the 'stickiness' of mature socio-technical systems as not only materially, but also socially and culturally conditioned. Connectedly, this literature highlights the need for parallel, long-term social and technological, cultural and material change to innovate unsustainable, yet mature and stable socio-technical systems, such as may be encountered in the transport sector. Scholars have termed these profound innovation processes *transitions* and more recently *sustainability transitions* to refer specifically to transitions from existing, unsustainable to alternative, more environmentally benign configurations of technologies and associated social practices. In contrast to the smart city literature, this literature offers an alternative, dual social and technological perspective on innovating existing large-scale city systems, such as the urban transport system, towards greater sustainability. Review of the transition literature specifically suggests that its recent orientation towards sustainability transitions has much to offer for researchers and other stakeholders in pursuit of socio-technical change towards more sustainable systems of production and consumption. The review also reveals important gaps in the literature and its practical applicability: specifically, the *multi-level perspective*, a key analytical framework, has experienced sustained criticism for relying on unduly thin

conceptualisations of the social and cultural context within which socio-technical transitions take place.[1]

This thesis seeks to contribute to the closure of resulting gaps in the literature on sustainability transitions. To do so, it brings a second literature to bear: the *cultural political economy* literature with the *strategic-relational approach* as its key heuristic. The resulting crossover enables study of the mechanisms underlying the path-dependent development of mature socio-technical configurations, such as the motorised transport regime in the urban transport sector. In particular, it sheds light on *strategic selectivities* inscribed in existing socio-technical systems and how these act to privilege the perpetuation of dominant socio-technical regimes, while challenging the establishment of novel regimes that could potentially yield more sustainable urban transport futures. Connectedly, the thesis asks how marginal transition stakeholders encounter, circumvent, exploit or subvert these selectivities to facilitate socio-technical change to more sustainable socio-technical systems of production and consumption. In doing so, the author seeks to challenge readers to consider whether cities and communities engaging critically and reflexively with such path dependencies may prove the 'smarter' cities.

The objective of bringing the two academic literatures and their associated heuristics together is, thus, the articulation of a critical and reflexive perspective on ongoing sustainability transition processes. The intended aim of such a perspective, in turn, is to enable transition stakeholders' reflexive and strategic engagement with the causal mechanisms underlying socio-technical inertia and aid a more strategic pursuit of profound socio-technical change.

To illustrate the usefulness of the articulated theoretical perspective empirically, the crossover is then applied empirically to study a socio-technical change process in London's urban transport system as the city promotes a return to cycling as a mainstream road transport mode.

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[1] Latest research from different disciplinary traditions has variously criticised the multi-level perspective for an *overemphasis of technological artefacts* (Genus and Coles 2008; Shove and Walker 2007) at the expense of a proper *geographical grounding of the institutional and agential variety* of transitions, (Bulkeley and Betsill 2005; Coenen et al., 2012; Hodson and Marvin, 2010; Truffer and Coenen, 2012), thereby substantially neglecting the *impact of locally specific power relations* on transition outcomes (Lawhon and Murphy, 2012; Raven et al., 2012).

In what follows, the reasons for focusing research on cycling (as opposed to other urban transport modes), and specifically cycling in London, are set out.

Why cycling?

Compared to other modes conventionally thought of as innovative, the bicycle stands out as a mature technology with several dominant designs available via well-established, competitive markets. Its general purpose, and principles of its operation, are well-understood both by cyclists and non-cyclists. However, within the urban road transport sector the bicycle competes with a range of other road transport modes on bases of price, speed, comfort, safety, convenience, etc. to provide individual mobility. Most notably the bike competes with the car as a means of individual motorised mobility widely preferred even for short inner-urban journeys.

As such, the bicycle may be conceptualised as part of an existing, but marginal, socio-technical configuration. The study of currently ongoing cycling transitions then offers an opportunity to investigate barriers and opportunities at more advanced moments of the transition process. More to the point, it presents a chance to shift focus from techno-economic challenges, such as the development of a dominant design, which often challenge socio-technical change processes from gathering early momentum, to focus more heavily on contextual cultural, structural, institutional and material change processes required to enable stable, but marginal socio-technical configurations in niches to establish themselves more firmly as sub-regimes or even counter-regimes. As such, the study of cycling transitions may allow the focused investigation of socio-technical change processes at a point when niche stakeholders can turn their attention outside of the niche to confront transition barriers arising from the dominance of existing regimes, rather than lacking alignment within the niche itself.

Why London cycling?

The focus on cycling further offers a wide array of potential empirical cases for study. Cycling has been experiencing a renaissance in many cities globally, partly encouraged by the growth and diffusion of bike-sharing schemes worldwide (Parkes, et al. 2013). Additionally, in the UK, more strategic political interventions have been undertaken with the aim of reinvigorating the bicycle's status as a mainstream mode in urban transport.[2]

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[2] In 2005 the UK Government invested in six Cycling Demonstration Towns and between 2008 and 2011 made further investments of £43 million (excluding local match funding)

As such, there exists a large pool of potential cases of urban transitions to cycling that this research could have investigated. The choice of London as a case of a cycling transition in-the-making is explained as twofold.

On the one hand, London presents a *key case* as it is a global city with a large road transport system subject to complex governance arrangements mediating a potential transition to more utility cycling. Notwithstanding this, the London case is marked by strong commitment from key actors including London's Mayor and the metropolitan transport authority, Transport for London. Their recognition of cycling as a potential means to provide congestion relief as well as health, environmental and social benefits further motivated large-scale, long-term financial commitments to be made to the mode. Yet, lacking and poor quality infrastructure, perceived and actual safety issues vis-à-vis other modes still appear to pose large challenges to increasing numbers and broadening demographics of London cyclists.

The impetus for undertaking this case study came specifically following the deaths of six cyclists in London within a two-week period in November 2013. Around eight months prior, in March of 2013, the London Mayor had published his *Vision for Cycling in London* in which he committed to deliver "substantial – eventually transformative – change" that will see cycling being no longer treated "as niche, marginal, or an afterthought, but as what it is: an integral part of the transport network, with the capital spending, road space and traffic planners' attention befitting that role" (GLA, 2013a, p.4). The cycling-positive language of the vision was welcomed by cycling advocates, albeit with some caution. A widely-read blogger on the issue of cycling in both London and the wider UK summarising the mood succinctly: "The language of the new strategy is very welcome, but the approach has to match it" (Treasure, 2013).

However, its progressive tone and the substantial financial commitments accompanying the strategy set the stage for increased scrutiny of how cycling was being talked about and provided for at the Greater London level. In connection with this, the deaths of six cyclists on London's roads within a fortnight in November 2013 opened a crucial fault line and raised questions regarding the extent to which the ambitious language of the Mayoral strategy was being matched with determined action. Of course, a complex road transport

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in 12 British cities and town. Both the Cycling Demonstration Towns and the so-called Cycling City and Towns programme were intended to "explore the relationship between investment in cycling, as part of a whole-town strategy, and the number of cyclists and frequency of trips" (Christensen, et al., 2012, p.8).

system, such as that of London, cannot be turned into a cycling Nirvana within a matter of months. However, public minutes of Greater London Authority transport committee meetings in the aftermath of the deaths suggested that TfL faced important challenges beyond the usual suspects – political will and financial resources – in delivering on the ambitious vision set out by the Mayor. Meanwhile, the Mayor's reaction to criticisms of the safety of cycling in London were perceived as decidedly un-progressive. He sought to emphasise the overall safety of cycling in London by citing statistical trends of killed or seriously injured (KSI) casualties, and stressed that it was "vital that all road users respect the rules of the road" and that a "simultaneous, parallel, additional duty of cyclists to behave responsibly" be recognised (GLA, 2013c). While the Mayor considered his responses reasonable in light of road traffic conditions in London at the time, others perceived them as contradicting the language of his cycling vision. The language there suggested greater recognition of the heightened vulnerability of modes, such as cycling, vis-à-vis motorised modes as well as a strong commitment to increasing both actual and perceived safety to encourage a broader demographic to cycle in London.

Based on the above, more extensive research of the London case was deemed interesting. Specifically, it presented itself as particularly interesting moment in a special kind of transition. On the one hand, the case represented a transition 'back' to what was once a mainstream transport mode. On the other hand, it presented a moment in a potential transition process when conventionally cited barriers to socio-technical change, such as lack of political will and available funding, appeared to have been addressed yet challenges in translating the vision of radical socio-technical change into action appeared to remain.

As such, the thesis presents the case of an ongoing transition involving a well-established and familiar, yet marginal transport technology – the bicycle – in a broadly favourable transport policy environment:

Diverse stakeholder groups are endorsing the bicycle as a mode that may reduce congestion and enable city dwellers of all ages to live more active lifestyles while also contributing to councils' public health, urban regeneration and social inclusion agendas. In London, specifically, the mode has received high-level political and financial backing from the Mayor of London who in 2013 pledged to pursue a "cycling revolution" with the goal of making cycling "an integral part of the transport network" rather than a mere afterthought (GLA, 2013a). However, in the capital and elsewhere in Britain ridership rates remain at an average mode share of around two per cent (DfT, 2016; TfL, 2016a)

while, demographically speaking, white, middle-aged men continue to be overrepresented among the population of regular cyclists. This combination of stalling progress indicators, despite high-level support for a transition involving a technology as mature as the bicycle, makes the London case a unique opportunity for studying a transition *in progress*.

The thesis takes this case of London's ongoing cycling transition as an opportunity to study key actors, their activities and interactions and explore the micro-level mechanisms that seemingly obstruct the transition to more utility cycling on London's roads. To do so, initial analysis focuses on establishing the transition character of the changes currently ongoing in London's road transport system and the relative dominance or subordination of cycling as one of many modes within that system. A second analysis turns to study the differential opportunities and barriers for action, which transition stakeholders occupying various social roles and positions face in terms of intervening in and shaping ongoing socio-technical change at a given moment in the transition process. By drawing attention to the spatially, temporally and relationally contingent nature of these opportunities and barriers for action the thesis impress upon, particularly marginal, stakeholders of ongoing transitions the usefulness of strategic, multi-level analysis of their action context to yield potentially instructive insight for more hands-on, strategic intervention in ongoing sustainability transitions in the urban transport system and beyond.

In doing so, this research seeks to make a dual theoretical and empirical contribution to existing research by articulating a starting point for more critical transition scholarship that contrasts with the normatively-naïve managerial perspectives that dominate transition literatures to date.

1.2. Aims, objectives and research questions

Research aims

As briefly mentioned above, transition research has recently shifted its focus from past to ongoing transitions and from plain socio-technical to sustainability transitions. Moving forward, transition researchers must seriously assess the implications of this shift. A specific point of concern is whether key frameworks, such as the multi-level perspective, which were largely developed in connection with the retrospective study of past successful transitions, are equally useful for the study of sustainability transitions that are currently underway. Since the multi-level perspective was developed with an explicit long-term perspective on socio-technical transitions, it will require adaptation, extension or

replacement to enable the study of the everyday micro-moments underlying ongoing sustainability transitions and how these connect to the dynamics of long-term, large-scale socio-technical change.

Therefore, key aims of this thesis are (1) to articulate a crossover framework between the existing transition studies literature, specifically the framework of the multi-level perspective, and insights from cultural political economy, specifically the heuristic of the strategic-relational approach; and (2) to apply the resulting crossover to test and illustrate its usefulness for enabling transition stakeholders' strategic analysis of and decision-making in ongoing sustainability transitions in urban transportation systems (and beyond).

On the one hand, the thesis aims to show how such a crossover can extend the usefulness of the multi-level perspective framework for the analysis of ongoing sustainability transitions by connecting the everyday, micro-level interactions of structure and agency with the long-term, macro-level dynamics of socio-technical change or inertia shaping sustainability transition trajectories. And, on the other hand, it will seek to demonstrate how an explicitly critical perspective on socio-technical transitions can yield emancipatory insight, which can enable more strategic action and intervention of specifically marginal niche stakeholders in ongoing socio-technical change processes towards more sustainable systems of production and consumption.[3]

The crossover framework to be articulated in the context of this research will serve to draw attention to power differentials and variable action and intervention potentials faced by different transition stakeholders. It will thereby help to highlight barriers to and opportunities for strategic action facing particularly marginal transition actors. It is in this sense that the thesis pursues emancipatory insight that can be used by transition stakeholders themselves to shed light on and evaluate their strategic action context,

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[3] The emphasis is strictly on emancipatory insights as opposed to prescriptive, normative recommendations in alignment with the critical realist ontology informing this research. Following these ontological commitments, the thesis and research reject the possibility of delivering objective, normative prescriptions or even recommendations for action. Instead, this study is conducted on the understanding that, while there may be a single objective reality out there in the world, no social actor or actor group, including researchers, has privileged access to this single objective reality. The author therefore follows the critical theory tradition which does not intend to "serve as a formula for any particular course of social change… It may – indeed, it *should* –have mediations on to the realm of practice, and it is explicitly intended to inform the strategic perspective of progressive, radical or revolutionary social and political actors. But at the same time…critical theory is focused on a moment prior to the … question of 'What is to be done?'" (Brenner, 2009, p.201).

thereby informing strategic decision making and action rather than prescribing concrete courses of action or making normative recommendations for action.

Research objectives

To achieve the broad research aims set out above, a first key objective of this thesis is to assess the continued usefulness of the multi-level perspective for researching ongoing transitions towards more sustainable systems of production and consumption. To do so the thesis builds on recent transition literatures in combination with alternative literatures to identify key barriers or challenges to using the multi-level perspective in the study of ongoing sustainability transitions. This is a necessary step in determining whether the multi-level perspective as a heuristic device is flexible enough to be used for studying both the micro-level moments of socio-technical change as well as the macro-phenomena of sustainability transitions. Enabling such dual use of the multi-level perspective would be desirable as it would offer a way of linking patterns of micro-level, short-term action and interaction with macro-level, long-term transition dynamics and trajectories.[4] And doing so may ultimately yield more instructive insight for transition stakeholders seeking to pro-actively shape ongoing sustainability transitions.

A second key objective in the context of this research is the extension of the multi-level perspective to enable analysis of ongoing transitions in a way that can take account of power differentials between various transition stakeholders and resulting differences in their respective abilities for strategic action and intervention in ongoing transition processes. To do so the thesis will seek to extend the multi-level perspective via a crossover with the strategic-relational approach developed in the context of the cultural political economy literature. This crossover is motivated by the recognition that cultural political economy, itself informed by critical political economy and critical semiotic analysis, pays great attention to the impact that power, and specifically structurally conditioned power differentials, have on the ability of different social actors to successfully navigate or even shape social change processes. Likewise, cultural political economy emphasises the need for critical assessment and critique of dominant and/or hegemonic social formations to generate emancipatory knowledge particularly for actors

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[4] Note that such a link must not be understood as a direct explanatory relation. The notion of emergence and the connected irreducibility of complex macro-phenomena such as transitions to the mere aggregate effect of micro-level events and actions suggests that such direct explanatory linking of the macro- and the micro-level of socio-technical change is improbable.

who find themselves marginalised by these formations. On the surface these key concerns of cultural political economy suggest a significant overlap with transition scholars' interest in advancing socio-technical regime change and the displacement of existing, unsustainable, yet dominant and self-perpetuating socio-technical systems. Therefore, a crossover between transition studies and cultural political economy appears at first sight worthy of exploration as it may offer a means to enrich transition theory's conceptual and methodological toolbox, particularly for the engagement with and study of ongoing transitions towards sustainability.

A third key objective is to test the developed crossover framework by applying it to an empirical case of a currently ongoing transition. The thesis will do so by studying the case of recent efforts to return cycling to its former status as a mainstream mode on the roads of London – capital of the United Kingdom. Empirical application of the newly formulated crossover framework within the context of the thesis has two broad purposes: On the one hand, it is intended to test suitability of the new framework for the analysis of ongoing transition processes as well as its ability to generate insights into these ongoing processes that may enable transition stakeholders' more strategic and pro-active engagement in these processes. On the other hand, empirical application of the new framework in the context of a concrete case is further intended to provide an illustrative, detailed example of how the modified multi-level perspective may be applied in practice. In this context, it is important to note that the application articulated crossover between transition studies' multi-level perspective and the strategic-relational approach as demonstrated in the context of this thesis should be understood as one among likely many other ways of putting the modified multi-level perspective to work in practice. In this sense, it is not meant to provide a prescriptive example of how to deploy the new framework but rather an example that may serve as inspiration for researchers seeking to deploy, modify or extend the presented framework for their research purposes.

Research questions

To address the above outlined aims and objectives, this research pursues the following central research question:

What is the role of micro-level structure-agency interactions in the transition process and how do these dynamics contribute to the stimulation or obstruction of radical socio-technical change towards more sustainable urban transport futures over time?

In order to address this overarching research question the thesis investigates a number of sub-research questions more specifically:

(i) *Do all transition actors face a common structural context, i.e. the same action constraints and opportunities?*

(ii) *If yes, do different actors pursue different action strategies in this common structural context and why?*

(iii) *To what extent and why are some transition actors and their actions more successful in given moments or periods of a transition?*

1.3.   Central research gaps addressed by this thesis

In addressing the above outlined questions the thesis on hand seeks to contribute to the closure of the following central research gaps identified through review of relevant literatures:

In the first instance, the research targets a theoretical gap in the field of transition research, relating specifically to the multi-level perspective and the conceptualisation of the structure-agency relation at the heart of it.

Review of existing literatures suggests that transition research remains reliant on the retrospective study of past transition processes in search of generalisable insights that may also be of benefit in engaging with or even managing ongoing and future transitions to more sustainable systems of production and consumption. Meanwhile, application of the multi-level perspective to currently ongoing transition processes towards more sustainable systems of production and consumption remains limited. As the thesis shows, this is due to limitations inherent in the conceptualisation of the structure-agency relation at the heart of the existing multi-level perspective framework. These limitations work to systematically draw transition researchers' attention towards the examination of the longue durée of socio-technical change processes with limited concern for making explicit how these aggregate dynamics are produced through continuous action at the micro-level of the everyday of transitions.

The thesis on hand seeks to contribute to the closure of this research gap through initial critical examination of the conceptualisation of the structure-agency relation underlying the multi-level perspective in its current form. Subsequently, the thesis draws on the strategic-relational approach to articulate an alternative theoretically sound framework to

more effectively link the micro-level structure-agency interactions of ongoing transition processes to observed transition dynamics at the aggregate level. In doing so the thesis

(i)   sharpens the multi-level perspective's attention for the localised, socio-spatially embedded, everyday actions and interactions of transition actors that inform observed long-term transition processes.

(ii)   develops the multi-level perspective in response to persistent criticisms levelled at the framework for the insufficient attention it is able to pay to the local, geographical embeddedness of transition processes and, connectedly, the role of agency, power and politics in these processes.

In doing so, this thesis does not mean to deny the usefulness and importance of existing transition research strands primarily concerned with the description of past transition processes. Instead, the research seeks to contribute towards the development of an alternative, more socio-spatially sensitive and reflexive transition research. One that takes seriously the historically conditioned, yet contingent, marginalisation of socio-technical niches and their stakeholders vis-à-vis existing dominant regimes and that may usefully inform strategic engagement with ongoing and future transition processes.

Secondly, the thesis addresses a gap in the broader transport literature by making a case for more explicitly *socio-technical* studies in the field of transportation research, particularly in light of the growing popularity of smart city discourses in the realms of transportation policy, practice and research.

Here, the thesis points towards the need to consider a dual social and technological approach and to investigate innovation in the urban transport sector from a socio-technical innovation perspective and through the specific lens of socio-technical transitions to more sustainable systems of production and consumption. This socio-technical transition literature draws attention to the coevolutionary development of society and technology to develop insights relevant for understanding the relative stability and perpetual reproduction of dominant socio-technical regimes, such as the motorised road transport regime. Connectedly, engagement with transition literatures can offer insights on how the relative stability of dominant yet unsustainable socio-technical configurations may be challenged to enable the breakthrough of alternative and potentially more sustainable socio-technical configurations in the transport sector. The thesis thereby seeks to make a contribution to ongoing discussions in the field of transportation research and practice at

a time when fast-moving and disruptive technological changes are anticipated to shape and change the sector profoundly.

1.4.   Overview of chapters

To achieve the above outlined aims and objectives and realise the contributions this research is anticipated to make, the thesis proceeds as follows:

Chapter 2 presents a preliminary review of smart city as well as transportation research literatures to properly situate the research interests and rationalities informing this thesis The chapter challenges the smart city's tendency to treat urban sustainability challenges, including urban transport problems, primarily as technological optimisation problems and, instead, introduces an alternative theoretical lens in the form of the literature on socio-technical innovation and transitions.

Having situated the research interests of the thesis both empirically and theoretically, *Chapters 3 and 4* lay the groundwork for the articulation of the theoretical crossover in *Chapter 5*. *Chapter 3* delivers a more focused review of the socio-technical transition literature. It presents four central strands of transition scholarship alongside their key frameworks, before turning to examine the multi-level perspective, as the most appropriate framework in the context of this thesis, in more detail. *Chapter 4* introduces the literature of cultural political economy and its critical realist foundations with a specific focus on the strategic-relational approach as one of the central heuristics employed in the cultural political economy literature. *Chapter 5* focuses on bringing the sustainability transition literature and the cultural political economy literature together to formulate a crossover research framework. The chapter examines the feasibility and theoretical consistency of such a crossover and considers its potential benefits and drawbacks.

Chapter 6 outlines in detail a methodology that mobilises the new crossover framework empirically to enable the critical study of a transition currently in progress, specifically the ongoing transition towards more utility cycling in the London road transport system.

Chapter 7 and 8 discuss the findings of empirical research in two stages: *Chapter 7*, reconstructs the transition character of the ongoing changes in London's road transport sector by tracing historical trends in the material presence of cycling on London's roads as well as changes in how the mode has been discursively constructed over time. *Chapter 8* examines aspects of the dominant road transport regime that act to challenge the ability of cycling advocates to strategically advance the transition to more utility cycling in

London. On the other hand, it also sheds light on how these stakeholders encounter, recognise, and in some instances strategically exploit, circumvent or subvert these barriers to promote socio-technical change to more cycling on London's roads.

Chapter 9 concludes the thesis by returning to the research questions posed at the beginning of this chapter. The final chapter further assesses the contributions as well as limitations of the research as presented and closes by pointing out avenues for further research as arising from the finding of this study.

2. SITUATING THE RESEARCH

The following chapter serves to broadly contextualise the research interest of this thesis – socio-technical innovation towards more sustainable urban transport futures – both empirically and theoretically:

The chapter briefly discusses the challenges global urbanisation processes and arising externalities pose for the sustainability of cities and their transportation systems before critically examining the urban development concept of the *smart city* as offering a potential solution to these urban challenges. Initial review of the smart city literature suggests that it offers neither an easily applied framework for the pursuit of smarter, more sustainable urban transport futures, nor a definitive concept of the smart city. On the other hand, evidence suggests that the pursuit of more sustainable transportation systems and practices primarily via technological improvements is likely to lead to rebound effects and a negation of some or all sustainability gains realised in the short term.

Therefore, Chapter 2 discounts the smart city concept as a stand-alone response towards realising more sustainable urban transportation systems. Instead, the thesis establishes an alternative theoretical entry point by casting urban transport innovation as a *'wicked' problem*, better addressed via a socio-technical perspective on innovation. The chapter then closes with a brief introduction to *socio-technical innovation literature*. This broader socio-technical perspective is thought to enable an understanding of the complex, co-evolutionary dynamics shaping processes of urban transport innovation towards genuinely more sustainable urban futures.

2.1. Background

The efficient movement and increasing mobility of people and goods is thought to be central to cities' prosperity and the quality of life enjoyed by their inhabitants. Therefore, both established and growing urban agglomerations are keen to ensure high mobility and to accommodate rising transport demand and motorisation levels. At the same time, economic, material and spatial constraints limit cities' ability and readiness to reduce the significant environmental impacts urban transportation activities are having both at the local and global scale. Nonetheless, delivering on existing political commitments regarding the reduction of emissions and other transport externalities will require profound change in urban transportation infrastructures and practices.

A popular response aimed at balancing efficiency and sustainability concerns at the city scale has been the urban development concept of the *smart city*. The smart city seeks to draw on human, social and, in particular, technological capital stocks to improve the effectiveness and efficiency of urban systems and services from energy, water, and waste, to education, housing, and transport in order to drive economic prosperity and enhance city inhabitants' quality of life. However, the value of the smart city concept remains challenged due to its ambiguity, its questionable emphasis on technological innovation as a primary source of urban 'smartness' and a lack of concrete strategic frameworks or roadmaps to undergird the concept.

Due to this, research for this thesis set out from the question of whether, and to what extent, the concept of the smart city can be usefully operationalised in pursuit of sustainable urban transport futures. However, an initial review of the smart city literature suggests that technological innovation alone is not sufficient to address the sustainability challenges facing the urban transportation sector. Therefore, the thesis connects the ambiguous smart city concept with the literatures on *socio-technical innovation* and *sustainability transitions*. In line with this shift in empirical and theoretical emphasis the thesis reconceptualises urban smartness as a measure of a city's ability to pursue complex socio-technical change in a strategic and effective manner to achieve broader transitions to alternative, more benign systems of production and consumption.

Towards this end, Chapter 2 provides a perhaps unusually elaborate empirical and theoretical contextualisation of the research topic of this thesis: it outlines current and future transportation challenges at the urban scale as they connect to on-going urbanisation processes, associated expansion and agglomeration of urban areas and resulting growth of environmental pressures due to a rise in productive and consumptive activity in cities. This is followed by a discussion of the complex, divergent and at times contradictory demands driving innovation at the city scale and particularly in the context of urban transportation. The chapter illustrates these challenges by critically examining the techno-centric smart city literature and contrasting it with a range of alternative urban transport narratives of the past, present and future. Following on from this, it argues for a more sophisticated socio-technical perspective on transport innovation, in lieu of the techno-centric smart city approach. The chapter concludes by introducing the literature on *innovation* and *systems approaches to the study of socio-technical innovation*.

Present and future urban challenges

Over the past two decades globally progressing urbanisation processes have motivated a wealth of research. Associated changes in urban production and consumption practices, and their relative economic, environmental and social impacts have received much of this attention. And while exact figures and statistics illustrating these developments are well-publicised, these are constantly reviewed and updated and vary greatly. However, estimates suggest that by 2045, the rapid global urbanisation process already taking place will see around 75 per cent or as many as six billion people worldwide living in cities (World Bank, 2016). Already, urban areas are generating more than 80 per cent of the entire global GDP (ibid.), whilst at times attributed as the source of as much as 75-80 per cent, or as little as 30-40 per cent of global CO_2 emissions (depending on whether these are primarily attributed to producers (Seto and Shepherd, 2009) or consumers (Satterthwaite, 2008), respectively). To sustain their vitality in the face of such exponential growth, it has been argued, cities need to find 'smart' ways to not merely cope with, but redress the economic, environmental and social externalities accompanying these trends. Therefore, cities are increasingly recognised as key arenas of local and global climate change mitigation and adaptation efforts (Bulkeley et al., 2013).

Due to forecasted population growth, urban transportation systems around the world face increasing demand, longer peak times, higher operation and maintenance costs and expanding congestion both within and around city areas. The impacts listed are not exhaustive, and they also give rise to further externalities of economic (e.g. higher fuel use, longer commute times, lost work hours), environmental (e.g. increased emission levels, noise and visual pollution) and social nature (e.g. accidents, segregation, low quality of life). Connectedly, cities globally are recognising the pressing need to innovate urban transportation systems and practices.

Socially and economically speaking, individuals and businesses depend on urban transport systems for the efficient and reliable distribution of goods and services in urban and peri-urban areas. However, both passenger and freight transport systems together with the large-scale infrasystems (Frantzeskaki and Loorbach, 2010) they depend on, tend towards incremental innovation rather than radical change. This is due in part to "the sunk-costs, the social dependencies and the impossibility for a sudden shift to a completely new and functional infrasystem [making] infrastructural change a high-risk activity" (ibid., p.1295). Alongside material, infrastructural constraints the urban transportation system is, therefore, also subject to strong immaterial social, institutional and cultural rationalities.

Both these material and immaterial aspects of the transportation system depend on and reinforce one another. This mutual reinforcement between materialities, social practices and cultural rationalities gives rise to robust socio-technical configurations that lock society into existing systems of production and consumption.

A prominent example of such lock-in in the realm of transportation is the dominance of the personal automobility paradigm (see e.g. Urry, 2004). It is important to note, however, that these path dependencies not only perpetuate particular socio-technical arrangements. They are also both affected by and have themselves structuring effects on other sectors and realms of the social world. Consider, for example, transport's persisting reliance on petroleum-based fuels. This is on the one hand historically conditioned by how engine and fuel technologies coevolved over time. On the other hand, the historic coevolution of motorised modes with petrol-based fuel technologies also fundamentally link the transportation sector with globalised energy markets and ultimately the economic and political rationalities that govern the same. These far-reaching interdependencies and mutual reinforcements serve to add to the resilience and persistence of the petrol-based motorised transportation regime (Cohen, 2010). This relative rigidity of existing transport systems in the face of a pressing need to balance urban demands for economic efficiency, environmental sustainability and social equitability, suggests that radical paradigm shifts may be required to help plan for smarter urban transport futures.

The smart city

Innovation is a key response to the challenges cities face due to the above outlined trends of urbanisation, general population growth, and resulting environmental and resource pressures. Such calls for urban innovation and modernisation can be found embedded within a number of distinct narratives of prosperous urban futures employed across research, policy and practice domains and within public discourse. A particularly dominant narrative in recent years has been that of the *smart city*.

Since its first appearance in an academic publication 25 years ago (Gibson et al., 1992), the notion of the smart city has greatly grown in popularity and significance and continues to garner attention well beyond the context of urban technology research where it originated. A popular topic both in research and practice, the concept of the smart city is by no means uncontroversial or even clearly defined. As the following review of the smart city literature will show, this is in part due to the 'smart' label being stretched to apply to innovative developments across a variety of city sectors concerned e.g. with the provision

of water, energy, waste management and transportation, as well as health, education and urban democracy. Due to this stretching of the label, a city's smartness is increasingly judged on the basis of the smart means it employs instead of the smart ends it achieves across a range of highly intertwined city systems with complex feedback loops.

In part the coherent theorisation of the smart city concept has been complicated by the fact that different sources attribute the origins of the concept to the convergence of various related ideas and theories.[5] As a consequence of the ambiguity surrounding the origin and substance of the smart city a growing body of scholarly publications employs the term as little more than a conceptually empty catchphrase (Wolfram, 2012) referring to applications of a diverse range of information and communication technologies (ICTs) across all aspects of urban service provision (see Table 2.1 for an overview of smart city technologies and policies across different functional domains of the city).

DOMAIN		APPLICATION
Natural resources & energy	Smart grids	Smart grids track user behaviours to deliver electricity efficiently, sustainably, reliably and securely.
	Public lighting	LED technology; managed via networked system to reduce maintenance/operating costs; real-time information to regulate light intensity
	Green energy	Renewable energy resources (e.g. heat, water, wind power)
	Waste management	Management of waste in ways that minimises negative effect of waste on humans and environment
	Water management	Water management to assure quantity and quality of water throughout hydrological cycle
	Food and agriculture	Food/agricultural crop cultivation: sensor networks provide real-time information (temperature, light, soil/air humidity, etc.)
Transport & mobility	City logistics	Optimisiation to suit traffic conditions, geographical, and environmental issues
	Info-mobility	Distributing and using selected dynamic and multi-modal information, both pre-trip and, more importantly, on-trip, with the aim of improving traffic and transport efficiency as well as assuring a high-quality travel experience
	People mobility	Innovative and sustainable ways to move people in cities; public transport modes and vehicles based on environmental-friendly fuels and propulsion systems supported by advanced technologies and citizens' behaviours

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[5] For Hollands (2008) and Vanolo (2014) the smart city builds on previous concepts of smart growth and the intelligent city, while Wolfram (2012) locates the smart city at the overlap of the digital city with the innovation systems literature. Komninos (2008), by contrast, situates the intelligent/smart city at the overlap of literatures on smart growth, intelligent communities, intelligent environments and cyber-cities.

Buildings	**Facility management**	Cleaning, maintenance, property, leasing, technology, and operating modes associated with facilities in urban areas
	Building services	Building services provision to existing buildings based on computer systems to control the electrical and mechanical equipment of a building
	Housing quality	Optimisation of Housing quality in residential buildings including lighting, temperature regulation, ventilation and general comfort of inhabitants
Living	**Hospitality**	User specific solutions for foreign students, tourists, and other non-residents
	Pollution control	Controlling emissions and effluents by using different kinds of devices. Stimulating decisions to improve the quality of air, water, and the environment
	Public safety	Collecting and monitoring information for crime prevention through active involvement of public organisations, police force, and citizens.
	Healthcare	Prevention, diagnosis, and treatment of disease supported by ICT. Assuring efficient facilities and services in the healthcare system
	Welfare & social inclusion	Improving quality of life by stimulating social participation and learning particularly amongst elderly and disabled
	Culture	Diffusion of information about places, cultural activities, events and activities
	Public spaces	Care, maintenance and management of public spaces
Government	**E-government**	Digitization of public services through ICT tools to provide new and better services to citizens
	E-democracy	Using innovative ICT systems to support ballots
	Procurement	Public sector procurement and contract management procedures optimised to assure quality-cost ratio
	Transparency	Enabling citizens' easy access to official documents and public decision processes. Minimising misuse and abuse of public system and services.
Economy & people	**Innovation**	Facilitation of innovation and entrepreneurship through e.g. incubators
	Cultural heritage management	Use of ICT systems (e.g. augmented reality technologies) to deliver new customer experience in enjoying cities' cultural heritage. Use of asset management information systems to handle maintenance of historical buildings
	Education	Extensive use of modern ICT tools in public schools
	Human capital management	Policies to improve human capital investments and attract and retain new talents, avoiding human capital flight (brain drain)

Table 2.1 Overview of smart city policies and practices (adapted from Neirotti et al., 2014)

The smart city concept has likewise appealed greatly to private sector companies, city authorities as well as to national and intergovernmental organisations. These sectors' interest in the smart city topic as well as their division on what exactly it entails is evidenced in Table 2.2. The table offers an overview of the variety of working definitions employed in different organisational fields.

ACADEMIA
Giffinger, et al. (2007): "A Smart City is a city well performing in a forward-looking way [with respect to its economy, people, governance, mobility, environment and living] built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizen."
Komninos (2008, p.131): "[I]ntelligent cities […] are territories with a high capacity for learning and innovation, which is built-in: (1) the creativity of their population; (2) their institutions for knowledge creation; and (3) their digital infrastructure and services for communication and knowledge management."
Caragliu et al. (2009, p.50): "We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance."
PUBLIC SECTOR
European Union (2014, p.24): "A Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership."
Department for Business, Innovation and Science (2013, p.7): A"Smart City […] brings together hard infrastructure, social capital including local skills and community institutions, and (digital) technologies to fuel sustainable economic development and provide an attractive environment for all."
British Standards Institution (2014, p.4): A smart city is the "effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens"
PRIVATE SECTOR
IBM (2010, p.2): "'Smart' cities know how to transform their systems and optimize the use of largely finite resources. To help drive efficiency and increase effectiveness, they leverage technology to make systems instrumented, interconnected and intelligent …"
Arup (2010, p.4): "A smart city is one in which the seams and structures of the various urban systems are made clear, simple, responsive and even malleable via contemporary technology and design. Citizens are not only engaged and informed […], but are actively encouraged to see the city itself as something they can collectively tune, such that it is efficient, interactive, engaging, adaptive and flexible, as opposed to the inflexible, mono-functional and monolithic structures of many 20th century cities"
Smart Cities Council (2012): "A smart city gathers data from smart devices and sensors embedded in its roadways, power grids, buildings and other assets. It shares that data via

a smart communications system that is typically a combination of wired and wireless. It then uses smart software to create valuable information and digitally enhanced services."
CITY AUTHORITIES
Smart Dublin (2016): "'The smart Dublin vision is a mix of data-driven, networked infrastructure, fostering sustainable economic growth and entrepreneurship, and citizen-centric initiatives, with a particular focus on improving city services' – Rob Kitchin, Programmable Cities, Maynooth University"
Ajuntament de Barcelona (2013): "Barcelona is working to merge urban planning, ecology, and information technology to ensure the benefits of technology reach every neighbourhood and improve the lives of citizens. Barcelona's transformational approach follows a long-term vision based on building productive, human-scale neighbourhoods within a hyper-connected, high-speed and zero-emission metropolis."
Smart London Board (2014): "Smart London is about how the capital as a whole functions as a result of the interplay between its 'systems' [...] Smart London is where the linkages between these different systems are better understood, where digital technology is used to better integrate these different systems, and London as a whole works more efficiently as a result - for […] its inhabitants and visitors."

Table 2.2 Overview of varying smart city definitions in different organisational contexts

While opinions regarding the usefulness of the smart city concept diverge, its proponents and critics agree that the concept itself remains fuzzy and ambiguous with a unifying definition yet to emerge. However, to date only a limited number of publications have examined the variable use of the concept critically in an attempt to theorise smart cities more definitively (Allwinkle and Cruickshank, 2011; Angelidou, 2014; Caragliu et al., 2009; Deakin and Al Waer, 2011; Hollands, 2008; Wolfram, 2012). The following discusses a selection of highly cited contributors to the theorisation of smart cities to illustrate the critical reception of the concept.

Critical engagement with the smart city concept first peaked with the publication of Hollands' (2008) much-cited paper "Will the real smart city please stand up?". The article provided a first comprehensive and critical review of the existing literature and identified four distinct attributes of the smart city:

(i)   an orientation towards urban development that is led by the so-called triple-helix of business, research and government;

(ii)   a focus on fostering smart communities, i.e. urban cultures of creativity, diversity and tolerance in pursuit of humanist ideals, such as quality of life, social inclusion, lifelong learning, etc.;

(iii)   a concern with the environmental and social sustainability of cities' economic development and urban growth (both in production and consumption terms);

(iv)   the extensive use of networked ICTs to revitalise cities and improve their political and economic efficiency.

Particularly the identified features (i) and (ii) show great overlap with Komninos' (2008, p.113) notion of *intelligent cities* as "territories with a high capacity for learning and innovation, which is built-in to: (1) the creativity of their population; (2) their institutions for knowledge creation; and (3) their digital infrastructure and services for communication and knowledge management". Building on this conception Komninos (ibid., p.77) argues that the smart and the intelligent city overlap significantly in terms of their shared reliance "on a core of knowledge processes". The difference between the two, and here Komninos (ibid.) appears to agree with Hollands, lies in the smart city being characterised by two new concerns in relation to these knowledge processes, i.e. "the pursuit of sustainability" (iii), and "the rise of new internet technologies" (iv).

Authors such as Giffinger et al. (2007) and Caragliu et al. (2009), highlight notions of competitiveness and economic benefit while placing less emphasis on the technological aspect of the smart city.[6] Following their studies, the development of rankings and indices as measures of urban competitiveness and wider smart city trends has become the focus of a growing number of scholarly articles on the subject of smart cities (see e.g. Debnath et al., 2014; Lazaroiu and Roscia, 2012; Marsal-Llacuna et al., 2015; Neirotti et al., 2014). The broader socio-environmental sustainability of such an orientation towards urban growth and development remains largely unquestioned, although the framework by

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[6] Giffinger et al. (2007, p.11) identify six key domains of the smart city: (1) the economy, (2) people, (3) governance, (4) mobility, (5) environment and (6) living. Therefore, they define the smart city as "well performing in a forward-looking way in these six characteristics, built on the 'smart' combination of endowments and activities of self-decisive, independent and aware citizens". Based on these dimensions Giffinger et al. develop a benchmarking methodology for European cities. However, the study remains silent as to the normative values informing the smart city concept beyond the mere motivation of cities to perform well in 'smartness rankings'.

Caragliu et al. (2009), building on Giffinger et al. (2007, p.47), investigate the correlation between five selected indicators, (namely (i) employment in the entertainment industry, (ii) multimodal accessibility, (iii) length of public transport network, (iv) e-government and (v) human capital (as measured in terms of education levels) and per capita GDP as the designated measure of wealth and urban success. They conclude their study by suggesting that indicators positively associated with urban economic growth constitute urban 'capital stocks', which "clearly define a policy agenda for smart cities" (ibid., p.58).

Caragliu et al. (2009) seeks to account for the role of social and relational capital factors as well as social and environmental sustainability in smart urban development. In this context then, the smart city amounts primarily to an "investment program for strengthening certain location factors" (Wolfram, 2012, p.175), with smartness deemed a prerequisite for cities' ability to compete in an increasingly globalised and knowledge-based economy (Nam and Pardo, 2011).

The simultaneous adoption of the concept by the commercial sector adds a further layer of complexity to the challenge of delineating the smart city. Large global technology enterprises, such as IBM, Cisco Systems and Siemens AG as well as Hitachi, Philips, Samsung and Intel have in recent years carved out a new market for large-scale urban technology projects forecast to grow from an estimated market size of "$654.57 billion in 2014 to $1,266.58 billion by 2019" (Markets and Markets, 2014). In this commercial context, the smart city is promoted largely as one that deploys technology, which:

> *"synchronizes and analyses efforts among sectors and agencies as they happen, giving decision makers consolidated information that helps them anticipate – rather than just react to – problems [and] manage growth and development in a sustainable way that minimizes disruptions and helps increase prosperity for everyone." (IBM, 2014)*

Technology providers variously envision these technologies to be predominantly utilised and controlled by public-private partnerships of governmental and commercial actors or to be explicitly open source and offering a shared resource for all urban stakeholder groups (Greenfield, 2013).

Research by Neirotti et al. (2014, p.34) on such commercial smart city initiatives indicates that cities across the Americas, Europe and Asia Pacific focused their initiatives largely on the adoption of "hard" technology-based smart city solutions, particularly in the realms of transport, governance and energy. The authors further specifically identify the fields of urban transport alongside energy as hard domains particularly suited to the deployment of software, sensors and wireless technologies as these represent "areas where enabling technologies are more mature" (ibid., p.31). This techno-centrism when it comes to smartening urban transport infrastructure and services is not unusual. A study by Debnath et al. (2014) developing a benchmarking tool for smart urban transport cities focuses almost exclusively on technological and infrastructural features of cities' transport systems to determine their smartness.

The technology focus characterising particularly commercial as well as many urban authority-led smart city plans (compare Table 2.2) has inspired much criticism. Empirically, Hollands (2008) argues, the smart city often amounts to little more than a labelling exercise so-called "entrepreneurial cities" engage in for purposes of what Jessop (1997a) calls out as "civic boosterism and deregulatory place-marketing". To remedy this Hollands explores the notion of "a more progressive" smart city (2008, p.315). Such a city, he argues, must focus first and foremost on its human capital employing smart technologies as means to inform, empower and involve the diversity of urban inhabitants in an effort to bridge the digital divide and address "issues of power and inequality" (ibid., p.316). In this sense, Hollands clearly acknowledges ICTs as a necessary condition of the modern smart city while cautioning that it is by no means a sufficient one. This conclusion is shared by others, such as Allwinkle and Cruickshank (2011), Deakin and Al Waer (2011), and Wolfram (2012).

Allwinkle and Cruickshank (2011) specifically place an emphasis on the application of ICTs as a means to form community platforms for the liberal democratic governance of city services and their social, economic, environmental and cultural impact (see also Amin et al. 2000; Coe et al. 2000). Similarly, Nam and Pardo (2011) argue for a socio-technical conceptualisation of the smart city that explores the interaction between novel technological factors and traditional human, social and institutional factors of the city. Vanolo (2014) likewise favours a critical engagement with the techno-centrism of the current smart city discourse, as outlined in his paper on the indiscriminate "smartmentality" pervading research, policy and practice. Echoing Hollands (2008), Allwinkle and Cruickshank (2011) and Vanolo (2014) argue that a critical interrogation of the politics of the smart city is required to enable alternative framings of urban challenges other than as mere technological (optimisation) problems. These criticisms also find reflection in recent publications of more holistic frameworks for the evaluation of cities' smartness, which consider socio-economic, political and institutional dimensions among the significant indicators of potential smart cities (e.g. Lee et al., 2014; Kourtit et al., 2014).

Other authors similarly treat the smart city concept with marked scepticism: Greenfield (2013) comprehensively explores various commercial smart city visions, disassembling the smart city rhetoric in great detail to identify "just what kind of place" the smart city is and is not. According to Greenfield this rhetoric has brought about "a premature and pre-emptive consensus ... around the desirability of something called the smart city" – pre-

empting, in particular, questions regarding power, privilege and justice at the urban scale. He, therefore, argues for a critical interrogation of the normative assumptions underpinning the commercial smart city rhetoric that "sets agendas, influences perceptions of what it means to be 'advanced', recalibrates norms and guides the allocation of resources" and thereby curtails "an entire space of sociotechnical possibility to the airless hegemony of [the technologically smartened city]" (ibid., loc.1364).

The above discussion of various interpretations of the smart city concept reveals little agreement and much criticism.[7] As Kramers et al. (2014) point out, the sole unifying characteristic and conceptual content of these divergent interpretations may be seen in their (varying degrees) of emphasis on ICTs as means for cities to gain competitive advantage in a growing world of cities. Whether it is political, cultural, economic or social advantage, the desirability of the smart label to cities is self-explanatory (Hollands, 2008, Vanolo, 2014). What remains questionable is the "substance behind the claim of being 'smart' or how that links to sustainability" (Kramers et al., 2014, p.53).

Overall, the smart city concept remains far from uncontroversial or readily operationalised in the service of innovating for more sustainable urban futures (see more recently e.g. Taylor Buck and While, 2017). In light of this, narratives of technology-based smart urbanism, as are particularly prevalent in the transportation sector, demand critical appraisal (Lyons, in press). Not least because they posit a very reductive and short-term vision of what smarter urban transport futures might look like. Based on their commitment to high mobility at reduced environmental and social cost, such future transport scenarios may promise little beyond technologically-optimised extrapolations from the status quo.

Therefore, radically altering the environmental impact and sustainability of urban transport systems and activities may once again demand thinking outside of the proverbial box. The following section compares and contrasts several alternative, though by no means mutually exclusive, narratives of the role and function of transportation in cities. The discussion is intended to provide an overview of the different values and rationalities

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[7] Of course, it is largely paradigmatic and highly stylised conceptions and narratives of the smart city that have been criticised in the literature to date. Shelton et al. (2014, p.22) point out that a less polemic and more productive engagement with the concept of the smart city requires examination and theorisation of the "actually existing smart city". For, it is only "through a grounding of our analysis in the actually existing cities, territories and relationalities where these policies are being constructed and implemented that we can understand both the promise and the peril of the smart city model", they suggest (ibid.).

informing urban transport provision while evading overly narrow conceptions of the proper shape and purpose of transport in the city based on the status quo. This discussion is interspersed with information illustrating how these narratives and rationalities have influenced historic and recent transport policy and practice, specifically in the UK, but also beyond.

Contrasting narratives of transportation in the city

Transport and the economy

Historically, transportation has been a key driver in the expansion and economic development of cities (Grant, 1977 as cited in Vigar, 2002). Aiding what Marx (1973, p.538) termed economic capital's project of "the annihilation of space through time", transportation, alongside communication technologies, serves to minimise spatial barriers to economic interaction in the city and "reduce to a minimum the time [people, goods and ideas spend] in motion from one place to another" thereby making them more readily and profitably exchangeable in the marketplace (see also Harvey, 2006, p.100). A central role of transport in the city is in this context the facilitation of economic interaction by connecting people, goods and ideas at a high speed, low costs and with considerable safety.

Informed by economic expediency, these criteria dominated particularly UK road transport policy making until the late 1990s: following the dogma of *'predict and provide'* transport planners forecasted traffic rates to provide the infrastructural capacity necessary to ensure smooth traffic flow and maximise economic competitiveness. Such a policy, while suitable to maximise inter-urban passenger and goods flows, creates substantial problems within cities and towns where these flows concentrate (Docherty and Shaw, 2011). In response to high levels of congestion and pollution in their centres, cities expanded into sprawling suburban settlements (Hickman and Banister, 2014).

Despite cities spreading out further in space, average travel time has remained relatively constant over the decades (Lyons and Urry, 2005): a stagnation made possible only through substantial increases in speed and reach of the transport networks servicing cities (Banister, 2011a, 2011b, 2008). Likewise, travel time savings resulting from greater transport efficiency allowed travellers to make journeys over greater distances without increasing the average time spent travelling (Metz, 2008). Motorised modes of transportation - individual automobility in the sprawling suburbs and public transit in the

congested city centres - became favoured over active modes, such as walking and cycling (see e.g. for the case of London: Banister, 2011a; for other European cities see: Hartog, 2005, 1999). Urban sprawl, though resulting from efforts to alleviate high levels of urban congestion and pollution, only served to increase dependency on motorised modes, thereby exacerbating negative transport externalities further.

During the 1990s, this realisation, intermittently led to a *'new realism'* (Goodwin et al., 1991) among UK transport policy makers seeking to balance the demands of economic competitiveness with growing concerns about the sustainability of transportation policy. However, the notion that infrastructure provision generates economic growth remains alive and well and with it the imperative to alleviate congestion through the construction of additional infrastructure (Goulden et al., 2014), despite a persisting lack of conclusive evidence in support of this link (Banister, 2012; Banister and Berechman, 2000). In the UK specifically, a Royal Automobile Club (RAC) Foundation publication entitled "Motoring towards 2050: Road and Reality" (Banks et al., 2007) called for "renewed, large scale road building so that ever-increasing congestion does not further damage the UK's economic competitiveness or quality of life" (ibid., p.244). These calls were answered by the former Coalition Government when Chancellor Osborne committed firmly to "spending more on new roads than in a generation" in his 2013 Budget speech (HM Treasury, 2013; see also: DfT, 2015, 2013a, b). According to Banister (2011b, p.1540), this and similar transport infrastructure investment strategies in low- and high-income cities across the globe are driven by an overwhelming appetite for economic growth posited as an "imperative [which] often takes precedence over other priorities".

Transport and sustainability

Sustainability is one such urgency, which, though of increasing significance to urban policy making, is rarely prioritised in the context of transport decision making. Following the ratification of the Kyoto Protocol in 1997, governments in the UK and beyond concluded that "[s]imply building more and more roads is not the answer to traffic growth" (DfT, 1998, p.3). With the publication of its "New Deal for Transport" the UK government replaced 'predict and provide' with an explicit *transport demand management approach* (TDM). Similar approaches were adopted across the EU, Australia, New Zealand and the US (here under the title *travel demand management*) in an attempt to moderate mobility demand through measures, such as speed management, traveller information, demand-responsive pricing and the promotion of public and active modes of travel (United States Department of Transportation, 2012, 2006).

This historic shift in transport policy thinking, particularly at the urban scale, at the time reflected a heightened concern over the social and environmental impact of increasing levels of traffic congestion and emission pollution. Since then the issue of "solving congestion" (Goodwin, 1997) has been increasingly exacerbated by the pressing demand to address climate change and the emission intensity of current transport practices (Hickman and Banister, 2014; Lyons, 2012).

The urban scale has, therefore, become a particular focus in addressing the challenge of climate change and emissions (Bulkeley et al., 2013) as cities and towns around the world are estimated to account for 70 per cent of energy-related CO_2 emissions (IEA, 2016). Transport, more specifically, contributes around 13 per cent of global greenhouse gas emissions, of which between 60 and 70 per cent derive from urban transportation activities (UN Habitat, 2011). In addition to contributing to global climate change, transport causes significant pollution and adverse health effects at the local urban scale (Woodcock et al., 2009). Following several high-profile international policy reviews (King, 2007a, b; Stern, 2008, 2006), governments focused their strategic efforts mainly on the development of ultra-low emission vehicles, the adoption of alternative fuel sources and the promotion of modal shift and behavioural change (see e.g. Commission of the European Communities, 2007; HM Government, 2011; United States House of Representatives, 2008).

Interventions aimed at facilitating behavioural change hold great promise to deliver large-scale short-term emission reductions. However, proponents of such changes, particularly in the UK and US, rely heavily on soft policy measures that seek to 'nudge' or incentivise consumers instead of instantiating hard legislative restrictions to induce the desired changes in individual travel behaviours (Goulden et al., 2014). This, however, is problematic, as nudges alone are not deemed sufficient to induce lasting changes in travellers' underlying reflective decision-making processes (Avineri, 2012; Avineri and Goodwin, 2010). Goulden et al. (2014, p.144) further emphasise the parallel popularity of "nudging" in the market sphere where consumers are systematically incentivised "away from low carbon behaviours" and towards consumption patterns that facilitate economic growth. This conflict is most evident in governments' efforts to incentivise modal shifts away from individual car-based mobility vis-à-vis the automobile sector's tireless "promotion of the status quo (i.e. car dominance)" through powerful advertising campaigns that frame automobility as a lifestyle and status affirmation rather than a mere mode choice (ibid.).

Transport and technology

The extensive promotion of technological fixes to the transport emission problem on the other hand, gives further weight to the underlying mainstream understanding that "society still values continued mobility as now, but the technology should become much cleaner" (Hickman and Banister, 2014, p.33). Such cleaner technologies include, amongst others, fuel-optimised engines and a wide range of alternative low-carbon fuels (e.g. biofuels, electricity, and hydrogen). Further incremental improvements are expected to come from the development of new materials and improved vehicle designs as well as energy recovery technologies and so-called idle reduction technologies. Driverless vehicle and associated sensor technologies, though at the point of writing their widespread application is still far from reality, also promise substantial increases in transport efficiency by allowing for the "platooning of vehicles at high speeds" (Mokhtarian, 2009).

However, the emphasis on technological innovation as a main driver of carbon emission reductions is contentious. As Hilty et al. (2011, p.23) point out in the context of ICT innovation, "[s]ustainable development cannot be achieved by decoupling strategies alone": without accompanying lasting changes in mobility practices and individual travel behaviour, technological improvements bear the risk of prompting rebound effects (see Box 1. Below for more details) similar to the additional transport demand induced by expansion of road space in previous decades (Goodwin, 1996; Herring and Roy, 2007).

Box 1. Insights from transport economics, Jevons' Paradox and rebound effects

The issue of rebound effects links closely to a phenomenon first described by economist William Jevons in 1865 (Jevons, 1865 as cited in Alcott, 2005) and subsequently called Jevons' Paradox. According to Jevons' Paradox, technological efficiency improvements are often accompanied by reductions in the individual and/or social costs of transportation, such as fuel cost savings or emission reductions, respectively. In the long term these cost reductions may in turn lead to additional demand for transportation and mobility (*induced demand*). Thus, short-term technological efficiency improvements and associated reductions in the relative costs of transportation activity may be partially or even wholly offset by induced increases in absolute transport activity and associated resource consumption (*rebound effect*) in the long term.

To understand Jevons' paradox and the implications of technology-based efficiency gains in transport consider the example of automobile engine technology: a hypothetical innovation in engine technology allows car drivers to travel a distance of 100 km at reduced costs to (a) the individual motorist (e.g. in terms of travel time, expenditure, convenience) and (b) society at large (e.g. in terms of emissions, consumption of finite fuel resources). The Jevons paradox posits that if technological innovation allows individual drivers to make the same 100km journey at a smaller cost

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to themselves and society they are likely to reinvest some of these 'savings' by driving more often or for longer distances (*direct rebound effect*). As such, the paradox implies that the originally realised individual and social cost savings are likely to be to some extent offset by increases in aggregate motoring activity.

However, the literature suggests that direct rebound effects rarely exceed or even match the efficiency savings generated through technological innovation in the first place (Gillingham et al., 2015). In connection with this, consider the example of average travel time budgets having remained broadly stable at 1-1.1 hours/day over the course of successive technological improvements in transport (Metz, 2008): a hypothetical innovation in engine technology that enabled motorists to travel a 100km distance at half the monetary and environmental cost would unlikely induce drivers to travel twice the distance (unless travel speed doubled at the same time).

In microeconomic terms improvements in engine technology may, therefore, lead to a reduction of the social and individual costs of motoring and short term efficiency savings overall. At the macroeconomic level and in the long term, cost and efficiency savings in the motoring sector may, however, be reinvested in other activities or sectors. This occurs when drivers reinvest savings made on motoring in other transport activities, such as flying, or in other consumptive activities altogether (*indirect rebound effect*). These reinvestments may lead to growth in production and consumption overall. Consequently, direct and indirect rebound effects combined tend to increase aggregate productive and consumptive activity and associated individual and social costs (see also Saunders, 2015).

It is, therefore, reasonable to expect that short-term efficiency gains from technological innovation in urban transportation will induce additional demand for transport in the long term (direct rebound effect). Of course, the newly induced transport demand may not offset the reductions in externalities from transport in their entirety. However, recent research (see, for example, Gillingham, et al., 2015; Saunders, 2015) has pointed out that efficiency improvements in one area of consumption may lead to an increase in other areas of consumption (indirect rebound effect) thereby potentially exacerbating environmental externalities overall. The sheer magnitude of global and local emission reductions required, both in the transport sector and beyond, suggests that technological improvements are a necessary, yet by no means a sufficient solution in response to climate change (Anable and Shaw, 2007; Hickman and Banister, 2014; Stern, 2006).

Smart urban transport

The concerns outlined above have done nothing to dent the persistent enthusiasm for technology-based solutions to cities' emission problems, which has most recently driven international enterprises, such as IBM, Cisco Systems and Siemens, to broaden their

commercial smart city offerings.[8] These promote high-tech, networked information and communication infrastructures, including cloud computing, sensor and radio frequency identification (RFID) technologies, to maximise the efficiency and minimise the environmental impact of urban service delivery. As mentioned in the earlier review of the broader smart city literature, smart city interventions in the realm of the urban transport sector focus particularly heavily on "hard" material interventions in the urban transport system (Debnath et al., 2014; Neirotti et al., 2014).

These commercial ICT based smart city initiatives contrast starkly with bygone visions of ICTs directly substituting for transport (Mokhtarian, 2009). Instead, commercial smart city transport initiatives advocate the implementation of large-scale ICT solutions to increase the efficiency of urban transportation systems, both in terms of time and money spent travelling. However, Mokhtarian (ibid., p.6) identifies succinctly that though the

> *"congestion-improvement goals of such applications is laudable, […] increasing the speed of travel (whether through making more efficient use of existing capacity, or adding new capacity) does not ultimately reduce trips or improve congestion."*

Instead, research has found that ICT innovation substitutes only a relatively small portion of individual travel. At the same time, ICTs complement and augment existing travel, thereby generating a substantial amount of additional travel, which may not otherwise have been undertaken (Hilty, 2008; Mokhtarian, 2009). This applies to passenger transport as well as to freight transport where applications, such as Global Positioning Systems (GPS) and RFID, improve the speed and cost effectiveness of logistics activities. In line with general equilibrium theory, resulting decreases in consumer goods prices induce increased consumer demand, which in turn requires the movement of more finished goods and raw materials (Hilty, et al., 2006). The consequence is increased transport demand that yet again will have to be accommodated by existing transportation networks.

More encouraging in this context is the concept of 'shared mobility', which is in large parts directly enabled by ICTs. Here the use of ICTs for capturing, processing and providing real-time information on the availability of shared means of mobility has the potential to bring about lasting shifts in vehicle ownership patterns (Mont, 2004).

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[8] Note that this commercial smart city interpretation centres explicitly around the use of networked ICTs. In this sense, it represents a significantly limited concept compared to some of the richer notions of the smart city considered for example in various academic research as discussed at the beginning of this chapter.

Promising examples are the rapid expansion of bicycle share schemes globally (Larsen, 2013; Parkes et al., 2013), car-sharing (Prettenthaler and Steininger, 1999; Transit Cooperative Research Program, 2005) and smart para-transit (Sperling and Gordon, 2009). However, the role of ICTs as facilitators of fundamental changes in urban mobility cultures, transport consumption and vehicle ownership patterns remains a relatively new field of research (see also: Meyer and Shaheen, 2017, Shaheen, 2016). Likewise, urban transport policy often considers these disruptive technology-enabled transport innovations "almost as an afterthought" to less radical solutions, such as electric vehicle technology and other alternative fuels (Hickman and Banister, 2014, p.33).

Connectedly, it may be said that technologically smart and sustainable transport systems remain wedded to the paradigm view of transport as a derived demand. Connectedly, their imperative is to enable high mobility and transport efficiency by improving travel flow (Banister, 2011a) and reducing externalities, such as congestion and the environmental impacts of urban transportation activities. Transport in the technologically smart city is, therefore, focused strongly on maintaining (or even increasing) current mobility levels and transport practices whilst looking towards technology and ICT applications to reduce the resulting detrimental social and environmental impact. Especially in a complex urban system, such as transport, these technology-based initiatives bear significant risks of inducing unforeseeable rebound effects (Berkhout et al., 2000; Chakravarty et al., 2013; Hertwich, 2005).

Alternative transport and mobility futures

However, particularly in the academic field of transport research, there continues to exist a wide literature challenging entrenched social and cultural assumptions underlying past and present transportation policy. This literature harbours aspirations for a genuine departure from mainstream (urban) transport policy making and practice, which as the previous sections illustrated, is often heavily informed and motivated by:

(i)   an implicit understanding that current (and increasing) levels of mobility remain desirable (Hickman and Banister, 2014);

(ii)   a primary focus on decoupling current mobility practices and their adverse effects (e.g. congestion and pollution) without due consideration for rebound effects (Hickman and Banister, 2014, p.72);

(iii)   overarching concerns for economic expediency, similar to those which informed the old 'predict and provide' paradigm (Docherty and Shaw, 2011; Goulden et al., 2014; Lyons, 2012);

(iv)   a partiality towards technological fixes over the pursuit of lasting change in individual travel behaviour and societal mobility practices (Goulden et al., 2014; Hickman and Banister, 2014).

Such a departure would demand a critical engagement with the social and cultural roots of current mobility and transport rationalities: for a start, the overriding conception of travel time as a negatively valued expense to be minimised is best understood as a social construct of the market society in which time is money. Several authors (Banister, 2011a, 2011b, 2008; Lyons and Urry, 2005; Sheller and Urry, 2006; Urry, 2007) have highlighted that the imperative of travel-time minimisation, which continues to dominate transport planning, is based on the overly simplistic notion of transport as a derived demand. Counter to the understanding of travel as a mere intermediate good that enables the pursuit of beneficial activities, they argue that travel should be conceptualised as a valued activity (Banister, 2011a; Moktharian, 2009) that occasions the pursuit of a variety of other productive or leisure activities (Lyons and Urry, 2005; Sheller and Urry, 2006). Understanding transport as such a 'multitude of mobilities' (Sheller and Urry, 2006) would then require transport planning to more systematically take account of a variety of positive values associated with the experience of travel, such as comfort, social interaction and access to amenities that can turn e.g. commuting time into productive time. Indeed, a growing literature suggests that some transportation activity could and should be valued as worthwhile in and of itself provided time on the move can be 'unlocked' for productive activity (Banister et al., 2016).

Reconsidering the positive values associated with travel would inevitably bring to light and into discussion the societal choices, norms and logics of society's spatial organisation that today motivate an ever-increasing demand for mobility. Connectedly, Goulden et al. (2014, p.146) highlight that such reconsideration would demand us to

> *"examine how and why certain patterns of movement have come to be regarded as fundamental to the societies in which we live, and whose voices and interests have come to dominate in that assessment."*

If applied in practice such positive valuation of travel time could then offer a counterpoint to the drive for ever increasing speed and range of transportation systems and services.

Intricately connected to a genuine departure from the high mobility patterns dominating current transportation practices is, therefore, the challenge of rebalancing economic concerns with the overarching goals of social equitability and environmental sustainability (Banister, 2011b; Lucas et al., 2016; Martens, 2017; Urry, 2008). Bruun and Givoni (2015) further highlight the importance of integrated land use and transportation planning for reducing the need for mobility while increasing accessibility, sustainability and quality of life in urban areas.

At this point it is important to emphasise that the presented discussion of the logics and narratives driving urban transport development has more or less explicitly focused on cities of the Global North. At the same time, it has undoubtedly highlighted valuable insights that could be of use to expanding cities of the Global South looking to safeguard against the unfettered growth of individual automobility and the associated lock-in into unsustainable social practices and land use patterns many cities of the Global North are experiencing today.[9] And already lessons have been drawn and strategies articulated to put growing mobility demands in the Global South on a more sustainable footing. What is more, the strategies articulated and implemented in the Global South could inform more equitable and sustainable transport policy making and practice in cities of the Global North. One example of a concrete transport paradigm, which is widely advocated in cities of the Global South, is the paradigm of 'avoid-shift-improve' (A-S-I). Formalised by the German Gesellschaft für Technische Zusammenarbeit (GTZ; Dalkmann and Brannigan, 2007) this approach has in recent years been advocated by the Gesellschaft für Internationale Zusammenarbeit (GIZ), the United Nations (UN; previously as part of their Millennium Development Goals, more recently in the context of the United Nations Sustainable Development Goals), the International Energy Agency (IEA, 2013) as well as EMBARQ (Dalkmann, 2012), a program of the World Resources Institute focused on the development and promotion of sustainable urban transport systems.

The A-S-I paradigm prioritises spatial planning and travel demand management policies in order to slow urban mobility growth and *avoid* unnecessary transport activity and associated rising energy use and emissions. Secondly, the paradigm advocates the *shift* of unavoidable transport journeys away from motorised to more energy efficient modes, such as active and public transit or rail and waterways for logistics purposes. The paradigm

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[9] This is not meant to suggest that cities of the Global South and North are merely at different chronological stages of a single trajectory of development leading "from tradition to modernity" (Pletsch, 1981).

ultimately advocates to *improve* journeys relying on motorised modes that cannot otherwise be shifted or avoided in the first place (Dalkmann and Sakamoto, 2011). Such improvements may be achieved based on fuel-efficiency and a wide range of other technological improvements. Therefore, the A-S-I framework may be said to deviate genuinely from dominant transport policy and practices by (i) challenging the paradigm of high mobility, (ii) prioritising a socially equitable mix of active and public transportation modes and (iii) attributing technology a tertiary and fundamentally subservient role in the shaping of future urban transportation systems. It is important to note, however, that opportunities for deliberate coordination of spatial planning and transport demand management policies are much greater in contexts, such as the Global South, which is seeing rapid expansion of cities into previously undeveloped land. In the context of existing settlements of the Global North, characterised by high densities and mixed land uses, such coordinated interventions can be much more complicated as they demand arbitration of various, and at times competing public and private interests.

2.2. Critique

As the preceding review sought to show, urban transportation systems are under strain to both adapt to and mitigate against the adverse effects of climate change, population growth and urbanisation trends while enabling the unencumbered movement of goods and people. In connection with this, competing and at times conflicting demands are being placed on urban transportation systems as outlined in the previous section. This makes urban transport innovation a particularly complex undertaking.

In recognition of this complexity, the following section 2.2 of this thesis initially conceptualises the challenge of urban transport innovation as a '*wicked' social problem* (Head, 2008; Head and Alford, 2013; Røste, 2014) with significant implications for thinking, researching and doing innovation for sustainable urban transport futures. The section argues that material-technological innovation, such as alternative fuels, novel engine types and sensors and similar ICTs will unlikely suffice to address these problems in all their complexity. In addition, immaterial, social innovation, e.g. in urban planning practices, efficient driving behaviour, regulatory changes and individual consumption practices are of equal importance in shaping transportation trends and mobility preferences. Strategic social *and* technological – i.e. socio-technical – innovation should, therefore, be considered both a key aim and response for cities facing the above outlined economic, environmental and social challenges. To close, the chapter introduces and

defines the key terms – *socio-technical* and *innovation* – as used in this thesis, before presenting a brief review of the socio-technical innovation literature with a specific focus on socio-technical change (or transitions) towards sustainability.

'Wicked' problems, complex solutions

As has been illustrated to some extent already, innovation towards more sustainability in the urban transportation sector poses a particular challenge due to a number of reasons: on the one hand, cities are places where a variety of consumption and production activities, all of which are to a greater or lesser extent dependent on transportation, are concentrated in space. Therefore, urban transportation systems need to be planned, built, maintained and controlled to satisfy the competing interests of different public and private user groups and associated modes. The notion of transportation as a derived demand has further led to transport provisioning being considered to play a key role in fostering regional economic development, local regeneration and social inclusion, above and beyond simply enabling the movement of goods and people from A to B (Deakin, 2001).

Another challenge arises from the way in which urban transportation systems are managed and funded. The planning, building and maintenance of road as well as public transit infrastructure remains largely managed by the public sector. However, different elements of urban transport infrastructures may variously be subject to broader local, regional or national transport interests with public and private actors at different geographical and institutional levels impacting on different aspects of transport policy making and infrastructure provision, maintenance and management (see e.g. Gudmundsson et al., 2016; Marsden and Rye, 2010).

The London road network is a particular example: here, Transport for London controls major roads, which form the Transport for London Road Network (TLRN) and account for around 5 per cent of London roads and about 30 per cent of total traffic volume in the capital (TfL, 2013a). Meanwhile, local authorities manage the remaining roads in their own boroughs. Traffic flows, however, are regulated primarily by TfL who control traffic signalling across Greater London as a whole (TfL, 2017a).

Furthermore, public transport authorities in London and beyond are growing more reliant on private sector actors and their planning and engineering expertise to deliver urban road

and other transport infrastructure.[10] From a financial perspective, on the other hand, transport infrastructure and service provision is increasingly dependent on a mix of funding streams including revenues from public transit operations as well as national, supra-national and private funding sources (see e.g. Fenton and Paschek, 2018; Raco, 2013). With finance, administrative, operational and maintenance responsibilities shared among such a rich mix of public and private actors across geographical and political scales, transport systems are subject to *complicated multi-level governance arrangements* (Gudmundsson et al., 2016). Innovating urban transportation systems may, therefore, be described as a complex social planning task that requires arbitration between a variety of stakeholders, including residents, visitors, businesses, and public and emergency services, who may have shared as well competing strategic interests in the public service of urban transport provision.

The competing and at times conflicting demands placed on current and future urban transportation systems and the resulting complexity of the transport innovation task, as outlined in previous sections, call to mind the public planning concept of '*wicked problems*' (Head, 2008; Head and Alford, 2013; Røste, 2014).

Box 2. Wicked social problems

First introduced and formalised by Rittel and Webber (1973) in their treatise on 'Dilemmas in a General Theory of Planning', social planning's wicked problems are thought to be fundamentally different in nature from the tamer problems natural scientists and engineers tend to face and solve. They escape neat and exhaustive description since delineating the full extent of a wicked problem would require advance knowledge of all possible solutions to the problem itself. Or, as Rittel and Webber (ibid., p.161) put it: "Problem understanding and problem resolution are concomitant to each other."

As such, wicked problems lack definitive solutions. Provisional solutions in turn can never be judged true or false, but only be deemed good or bad at addressing a wicked problem as per the parameters within which it has been described and delimited. As a consequence of the artificial problem delineation, provisional solutions to wicked problems inevitably impact aspects of social reality that have not been captured in the formal problem definition generating "'waves of consequences over an extended – virtually and unbounded – period of time" (ibid., p.163), which can neither be exhaustively foreseen ahead of time nor traced over a limited time-span.

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[10] Outside of London, private business has an even more direct influence on strategic transport investment decisions having been asked by the UK government to partner with councils to form Local Enterprise Partnerships in the delivery of regional economic growth (HM Government, 2010).

Wicked problems are, therefore, best understood and treated as one-shot problems with no opportunity for trial-and-error. The waves of consequences resulting from any solution implemented to alleviate a wicked problem alter the subsequent problem space irreversibly. Alleviating or reversing the consequences of one solution to a wicked problem demands the engagement with a new set of wicked problems. There exists no exhaustible set of solutions to a wicked problem, nor exists a well-described and limited set of permissible actions that may be taken to solve the problem. "Every wicked problem is essentially unique" (ibid., p.164), so although some wicked problems may share substantial features in common "one can never be certain that the particulars of a problem do not override its commonalities with other problems" dealt with previously.

Finally, every wicked problem is always also a symptom of another higher order wicked problem. Thus, any attempt to solve a wicked problem must aspire to go beyond the mere treatment of symptoms while formulating the problem at level were something can be done about it. "The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution." (ibid., p.166).

Contemporary challenges, such as climate change, population growth and urbanisation have long been identified and treated as wicked social problems (Head, 2014; Levin et al., 2012; Ney, 2009). Understanding urban transportation innovation as being both at the overlap of these wicked social problems and a wicked social problem itself has multiple implications:

Firstly, the fact that wicked urban transport problems may be delimited in a multiplicity of ways depending on the viewpoint of the respective analyst highlights how any attempt at description of and intervention in these problem spaces is fundamentally politically mediated (Benington and Moore, 2011). Likewise transport policy and infrastructural interventions themselves proceed via situated planning and implementation processes. Therefore, wicked urban transport problems, much like potential solutions and their practical implementation are fundamentally socio-spatially unique. As Borrás and Edquist (2013, p.30) highlight, though

> "some policy instruments are similar in their ways of defining and approaching a problem, there will always be substantial differences not only in terms of the concrete details of how the instrument is chosen and designed, but also in terms of the overall social, political, economic and organisational context in which the instrument is applied."

Following from this, it is unlikely that generic smart solutions to wicked urban transportation problems exist. Neither are they likely to be politically neutral and readily transferable from one urban context to the next. Consequently, the formulation of smart

solutions to urban transportation problems demands a balanced engagement with the various facets of locally specific transportation issues, such as the diverging social, political, technical, economic and environmental concerns and histories characterising them. It is vital that these aspects find consideration when formulating and negotiating solutions for more sustainable urban transport futures. Otherwise it must be feared that generic solutions transferred into specific locales conjure up waves of irreversible consequences and generate new potential problems that require complex point-specific solutions.

Secondly, and on an abstract level, thinking of urban transport innovation as a wicked problem invites thinking about urban transport, its constitutive systems and processes, as part of a complex open city system rather than as a defined and delimited process or system of processes that can be engineered and optimised in isolation from other city functions. This also draws attention to the reciprocal interaction between established urban transportation systems and practices and the wider problems and processes of climate change and urbanisation, etc. This becomes particularly salient in connection with the traditional conception of transport as a derived demand. In this sense, urban transportation systems fundamentally support and are supported by other urban processes and practices. Therefore, attempts at innovating urban transportation systems and practices should consider the possible desirable and undesirable repercussions these interventions may have on connected urban systems and processes as well as social practices.[11] Furthermore, the search for smarter urban transport systems should incorporate a concern for aspects of other city systems and go beyond mere transport technological innovation and efficiency improvements.

Finally, conceptualising innovation in urban transportation systems as a wicked problem invites a systematically critical engagement with established transport patterns and the social practices giving rise to them. It can thereby open up the processes of problem formulation and resolution in urban transport making them amenable to problem interpretations and potential innovations that fundamentally deviate from the dominant paradigm of transport as a derived demand and the high mobility imperative.

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[11] A historic example of this are the changes in land use patterns and growth of urban sprawl which were both enabled by and enabling the advent of individual motorised mobility (Urry, 2004).

A literature that has focused strongly on the investigation of such paradigm shifts, or *transitions* from one system of production and consumption to another is the literature on *socio-technical innovation* or *socio-technical transition studies*.

To briefly introduce this literature, the following final sections of Chapter 2 trace its genesis from the original conception of innovation as a residual category in economic theory to the notion of innovation diffusion as a process of societal embedding of technological novelty. The chapter closes by introducing the literature on socio-technical systems theory.

From innovation to socio-technical innovation

The word "innovation" tends to evoke a mental image of highly engineered novel products, services or production processes - a conception heavily informed by the business studies, economics and engineering disciplines. However, the discussion of urban transport narratives in Chapter 2 highlighted much greater scope for innovation beyond mere material technological artefacts and including innovations in societal organisation, cultural value systems and the transportation practices and mobility patterns they inform.

Fundamentally, and in line with Rogers (1983, p.11) an innovation may be any "idea, practice, or object that is perceived as new by an individual or other unit of adoption". Crucially, innovations are inventions or novelties that are successfully diffused i.e. brought to market and into societal use. Inventions without a market and without societal application run the risk of remaining just that – inventions rather than innovations. The innovation concept is, therefore, tightly linked with the process of innovation diffusion.

However, the process of innovation diffusion was long disregarded as a phenomenon worth researching, despite innovation being identified early on as one of the prime sources of economic growth in capitalist economic systems by scholars, such as Karl Marx and Joseph Schumpeter. The latter poignantly defined innovation as a process of "creative destruction" (2003 [1976]). Nonetheless, traditional economic theory long conceptualised technological change as a matter "to be tackled by engineers and scientists" (Freeman, 1994, p.463) and a factor largely exogenous to the production function. As a consequence, neo-classical economic theory considered technological progress only insofar as it served to explain residual economic growth after all other factors of the production function had been accounted for. By modelling technical progress as a shift of the production function and equivalent to a global increase in factor productivity neoclassical theory managed to

endogenise at least the effects of innovation, not, however, the causes underlying it (Beckert, 2002).

Seeking to theorise the drivers of technical progress, economists articulated various theories, including that of *demand-pull*, which considers stated consumer needs as among the prime drivers of innovation. An example of this view is Rogers' theory of the "Diffusion of Innovations" (1983), which understands innovations as largely non-malleable, finished material artefacts – though also including an immaterial knowledge-based component – which are either adopted or not. However, Rogers' perspective leads to an overemphasis of the significance of demand factors, such as user expectations for the success of the diffusion process, while the role technology suppliers may play in gradually adapting technologies to meet or even shape adopters' demands and expectations is largely neglected. Conversely, theories of *technology-push* assume the relative autonomy of the innovation diffusion process from such consumer signalling.

Although both technology-push and demand-pull theories have been helpful in the study of incremental innovation, they have been considered insufficient for understanding more radical and systemic technological change.[12] While incremental innovations tend to offer similar functionalities as existing dominant technologies coupled with greater efficiency, *radical innovations* compete with and displace existing dominant technologies based on offering radically new and superior functionalities. As such, radical innovations have the potential to be much more disruptive to existing markets and the social practices, norms and institutions that sustain them than incremental innovations. To realise their full innovative potential radical innovations, therefore, to some extent require the formation of new markets, social practices, norms and institutions.

Consider the example of fuel technologies as a case of incremental innovation in the motorised transportation sector: car engines variously running on biodiesel, ethanol, compressed natural gas, liquefied natural or petroleum gas or using hydrogen, fuel cells, hybrid-electric or fully electric propulsion undeniably constitute genuine technological innovations. However, none of these innovations has fundamentally disrupted existing markets, user practices or the norms and institutions that constitute the dominant paradigm

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[12] For a typology of innovation see Freeman and Perez (1988) who distinguish four types of innovation according to the depth and breadth of their impact on their wider societal context: incremental and radical innovations, new technology systems, and changes of techno-economic paradigm.

of individual automobility in the transport sector.[13] If anything, these incremental improvements have served to further sediment the dominance of the motor car and the individual automobility paradigm by gradually cleaning and greening a technology that has been subject to on-going sustainability concerns. From this perspective, novel fuel technologies may be considered incremental innovations within existing social, technological and economic systems favouring motorised transportation and individual automobility, as opposed to radical innovations that challenge said paradigms.[14]

Radical innovations, by extension, must, therefore, not be thought of as non-malleable, in the sense that they enter society or a market as a finished material or immaterial technology with pre-defined possibilities of relating to and being applied within a pre-given social, economic and technological context. Instead, their diffusion is best conceptualised as a complicated process involving a process of societal embedding, i.e. a mutual coevolution between technology and its societal context (Deuten et al., 1997).

Recognition of this eventually led research in the field of innovation studies to depart from linear models of market- or technology-driven innovation diffusion in favour of complex interactive systems perspectives on innovation (Freeman, 1994). These sought to offer more sophisticated innovation diffusion theories that could better account for the complex interaction of technological, social and economic factors in driving the innovation diffusion process than existing reductive demand-pull or technology-push theories (Dosi, 1982). Such systems-based perspectives on social and technological, i.e. *socio-technical innovation* explicitly recognise that technological novelty, whether material or immaterial, always diffuses against a backdrop of already existing technologies, markets, associated practices and institutions (Kemp et al., 1998).

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[13] Judging purely from a fuel engineering perspective one can, of course, come to the conclusion that each of these technologies represents a significant, perhaps even radical departure from traditional fuels. This highlights the need to make judgments as to the degree of innovativeness of novel technologies *in context*. In the case of this thesis the radical nature of an innovation is to be judged based on whether its societal application has incremental or radical impact on the wider organisation of society and social practices.

[14] Note, however, that what constitutes a radical innovation is relationally defined and thus relative. Innovations in fuel technologies may be deemed incremental innovations based on their impact on the automobile market and associated practices of owning and driving a car. The same technological innovations may, nonetheless, have a high potential to cause disruption e.g. to the prevailing order in underlying energy and fuel markets. A case in point is the technology of electric vehicles, though it has to date not realised its disruptive potential due to being largely marketed and used as a substitute for the combustion engine.

Systems approaches to the study of socio-technical innovation

Initially research on *large technical systems* (Hughes, 1986, 1983), *sectoral innovation systems* (Breschi and Malerba, 1997) and *technological systems* (Bijker et al., 1987; Carlsson and Stankiewicz, 1991) was concerned with demonstrating that technological innovation in large-scale sectors and industries, such as waste management, water and electricity supply, and transportation, is a complex process involving the coevolution of various actors, institutions and technologies. These approaches conceptualise the emergence of innovations mainly from a supply side perspective, focusing on the organised production of innovative technology by firms or entire industrial sectors.

In contrast, *socio-technical systems theory*, which developed at the overlap of these early systems perspectives on technological innovation, further incorporated the user perspective, i.e. dynamics of the diffusion, application and use of technology. In this sense, socio-technical systems theory builds on the recognition that technologies (their producers and production processes) themselves shape and are shaped by the broader social and economic systems within which they are embedded and which they seek to serve. A connected central assumption of the theory is that technologies align with other elements of a socio-technical system to form "configurations that work" (Rip and Kemp, 1998, p.330) in the sense that they "fulfil societal functions" (Geels, 2004, p.900).

Overall socio-technical systems theory seeks to investigate and explain systems innovation – so-called *transitions* – as constituting radical shifts from one socio-technical configuration to another (Geels, 2004). Central to such transitions is the coevolution of material and immaterial, social and technical components (such as firms, markets, social norms, user practices, policy, laws and regulation, artefacts and infrastructure, etc.) and their meshing to create novel complex and relatively stable socio-technical configurations. Hughes (1986) referred to these configurations as 'seamless webs' to imply "that the evolution of technology and the evolution of society cannot be separated, and should be thought of in terms of coevolution" (Rip and Kemp, 1998, p.337). However, once established, these relatively stable socio-technical configurations are hard to break as their constitutive elements coevolved over time to mutually reinforce on another. At its most extreme, this mutual reinforcement leads to the phenomena of socio-technical *lock-in* and *path dependency*, which account for the relative stability and inertia of socio-technical configurations (Berkhout, 2002).

Here again it may be useful to illustrate the above by way of an example: the rise of the motor car and motorised transportation in the early 20th century. When initially introduced the car, as an innovative technology, was not immediately considered the reliable mode of choice it is today. This would have been partly due to the immaturity of the technology itself, partly due to indispensable infrastructure, such as car-worthy roads, or fuelling, repair and maintenance opportunities being few and far between until the technology became more resilient and adoption reached a tipping point (Geels, 2005a). For example, one can imagine that, much like consumers contemplating the purchase of a fully-electric vehicle today (Tate et al., 2008), potential adopters of early motor cars may well have been put off by how limited the network of fuelling stations would most certainly have been early after cars became more accessible. However, as the car was more widely adopted and latent demand built up in rural and suburban areas existing infrastructures were adapted (e.g. road surfacing suited to the larger weight and higher speed of motor cars) and new infrastructures developed (e.g. highways for cars only; networks of refuelling stations and garages for car maintenance as well as dealerships for resales) to accommodate the new vehicle. Due to these changes the availability and reliability of the car as an everyday, long-distance mode grew steadily. This in turn had a lasting impact on urban form and land use patterns in the shape of sprawling suburban settlements, and out-of-town shopping centres and business districts. Our need to access these and ever further places, in turn, is what keeps us locked into motorised transportation systems with high levels of individual automobility today. The above by no means exhaustively describes the extent to which the car and society have mutually coevolved over time to form a stable socio-technical system that is hard to break (Urry, 2004). It does, however, serve to illustrate the dynamics of path dependency and lock-in which result from the way in which different social and technological elements of this socio-technical system speak to and reinforce one another. The mutual reinforcement among its constitutive elements gives a socio-technical configuration relative internal coherence and leads it to reproduce itself with relative consistency over time (Geels, 2004).

Initially systems-approaches to the study of socio-technical innovation focused on tracing and understanding innovation as a supply-side phenomenon within large technical systems and industry sectors. Since then research has broadened significantly to study specifically large-scale transitions from one socio-technical system of production *and* consumption to another across sectors as diverse as energy, water, food or transport. This shift has been accompanied by a growing interest in investigating the potential for strategic promotion and management of transitions and active scaling-up of innovations (e.g. Hoogma et al.,

2005, on the topic of strategic niche management; Ieromonachou et al., 2007, on strategic policy niche management). The growing significance and ubiquity of sustainability concerns has further motivated socio-technical change and transition researchers to focus more explicitly on researching the scope for so-called *sustainability transitions* (Coenen and Truffer, 2012; Markard et al., 2012; Smith et al., 2010). Such sustainability transitions aim at shifts to altogether novel and, crucially, more sustainable systems of production and consumption in part through paradigmatic changes in social, cultural, and institutional practices and discourses.

LITERATURE REVIEW

The following chapters present a review of the central literatures informing this thesis:

Beginning with the transition literature, *Chapter 3* presents four central strands of transition scholarship. Focussing on the framework of the multi-level perspective, the chapter elaborates persistent shortcomings and recent developments in the literature on socio-technical and sustainability transitions: specifically, it shows that the multi-level perspective is predicated on a restrictive conceptualisation of the structure-agency relation in socio-technical transitions theory. Consequently, narratives of socio-technical stability and change have been criticised as providing insufficient explanations for the success or failure of particularly marginal transition actors and actions. The chapter concludes by diagnosing that the facilitation towards more sustainable systems of production and consumption, including in the transport sector, requires a more explicitly and systematically critical transition scholarship.

Chapter 4 presents a review of a second key literature i.e. that of cultural political economy. Specifically, the chapter explains how, from a CPE perspective, social formations (including socio-technical configurations) may be understood as the emergent product of social actors' "existential need for complexity reduction [...] to 'go on'" (Sum and Jessop, 2013, p.24) in a world that is, in line with critical realist ontology, "too complex to be grasped" in its entirety by any one actor "in real time (or ever)" (ibid., p.3). Relatedly, the chapter discusses the two modes of complexity reduction recognised by CPE – semiosis and structuration – and explains how both coevolve to give rise to enforced selection and ultimately relatively stable, semi-coherent social formations reinforced by four interrelated kinds of strategic selectivities. Chapter 4 further outlines the role these selectivities play in the (re-)production of social domination and hegemony.

Chapter 5 in turn presents how the transition and CPE literatures can be usefully combined to inform empirical research on ongoing sustainability transitions in urban transport. Initially, the chapter sets out what a CPE perspective on socio-technical transitions entails and how it can contribute to the articulation of more critical transition scholarship. The chapter then turns to elaborate how a crossover may be achieved in practice. It is in this context, that the thesis introduces a central heuristic of the CPE literature – the strategic-relational approach – as offering a useful alternative conceptualisation of the problematic structure-agency relation underlying the MLP (as diagnosed in Chapter 3). The chapter then introduces Jessop and Sum's (2016) approach to the critique of dominant and hegemonic social formations, which is mobilised to inform the design and conduct of empirical research.

3. SUSTAINABILITY TRANSITION STUDIES

3.1. Socio-technical transition research

As mentioned previously (see Section 2.2), socio-technical transition research is concerned with shifts from established socio-technical systems of production and consumption to radically new ones as a result of coevolutionary social and technological change. Such socio-technical systems exist within and across a variety of societal domains, such as energy, water, housing, food and agriculture or transport.

No matter the societal domain, among transition researchers these socio-technical systems are generally thought of as complex configurations of components belonging to three analytical categories: (1) technologies, (2) the rules, institutions and social practices that developed around these technologies to facilitate and regulate their adoption and application, and (3) the organisational field of actors enacting and directing these adoption and application processes (Geels, 2004). Radical shifts, or transitions, from one such configuration to another in turn are assumed to come about through the interaction of complex social and material change processes occurring in parallel across multiple levels and both within and across different societal domains, such as private and social life, or the economic and political sphere (see also Box 3, for an overview of key transition studies concepts). Therefore, transitions are complex multi-scalar, multi-actor processes that occur over long timeframes, variously specified as lasting between 30-40 years[15] and 50-100 years (Schot et al., 2016).

Box 3. Basic concepts for understanding transitions as multi-level processes (Source: Adapted from Schot et al., 2016)

Socio-technical regime. A shared, stable and aligned set of rules or routines that guide the behaviour of actors on how to produce, regulate and use energy, transportation, food production or communication technologies. These rules are embedded in the various elements of a socio-technical system. Rules force [transport] provision to evolve along the specific trajectory of incremental innovation. The [motorised transport system] that is dominated by fossil fuels and energy-intensive practices is an example of a socio-technical regime that is guided by rules that favour [ever increasing

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[15] Grin et al. (2010), for example, suggest that, while the eventual breakthrough of a new socio-technological systems and with it the successful displacement of an existing one may occur quite quickly over the course of as little as 10 years, such breakthroughs are always preceded and facilitated by 20-30 years in which a novel socio-technical system gradually evolves and emerges.

levels of individual mobility and choice while seeking to reduce economic costs and environmental and social impacts].

Socio-technical system. A configuration of technologies, services and infrastructures, regulations, and actors (for example, producers, suppliers, policymakers, users) that fulfils a societal function, such as [transport] provision. These elements are aligned and fine-tuned to each other, forming a system.

Niche. Protected from direct mainstream market pressures, a niche is a space in which radical solutions that compromise the logic of incumbent regimes are being developed. Compared with regimes, the actors in niches are few, their interrelations sparse, the focal technology immature and the guiding rules in constant flux. [An example of a niche in the transport sector is that of electric vehicle technology challenging the dominant regime of internal combustion engine technology].

Socio-technical landscape. Exogenous macro-events and trends (such as wars, migration, urbanization and totality of infrastructures) that shape the dynamics between niches and regimes, but are not affected by the latter in the short or mid-term.

Transitions. Large-scale and long-term (50–100-year) shifts from one socio-technical regime and system to another, involving interactions between landscape, regime and niche dynamics. Examples include shifts from sailing ships to steamships, or from horse-drawn carriages to automobiles. Transitions can be conceptualized as a sequence of three phases:

- o **Start-up.** The internal problems of the regime are intensified by landscape pressure, creating a window of opportunity for novelties that, for the time being, emerge and mature in niches.
- o **Acceleration.** Niches enter the mainstream market and start to compete with the incumbent regime. Increasing diffusion is accompanied by redefinition of rule sets, and thus also of user needs, leading to collective learning processes and, if successful, to new stable rule sets.
- o **Stabilization.** As the niche's actors grow in number, its technology matures and its guiding rules stabilize, the (now former) niche gradually establishes itself as a new regime. This allows for a sharp increase in adoption as the regime now provides a ready-made "template" for largely routinized user behavior

Research on socio-technical innovation towards transitions to date has tended to employ four major approaches (Markard, et al., 2012): *the multi-level perspective* (hereafter MLP); *transition management* (hereafter TM; e.g. Kemp et al., 2007a, 2007b); *strategic niche management* (hereafter SNM; e.g. Caniëls and Romijn, 2008; Kemp et al., 1998) and *strategic policy niche management* (hereafter SPNM; e.g. Ieromonachou et al., 2004); as well as *technological innovation systems* (hereafter TIS, e.g. Bergek et al., 2008, Hekkert et al., 2007).

All four strands share common theoretical roots, assumptions and key analytical concepts. A heuristic framework and middle-range theory, the MLP outlines the foundational

analytical categories of transition studies literature, and illustrates the relations and dynamics among these over the life-cycle of a socio-technical transition in somewhat idealised terms. These assumptions and conceptualisations are significantly echoed in other key strands of transition research, particularly TM as well as SNM and SPNM. These strands of socio-technical transition research pursue a much more active and interventionist transition agenda, while the MLP has largely served more analytical-descriptive purposes. However, a similarly descriptive analysis of past and ongoing transitions is no doubt required to underpin the research for measures, frameworks and roadmaps for actively managing the scaling-up of socio-technical (policy) niches, in the case of SNM and SPNM, alongside the breaking-down of existing regimes, in the case of TM. A fourth major strand of transition research, namely research on TIS completes the set of key transition frameworks and theories. Despite common empirical interests and shared theoretical roots, TIS stands somewhat separate from the MLP, TM and SNM/SPNM. Opportunities to build an integrated MLP-TIS framework have, however, not remained unexplored in the literature (e.g. Markard and Truffer, 2008).

In acknowledgement of their particularity, the remainder of section 3.1 presents each of the four transition research frameworks in turn. The motivation for this is to critically assess the perspective each offers for the study of socio-technical innovation in urban transportation. Secondly, it serves the purpose of assessing the compatibility of each framework with this thesis' ambition to articulate a critical transition research perspective. Developing such a critical perspective on transitions is only possible if the transition framework to be put to work is broadly compatible with critical philosophical assumptions and in the case of this thesis specifically critical realist assumptions.

Before introducing and evaluating the four transition research strands and their central frameworks it is, therefore, worthwhile reiterating what a critical transition research perspective may demand. As briefly outlined in Chapter 1, a critical transition research would be geared towards delivering emancipatory insight into ongoing transition processes. This emancipatory ambition is very much in line with critical theoretical approaches and is thought to be a more rational approach to engaging with ongoing socio-technical transition processes for two important reasons:

Firstly, a critical transition perspective rests on the understanding that researchers, including transition scholars, do not have privileged access to the social phenomena they are investigating. Rather they are one among many stakeholder types involved in the transition process. As a result, they may have a perspective on the reality of these transition

processes that can complement, but also contradict the perspectives of other social actors and transition stakeholders. Based on the acknowledgement that no single actor has privileged access and objective knowledge of complex social processes, such as socio-technical transitions it would be hubris for transition researchers to pose as objective outside observers and facilitators of ongoing socio-technical transitions towards more sustainable systems of production and consumption.

Secondly, and even if such a removed engagement with and objective understanding of ongoing transition processes was possible, then the naïvely normative and interventionist ambitions informing transition literatures to date are questionable. Transition scholars' active transition intervention and promotion of one socio-technical solution over another is problematic, particularly in light of their beliefs about the complex and emergent nature of coevolutionary socio-technical change, the connected development of unforeseeable and unintended novel practices and institutions, and the ultimate inevitability of path dependencies and lock-ins arising from any intervention, however well-planned and intended these may have been. Taking these assumptions about the nature of socio-technical change processes seriously must require a more measured, realistic and humble engagement with ongoing socio-technical change processes. A critical transition research perspective is, therefore, likely to contrast markedly with the normatively naïve, interventionist and managerial approaches dominant in transition literatures to date.

The choice of transition framework to be deployed in the context of this thesis should reflect this. As such, the following four subsections introduce the TIS, TM, SNM/SPNM and MLP frameworks providing a brief assessment of their suitability in the context of this thesis, in turn.

Technological innovation systems

Research on TIS originated as an amalgamation of the literature on innovation systems (Freeman, 1987; Nelson and Nelson, 2002) and technological systems (Carlsson and Stankiewicz, 1991; Carlsson et al., 2002). Innovation systems are broadly understood as "the [networks] of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies" (Freeman, 1987, p.1). TIS research critiques the original notion of innovation systems on the basis of its pre-occupation with sectoral and national scales. The large number of actors, institutions and network relations making up sectoral and national innovation systems are argued to prohibit the dynamic analyses of systemic innovation (Hekkert et al., 2007). As a

consequence, research on TIS seeks to reduce this complexity in order to be better able to identify and understand the conditions under which emerging innovation systems may grow to compete with or replace existing dominant innovation systems. It, therefore, concentrates on the actions and interactions amongst the actors, institutions and organisations that constitute a technology-specific innovation systems located at the partial overlap of various sectoral and national innovation systems. As Markard et al. (2012, p.959) summarise succinctly, the development of TIS reflects a shift in analytical interest from "technological innovation contributing to economic growth of countries to new technologies as nuclei for fundamental socio-technical transitions".

This shift to technology-specific delimitations of innovation systems has proven multiply advantageous: TIS research motivated and informed the re-diagnosis of market failures in terms of much broader *system failures* (e.g. institutional, network and infrastructural failures). Its insight into these modes of system failure (Bergek et al., 2008; Kuhlmann et al., 2010; Weber and Rohracher, 2012) coupled with an increasing analytical focus on specific technologies (Hekkert et al., 2007) has established TIS as a strong research framework for the formulation of technology-specific innovation policies (Markard et al., 2012).

In the context of researching innovation in urban transportation systems TIS offers both advantages and disadvantages. On one hand, its emphasis on technology-specific innovation systems is strongly preferable to a sector or national innovation system perspective on urban transport innovation. It allows for the analysis to take place along the lines of actor and institutional networks without explicitly favouring any particular scale. This is preferable in the context of urban transport innovation as transport policy and practice involves a variety of actors, including policy makers, transport planners as well as users and other beneficiaries, all of whom are acting and interacting at different geographical and functional scales. The TIS approach with its focus on technology and functions (Hekkert et al., 2007) cuts through these geographical and sectoral multiplicities. It offers a sound framework for carving discrete innovation systems out of the urban transportation system, thereby reducing its inherent complexity to a level that can feasibly be analysed and managed.

However, whilst the technology centrism of TIS is advantageous in getting to grips with the dynamic and complex nature of systemic innovation processes, it unwittingly produces a strong inward bias (Markard et al., 2007). This is in part due to the framework's reliance on a static conception of a specific technology in delineating the corresponding TIS.

Consequently, TIS accounts struggle to pay due attention to system external agents, institutions and organisations that may positively or negatively impact on the innovation process and the development of a technology over time (ibid.). Bridging the gap between this static technology conception and the dynamic change processes involved in socio-technical innovation is a major challenge for the TIS approach.

Though preferable to a national or regional focus, its strong technology emphasis and the static nature of its underlying technology conception makes TIS an inappropriate framework in the context of this research, which seeks to explicitly account for the multiplicity of components – agential, institutional, technological, material and immaterial social – *dynamically* interacting to create conditions of stability and change in urban transportation systems.

Transition management

TM takes a reflexive governance approach to socio-technical innovation towards transitions. This perspective is rooted firmly in governance theory (Rotmans et al., 2001) and complex systems theory (Rotmans and Loorbach, 2009): the central assumption informing the framework is that there exists a range of persistent problems, which are inherently complex and uncertain and without immediately apparent solutions. Rather than considering them challenges to be overcome, TM accepts complexity and uncertainty as fundamental constraints within which socio-technical innovation may nonetheless be achieved. TM in this sense transposes these persistent problems into governance challenges that focus on searching out, developing and ultimately experimenting with a range of possible solutions and pathways on a small scale. Feedback from these small-scale experiments further guides the on-going variation-selection processes into more socio-technically benign directions and pathways.

Connectedly, the approach of TM understands socio-technical innovation as a reflexive, iterative and evolutionary change process requiring the interaction and partial coordination of multiple actors, acting across multiple societal and functional domains, and at multiple scale levels (Markard et al., 2012; Rotmans et al., 2001). To this end, TM explicitly seeks to bridge the gap between the incrementalism characterising bottom-up innovation and the lack of flexibility and reflexivity present in top-down planning approaches by facilitating and steering vital coevolutionary processes between both. Kemp et al. (2007a, p.10) describe this hybrid succinctly as "directed incrementalism" (in reference to Grunwald, 2000) relying "on 'darwinistic processes' of guided variation and

selection instead of planning" (Kemp et al., 2007b, p.320). The stated aim of TM as a form of meta-governance approach is, therefore, the coevolutionary formation of new and more sustainable configurations able to compete with and ultimately replace dominant undesirable systems of production and consumption (Loorbach, 2010).

At the outset, the TM approach constitutes a promising framework for empirical research such as the one on hand. As previously emphasised by Frantzeskaki and Loorbach (2010), TM's appreciation of real-world complexity and its consequent ambition to "[create] space (institutional, technological, financial and regulatory space) for social innovation" (ibid., p.1296) suggest it as a suitable framework for the study of transitions in large infrastructural systems, such as (urban) transportation systems.

However, in view of the critical transition perspective to be developed in this thesis the TM approach to socio-technical innovation is deemed an unsuitable framework. Whilst not pursuing "command-and-control" style management, TM aims at the "reflexive steering" of transition processes and in this sense "an active intervention", nonetheless (Shove and Walker, 2008, p.1012). From a critical perspective, such active intervention or management of any degree demands transparency and agreement among all parties to the transition management process with regards to the normative aspirations they are pursuing, respectively. In connection with this, Shove and Walker (2008, 2007) identified a crucial blind spot in TM theory: the role of power and politics in delineating and shaping transition agendas, transition arenas, transition processes and transition outcomes is yet to be fully incorporated into the theory. Though some progress has been made (Smith et al., 2005) more recent research still finds that TM underplays or even deliberately avoids the political moment of transitions. As Kenis et al. (2016) critique, TM "considers change not as a power struggle between alternate visions for society, but as a quasi-market process whereby innovative niches compete with and outgrow the existing [regime]". Above and beyond that, the levels of complexity, uncertainty and associated dynamics of emergence, path dependence and lock-in that researchers suggest are so central to transition processes cast doubt on how seriously such normative aspirations, for example, towards sustainability (or even environmental benignity), can be taken by stakeholders external to the process and perhaps concerned about potential outcomes of aspired to transition processes.

Strategic niche management

According to Kemp et al. (1998, p.186), SNM, is

> *"the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technology and (2) enhancing the further development and the rate of application of the new technology".*[16]

Kemp et al. (ibid.) further highlight that these experimentation processes entail "bringing knowledge and expertise of users and other actors into the technology development process and generating interactive learning processes and institutional adaptation". The SNM framework is, therefore, primarily an analytical approach guiding

> *"the orchestration of the development and introduction of new technologies through setting up protected experimental settings (niches) in which actors learn about the design, user needs, cultural and political acceptability, and other aspects." (Ieromonachou et al., 2004)*

Radical socio-technical innovation is in this context understood to emanate from experimentation with novel technologies (or policies) in protected and nurtured niches, which provide a facilitating environment for socio-technical learning processes. Through these learning processes technology (or policy) designs and stakeholder attitudes and experiences with the same may mutually coevolve to a point where a viable 'proto-market' develops, which may over time be nurtured into an actual market niche (Caniëls and Romijn, 2008).

In connection with the variation of SPNM (strategic policy niche management; Ieromonachou et al., 2004) the SNM framework has shown considerable flexibility in dealing with innovation not primarily of material-technological nature. In this sense, it constitutes a first move towards a transition studies framework more adept at accounting for practice-based aspects of socio-technical innovation.

However, much like TM, SNM aspires to facilitate and undertake some degree of active intervention (Shove and Walker, 2008), which would demand researchers to reflect on and explicate the normative assumptions behind concrete management decisions made. Again, while such explicit engagement with normative transition ambitions has not tended to be central to SNM and SPNM research and case studies, there is nothing in the frameworks themselves ruling this out. However, even a normatively-considered

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[16] As acknowledged by Kemp et al. (1997) their definition is based on a Dutch language publication of Schot, J., Slob, A. and Hoogma, R., entitled Implementatie van Duurzame Technologie al seen Strategisch Niche Management Probleem (Den Haag, Programma Duurzame Technologische Ontwikkeling, 1994), Werksdocument CST3.

endorsement of one socio-technical solution over another remains problematic in light of transition research's commitment to complexity, coevolution and emergence as key dynamics shaping socio-technical change in often unplanned and possibly unintended ways.

Therefore, the interventionist and managerial agenda of TM and SNM/SPNM frameworks in favour of one socio-technical solution over others contrasts starkly with their lacking engagement with or explication of the normative desirability of competing socio-technical futures. As such, both SNM and SPNM, alongside TM, are considered unsuitable frameworks in the context of this research project.

Multi-level perspective

The multi-level perspective, or MLP, is the fourth prominent transition studies framework. It constitutes a middle-range theory (Geels, 2010) and key framework for exploring the multi-level change processes implied in the transition from one socio-technical system to another. The SNM and TM approaches may be said to build substantially on the MLP as a heuristic tool that charts socio-technical change processes across the lifecycle of a transition. The MLP can then be seen as a conceptual map against which SNM and TM practitioners plot the socio-technical change processes and dynamics and relevant actors and institutions they are interested in to better understand their action context and develop targeted managerial interventions in order to scale-up niches or engender transitions through more system-wide interventions, respectively.

The MLP was originally described by Dutch researchers Rip and Kemp (1998) and subsequently further developed on hand of a variety of historic and contemporary case studies. These case studies examined socio-technical change and transition dynamics, for example, in sectors as diverse as transport (Geels, 2006a, 2005a, 2002), water and waste management (Geels, 2005b), energy and power generation (Geels et al., 2016; Raven, 2004; Verbong and Geels, 2007), food production (Belz, 2004), urban development (Næss and Vogel, 2012), policy-making (Kern, 2012) and even music (Geels, 2007). Articulated as a heuristic device and middle-range theory, and in contrast to TM and SNM, the MLP has no in-built aspirations to actively manage or steer transition processes. Instead, the framework has so far offered a useful tool for tracing and narrating historic transition processes from one socio-technical system to another.

The MLP's formulation as a heuristic for description and analysis of socio-technical change processes and its lack of any inbuilt interventionist or managerial ambitions suggests that the MLP may offer a suitable framework for the purposes this thesis.

Historically, however, the MLP has largely been used to study successful past transitions at the level of national industries and sectors rather than currently ongoing transitions taking place at the urban scale. To date, transition accounts have thereby served to create the impression that the levels of the MLP correlate to specific geographical scales. Innovative niche activities have often been assumed to arise at the local or regional level, while dominant regimes extended across the national scale and landscape pressures originated largely from an international or global scale. There is, however, nothing that concretely implies any of these scales within the basic formulation of the MLP. On the contrary, as argued by Coenen et al. (2012), the heuristic is compatible with and would benefit from incorporating geographical concepts more explicitly to account for the geographical embeddedness and resulting socio-spatial diversity of transition processes.[17] This suggests that the MLP is not inherently unsuitable for use in the study of transition processes taking place at the urban level.

A second point of criticism often levelled against the MLP is that case studies applying the framework have tended to overemphasise the material-technological aspects of transition processes (Genus and Coles, 2008; Shove and Walker, 2007). As already suggested in Chapter 1 of this thesis, the purpose of this research is to understand how the everyday micro-moments of socio-technical change are connected with long-term, large-scale transition phenomena. Any framework to be used in an investigation that seeks to link the micro-moments and macro-dynamics of socio-technical change must not unduly privilege the material-technological aspects of socio-technical change (more likely to play a greater role when taking a long-term perspective on the macro-dynamics of transitions). Instead, equal consideration must be given to the immaterial aspects of transitions more likely to manifest in the everyday micro-moments of socio-technical change in the form of new ways of acting and interacting, for example, via novel discourses and practices. However, the MLP's fundamental assumption that immaterial components, such as practices, rules, norms and institutions, coevolve with material aspects of technologies,

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[17] Important inroads in terms of explicitly discussing the geography of transitions and the treatment of geography and space within the MLP heuristic have been made (see e.g. Coenen and Truffer, 2012; Hansen and Coenen, 2015; Truffer et al. 2015; Truffer and Coenen, 2012).

suggests any documented bias towards material over immaterial aspects of transitions apparent in MLP case studies is not necessitated by the framework itself. Rather, it may result from partial application of the MLP heuristic by the analyst.

The MLP is, therefore, considered the most suitable framework for the study of innovation urban transportation systems to take forward in the context of this thesis. The following section will do so by introducing the MLP, its underlying assumptions and modes of operationalising the same in more detail.

3.2.   The multi-level perspective in focus

Having settled on the MLP as the foundational heuristic framework to be employed in the context of this thesis, section 3.2. now turns to introduce the MLP in greater detail.

Firstly, this section introduces the theoretical cornerstones on which the MLP rests; namely *structuration theory, evolutionary economics*, and *sociology of technology*. Following that, it outlines key concepts and assumptions informing the MLP, including its conception of structure and agency and the role of coevolution and structuration in connection with the study of socio-technical change and inertia.

This provides the context for the third and final section of Chapter 3, which offers a critique of the MLP's shortcomings, both in theory and practice.

Theoretical origins

To date the theoretical crossovers informing the MLP have been most explicitly spelled out in two publications of the year 2010 – a journal article titled "Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective" (Geels, 2010) and a chapter in the book "Transitions to Sustainable Development*" (Geels and Schot, 2010 in Grin et al., 2010). Both publications point specifically towards the MLP as a crossover of insights from *evolutionary economics* and sociological theory, specifically *sociology of technology (STS)*. Geels and Schot (2010) further highlight the significance of another strand of sociological theory: Giddens' (1984) *structuration theory*.

The following three sub-sections introduce each in turn and highlight how their respective assumptions and insights combine to make the MLP a useful heuristic for investigating socio-technical change and inertia. For an extended discussion of these theoretical foundations of the MLP see Geels and Schot (2010).

Structuration theory and neo-institutional theory

As many social scientific research heuristics before and since, the MLP partly developed from a need to make sense of competing innovation accounts that respectively privileged the role of structure or agency in the shaping radical socio-technical change. Seeking to overcome the traditional structure-agency dichotomy the MLP drew inspiration from a range of scholars including Bourdieu (1977) and Burns and Flam (1987). However, key transition studies publications point explicitly to Giddens' notion of the duality of structure and agency as informing the conception of the structure-agency relation at the core of the MLP (Geels, 2012, 2011, 2004; Geels and Schot, 2007).

In line with Giddens' (1984) structuration theory actors are thought of as "knowledgeable agents, who interpret and apply rules creatively (although within constraints)" (Geels, 2010, p.504). Rather than being seen to act in a vacuum, actors are considered embedded within more or less stable socio-technical regimes, which provide a set of sedimented rules that guide and coordinate actors' actions and perceptions (Geels, 2012). Furthermore, and similar to Giddens, the MLP understands rules as "always implicated in action" meaning that they do not exist as facts external to action, but as a consequence of being used and ultimately reproduced through concrete action (Geels and Schot, 2007, p.403). In conclusion, the Giddensian structure-agency relation and its conceptualisation of structure being "recursively reproduced (used, changed) by actors" are fundamental to the MLP (ibid., p.415).

On the one hand, actors are thought to "enact, instantiate and draw upon rules in concrete actions". On the other hand, action is equally understood to be configured by rules, such as "cognitive routines and shared beliefs, capabilities and competences, lifestyles and user practices, favourable institutional arrangements and regulations, and legally binding contracts" (Geels, 2011, p.27).

Evolutionary economics

The second theoretical cornerstone of the MLP is evolutionary economics. Its relevance in the context of research on socio-technical change and inertia rests on its fundamental interest in technological and organisational innovation as the product of complex interactions between heterogeneous agents and the source of economic growth.

Evolutionary economic theory emphasises the role of experience, knowledge and learning in shaping agents' differential ability to act and innovate in complex and changing

environments. As a consequence, and in contrast to mainstream economic theory, evolutionary economics characterises agents as boundedly rational[18] and prone to doing different things in different ways as a result of their divergent competencies, objectives and expectations in a given action context.

Individual agents' bounded rationality in divergent local action contexts, in turn, gives rise to technological and organisational novelty – *variation*. Evolutionary economic theory discusses this variation primarily in the context of intentional and directed innovation processes such as the research and development activities which firms, sectors and industries undertake in an effort to gain competitive advantage in the marketplace. And it is through these markets that the second evolutionary mechanism – *selection* – is assumed to operate thereby reducing technological and organisational variety within the economic system. The market mechanism selects those variations that are resonant and in alignment with existing evolutionary trajectories. These selected novelties then combine with previously existing as well as other, new socio-technical elements to form configurations that work and resonate, and ultimately serve the *retention* of novelty into the future.

The MLP incorporates the evolutionary dynamics of variation, selection and retention as the mechanisms by which socio-technical ensembles come to be newly created, retained over time and, ultimately, replaced by alternative and in some way superior socio-technical ensembles.

Shortcomings of this evolutionary economic perspective include a tendency to emphasise the constraining aspects of structure in the form of rules and routines and cognitive frames without recognising the extent to which such structural aspects simultaneously enable actors to undertake any action at all - whether commonly accepted or novel. This tendency is to some extent counteracted by the MLP's incorporation of structuration theory and neo-institutional theory which rebalances attention through its emphasis of the duality of structure and agency.

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[18] Evolutionary economic theorising has been criticised as discounting the enabling qualities of structure in the form of rules and routines (e.g. Geels and Schot, 2010, p.38) by emphasising the constraining effects these have on individual agency. However, the very concept of bounded rationality may also be interpreted as hinting at a duality of structure and agency: it does so in the sense that rules and routines (though certainly constraining agency) also enable it by providing ready-made categories through which agents can interpret uncertain and changing environments and act rationally within them in the first place.

Sociology of technology

Sociology of technology literatures, and specifically the theory of the social construction of technology (e.g. Bijker et al., 1987) form a third cornerstone of the MLP. The sociology of technology literature specifically introduces a constructivist element to the MLP to counter technological-determinist tendencies in evolutionary economic theorising.

As discussed in the previous section, evolutionary economic thought tends to emphasise intentional variation through directed research and development activity that seeks to link heterogeneous elements into "configurations that work" (Rip and Kemp, 1998, p.330). However, sociologists of technology contend that innovation often arises from the "alternation of variation and selection" including also multi-directional and unintentional action rather than purely intentional and directed linear innovation activities as may often be the appearance in hindsight (Pinch and Bijker, 1984, p.411). In their view unintentional departures from regularised and commonly accepted ways of thinking and using technologies are, therefore, just as likely to align with other heterogeneous elements to form configurations that work and are ultimately retained. How material technologies come to be used in the final instance thus cannot be fully inscribed into their materiality by the individuals or organisations that developed or designed them. Instead, as Bijker (1995, p.270) puts it, the technological design process ends "not because the artefact works in some objective sense, but because the set of relevant social groups accepts that it works for them". There is, therefore, large need to give the social construction (and reconstruction) of technologies equal consideration when studying socio-technical change.

Therefore, the MLP combines all three views, the sociology of technology and evolutionary economics as well as Giddens' structuration theory to conceptualise socio-technical innovation as arising from complex processes of both intentional and unintentional variation, selection and retention at the macro-level. Underlying these macro-level evolutionary dynamics, are the micro-level actions and interactions of individual and collective social actors who are fundamentally structurally and institutionally embedded (though to varying degrees). These agents' capabilities for exercising agency, e.g. in the breaking down of existing and the construction of new socio-technical configurations that work, in turn is simultaneously enabled as well as constrained due to their structural embeddedness (see Figure 3.1).
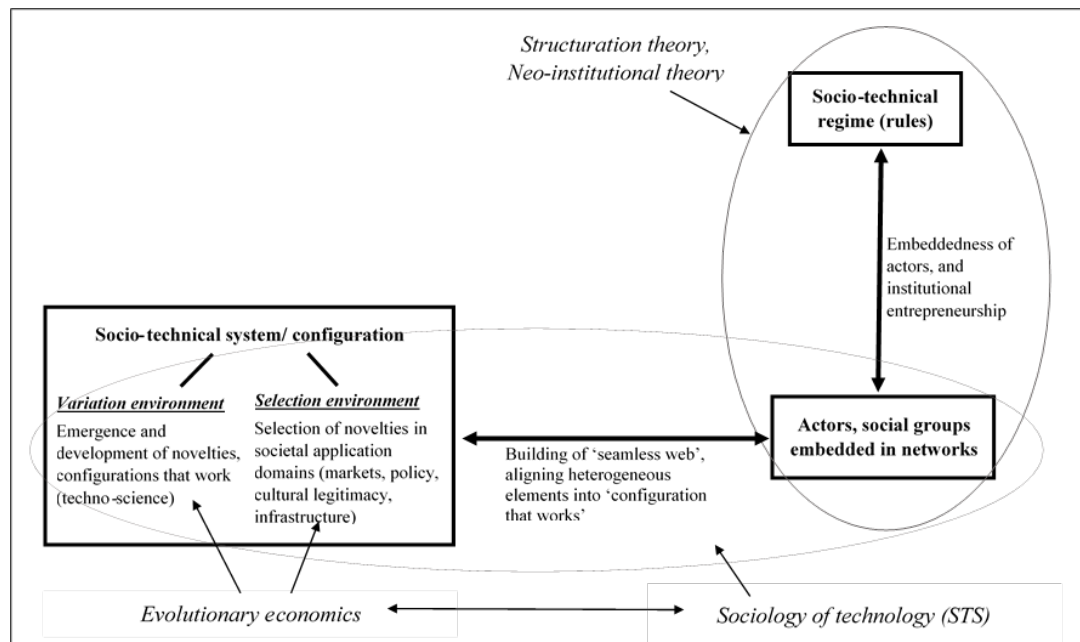
Figure 3.1   Theoretical foundations of multi-level perspective (recreated from Geels and Schot, 2010, p.53)

A multi-level perspective on innovation: Niche, regime, landscape

The MLP heuristic combines the above outlined insights from structuration theory, evolutionary economics and sociology of technology, to investigate the mutual implication of three analytical categories in processes of fundamental socio-technical change. These categories lying at the heart of the MLP are (1) socio-technical systems (encompassing both material and immaterial aspects, e.g. artefacts, infrastructure, technical processes, practices, methods of organisation and knowledge systems), (2) actors, i.e. technology producers, users and other stakeholders, and (3) institutions, as the social rules that enable and constrain processes of technology production, diffusion and use (Geels, 2004).

These elements are assumed to coevolve dynamically to form systems and networks of mutual reinforcement and co-production. Interactions between these elements are considered to be at the heart of the socio-technical change processes underlying large-scale, long-term transitions and to take place within and across three distinct analytical levels[19]: (a) innovation-niches, (b) the socio-technical regime and (c) the socio-technical landscape.

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[19] These levels, though they have been criticised as implying a form of hierarchy (Shove and Walker, 2010), are instead indicative of varying levels of stability.

The socio-technical transition process starts with the development of a novel technology in a so-called *technological niche*. This niche acts as a protective space in which the further development of the innovative technology may be nurtured and supported, for example, by means of government subsidies, protective legislation, trials and experimental application, etc. These measures are aimed at further developing and growing the technological niche by facilitating the building of a web of heterogeneous elements around the novel technology, such as robust design standards, laws and regulations, social practices, customer expectations, markets and material infrastructures. As this happens the niche may progressively grow into an ever-broader configuration of heterogeneous socio-technical elements – elements that, dissimilar though they may be, continuously coevolve over time to complement and mutually reinforce one another.

The resulting configuration is called a *socio-technical regime* and is characterised by dynamics of path dependency and self-(re)production propelled by the complementary interaction and mutual reinforcement among its constitutive elements. These self-(re)productive and path-dependent dynamics, in turn, give the regime a high degree of internal coherence. And it is this internal coherence that strengthens the regime against displacement by alternative, inferior socio-technical configurations arising in fresh technological niches.

The inferiority or superiority of a new niche vis-à-vis an existing regime is a function of its fit with developments at a third analytical level – the *landscape* level. A regime would generally have evolved and continue to evolve to have a close fit with the landscape level. This fit of regimes, which coevolved over time and in resonance with landscape dynamics makes it harder for novel niche technologies to break through, especially if they do not resonate to a similar degree with developments shaping the landscape level. In this way, the landscape may serve to reinforce the reproduction of the regime. And, at the same time, the coevolution and break-through of novel socio-technical niches is hindered if they do not resonate sufficiently with developments at the landscape, which thereby acts to protect existing socio-technical regimes against replacement by niches.

However, every now and then dynamics at the landscape level may shift to open up *windows of opportunity* for more agile niche configurations to successfully challenge and potentially replace a dominant socio-technical regime. A niche may then be able to break the dominance of an existing regime, whose constitutive elements may no longer resonate as strongly with changing landscape dynamics.

Figure 3.2 below serves to illustrate the multi-level interactions between elements at the niche, regime and landscape level as described above (compare also Box 3 in Section 3.1).

Increasing structuration of activities in local practices

Socio-technical landscape (exogenous context)

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties

New regime influences landscape

Socio-technical regime

Markets, User preferences

Industry

Science

Policy

Culture

Technology

Socio-technical regime is 'dynamically stable'. On different dimensions there are ongoing processes

New configuration breaks through, taking advantage of 'windows of opportunity'. Adjustments occur in socio-technical regime.

Elements become aligned, and stabilise in a dominant design. Internal momentum increases.

External influences on niches (via expectations and networks)

Niche-innovations

Small networks of actors support novelties on the basis of expectations and visions. Learning processes take place on multiple dimensions (co-construction). Efforts to link different elements in a seamless web.

Time

Figure 3.2 Multi-level perspective on transitions (Source: Geels and Schot, 2010, p.25)

Of course, such a socio-technical transition is not an agentless process. Social actors pervade the framework throughout taking purposeful and more or less strategic action to variously obstruct or facilitate socio-technical change across the levels of niche, regime and landscape. The following section will hone in on the structure-agency relation at the heart of the MLP and its relevance for understanding long-term socio-technical change and inertia in transitions.

Structure and agency, socio-technical coevolution and structuration

Structure and agency

When originally formalising the structure and agency dynamics that inform the MLP, Geels (2004, p.907) argued that transition stakeholders' actions ought to be understood as neither entirely voluntaristic, nor altogether structurally determined. Transition actors are not "cultural dopes" (Garfinkel, 1967, p.68) bound to enact a set range of socially and culturally sanctioned behaviours and practices that inevitably reproduce the (socio-technical) status quo. And, while the MLP recognises transition actors as fundamentally structurally embedded, it conceptualises this embeddedness as a factor that simultaneously serves to both constrain *and* enable agency. Their institutional context may at times compel transition actors to enact very specific courses of action while leaving seemingly little room for free will. On the other hand, for these actors to act at all freely and with agency demands that they act purposefully, i.e. based on a reasonable expectation of the likely consequences of their actions. In the absence of structural frameworks, institutional rules and social norms forming such reasonable expectations and calculating the likely outcomes of competing courses of action would be all but impossible.

Consequently, the MLP understands agency as fundamentally institutionally structured. Geels (2010, p.499) characterises institutions as "rules and resources", echoing the terminology introduced by Giddens (1984, p.17) who, in his theory of structuration, equates these rules and resources to structures "in [their] most elemental meaning". Agency in turn is fundamentally enabled and constrained (though not determined) by such rules and resources and, therefore, conceptualised as always institutionally embedded. Within the MLP, rules and resources serve the purpose of coordinating the actions of individuals, groups and organisation across niche and regime contexts (Geels and Schot, 2007, p.402). More to the point, they are essential elements of socio-technical regimes and form

> *"the 'deep structure' that accounts for the stability of an existing socio-technical system [and] refers to the semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems" Geels (2011, p.27).*

Therefore, socio-technical regimes are substantially constituted and reproduced by those rules and wider rule systems, which tend to enable and constrain agency to actions and interactions that align with the reproductive logic of the socio-technical system they are a

constitutive element of. Connectedly, the MLP may be said to build firmly on Giddens' (1984) theory of structuration in suggesting that agency is both simultaneously constrained, yet also fundamentally enabled by actors' institutional embeddedness.

Socio-technical coevolution and structuration

The above conceptualisation of the structure-agency relation is central to the MLP, as it forms the basis for differentiating the three levels of niche, regime and landscape. What separates these three levels analytically is their respective degree of structuration, i.e. the degree to which the exercise of agency at each level is mediated by structure.

The three levels, though they have been criticised as implying a form of hierarchy (Shove and Walker, 2010), are instead indicative of varying levels of stability in terms of their own reproduction. This relative stability, in turn, results from differential degrees of structuration enabling and constraining local actors and actions to different degrees across the three levels (Geels, 2011). Institutions and rules, which may range in quality from laws and industry standards to social norms and practices, guide (though do not determine) individuals' actions and perceptions across the different levels of socio-technical system. As individuals enact these practices, norms or rules they are re-produced and reinforced. Their re-enactment lends existing rules and norms continued legitimacy, perpetuates their structuring effect and thereby contributes to the stabilisation and relatively stable reproduction of the wider rule regimes and systems these rules and norms are a part of. Similarly, individual actors and groups form networks across organisational fields in order to facilitate the production, diffusion and use of technologies and their material and immaterial aspects. The formation of these agential, material and institutional networks occurs in tandem. This process of socio-technical coevolution creates mutual dependencies among its constitutive elements, thereby meshing and stabilising them into a semi-coherent socio-technical system (Geels, 2005c).

The extensiveness of these socio-technical assemblages varies as does their power to enable and structure action in ways that serve to reproduce and reinforce the existing assemblage. For example, the *niche-level* is generally considered least stable and structured, due to a lack of formalised rules and institutions mediating action. On the one hand, the niche's lack of structuration suggests greater freedom for action and more importantly room for experimentation and innovation. On the other hand, niche actors may also face greater risk and uncertainty due to a lack of "clear role relationships, interlinked dependencies and normative rules" that can guide action (Geels, 2004, p.912).

One level up, at the *regime* level, rules can be said to have stabilised, consequently, having greater structuring effects. Actors, institutions and technologies at this level have typically coevolved to form networks of mutual interdependency, with their interactions governed by a shared socio-technical rule-regime (though their individual rule systems may differ beyond the rules of this shared regime). Action and interaction between elements is structured to a greater extent due to these shared rules. As a result, the regime-level is characterised by a greater degree of certainty and cooperation, but it also offers significantly restricted scope for innovative action and experimentation.

At the socio-technical landscape level action is structured to an even greater degree than within regimes (Geels, 2004, p.913). The landscape encompasses aspects such as "[material] environments, shared cultural beliefs, symbols and values [which] are hard to deviate from" (ibid.) and assumed to be beyond the control or influence of any single actor at a given point in time. As such, the landscape level may be understood as encompassing structural elements that stakeholders of an ongoing transition cannot strategically alter or influence during a given period of that socio-technical change process.[20]

Socio-technical change and inertia, and the structure-agency relation

As mentioned previously, the structure-agency relation in the MLP draws inspiration from a range of scholars (e.g. Bourdieu, 1977; Burns and Flam, 1987; Giddens, 1984) who theorised on how the longstanding structure-agency dichotomy could be overcome. As also explained in detail previously, the MLP incorporates Giddens' notion of the duality of structure and agency explicitly to resolve the structure-agency dilemma in the context of the study of long-term socio-technical transitions (e.g. Geels, 2012, 2011, 2004; Geels and Schot, 2007). On the one hand, the MLP believes actors to "enact, instantiate and draw upon rules in concrete actions" (Geels and Schot, 2007, p.403). On the other hand, it understands rules as "always implicated in action" meaning that they do not exist as a fact external to action, but as a consequence of being used and reproduced through agents' concrete actions (ibid.). Consequently, the Giddensian structure-agency relation and its

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[20] This points to the MLP's limited ability to account for spatio-temporally changing dynamics of transition processes: what the MLP considers part of the landscape and beyond the direct influence of niche or regime actors at any one point in time and place, can come within more direct influence of the same stakeholders as a transition unfolds over time.

conceptualisation of rules as "recursively reproduced (used, changed) by actors" is deemed "crucial for the MLP" (ibid., p.415).
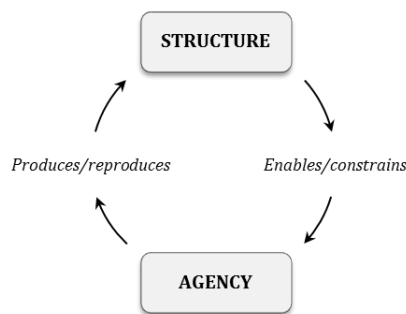
Figure 3.3   Schematic depiction of the recursive nature of the structure-agency relation

Due to this recursive nature of the structure-agency relation, action at any moment in time must be understood as enabled and constrained by rules, which are themselves the result of previous action (see Figure 3.3). Hence, change and stability in socio-technical systems are no longer seen to be the result of either absolute structural determination or entirely free-willed action. Through this move, the MLP is able to resolve the original dualism of structure and agency into a duality in which both structure and agency are mutually constitutive elements in the production of socio-technical change or inertia (see Table 3.1).

	Structural component	**Agential component**
Structure-agency dualism	Structure as absolute external constraint	Agency as completely free-willed action
Duality of structure	Structure emerges as a consequence of agents' enactment of existing social structure	Agency enacted by agents who are partly socialised by existing social structure

Table 3.1   Structure and agency: from dualism to duality (adapted from Jessop, 2005, p.41)

What, then, is the primary source of change in socio-technical systems? In line with the above, socio-technical change (or indeed inertia) is understood to arise primarily as a result of how intended and unintended consequences of actions in the present moment shape and reshape the institutional, cultural and physical context for future action (Geels, 2004, p.907; see Figure 3.4 for more detail). At times these action consequences, whether

intended or unintended, may be far-reaching. They may lead to structural change in the rule system shared across all actors of the socio-technical regime, thereby inducing what Geels (ibid.) calls "social learning". Other times the fall-out from actors' actions may only impact specific actors, prompting them to re-evaluate past actions and, if necessary, adjust their strategies, perceptions and goals in a process Geels (ibid.) terms "actor structuring".

Connectedly, transitions from one socio-technical system to another are best understood as the cumulative result of perpetual social learning and actor structuring processes. At times, processes of actor structuring and social learning may serve to chip away at existing rule and resource structures, thereby slowly reconfiguring the institutional, cultural and material contexts for future action. At other times, processes of actor structuring and social learning may reinforce existing rule and resource structures thereby reproducing also existing institutional, cultural and material action contexts, which guide individuals' decision making. Yet again, processes of actor structuring and social learning may fail to materialise or may offset each other so that existing socio-technical systems are more or less stably reproduced.
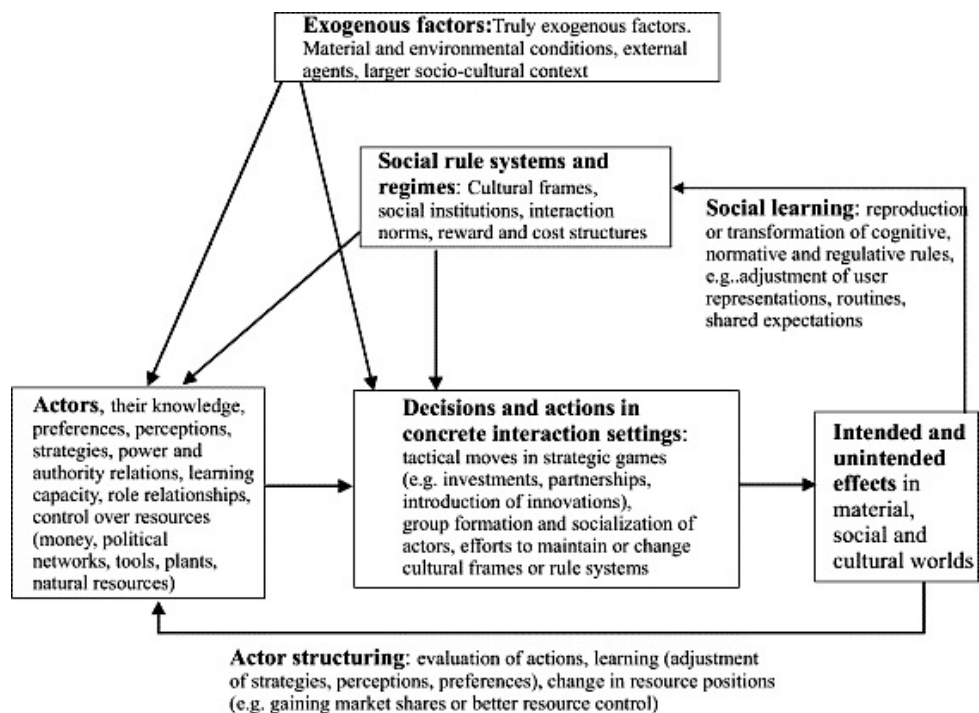
Figure 3.4   Actor-rule system dynamics (Source: Geels, 2004, p.908; original based on Burns and Flam, 1987, p.4)

Accounts of successful socio-technical transitions that occurred in the past have historically not had much to say on these crucial processes of social learning and actor

structuring. They instead focused largely on macro-level socio-technical change, by tracing how social rule systems and regimes, and actors' knowledge, perceptions and preferences (as partly facilitated by exogenous landscape developments) changed over timeframes as long as fifty to a hundred years. As a consequence, resulting narratives of historic transition processes, while adequate representations of socio-technical transition processes at the macro-level, convey a very incomplete picture of the everyday, micro-level dynamics underlying large-scale long-term socio-technical change. Connectedly, MLP-facilitated accounts of past transitions have more recently been criticised as leaving readers "without a sense of how, why, and through whose agency" socio-technical change came about (Lawhon and Murphy, 2012, p.360).

Such in-depth understanding of socio-technical change processes is, of course, not necessarily feasible in the context of the retrospective study of past successful transition.

However, as the next section discusses, a recent shift in research focus from past 'conventional' transitions to ongoing transitions towards sustainability has been accompanied by demands for a more explicit engagement with the micro-moments of socio-technical change and inertia as well as for the link between these micro-moments and the macro-dynamics of transitions to be made more forcibly.

From generic transitions to sustainability transitions

Over the past decades, research employing the MLP has progressed notably in identifying barriers and pathways towards socio-technical innovation in diverse sectors, including that of transportation, and across diverse national and regional contexts.

More recently the field of transition research, and with it research employing the MLP, has shifted its attention from historic transitions to focus on on-going and future *sustainability transitions*. The term is used to designate transitions from existing socio-technical systems of production and consumption with significant negative social and environmental externalities, to alternative and socio-environmentally more benign ones (Markard et al., 2012). The shift from 'generic' to sustainability transitions has further been accompanied by greater attention to the inherently contested nature of transitions. Where generic transition research investigates socio-technical change in and of itself, research on sustainability transitions seeks to understand the change processes involved in bringing about change towards more sustainable socio-technical systems, i.e. systems that may be judged to be in some way better, e.g. more conducive "to the larger goal of

providing long term human well-being in the face of real bio-physical limits" (Meadowcroft, 2011, p.71). As such, sustainability transitions are inherently normative and strongly politicised projects in which a multiplicity of actors contest and negotiate the desirability of potential alternative socio-technical arrangements.

This development has been recognised, discussed and critically reflected on to varying degrees in the literature over the years (see, for example, Audet, 2014; Grin et al., 2010; Shove and Walker, 2007). However, a general shift towards a more reflexive transition research practice and a more explicit engagement with issues of normativity among transition researchers has yet to occur. Nonetheless, the field has over the past years witnessed a proliferation of research offering constructive critique of existing transition concepts, frameworks and narratives in light of the emphasis on sustainability. This development is amplified by the growing ambition for more thorough understanding of transitions in the making, as opposed to those that concluded in the past and which may be judged and narrated more coarsely and decisively with the benefit of hindsight. In contrast, the investigation, description and theorisation of ongoing transitions has been argued to require a language, set of concepts and frameworks that are richer and better able to account for the variegated, contested, politicised empirical reality of sustainability transitions.

In connection with this shift towards sustainability transition research, the MLP has been criticised for generating overly homogeneous conceptualisations of regimes, which suggest a level of regime-internal coherence that rarely matches reality even in the case of dominant socio-technical configurations (Fünfschilling and Truffer, 2014; Smith et al., 2005). According to critics this shortcoming is linked directly to the MLP's lacking concern for the geographical situatedness and socio-spatially differentiated progression of transition processes (see, for example, Bulkeley and Betsill 2005; Coenen et al., 2012; Hansen and Coenen, 2015; Hodson and Marvin, 2010; Murphy, 2015; Sengers and Raven, 2015; Truffer et al., 2015; Truffer and Coenen, 2012). Due to this lack of a proper geographical grounding of transition case studies, accounts of agency (Genus and Coles, 2008; Pesch, 2015; Shove and Walker, 2007) and connected issues of power, politics and political economy in transitions to sustainability remain underexplored or entirely ignored (see, for example, Kern and Markard, 2016; Lawhon and Murphy, 2012; Meadowcroft, 2011, 2009; Murphy, 2015; Shove and Walker, 2007).

The above outlined criticisms hint that the MLP has not fully bridged the long-standing dualism between agency and structure. Agency, particularly "at the level of novel

practices [remains] a crucial blind spot" of transition studies more generally (Hoffman, 2013, p.258). As a consequence, many case studies of successful transitions employing the MLP leave readers "without a sense of how, why, and through whose agency" socio-technical change came about (Lawhon and Murphy, 2012, p.360). The implicit treatment of the geographical embeddedness and spatio-temporal specificity of structure and agency relations similarly contributes to transition studies' failure to "provide a more systematic and rigorous account of why, for what reason and where" transition processes occur (Coenen et al., 2012, p.973).

Without such differentiated accounts of the politics, geography and the practice and performative aspects of transitions, Lawhon and Murphy (2012) suggest, explanations of socio-technical change in urban transportation systems risk oscillating between the seeming inevitability of "emergent transformations" (see Table 3.2, transition pathway: '1. Transformation') and the mere contingency of radical "reorientations of trajectories" (see Table 3.2., transition pathway '4. De-alignment and re-alignment') in response to external or internal shock to the socio-technical system (Berkhout et al., 2003, p.27). Consequently, such transition accounts provide stakeholders of currently ongoing socio-technical change processes with little instructive insight to aid their day-to-day, purposive engagement in ongoing transition processes towards more sustainable systems of production and consumption.

Transition pathways	Main actors	Type of (inter)actions	Keywords
1. Transformation	Regime actors and outside groups (social movements)	Outsiders voice criticism. Incumbent actors adjust regime rules (goals, guiding principles, search heuristics)	Outside pressure, institutional power struggles, negotiations, adjustment of regime rules
2. Technological substitution	Incumbent firms versus new firms	Newcomers develop novelties, which compete with regime technologies	Market competition and power struggles between old and new firms
3. Reconfiguration	Regime actors and suppliers	Regime actors adopt component-innovations, developed by new suppliers. Competition between old and new suppliers	Cumulative component changes, because of economic and functional reasons. Followed by new combinations, changing interpretations and new practices

| 4. De-alignment and re-alignment | New niche actors | Changes in deep structures create strong pressure on regime. Incumbents lose faith and legitimacy. Followed by emergence of multiple novelties. New entrants compete for resources, attention and legitimacy. Eventually one novelty wins, leading to restabilisation of regime | Erosion and collapse, multiple novelties, prolonged uncertainty and changing interpretations, new winner and restabilisation |

Table 3.2   Main actors and (inter)actions in transition pathways (Source: Geels and Schot, 2007, p.414)

As such, it is fair to say that serious barriers to the use of the MLP framework in the context of ongoing transitions with the strongly normative aim of yielding more sustainable socio-technical systems have revealed themselves.

Firstly, the MLP framework is a framework developed and refined based on case studies of historic transitions, such as the transition from horse-powered transport to automobiles or the transition from cesspools to sewer systems in public hygiene (Geels, 2005a; 2006b). And, while this historically grounded transition research has done much to shed light on the longue durée of transitions, it has not so far generated useful insights to inform the day-to-day actions of stakeholders of ongoing socio-technical transitions and transitions to sustainability, as already highlighted above.

This is not surprising. Socio-technical transition theory understands socio-technical systems as complex adaptive systems arising from processes of dynamic coevolution, self-organisation and emergence.[21] Emergence as a term specifically refers to the fact that macro-level phenomena – such as socio-technical transitions – are irreducible to the micro-level events and processes that aggregated to bring them about. By that same token our understanding of transitions as macro-level, long-term phenomena by itself cannot offer sufficiently instructive insight on how to facilitate a socio-technical transition at the micro-level of everyday action and interaction. To yield relevant insights existing

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[21] As Mesjasz (2016, p.439) points out, concepts such as emergence, self-organisation and coevolution "associated with complexity, or complexity theory and science, are the key foundation of sustainability transition theory" the narratives of which "are completely permeated with the terminology of complex systems research."

knowledge of transitions as long-term phenomena needs to be complemented by focused inquiries into the everyday micro-moments underlying such macro-level socio-technical change processes.

Secondly, the unqualified use of the MLP framework in the context of currently ongoing transitions has been criticised for generating transition accounts that lack nuance, a sense of agency and sensitivity for the role of power, culture and geographical distinctiveness. Transition research's lack of attention to the role that power and politics play in the 'making' and 'management' of transitions, thus evidenced, has been the object of criticisms for a long time (see, for example, Shove and Walker, 2010). Transition scholarship's recent shift in focus from researching generic transitions to studying transitions towards sustainability has only served to further emphasise these shortcomings. The resulting pronounced normative orientation of transition research has been accompanied by a greater awareness of and concern with the politics, and political economy of transitions (Kern and Markard, 2016; Meadowcroft, 2011, 2009). It has likewise motivated the proliferation of new transition research approaches and fruitful crossovers with other theoretical traditions to investigate the role of power, geography, political economy and culture, and so on in transitions more explicitly and more centrally (see e.g. Avelino et al., 2016; Avelino and Rotmans, 2009; Geels, 2014; Hoffman, 2013).

To summarise, the usefulness of the MLP in its current form can be described as limited. Limited on the one hand in terms of yielding nuanced accounts of the intricacies and heterogeneity characterising currently ongoing transition processes. And limited on the other hand in its ability to yield instructive insights that can enable transition stakeholders to engage pro-actively and strategically in these socio-technical change processes.

Allowing transition frameworks, such as the MLP, as well as the concepts and language informing it, to develop and extend to account for this nuance and heterogeneity is critical. Otherwise transition research runs the risk of imposing conceptual straightjackets onto a diversity of 'actually existing sustainability transitions'[22]. Transition processes that are not only locally specific, but also more normatively charged and politically contested than

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[22] The thesis borrows here from Brenner and Theodore (2002, p.351) who originally called for a need to theorise and understand varieties of "actually existing neoliberalism" to challenge the imposition of a highly-idealised concept onto locally specific articulations of neoliberalism without due regard for the contextual embeddedness of these phenomena.

the accounts of successful historic transitions (which originally informed the development of transition concepts and frameworks currently in use) would lead one to believe.

The following Section 3.3 turns to present a critique of the MLP in light of the above outlined evolving transition studies agenda. It diagnoses shortcomings of the conceptualisation of the structure-agency relation at the heart of the MLP as limiting the heuristic's usefulness for the study of ongoing transitions towards sustainability.

3.3.   Critique

As previously outlined in section 3.2, Geels builds strongly on Giddens' structuration theory (1984) and his concept of the duality of structure to conceptualise the structure-agency relation central to the MLP. Giddens' concept of the duality of structure, understands agency and structure as co-constitutive or mutually reproductive of one another. As both are implied in each other's reproduction, agency and structure must also be temporally intertwined. And, consequently, the processes of actor structuring and social learning (see Figure 3.4), which Geels' argued result from the interaction of structure and agency, and condition socio-technical change and inertia in the MLP, must share a temporal overlap.

Geels (2004, p.908), however, assigns each dimension a distinct temporal frame. Specifically, processes of social learning are said to be more significant over "longer time-scales (years, decades)" while actor structuring can be observed within a time frame that "is usually shorter (e.g. months, years)". Neither process, however, is explicitly anchored or explained in terms of how it arises from everyday interactions of structure and agency. In sum, this explanation of the long and short of socio-technical change contradicts the conceptualisation of "structures as both the product and medium of action" (Geels, 2004, p.907). Furthermore, it suggests a disconnect between micro-level structure-agency interactions and macro-level social change (if only for analytical purposes).

This disconnect is problematic for the operationalisation of the MLP framework for research of ongoing transition processes. Specifically, the assignment of contrasting temporal scales to the processes of social learning and agent structuring has the effect of temporally isolating the two and as a consequence structure from agency. As a result, the analysis of the effects of either structure or agency at any moment in time necessarily ignores aspects, which are the product of their co-constitutive relationship with each other.

88

Though Geels does not explicitly describe structure and agency as temporally isolated from each other his advice for the analysis of actor-rule system dynamics, both in the short and long-term, amounts to as much. By suggesting that structural aspects ought to be assumed immutable over the short-term, Geels (2004, p.908) implies that action and 'actor structuring' effects may be analysed in isolation from any effects they may have on structural features. And, while Geels concedes that in the long run "attention should be paid to social learning and institutional change", it remains unclear how such structural change could be analysed, in the absence of an account of how agency can impact structure at the micro-level and over shorter timeframes.[23]

Consider an example: in line with Giddens's notion of "rules [as] the outcome of earlier (inter)actions" (ibid.), Geels originally argued that rules – a structural feature – are perpetuated as a direct consequence of being enacted at the micro-level. By extension, a social rule not being enacted, at the very least, implies a discontinuation of its reproduction at that moment in time. Of course, a single actor's non-observance of a specific rule, while it may cause the discontinuation of that rule at a single point in time, is unlikely to immediately result in a change of that rule or indeed the wider socio-technical rules system. However, if non-observance of the rule proves expedient the same and other actors may repeatedly disregard the original rule in favour of alternative courses of action. If out of these alternative courses of action a specific action transpires to be the most expedient, and effective in terms of achieving an aspired outcome this course of action may come to be instantiated as a novel rule for action. Of course, it is not explicitly declared as such, but rather emerges as such due to being repeatedly and successfully applied by actors.

Such repeated instances involving the re-articulation of existing rules at a meso-level through action at the micro-level may in turn accumulate until they do effect noticeable changes in the macro-level socio-technical rule system. In this sense, macro-level socio-technical regimes must be understood as chronically and tendentially evolving or stagnating with every single instance of novel rules being produced or existing ones being reproduced through micro-level action. On a meso-level these various tendencies and countertendencies may then act to offset each other leading to socio-technical stasis. Alternatively, they may accumulate either to consistently reproduce the existing socio-

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[23] This criticism persists even in the event that Geels intended his suggestion to disregard the social learning feedback loop in analyses over shorter time-scale as a mere heuristic simplification.

technical regime (socio-technical stability) or to produce a shift in the socio-technical regime (socio-technical change).

However, due to its apparent disinterest in the tendential nature of institutions as rules and resources for action, the MLP fundamentally lacks the capacity to account for the meso-level tendential production and reproduction of the socio-technical rules and resources that constrain and enable innovative action.

The above criticisms are particularly problematic, as both long-term stability and change in socio-technical systems are conditioned on the structure-agency relation (Geels, 2004, p.910). Stability in socio-technical systems fundamentally arises from the consistent (re)-production of rules at the meso-level, which align with the macro-level socio-technical regime. This alignment of rules creates and upholds a vital level of inertia in socio-technical regimes (Arthur, 1988; Rycroft and Kash, 2002), which strengthens these regimes against the emergence of and replacement through radical innovations in socio-technical niches (Geels, 2004, p.911).

As such, socio-technical change is predicated on the initial production and subsequent reproduction of rules that do not align with and re-produce elements of the dominant socio-technical regime. As these misalignments multiply and aggregate the regime becomes more vulnerable relative to novel socio-technical configurations that may arise in niches and consolidate over time. Since both socio-technical change and stability are conditioned on the chronic (re)-production of rules through action, an adequate conceptualisation of the structure-agency relation and its relevance for linking short-term action with long-term structural change is central to understanding socio-technical change processes *in progress*.

The following section presents evidence suggesting that Giddens' notion of the duality of structure received similar criticisms prior to these being levelled against the MLP. In doing so, the thesis seeks to show that the structure-agency conception at the heart of the MLP, while not necessarily faulty, certainly acts to limit the usefulness of the MLP in the context of studying and engaging with ongoing transitions towards sustainability.

Critique of Giddens' structuration theory

As outlined in the foregoing sections, the MLP builds fundamentally on Giddens' structuration theory and his concept of the 'duality of structure' to conceptualise the structure-agency relation at its heart. Giddens' theory, however, has been criticised as

creating a "false duality" (Jessop, 1996, p.123). Rather than alleviating the traditional dichotomy between agency and structure it acts to recreate a dualism that posits structure and agency as mutually reproductive of one another. According to Jessop (ibid.) this results in the "tight imbrication" of structure and agency and the essential conflation of structure with agency and vice versa (Archer 1989, 1982; Layder, 1987; Callinicos, 1985; as cited in Barley and Tolbert, 1997). Due to this conflation, argues Archer (2000, p.6), structure and agency's "reciprocal influences cannot be teased out, […] which severely limits their utility in practical social research". Unable to tease out the effects each element has on the respective other Giddens, and similarly Geels, are forced to relate micro-level action and macro-level structure "in a rather mechanical fashion" by temporarily ignoring one moment of the duality in its analysis of the respective other (Jessop, 1996, p.123).

Giddens' structuration theory, consequently, appears ontologically flat and "largely atemporal" (Sum and Jessop, 2013, p.49), despite its persistent reference to the recursivity of the structure-agency relation. However, the notion of recursivity cannot provide his theory with a temporal dimension since structure and agency can only be analysed at distinct isolated moments of the recursive relationship.
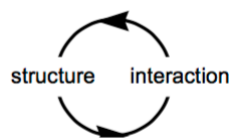
Figure 3.5   Life cycle of a social practice
                (Source: Rose, 1999)
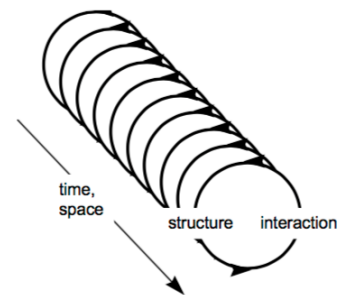
Figure 3.6   Structuration over time
                and space (ibid.)

This temporal isolation is shown in Figure 3.5 above, which depicts the (re)production of a social practice through the recursive interaction of structure and action. Although the model shows structure and action as mutually constitutive of each other, it also suggests that analysis of the two dimensions is only possible at separate and distinct moments of the life cycle of the social practice. Instead, analysis must focus on either its structural moment or its action moment. Figure 3.6 on the other hand depicts the process of structuration over time and how Giddens envisaged that the temporal isolation of structure and agency "at any given time" (Figure 3.5) could be "resolved theoretically over time"

(Figure 3.6) (Jessop, 2005, p.45). By claiming that structural transformation occurs in and through the intended and unintended effects of action and inaction "thereby creating new sets of constraints and opportunities for action" across time-space (ibid.).

In this sense, Giddens' structuration theory and the MLP (by virtue of the fact that it builds on Giddens' theory) is adequate for narration and explanation of how social structures (or, socio-technical systems and regimes, in the case of transition studies) come to be reproduced. Yet, both lack the conceptual means to provide insight into the moments at which either social reproduction prevails over change, or vice versa. Consequently, neither Giddens' structuration theory nor the MLP in its original formulation offer the means to further "advance the theorisation of social [and socio-technical] change" (Archer, 1996, p.691). Instead, so Dean (1994, p.9) "the famous 'duality of structure' [forms] an unstable amalgam sliding between a structure whose effectivity knows no limits and a form of agency that knows no determination".

Crucially, what is lost through the essential conflation of structure and agency into an inseparable duality is then an account of agents' abilities to reflect on and strategically navigate their structural context in pursuit of their individual ends. And, on the other hand, an account of how existing structures act to differentially privilege some actions and actors over others (Sum and Jessop, 2013, p.48).

Elaborating the duality: Archer's morphogenetic cycle model

In recognition of the above, transition researchers have since sought to put forward a more suitable explanation of how micro-level action may affect macro-level change or stability over time in recent edited volume (Geels and Schot, 2010). There, they specifically draw on Margaret Archer's (1982) morphogenetic cycle model of social change.

Archer's morphogenetic approach proposes to investigate the production of structural stability and change along three phases: (1) structural conditioning, (2) social interaction and resulting (3) structural elaboration. Geels and Schot (2010) add a fourth phase: (4) externalisation and objectification of the structural modification (see Figure 3.7 below).
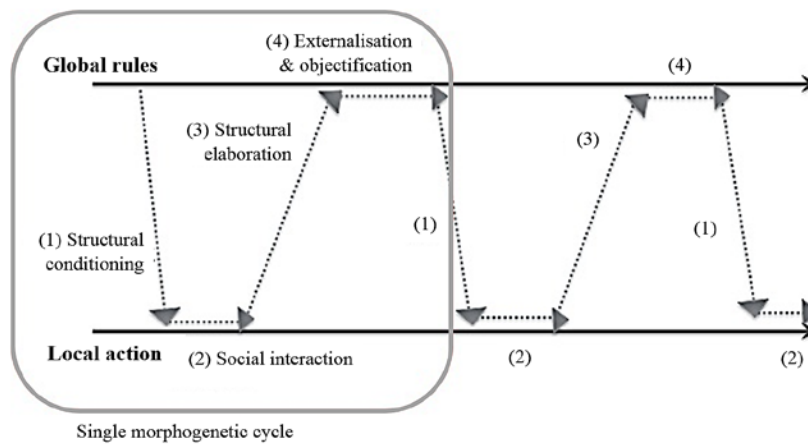
Figure 3.7 Dynamics of socio-technical change and inertia based on Archer's morphogenetic cycle model (based on Geels and Schot 2010, p.49, who adapted from Barley and Tolbert 1997, p.101)

For an illustrative example of this consider the case of transport infrastructure investment decision-making: standard economic appraisal methods, such as cost-benefit analysis (hereafter CBA), have tended to privilege infrastructural interventions that benefit motorised modes. Such interventions may yield reductions in average journey time, the benefits of which are readily quantified in monetary-economic terms, following the maxim 'time is money'. In contrast, gaining funding for interventions that benefit non-motorised modes can be trickier as cycling and walking interventions do not tend to generate large travel time savings, though they may have environmental, social and public health benefits that are not as readily quantified.

Connectedly, transport infrastructure planners contemplating an intervention for cycling used to face the dilemma of having to conduct CBA to gain funding [Structure: (1) structural conditioning], in the full knowledge that, for example, a cycling intervention may not achieve high cost-benefit ratios based on low or negative impacts on travel time savings. Confronted with this structural constraint some transport planners became creative and experimented with proxy data to quantify the monetary-economic benefits accruing from an intervention that would benefit people who cycle. For example, they linked demonstrated health impacts of active transport to reduced rates in obesity, heart disease and the like to quantify economic savings that would accrue to the public health sector (as opposed to economic gains made through additional travel) [Agency: (2) social interaction]. This allowed for active modes to yield more favourable cost-benefit ratios, thereby enabling the funding and implementation of active transport interventions previously deemed unattractive investments [Structure: (3) structural elaboration]. The

further dissemination and successful application of this practice of accounting for the broader environmental, social and public health benefits of active travel interventions by transport planners in other locales helped to establish this enhanced accounting method as part of common cost-benefit appraisal practice. Actors at national transport governance levels in turn acted to formalise the approach in binding national transport appraisal guidelines, such as WebTAG (Web-based Transport Analysis Guidance) in the UK thereby elaborating the existing set of institutional rules and guidelines informing individual action [Agency: (4) externalisation and objectification].

In the context of her morphogenetic cycle model then, Archer reinstates the original dualism by according structure and agency separate phases of the morphogenetic cycle (if for analytical purposes only). In doing so, she hopes to better capture the changing relation between structure and agency over time ultimately shedding light on when and to what extent certain kinds of agency may be constrained or enabled by a given set of structures. However, Archer does not translate this more nuanced conceptualisation of the structure-agency relation into the morphogenetic approach. It remains ontologically flat and no more able to analytically account for the tendential nature of structure and agency underlying empirically observable conditions of change and stability than the duality of structure it seeks to replace (Jessop, 2005).[24] This explains why Geels and Schot (2010, p.51) deem the morphogenetic cycle model a suitable "extension of structuration theory thus [providing] a systematic sociological explanation of (technological) trajectories", despite Archer having originally formulated the approach explicitly in opposition to Giddens' duality of structure.

Consequently, the MLP in its original formulation remains fundamentally unable to analytically account for underlying structural and agential tendencies involved in the production of emergent structural change and inertia. Empirically manifest structural change and stability can be traced using the morphogenetic cycle model much as through the original duality. However, the tendencies underlying the observed empirical manifestations remain opaque. And, underlying causal mechanisms, i.e. the varying causal efficacy of structure and agency at particular conjunctures remain 'black boxed'. As a result of this, narrative accounts of past socio-technical change inevitably come to convey

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[24] Interestingly, Archer (1982) herself first criticised Giddens' notion of the duality of structure in her aptly titled article 'Morphogenesis versus Structuration'. In this article, she points out that the duality's tight imbrication of structure and agency leaves analysts fundamentally unable to tease out the structural/agential moments of change and stability.

a sense of inevitability or mere contingency on change in external landscape factors as has been diagnosed by transition scholars and other commentators including Berkhout, et al. (2003) and Lawhon and Murphy (2012).

Charting a way ahead for sustainability transition research

However, the study of ongoing (or indeed future) transitions specifically towards sustainability requires such insight. Radical socio-technical change, by definition, is reliant on developing an understanding of when, why and how agency can and does trump structure to successfully disrupt institutionalised logics. If the strength of institutionalised logics is the reason for socio-technical inertia and path dependence, transition scholarship needs to inquire into what gives institutionalised logics their strength, and offer a causal explanation to how and where this strength arises from. Otherwise, transition research will remain locked in circular reasoning with novel socio-technical configurations diffusing on account of their resonance with established institutional logics, while the strength of an institutional logic is based on the extent to which it is institutionalised i.e. manifested in the form of dominant socio-technical configurations.

Escaping this circular reasoning requires an investigation into how the structuring power of institutions is created and undone. And since transition research considers institutions to exist only in so far as they are continually enacted from one moment to the next this requires an investigation into (1) how structure and agency interact at concrete moments in the transition process and into (2) what cause both to interact in ways that bring about sedimentation and ultimately institutionalisation of novel discourses, ideas and narratives over time.[25]

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[25] Recent research has gone some way towards addressing the problem (though unfortunately room to review these works is limited within this thesis): Fünfschilling and Truffer (2016) and Smink, et al. (2015), for example, conceptualise agents as fundamentally embedded within institutions and subject to institutional logics, yet able to undertake 'institutional work', i.e. creatively interpret and enact institutional constraints. Other authors highlight the need to investigate the cultural dimensions of socio-technical stasis and change: Rauschmayer et al. (2015) and Wittmayer et al. (2014), for example, draw on insights from practice theory to link actors' changing local practices, the changing meanings they attach to these practices and how the relative coherence of practices' material and discursive moments contributes to macro-level structural change or inertia. Bosman et al. (2014) and Pesch (2015) argue for greater attention to the role of discourse as a central means through which transition actors make sense of their macro-level structural context and impute meaning into the micro-level actions appropriate for them to undertake within that context.

Specifically, this thesis contends that transition research needs to further sharpen its view for the relative structuring power of institutions, that is both to the fact that not all institutions are equally constraining or enabling and even a specific institution is not equally constraining and enabling to all transition actors and actions, nor at all times and in all places. Rather, different institutions limit some and enable other actions, and act in some though not at other moments of a transition process. Regime institutions, for example, may be said to enable the actions of stakeholders whose interests benefit the perpetuation of the regime while limiting the actions of niche actors whose interests do not benefit the perpetuation of the regime. However, since regime institutions themselves cannot be said to hold any ordering power over stakeholders' actions, or only in the sense that they are enacted by said stakeholders, what yields their perpetuation by stakeholders? An explanation must be sought at a deeper level, and it must take seriously the role of agency in both the interpretation and enactment of institutions.

Therefore, transition research needs to interrogate the rationales informing agency as based on actors' perceptions of and strategic calculations within their action context. Of course, such insight is not only enabled by, but positively necessitates investigation of particular transition moments with concrete constellations of actors who present specific strategic barriers and opportunities for action to one another. It is through examining the micro-moments of socio-technical transition processes that a better understanding of the causes of socio-technical inertia and change as arising from the interaction of calculated and strategic action by different transition stakeholders can be developed.[26] In connection with this, sustainability transition research requires a relational lens on transition dynamics. Such a relational perspective should draw out relative differences between transition stakeholders, emphasising their differential opportunities and barriers for action, both in terms of how these opportunities and barriers present themselves structurally as well as how they are perceived by actors themselves, i.e. made sense of from an agential perspective.

This is where the research seeks to make a contribution to transition scholarship by articulating a step forward in the development of a more critical and reflexive sustainability transition research. Specifically, it proposes a further move from the general to the particular: from studying forms of agency, "that are likely to influence the creation,

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[26] Note that though the actions of transition stakeholders may be deemed calculated and strategic, they need not necessarily produce the calculated and desired effect to be deemed causally efficacious.

maintenance or disruption of institutions" (Fünfschilling and Truffer, 2016, p.310) to interrogating whether and why some forms of agency are more likely to be successful in terms of creating, maintaining or disrupting institutions than others at specific moments of a concrete transition process. To this end empirical research focuses on the specific case of a currently ongoing socio-technical transition process within the urban transport sector, namely the transition to utility cycling in the road transport system in London, UK. The explicit intention of this empirically grounded case study is to demonstrate the usefulness of such a critical transition research perspective in generating insights that can enable transition stakeholders, whether technology producers or consumers, policymakers, practitioners and activists, and even researchers, to pursue (or indeed obstruct) long-term socio-technical change more strategically.

In a first step towards this end, the following Chapter 4 presents the literature on cultural political economy as a grand-theoretical project built on critical realist foundations and offering a fruitful crossover with sustainability transition theory.

4. CULTURAL POLITICAL ECONOMY

To develop a critical transition perspective this thesis draws on Jessop and Sum's (2016) approach to the critique of dominance and hegemony of social formations as arising from their articulation of cultural political economy (Sum and Jessop, 2013). Their cultural political economy (hereafter CPE) itself builds centrally on complexity theory, critical realism and the strategic relational approach as well as combining insights from Marxian critique of political economy, concepts such as Foucault's notion of truth regimes and Gramsci's notion of hegemony. How all these elements are combined in Sum and Jessop's cultural political economy approach and how they combine to enable critique of dominant and/or hegemonic social formations is presented in detail in the following sections.

In their 2013 book, Bob Jessop together with Ngai-Ling Sum present a first systematic articulation of CPE as an emerging transdisciplinary social scientific approach concerned fundamentally with understanding social life, and thus social change, through analysis of both its semiotic and structural features. Though billed as a "grand-theoretical project" (Sum and Jessop, 2013, p.1), this CPE approach developed to a large extent, though not exclusively, from Jessop's own decades-long engagement with political economy topics, including state theory (as concerned with the study of the nature and role of the state; see also: Jessop, 2016, 1990) and the regulation approach (as concerned with studying the role of changing institutional ensembles in securing temporary stability and long-term durability of capitalist systems of production and consumption; see also: Jessop, 1997b). The relevance of such a political economy inspired literature for research on socio-technical change and sustainability transitions is self-evident. It arises in connection with the central role of socio-technical systems of production and consumption in the economy as well as the political dimensions and implications of seeking and enacting change in these socio-technical systems. In what follows, the thesis presents the central tenets of Sum and Jessop's CPE approach and outlines how it can fruitfully enrich socio-technical transition literatures, and specifically the theoretical underpinnings of the MLP.

After introducing the theoretical and conceptual foundations of CPE the thesis turns to translating Jessop and Sum's (2016) CPE-based approach to the critique of dominance and hegemony for the context of socio-technical transitions. That is, the thesis re-articulates it as an approach for the critique of dominance and hegemony of socio-technical regimes, as special kinds of social formations oriented and organised around socio-technical configurations fulfilling a specific societal function.

4.1. Introducing cultural political economy

In what follows, Section 4.1 of this thesis first lays out the theoretical roots of CPE in institutional-evolutionary political economy and critical semiotic analysis. The section further outlines the role of complexity theory and critical realism within the CPE approach, before explaining the central significance of semiosis and structuration as key means for overcoming what CPE diagnoses as a fundamentally complex and objectively unknowable reality.

Theoretical origins of CPE

CPE links literatures on *institutional-evolutionary political economy* and *critical semiotic analysis* to understand the role of culture in processes of "ordering, reproducing and transforming capitalist social formations" (Jessop, 2004, p.159). The following section presents both literatures discussing their commensurability with transition theory and explaining how both literatures are combined to articulate CPE.

Institutional-evolutionary political economy

Institutional-evolutionary political economy (hereafter IEPE) has been defined as:

> *"a realistic, interdisciplinary study of the dynamic structure, evolution and transformation of human action within socio-economic systems, paying particular attention to the reproduction, functions, contradictions, and unstable dynamics of the institutions of production, distribution, and exchange of material and immaterial resources set within a social and ecological environment through historical time." (O'Hara, 2007, p.6)*

Much like socio-technical transition theory, IEPE is interested in social change and stability as resulting from the coevolutionary interaction of structure and agency, with human agency understood to be boundedly rational in nature. As an institutional-evolutionary variant of political economy, IEPE's specific entry point to the study of social change is a focus on "the formation and change of […] preferences, knowledge, technologies and institutions through historical time" to enable a better understanding of the past and ongoing evolution of capitalist systems of production and consumption and associated social formations (ibid.).

The above aligns well with socio-technical transition theory's own conceptualisation of innovation in socio-technical systems of production and consumption as resulting from a process of coevolutionary variation, selection and retention of novelty generated through

the exercise of boundedly rational human agency within the constraints of a given structural context. IEPE's (and connectedly CPE's) specific focus on broader matters of political economy and the reproduction of capitalist social formations in this context should not be interpreted as conflicting with transition research's more specific interest in socio-technical change. Both theories are fundamentally interested in conditions and processes of social change and inertia. Of course, IEPE's primary interest is in the changing material and institutional dimensions of the socio-economic aspects of social formations, while transition research is primarily interested in the immaterial and material dimensions of, in particular, the socio-technical aspects of social formations. Importantly, though, neither of the two would pose the primacy of socio-economic or socio-technical aspects in explaining social change and inertia, respectively. As such, the two literatures should be understood as offering potentially complementary rather than competing approaches, methods and insights for the study of social change and inertia though perhaps choosing alternative entry points for their respective investigations.

In addition to the IEPE perspective, CPE further draws on tools and concepts from a second field of research: critical semiotic analysis.

Critical semiotic analysis

Critical semiotic analysis (hereafter CSA) is concerned with semiosis as the "intersubjective production of meaning" (Jessop, 2004, p.161) and "an important element/moment of 'the social' more generally" (ibid., p.172).

CSA, similar to other cultural turns, posits the causal efficacy and meaningfulness of semiosis, and the connected need for social phenomena, their underlying processes and emergent effects to "not only be interpreted but also explained, at least in part, in terms of semiosis" i.e. the sense- and meaning-making categories and processes informing them (ibid., p. 161). In connection with this, CPE is interested in interrogating the processes and means through which social actors make sense of their action contexts and imbue actions within these contexts with meaning.

In connecting IEPE with CSA, CPE suggests that how boundedly rational human agents act in a given structural context is not only mediated by the objective institutional and material features of this structural context: CPE would argue that agents' individual capacities to make sense of a given structural context, and the categories and means available to them to impose meaning on actions within that context, are causally efficacious. That is, the categories, concepts, conceptual frameworks, discourses,

narratives, imaginaries, and so on, which they can and do draw on to interpret their action context and to impose meaning on competing courses of action possible within that context are significant and have explanatory value. Connectedly, CPE would argue that there is no single, shared structural context within which different actors may exercise agency. Rather there exist manifold subjective readings and interpretations of a single objective action context, which actors may make sense of and rationalise action within quite differently. Their subjective interpretation of this structural context in turn depends on their varying ability to read this context as partly mediated also by the different conceptual categories, discourses and narratives available to different actors in a given place and time and depending on their structural position.

However, much like processes of structuration, semiosis too is subject to evolutionary dynamics of variation, selection and retention. Connectedly, CPE cautions analysts to also remain aware of the existence and influence of a wide range of more or less sedimented interpretations, meanings and discourses, which actors may draw on more or less habitually to interpret and enact their structural contexts. The sedimented, institutionalised nature of these sense- and meaning-making tools in turn enables and at times enforces convergence in terms of how different actors interpret a given structural context. Thus, despite there being room for agency in the form of novel and alternative interpretations of strategic action contexts arising, there is also always a potential for structurally conditioned and path-dependent interpretations of these strategic action contexts.[27]

This interest in individual actors' perceptions, knowledge, preferences, etc. as well as in sedimented cultural frames, social institutions and norms of interaction, etc. as factors influencing social-technical change is also not foreign to transition scholarship (see Figure 3.4). However, continued criticism of transition accounts suggests that transition research struggles to pay these factors due attention by effectively steering a course between structural determinist and social constructivist explanations of socio-technical change. As explored in Section 3.2 and onwards, case studies have repeatedly been criticised as delivering accounts of transitions that make the underlying socio-technical change

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[27] This is also where the recursive nature and dialectial relationship between semiosis and structuration should become apparent: as sense- and meaning-making categories, discourses, imaginaries and the like are selected, retained and re-produced they may sediment and become institutionalised and structurally inscribed features of a social formation.

processes appear inevitable, with little "sense of how, why, and through whose agency" socio-technical change was brought about (Lawhon and Murphy, 2012, p.360).

CPE, in contrast, is determined to pay due attention to both semiosis and structuration as analytically distinct, yet coevolving and, therefore, related elements in the constitution of social formations and, by extension the production of social change and inertia.

CPE's interest in the analysis of semiosis and structuration is grounded in its foundational assumption of reality being fundamentally complex – so much so that it cannot ever be objectively understood or mastered in its entirety by any one actor. As Sum and Jessop (2013, p.3) note, "[t]his is self-evidently and trivially true, of course, yet is has important implications for social science and everyday life": If the complexity of reality is such that it prevents social actors from fully and objectively comprehending that reality at any given moment in time, it is reasonable to assume that social scientists, who are after all social actors themselves, face similar restrictions in terms of their ability to theorise or model this complex reality accurately and exhaustively.

CPE's supposition of the insurmountable complexity of reality is further compounded by its critical realist understanding of reality. This critical realist philosophical stance is in stark contrast to positivist and interpretivist traditions, both of which, it has been argued, commit the epistemic fallacy (Bhaskar, 2008) of equating knowing with being, i.e. conflating what is or can be known about reality with reality itself.[28]

4.2.   Interlude: Critical realist philosophy of social science

At the heart of the critical realist philosophy is the notion that social reality is stratified with "the empirical […] conceived of as only one element of social reality" (Carter and Sealey, 2009, p.70). Specifically, critical realists believe reality to be stratified into the overlapping domains of the real, the actual and the empirical (Figure 4.1).

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[28] Two key competing ontologies informing scientific research are objectivism and subjectivism. Objectivism holds that the nature of reality is singular and mind-independent, i.e. there exists only one reality and it does so independently of our consciousness. The purpose of research under objectivism is then to generate objective insight of the single reality 'out there'. In contrast, subjectivism holds that there is no singular, objective reality out there that could be grasped independently of the human consciousness. Instead, knowledge of reality is always mediated by the consciousness and subjective interpretations of the onlooker. As a consequence, all knowledge of reality is considered subjective in nature.

	Domain of Real	Domain of Actual	Domain of Empirical
Mechanisms	x		
Events	x	x	
Experiences	x	x	x
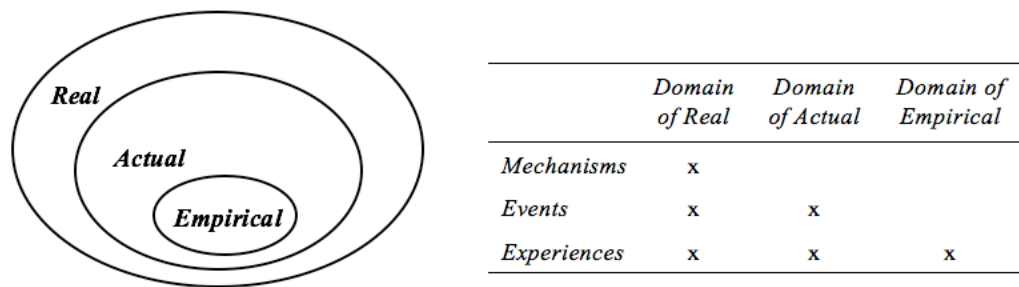
Figure 4.1   Inclusion relations of the three domains of reality and their populating entities (Source: Elder-Vass, 2007, p.161)

The smallest and most directly accessible domain is the domain of the *empirical*. It is constituted by events, which can be in some way observed and experienced. The domain of the empirically observable is wholly contained within a second domain: the domain of the *actual*. This domain encompasses all actual events resulting from the interaction and actualisation of underlying real causal mechanisms, whether or not these actual events are or can be observed empirically. A third domain is the domain of the *real*. This third and final domain comprises all existing causal mechanisms whether they become actualised events and observable experiences or not.

This stratified conception of reality enables the critical realist to combine a position of ontological realism with an epistemological relativist stance: Though there exists a singular, objective reality out there it is not directly accessible and, therefore, never fully knowable to us due to its stratified nature.

Empirical experiences are most readily accessible to us by virtue of the fact that we have the requisite knowledge, concepts, language, tools and technologies that enable us to experience, examine and communicate them. The deeper domains of reality, i.e. those of actual events and real mechanisms in turn may not be directly empirically experienced by virtue of the fact that we lack the requisite means to render them readily accessible and observable. However, these events and mechanisms at these domains may nonetheless become the subject of scientific enquiry in an effort to generate new knowledge, concepts and language to capture previously inaccessible aspects of reality.

As such, our access to reality is mediated, i.e. both enabled and constrained, by the knowledge, language, concepts and other means (including tools for observation, measurement and recording) available to us at different moments in time and space. In other words, reality, our access to it and knowledge of it are mutually embedded and co-constitutive of one another. However, this means also that our knowledge of reality

remains at all times "partial, provisional and incomplete" (Sum and Jessop, 2013, p.5) and its production and application historically and contextually contingent. Knowledge in critical realist terms:

> *"is neither wholly objective nor subjective, but … some (social) explanations are more adequate representations of reality than others, though all are, […] always 'partial truths'"* Proctor (1998, p.361).

4.3.   One complex reality, two modes of complexity reduction

As outlined briefly above, critical realists are able to reconcile a position of ontological realism with one of epistemological relativism based on their conception of reality as stratified. This allows them to posit the existence of a single objective reality while denying the possibility of any one actor having full access or objective knowledge of this reality. They are able to do so based on a conceptualisation of reality as stratified into three levels (the real, the actual and the empirical) with the empirical being most and the level of the real being least directly accessible to actors. Building on this critical realist assumption of a stratified reality, CPE, despite acknowledging the existence of a single objective, if complex, reality, is able to contend that said reality can never be fully accessed and known in all its depth nor all its complexity by any one actor.

With the deeper strata of reality remaining inaccessible to them, social actors (including social scientists) find themselves facing a reality that they are unable to experience and understand exhaustively, or master at any point in time. CPE takes this as its starting point in positing that social actors, while unable to master reality in all its complexity, are nonetheless able to reduce complexity to enable them 'to go on in the world'.

Connectedly, CPE is primarily interested in exploring and understanding not complexity itself, but rather the means and processes by which social actors are able to reduce real-world complexity to an extent that enables them to go on in the world and act purposefully within it. And, as already hinted at above, Sum and Jessop's CPE approach distinguishes two fundamental and ontologically distinct modes of complexity reduction social actors draw on to enable purposeful action in a complex, ontologically stratified reality: (1) *semiosis* as a form of sense- and meaning-making, and (2) *structuration* or structure-building. Each is considered in turn overleaf.

Semiosis as sense- and meaning-making

The word semiosis derives from the Greek *sēmeiosis* ('[inference from] a sign', Oxford Dictionaries, 2017) and was introduced by Charles Sanders Peirce to denote the social process of meaning-production and communication via signs. Sum and Jessop (2013, p.3) employ the term semiosis specifically to refer to both sense-making as the "apprehension of the natural and social world" and meaning-making as the related process of "signification and meaningful communication".

These processes of sense- and meaning-making are essential in enabling social actors, who aspire to act purposefully in a highly complex world, to reduce said complexity. Reality is at all times constituted by a multitude of functional systems within which a variety of factors are at work at any moment in time, including other social actors with agendas of their own. These functional systems further act and interact across various geographical scales and time horizons. As such, social actors find themselves embedded in highly complex and dynamically changing action contexts and challenged to act with purpose and confidence within these contexts. Specifically, actors would likely find themselves facing inordinate amounts of information, but little means of discriminating between aspects of reality relevant for them to act in a purposeful and calculated manner at any given moment in time. Considering all potentially relevant variables prior to action, would not only prove prohibitive, but impossible. That is, in the absence of concepts, narratives, norms, institutions, material artefacts, technologies and the like. These, by contrast, enable social actors – via their semiotic aspects, i.e. their symbolic and cultural sign-values – to effectively make sense of and impose meaning on complex action contexts.

In this sense, actors draw on these concepts, narratives, norms, material artefacts, etc. as routinised, institutionalised and shared forms of sense- and meaning-making. To the extent that these semiotic elements coalesce into broader semi-coherent meaning systems they form, what Sum and Jessop (2013) term *construals*, or *imaginaries*. Such an imaginary is defined as:

> *"a semiotic ensemble (or meaning system) without tightly defined boundaries that frames individual subjects' lived experience of an inordinately complex world and/or guides collective calculation about that world. Without imaginaries, individuals cannot 'go on' in the world and collective actors (such as organizations) could not relate to their environments, make decisions, or engage in strategic action" (Sum and Jessop, 2013, p.165).*

These imaginaries further comprise "a specific configuration of genres, discourses and styles and thereby constitute the semiotic moment of a network of social practices in a given social field, institutional order or wider social formation", such as the urban transport sector (Sum and Jessop, 2015a, p.31). The term *'genre'* in this context is used to refer to distinctive formats in which discourses can be presented and through which they are framed. Examples of genres include interviews, news reports, political manifestos or, in the context of the urban transport sector, transport strategies. The term *'discourse'*, in turn, refers to the distinctive ways in which apparently similar aspects of the world or social events can be understood and represented differently based on different vantage points. An example of different discourses in the transport sector would be the competing discourses of 'predict-and-provide' and of 'demand management' introduced in Chapter 2. Both discourses are approaches to representing the challenges of transport provision, though they emphasise different aspects of social life or differ in their interpretation of these aspects. Finally, the term *'style'* refers to the ways in which different actors use language and discourse "as a resource for self-identifying" (Fairclough, 2003, p.26). This involves actors enacting specific social roles they inhabit through the way they speak or write, including, for example, the vocabulary they use, the formality or informality of their language, how personal their utterances are, etc.

> *"The relationship between genres, discourses and styles is dialectical. Thus discourses may become enacted as genres and inculcated as styles. What enters a practice as a discourse […] may become enacted as new ways of (inter)acting, which will in part be new genres (new ways of (inter)acting discursively). And such a new discourse may become inculcated as new ways of being, new identities, including both new styles and new bodily dispositions. Moreover, […] discourses may become materialised in new buildings, new technologies, etc." (Fairclough, 2003, p.214)*

Consider the role of imaginaries in the context of the urban transport system, for example: on the one hand, the system is materially constituted in the sense that there is what Sum and Jessop (2013, p.166) might term the 'actually existing urban transport system' as constituted by "the chaotic sum of all [urban transport] activities". However, in their totality these activities are profoundly complex and unstructured. So much so that they "cannot be an object of effective calculation, management, governance, or guidance" (ibid.). Instead, actors are reliant on semiotically constructing less complex and more calculable and manageable subsets of the totality of urban transport activities. To this end they articulate construals of 'the urban transport system' as "imaginatively narrated, more

or less coherent subset[s] of these activities occurring within specific spatio-temporal frameworks" (ibid.).

An example of such an urban transport imaginary is the imaginary of urban transport and mobility as a means of furthering economic exchanges, economic growth and development (as opposed to imaginaries of transport and mobility as a means of connecting people and communities for the interchange of care; as a means of furthering physical and mental well-being; or as a means of experiencing and connecting with the physical world). Based on this imaginary, certain discourses, genres and styles have developed and inform the ways in which social actors act and interact to intervene within the urban transport system. An example of a genre arising in connection with the imaginary of transport and mobility as a means of furthering economic benefits and economic growth is the genre of Value for Money (VfM) assessments. This genre is employed in the context of the development of Transport Business Cases, which form the basis on which government ministers judge the appropriateness and expediency a transport investment proposals in terms of their ability to demonstrate a case for change, value for money, commercial viability, financial affordability, and managerial achievability (DfT, 2013b). Specifically, Value for Money assessments are documents detailing the "economic, environmental, social and public account, impacts that transport interventions may have and, based upon these, give advice for investment boards and government ministers about the economic case for a proposal" (DfT, n.d.). These impacts, in turn, are measured in monetary terms and articulated in a benefit-cost ratio (BCR). Connectedly, it should be noted that "imaginaries have a crucial constitutive role" in the sense that they "identify, privilege, and seek to stabilize some […] activities from the totality of […] relations and transform them into objects of observation, calculation and governance" via the discourses, genres and styles that constitute them (Sum and Jessop, 2013, p.166).

Thus, complex social relations, such as the urban transport system or the economy have to be constituted semiotically first, before they can become the object of strategic calculation and intervention by actors. Note, however, that this does not suggest any primacy of the semiotic over the structural. The formation of imaginaries itself is always partially grounded in the existing material reality as well as mediated by already institutionalised discourses and imaginaries.

Connectedly, semiosis must be recognised as being subject to evolutionary processes of variation, selection and retention. Actors' subjective experience of a complex and

dynamically changing reality is a source of constant variation in sense- and meaning-making. Novel semiotic categories are recursively selected, retained and sedimented over time based on their resonance with existing structural and semiotic aspects of reality. And as sense- and meaning-making categories are selected, retained and re-enacted over time they are likely to come to have structuring effects on the material world.

Structuration: From construal to construction

Structuration, in turn, denotes the attempts of social actors to structure social relations. Structuration processes, much like semiosis, are also subject to evolutionary variation, selection and retention and contingent coevolution with semiotic aspects of reality.

On the one hand, semiosis provides the sense- and meaning-making categories, which, insofar as they are deemed useful categories for complexity reduction, are likely to be retained and made recurrent use of over time. As different actors select some semiotic categories as shared means for construing reality, these construals are likely to sediment and become institutionalised. They become the basis of actors' efforts to structure and to some extent to materially intervene in and construct reality. This occurs as semiotic construals enable the articulation and enactment of calculated and strategic social action, which in turn has real structuring effects on reality both institutionally and materially. The resulting material and institutional structuration of reality further serves to sediment, or routinise, certain construals of reality as well as acting to enforce selection of discourses, associated concrete social practices and material forms that are most resonant, or at least *compossible*, i.e. not inherently contradicting existing "relations among relations" within specific moments in space and time (Sum and Jessop, 2013, p. 4).

As such, semiosis as a mode of complexity reduction is not independent of structuration, but rather dialectically related to it. Hauf (2016, p.38) summarises the role of both modes of complexity reduction as follows:

> *"Semiosis and structuration serve as two ontological foundations of CPE. Semiosis is foundational to the social world, because it gives sense and meaning to it, without which it would remain incomprehensible for its inhabitants and could not be said to be social. Structuration is foundational, because it is necessary to transform the endless variety of possible elements of an unstructured complexity into a "requisite variety" of compossible moments that, when composed or articulated, may form a relatively stable and coherent structure (Sum and Jessop 2013, 24)."*

The 'requisite variety' Hauf alludes to results from the coevolution of semiosis and structuration as characterised by a mix of both path-dependent and path-shaping moments as is explained in more detail below.

The contingent coevolution of semiosis and structuration

The relationship between semiosis and structuration may, therefore, be characterised as coevolutionary in nature, involving "the coupling and coevolution of meaning-making and structuration with neither form of complexity reduction being reducible to the other" (ibid., p.184). Connectedly, structural elements of reality, including institutions, social practices, artefacts, technologies, infrastructures and the like, all have obvious material, extra-semiotic dimensions. However, all of them also have semiotic dimensions that imbue their use with meaning as well as enabling social actors to interpret and make sense of reality through the lens of the meaning inherent in these material forms and practices. Conversely, semiotic categories are never without extra-semiotic reference. In fact, they "cannot be understood without identifying and exploring the extra-semiotic conditions that make semiosis possible" (Jessop, 2004, p.164). The semiotic and extra-semiotic may not be identical, but both are dialectically related and mutually interdependent.

Consider, for example, the semiotic concept of the 'urban transport system': the concept serves to signify the totality of all transport activity occurring within a city, no matter what mode or whether freight or passenger transport. As such, the concept has a real-world referent, though it is not itself able to capture, nor does it seek to capture, the actually existing urban transportation system in all its complexity. The purpose of the concept is then to denote an imagined urban transport system as a subset of the actually existing, infinitely complex urban transport system, which can become an object of contemplation, discussion and ultimately calculation and purposeful intervention by social actors.

The coevolution of both modes of complexity reduction further gives rise to what Sum and Jessop (2013) term 'enforced selection' and the production of requisite variety (as opposed to strict uniformity) in social relations. As actors come to enact some values, narratives, practices, technologies, etc. with greater confidence regarding the calculations and strategic action these enable in a given context, the need for and appeal of novel and alternative concepts, imaginaries, practices, technologies, etc. is diminished while the use of existing ones is enforced. From an evolutionary perspective, 'enforced selection' acts to limit variation in sense-and meaning-making so that tried-and-tested ideas, imaginaries, practices, artefacts etc. are retained and reproduced over time and in different contexts.

As these categories are re-enacted across time and space they become increasingly sedimented and routinised, habitualised aspects of social action. In the short term, this sedimentation can serve to effectively limit the complexity social actors face when making sense of their action context at any given moment in time, insofar as actors are able to draw routinely on these sedimented semiotic categories, imaginaries, associated social practices and materialities.

However, in the long run and as the nature of reality and, consequently, the nature of actors' action contexts inevitably shifts, reliance on routinised forms of sense- and meaning-making and structuration can lead to contradictions in how reality is semiotically construed and materially constructed. Such shifts may occur for a variety of reasons not least as a result of the complex interactions among the totality of actors, who based on their unique position and interest in a social formation, may enact various complementary as well as competing imaginaries, social practices and so on. However, no matter the source of such contradictions, they can significantly disrupt and (re-)politicise formerly sedimented imaginaries, social practices and so on. Although at other times routinised forms of sense- and meaning-making and structuration remain sedimented, notwithstanding apparent contradictions and/or the possibility that alternative practices, institutional arrangements, technologies and the semiotic imaginaries and concepts informing them may represent superior construals of reality and, consequently, superior means for the construction of reality.

In connection with the above, CPE has an interest both in how the path-dependent development of social formations is secured via enforced selection, and how this path-dependent development at times may lead to moments of contradiction and crisis that can significantly unsettle sedimented forms of meaning-making and structuration allowing potentially new imaginaries and construals to shape the construction of social order.

To this end, CPE is focused on four interrelated mechanisms that together condition enforced selection in the construal and construction of reality: semiosis, agency, (disciplinary) technologies and structuration. The following section discusses each in turn.

Enforced selection via strategic selectivities

As indicated above, CPE understands relatively stable, semi-coherent social order to arise via enforced selection as resulting from the coevolution of semiosis and structuration. This enforced selection serves to produce constrained heterogeneity, or a limited diversity,

among social relations and acts via four strategic selectivities: structurally-inscribed strategic selectivities, discursively-inscribed strategic selectivities, technologically-inscribed strategic selectivities, and agentially-inscribed strategic selectivities..

Structurally-inscribed strategic selectivities, or structural selectivities for short, are revealed in the extent to which a given structural context strategically privileges "some actors, some identities, some strategies, some spatial and temporal horizons and some actions over others" (Sum and Jessop, 2013, p.49). These strategic selectivities may be inscribed into structures both in terms of their content, form and operation. Structurally inscribed selectivities "are those elements in a situation that cannot be altered by agents in a given time period and vary according to the strategic location of agents in the overall social formation" (Jessop, 2016, p.95).

Discursively-inscribed strategic selectivities, or discursive selectivities for short, operate by limiting the discourses, imaginaries and meanings actors can draw on in order to make sense of their relative positioning within their structural context and to impute the actions they undertake within this context with meaning. Thereby they contribute to the privileging of actors and actions, which draw on and perpetuate specific discourses by virtue of their resonance and dominance within a given structural context. The more far-reaching, dominant and resonant a discourse the more likely it finds expression in the form of discursive selectivities within social structures and processes.

Technologically-inscribed strategic selectivities denote selectivities arising from disciplinary–technologies[29]*,* which "include diverse social practices that are mediated through specific instruments of classification, registration, calculation, and so on, that may discipline social action" (Jessop, 2009b). These disciplinary technologies play

> *"a key role in the selection and retention of specific imaginaries insofar as they provide reference points not only in the meaning-making but also in the coordination of actions within and across specific personal interactions, organizations and networks, and institutional orders. In this sense, they are important meaning-making instruments deployed by agents to translate*

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[29] Sum and Jessop (2013) in their original publication distinguish discursive and technological selectivities, with 'technological' selectivities to be understood in a strictly Foucauldian sense as beyond mere material technological selectivities. To avoid confusion in the context of this thesis, which also considers socio-technical innovation and the role of technologies (including, but not exclusive to material technologies), the thesis will refer to the 'technological selectivities' considered by the strategic-relational approach as *disciplinary-technological selectivities*.

specific social construals into social construction and hence to structure social life" (ibid.).

The enactment of disciplinary technologies, therefore, serves to reproduce specific configurations of discourses and associated social practices. As these discourse-practice complexes are re-enacted and sediment they give rise to selectivities that significantly limit the range of appropriate actions that can be undertaken in a given context and by whom these can legitimately be undertaken. That is, disciplinary-technological selectivities "create and regulate particular orders of social relations" by disciplining what kind of social actions may be undertaken within these orders (Sum and Jessop, 2013, p.218).

Finally, *agentially-inscribed strategic selectivities,* or agential selectivities, describe the differential ability of social actors to read selectivities inscribed in their action context and enact these strategically to make a difference in certain conjunctures, i.e. certain moments in space and time. And, while CPE understands structural, discursive and disciplinary-technological selectivities as imposing constraints on agency, individual agents are also considered to be fundamentally able to reflect on their structural context. At times, social actors may follow routinised or habitual behaviour, other times they may consciously examine their context for barriers and opportunities for strategic action, i.e "read particular conjunctures, displace opponents, and rearticulate discourses and imaginaries in a timely fashion" (ibid., p.204). Such strategic context analysis can in turn enable them to navigate said context more strategically through calculated rather than habitualised actions. Investigation of agential selectivities requires an assessment of how different actors reflect on the structural selectivities facing them and whether and to what extent they "come to orient their strategies and tactics in the light of" their relative positioning within and "their 'feel for the game'" (ibid., p.51). Agents' capacities to read and enact conjunctures strategically, i.e. agential selectivities, remain, however, significantly overdetermined by discursive and disciplinary-technological selectivities (see Table 4.1 for a summary of the above).

Mode of selectivity		Grounded in	Effects
Structural		"Contested reproduction of basic social forms (e.g. capital relation, nature-society relations, etc), their specific articulation in institutional orders, organisational forms and interaction contexts"	Structural selectivities are not universal across time and space, meaning they favour some agents, interests, actions, strategies, etc. over others though these preferences are subject to change over time. The inscribed selectivity for actions and strategies that perpetuate dominant institutional structures increases path dependency and limits opportunities for path shaping.
Over-determine agential selectivities	**Discursive**	Agential sense- and meaning-making in the face of complexity relies on socially developed and enforced perpetuation of certain discourses, which happens at all scales from the "pores of everyday life to the self-descriptions of world society".	Discursive selectivities constrain and frame the array of possible imaginaries, discourses, arguments, social and personal identities and feelings thereby shaping scope for development and perpetuation of regimes, sub-regimes and niches.
	Disciplinary -technological [30]	Disciplinary technologies as complex ensembles of knowledge, orders of discourse, sites and logics of governance and calculated intervention suited to create and/or regulate particular orders of social relations.	Disciplinary technologies are purposefully developed around, and thus favour the perpetuation of, specific socially construed truth regimes that problematise certain natural relations in discourse and practice by establishing and reinforcing specific subject-object positions, and resulting power relations. Their inscribed selectivity for a dominant truth regime gives stability to these disciplinary-technological ensembles thereby favouring path dependency and limiting opportunities for path shaping through variations in the disciplinary-technological ensembles and the underlying truth regime.

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[30] Disciplinary-technological instead of just technological to distinguish 'technological' in the sense that it is used in socio-technical transition theory from Jessop's (2009b) conception of technologies as social practices that serve to discipline social action so as to reproduce specific (forms of a) social order.

Agential	Ability of some actors to exploit structural, discursive and disciplinary-technological selectivities they face in specific conjunctures to 'make a difference' in pursuit of their own purposes.	Capacity to affect change depends on actors' abilities to 'read' conjunctures and identify inherent scope for action; to stimulate a review (and re-articulation) of dominant discourses; to exploit the array of established disciplinary technologies or devising new ones; and to force shifts in the balance of powers.

Table 4.1   Four modes of strategic selectivity (Adapted from Sum and Jessop, 2013, p.218)

The four selectivities are strongly interrelated. For example, agential selectivities, insofar as they give rise to novel and in some way superior ways of making sense of and enacting existing structural constraints, are the source of significant semiotic and extra-semiotic variation. This variation, if reproduced over time, as contingent on its resonance with existing semiotic and extra-semiotic forms within and across different social fields, may itself give rise to alternative dominant discourses and/or disciplinary technologies and associated selectivities. Likewise, to the extent that specific discourses and disciplinary technologies have real structuring effects on social action, they come to produce lasting structural effects on reality, giving rise to new expressions of basic social structures and associated structural selectivities over the long term.

To illustrate the interrelated nature of these selectivities consider the example of the road transport sector where all four strategic selectivities may be said to operate in the context of transport investment appraisal and decision-making.

The widely-promoted imaginary that considers economic growth to be conditioned on increasing levels of mobility and transport activity has historically (and arguably up until today) characterised much of UK transport policy making (compare Chapter 2). As transport policy making increasingly became the subject of economic rationalities, the calculus informing transport provision turned into one of utility-maximisation: limited resources were to be allocated and utilised in ways that maximise (often primarily economic) benefits. In connection with this, technologies and methodologies of measurement were developed to provide decision makers with relevant data to choose among competing road schemes as competing cases for road infrastructure investment. Present-day appraisal methods, for example, rely heavily on cost-benefit analyses and make use of quantitative measures such as travel-time savings and economic impact generated by large scale transport schemes as though these are entirely objective, value-

free measures.[31] At the same time, environmental, social and distributional impacts of these schemes are largely discounted or disregarded in these analyses (Van Wee, 2012). Further biases remain inherent in these mainstream appraisal methods due to, for example, the widespread neglect of induced demand (Nicolaisen and Næss, 2015) and the uncritical pursuit of travel time savings (Metz, 2008) in transport investment appraisal. Though undoubtedly due to their historical genesis, dominant professional methods of transport appraisal have thus often systematically privileged large-scale infrastructure schemes particularly for the benefit of motorised modes (Davis, 2014). As science and policy moves forward this may not so much be a case of conscious design, but rather a matter of path-dependent development as mediated by the different selectivities. Selectivities may, therefore, act as such without anyone explicitly intending them to.

As such, it may be said that in the context of transport provision a structural selectivity is at work in the sense that provisioning of the social activity of transport is to a significant extent subordinated to the reproduction of the capitalist social form. However, no (or few) social actors undertake travel or get involved in transport provision with the intention of reproducing the capitalist social form. Instead, the widely-shared discourse, which posits increasing transport and mobility levels as necessary means to generate economic growth and national and individual welfare offers an imaginary contributing to the effective ordering of social relations. In connection with this, discursive selectivities associated with social practices have developed and combined into effective discourse-practice complexes to discipline social action in the context of transport investment appraisal and decision-making in ways that align with the discursive selectivity described previously. The specific method of cost-benefit analysis, in turn, constitutes such a disciplinary technology, which enforces a narrow economic calculus guiding transport investment appraisal and decision-making. In this sense cost-benefit analysis imposes a disciplinary-technological selectivity in the transport provision context by placing at an advantage specific modes and concrete transport projects whose benefits are readily expressed in monetary terms while disadvantaging, for example, active modes whose benefits have not traditionally been measured in quantitative nor in monetary terms. Agential selectivities, in turn, have been observed recently as UK transport practitioners have turned to

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[31] This is to some extent supported by discursive selectivities characterising much of mainstream transport appraisal where hard, economically quantifiable evidence is perceived as delivering more objective appraisals than the inclusion of soft evidence on social and environmental impacts, which tend to be perceived as harder to delineate and, ultimately quantify in economic terms.

quantifying the economic benefits of active modes via proxy measures. This involves, for example, quantification of the financial savings accruing to the National Health Service (NHS) as increased physical activity among active transport users reduces obesity rates and associated negative health outcomes, the treatment of which presently demands significant portions of the NHS's financial resources.

Encouragingly, therefore, rather than enforcing strict uniformity, enforced selection via strategic selectivities can only ever hope to generate 'constrained heterogeneity' of social relations. According to Sum and Jessop (2013, p.192) this is due to the "improbability of complexity reduction via enforced selection" as is discussed in the following section.

The improbability of complexity reduction via enforced selection

The improbability of complexity reduction via enforced selection and the selectivities discussed above arises from the circumstance that, while semiotic and structural variety is constrained via enforced selection, there is nonetheless "constant variation, witting or unwitting, in apparently routine social practices" and discourses (ibid., p.184). This potential for intentional and unintentional variation is due to a variety of reasons, including the fact that language is never closed and so a single concept or discourse may have multiple meanings, express competing standpoints, and may be articulated in different ways to resonate with different social formations and their respective interests. Likewise, "subjectivities are plural and changeable; and extra-semiotic properties are liable to material disturbances as well as to discursive deconstruction" (ibid., p.181). All these factors make successful complexity reduction through the reduction of semiotic and structural variety via enforced selection altogether improbable. Conversely, the emergence of contradictions, paradoxes and crises in the relation between sedimented meaning and structured complexity is inevitable (see Figure 4.1).

In comparison to transition studies and the MLP where 'windows of opportunity' arise largely from external shock and changes at the landscape level, CPE is able to successfully endogenise the source of changes in the alignment of a social formation to some extent. In the context of CPE, such misalignments are conceptualised as 'contradictions', 'paradoxes' or 'crisis (tendencies)', which arise necessarily in the context of a social order perpetuated by enforced selection. A crisis denotes a conjuncture, or moment, in time-space at which the objective external reality, dominant narratives that evolved to master this reality (social discourses) and the established ways of enacting (social practices) this

discursively constructed reality no longer align to the extent that they generate contradictions and crises in the underlying social formations.
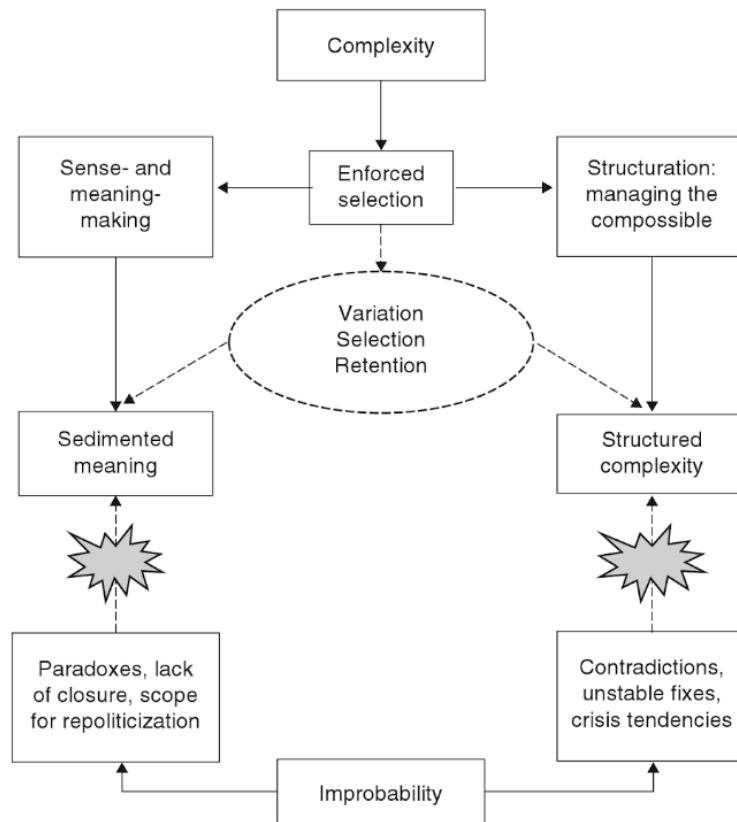
Figure 4.2   The improbability of complexity reduction via enforced selection
                  (Source: Sum and Jessop 2013, p.192)

Arising contradictions and crisis tendencies, in turn, may open the kind of windows of opportunity transition studies hypothesised. Specifically, such crises open windows of opportunity for new semiotic construals of the reality out there – contradictions and all. These offer the possibility of alternative problem definitions via new or existent, yet still marginal social discourses.

Connectedly, Jessop (2012) points out that "[v]iewed objectively, crises are complex moments of indeterminacy". That is, they are not only materially constituted, but to a significant degree discursively constructed with wildly different interpretations of a specific crisis phenomenon possible. For example, interpretations may diagnose crisis *in* a given social configuration, i.e. a crisis that presents as more readily manageable via established crisis management strategies. Alternatively, they may diagnose crisis *of* a given social configuration, and thus a crisis that is altogether more disorienting as it calls

into question existing social configurations including established crisis management strategies of that configuration. Which type of crisis is diagnosed is relevant insofar as interpretations, which resonate with the nature of the crisis as well as with established and influential structural, discursive, technological and agential aspects of the existing social formation are more likely to be enacted and re-enacted over time. Based on their resonance these crisis interpretations, and the social actors advancing them, are more likely to appear as offering 'organic' responses to the crisis at hand. Such crisis construals, in turn, are more likely to be recursively selected, retained and sedimented over time into a modified or radically new social formation. Therefore, the development of crisis construals and associated social imaginaries is subject to evolutionary processes of variation, selection and retention (see Figure 4.2).
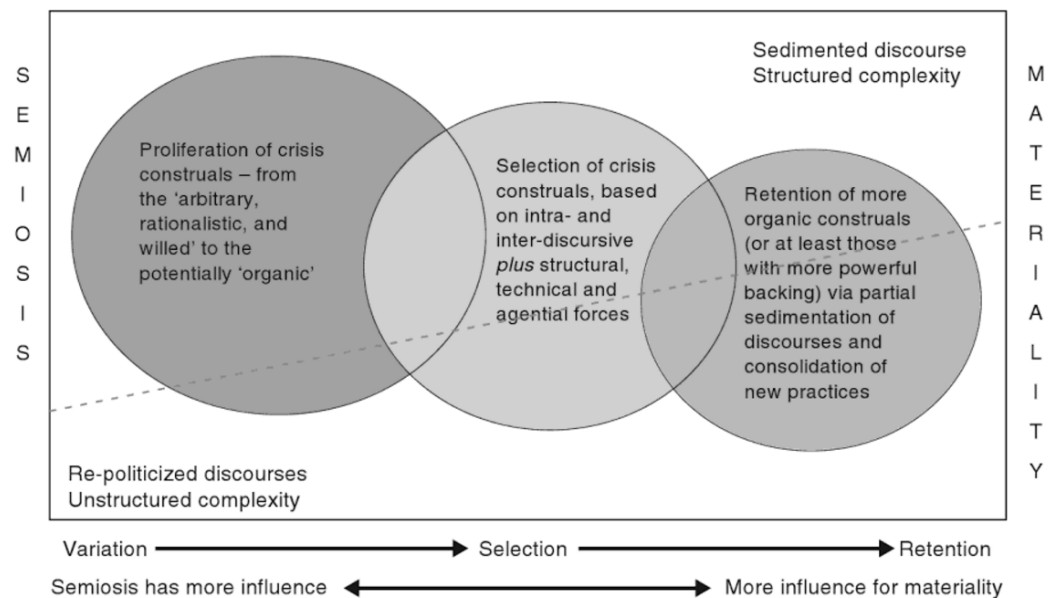
Figure 4.3   Schematic representation of variation, selection, and retention (Source: Jessop, 2013, p.238)

4.4.   The production of dominance and hegemony

It is the role of above outlined mechanisms of enforced selection via strategic selectivities, in securing relatively stable, semi-coherent social formations and mediating the selection and retention of 'organic' construals and social imaginaries following crises *in* or *of* a social formation, that informs CPE's interest in critiquing dominant social formations.

Drawing on the concepts and language of Antonio Gramsci and Michel Foucault, Jessop and Sum (2016, p.108) conceptualise *domination* and *hegemony* as arising from the co-evolution of described structural, discursive, technological and agential selectivities into powerful *dispositives.* Foucault (1980, p.194) circumscribes the singular *dispositif* as

> *"a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions – in short, the said as much as the unsaid. Such are the elements of the apparatus [dispositive]. The apparatus [dispositive] itself is the system of relations that can be established between these elements."*

Elden (2017, p.113) usefully condenses this circumscription explaining the term as relating to "the arrangement or set-up of a web of practices and their attendant discourses".

The Foucauldian notion of the dispositive has some resonance with the transition concept of the socio-technical regime. In fact, Foucault himself used the term regime throughout his work to mean something akin to his concept of the dispositif (dispositive). Both express a relative internal coherence in the organisation of "rationalities, technologies, fields of visibility, forms of subjectivity, and ends sought, which appear in a given domain of practice" (Dean, 2013, p.395). However, the concept of the dispositive should be taken to delineate "a greater immutability and breadth of impact than the idea of the regime" (ibid.).

Also of relevance in this context is Foucault's (1980, p.131) concept of the *truth regime,* or regimes of truth, as referring to a social formation's

> *"'general politics' of truth: that is, the types of discourse which it accepts and makes function as true, the mechanisms and instances which enable one to distinguish true and false statements, the means by which each is sanctioned: the techniques and procedures accorded value in the acquisition of truth; the status of those who are charged with saying what counts as true".*

Again, the framing of the concept invites comparison with the concept of the socio-technical regime, which may connectedly be reconceptualised as referring to combined regimes of practice and knowledge- or truth-production that are articulated around specific technologies and serve to fulfil a societal function.

In contrast to the traditional transition studies view of regimes, their re-conceptualisation along Foucauldian lines compels the analyst to undertake more critical readings of transition phenomena. This includes a more central concern for "how heterogeneous sets

of instituted social practices (including their discursive as well as material aspects)" serve to "instantiate, reflect and refract power relations and contribute to domination and hegemony" (Sum and Jessop, 2013, p.34, see also Tyfield, 2014).

Domination and hegemony, in turn, are Gramscian concepts articulated in the context of his studies on the functioning of culture and power in capitalist social formations (Jackson Lears, 1985). As Jackson Lears (ibid., p.568) suggests, domination and hegemony to Gramsci were related, at all times co-existent concepts, with domination referring to rule of a social group based on the monopolisation of the means of coercion. Hegemony, on the other hand, is rule of a social group by consent of the ruled. Crucially, though Gramsci as much as Foucault, recognise that such consent to hegemonic rule need not necessarily entail active and conscious submission. As the CPE perspective explains, hegemonic social formations are able to effectively limit – via the kind of dispositives and enforced selection mechanisms described earlier – the scope for alternative, counter- or sub-hegemonic discourses, imaginaries and social practices that can be conceived, articulated or indeed enacted. In the absence of social actors' ability to articulate dissent or even form dissenting ideas, consent to hegemonic rule and domination may arise by default rather than as the result of active choice. Of course, it is important to keep in mind that in practice pure forms of hegemony, and thus pure consent to hegemonic rule and a complete absence of alternative imaginaries, discourses and practices is highly improbable. From a CPE perspective, this is attributable to the improbability of complexity reduction via enforced selection (see p. 120) and the resulting inevitability of at least constrained heterogeneity of imaginaries and social practices within a social formation.

Consequently, strategic selectivities are not merely of interest in terms of how they contribute to relatively stable reproduction and change resistance of dominant social formations. Rather, CPE is concerned with the role these selectivities play in sedimenting and routinising some imaginaries and social practices to such an extent that they form powerful *dispositives* that may act 'behind the backs' of social agents to perpetuate "specific semiotic, social, institutional and spatiotemporal fixes that support the reproduction of economic, political and social domination" and "help to secure hegemonies" (Jessop and Sum, 2016, p.108). Connectedly, CPE has an interest in investigating to what extent dominant social forces are able to strategically read and exploit selectivities to perpetuate their dominance over other interests. Conversely, insight gained from such study is intended to have an emancipatory purpose in terms of enabling the articulation, consolidation and maintenance of a broad range of alternative sub-

hegemonic and counter-hegemonic imaginaries, discourses and social practices. To quote Milton Friedman (2002, p.xiv): "Only a crisis – actual or perceived – produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around". In connection with this, Jessop (2004, p.162) emphasises the "improbability of the smooth reproduction of complex social orders" via mechanisms of enforced selection and, consequently, the "importance of retaining an appropriate repertoire of semiotic and material resources and practices that can be flexibly and reflexively deployed in response to emerging disturbances and crises".

CPE's overall agenda may, therefore, be summarised as concerned with uncovering and limiting the efficacy of mechanisms of enforced selection so as to allow for a broader heterogeneity of imaginaries and associated social practices, and thereby constrain the scope for path dependence in the shaping of patterns of domination and hegemony.[32] CPE's consequent interest in how strategic selectivities come to serve some interests in securing domination over others is what contrasts this literature markedly from the to-date predominantly unpolitical readings of *socio-technical* dominance in the field of transition studies.

Recent efforts, for example by Fünfschilling and Truffer (2016, 2014), to combine transition theory with insights from institutional sociology, specifically the concepts of institutional logics and institutional work, share an interest in the mechanisms underlying structuration and the institutionalisation of dominant discourses, logics, and associated practices in the form of relatively stable regimes. However, their focus on how increasing institutionalisation contributes to socio-technical regimes' seemingly objective and politically neutral stability and resistance to change is in strong contrast to CPE's perspective on similar matters: CPE assembles a language and concepts to enable a critique of how "institutions aid the provisional stabilization (institutionalization) of specific systems of exploitation and domination" (Sum and Jessop, 2013, p.34)

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[32] "This does not commit the critic to (1) a utopian belief in a social world with no traces of ideology or domination or (2) a relativist position that all sets of social relations are equally bad, neutral or good. Within these limits convictions are contestable and must be justified. Reforms must be judged not only in terms of how they improve the quality of life of subaltern groups but also in terms of how and how far they create conditions conducive over time to break with existing relations of domination. Emancipation is never achieved once and for all" (Jessop and Sum, 2016, p.108).

5. A CULTURAL POLITICAL ECONOMY OF TRANSITIONS

5.1. Towards a CPE perspective on socio-technical transitions

The review of the CPE literature in Chapter 4 identified key assumptions and concepts of the CPE approach to understanding inertia and change in broader social formations, specifically via the entry point of political economy. As emphasised previously, the primary concern of CPE as formulated by Sum and Jessop (2013) does not preclude re-articulation of its assumptions, concepts and heuristics for the investigation of social formations via entry points other than political economy. In fact, in the introduction to their 2013 publication, which sets out the theoretical genesis and research agenda of CPE, Sum and Jessop designate CPE as a "grand-theoretical approach" enabling insights "far beyond its home domain in political economy" (ibid., p.1). And though driven by an ambition to "produce a consistent 'integral' analysis of political economy" this analysis is centrally embedded within the formulation of "a more general account of semiosis and structuration in wider social formations" (ibid.).

As has already become apparent in Chapter 4, the theoretical foundations of this account align well with those informing socio-technical transition theory: they include the central assumptions of the complexity of reality and the significance of evolutionary variation, selection and retention in the formation of dynamically stable, semi-coherent social orders. However, what has long been suggested as lacking in socio-technical transition theory is an account "of what is coevolving with what, how intense is this process and whether indeed there is a bi-direction of causality" (Malerba, 2006, p.18).

As a grand-theoretical project and via its critical realist foundations, CPE offers a suitable basis for gaining answers to these questions.

Firstly, via its critical realist roots, a CPE crossover can suitably serve to 'underlabour' transition theory and the MLP more specifically. As Sum and Jessop (2013, p.8) point out:

> "[c]ritical realism has an important 'underlabouring' role in the natural and social sciences. In other words, it examines, critiques, refines and reflects on the ontological, epistemological, methodological and substantive presuppositions of different theoretical traditions, disciplines, schools and so forth."

In the context of transition studies literatures, the critical realist philosophy, via CPE, offers an account of the source of the complexity of social reality and the sources of

continuing and perpetual evolutionary variation, selection and retention of socio-technical novelty.

According to the critical realist philosophy, reality is fundamentally complex and ontologically stratified. And, while it may be said that there exists a single objective reality 'out there', this objective reality remains at all times inaccessible in all its depth to individual actors. Due to this inaccessibility of objective reality the constant production of discursive novelty based on actors' differential sense- and meaning-making and enactment of their subjectively experienced reality is inevitable. Thus, while the objective complexity of reality cannot ever be mastered fully, actors do rely on reducing said complexity to be able to go on in the world.

Here, CPE points transition scholarship concretely towards the significance of semiosis and structuration as two key modes of complexity reduction, which social agents, including transition actors, rely on to enable them to 'go on' in an inordinately complex reality of which they only ever have partial and subjective knowledge of at any given moment in time. To this extent, a CPE perspective on transitions emphasises the need for transition frameworks, such as the MLP, to give equal consideration to how agential sense- and meaning-making, and structuration efforts perpetually coevolve to produce (and reproduce) socio-technical configurations that effectively serve to reduce real world complexity and allow actors to take calculated, (boundedly) rational actions.[33]

However, actors' experiences of reality are and remain at all times subjective. Their ability to make sense of said reality and articulate and communicate that understanding is directly informed by their changing subjective experience of it as well as the language, imaginaries, methods and so on mediating that experience at different moments in space and time. This gap between the single objective reality and actors' subjective experiences of that same is, therefore, a constant source of variation and novelty in social and socio-technical orders and the reason why seemingly dominant and steadily-reproduced social orders, and socio-technical configurations, are better described as *dynamically*-stable. They do not prevent heterogeneity and variation from arising, but tend to be able to

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[33] This is in line with an argument made by Grunwald (2008, p.43): what makes an action or artefact 'technical' is not primarily materially, but procedurally determined. Specifically, the term 'technical' denotes an action's and/or artefact's capacity to enable the calculated and reliable repetition and reproduction of specific actions and associated outcomes across historically changing spatial and temporal contexts.

constrain its scope to an extent that limits disruption to existing social orders of which socio-technical orders may be a specific kind.

Nonetheless, variation is produced at all times as induced both by structural material changes out there in reality and by novelty in actors' sense- and meaning-making. On the agential side, novel discourses may arise due to actors' targeted and skilful adaptation of existing discourses in light of new circumstances and challenges. However, it may also arise due to actors' incomplete mastery of existing discourses resulting in the production of novelty by accident. Whether purposefully generated or not, novel discourses that have resonance with established ways of sense- and meaning-making and enacting reality are more likely to be selected, retained and sedimented over time. On the structural side, it is important to note that every moment of reality is singular and as such actors' structural circumstances are never truly the same from one moment to the next. However, these changes may be more or less noticeable to actors. Large-scale structural shifts are perhaps more likely to create profound crises in existing socio-technical formations as established imaginaries and social practices are no longer useful to inform practical action, thus becoming redundant. As a consequence, such profound disruption is likely to give rise to a flurry of variation in agential sense- and meaning-making and greater scope for profound reorientations in how actors make sense of and impose meaning on their context.

The extent to which smaller shifts in the material reality underlying a socio-technical order, on the other hand, may give rise to variation in agential sense- and meaning-making is dependent on actors' differential ability both to recognise arising contradictions and paradoxes, and to discursively construct them as significant. And, while every actor's experience of reality is equally subjective in nature, some lead to construals of reality, which are more or less useful in enabling successful calculated action within an otherwise inordinately complex reality. Construals, which prove more useful for making sense of and enacting this complex reality, in turn, are more likely to be selected, enacted and retained over time. As they are successfully enacted by different actors in different contexts and over time, these construals and associated practices are likely to increasingly sediment and become taken for granted as true representations of the natural order of things. This in turn makes them more likely to become integrated into existing organisational routines and institutional orders with greater concrete effects on material reality. Of course, the shaping of material reality in light of a specific construal is likely to condition an increased resonance between construal and reality. To the extent that this occurs, the coevolution of semiosis and structuration gives rise to novel semi-coherent and

dynamically stable socio-technical configurations, whose continued existence requires continued enactment of the imaginaries and practices that constitute them.

A new graphical representation of the multi-level perspective on transitions illustrates the MLP – CPE crossover (see Figure 5.1). It narrates a multi-level perspective on the transition process that pays equal attention to the role of semiosis and structuration in the production of socio-technical change and inertia. It further indicates the changing relative importance of semiosis and structuration in the coevolutionary production of a new socio-technical configuration from mere imaginary to its structural expression.

In this sense then the structuration of a socio-technical configuration is not only a measure of the extent to which its constitutive elements are institutionalised, i.e. widely accepted and enacted. The degree to which a socio-technical formation is structured further signals the extent to which its continued re-production rests on sedimented imaginaries and construals that are taken for granted and enacted as more or less accurate representations of the 'natural order of things'.
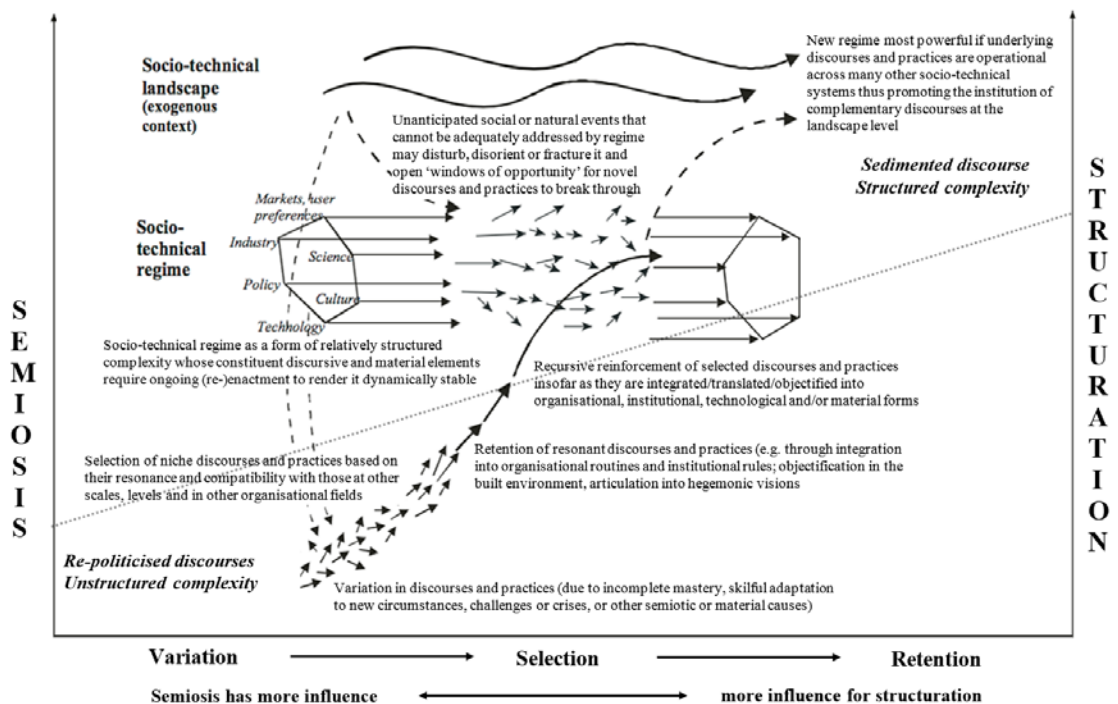
Figure 5.1   MLP-CPE crossover (based on Geels and Schot, 2010, p.25, and Jessop, 2013, p.238)

Socio-technical systems, similar to social formations more broadly, can, therefore, be reinterpreted as "relatively concrete-complex instantiations of the need to reduce the

complexity of the real world" (Sum and Jessop, 2013, p.23). Socio-technical regimes as their most coherent cores, in turn, may be characterised as dominant (or even hegemonic) dynamically-stable configurations of meanings, materialities and social practices within these broader systems. A socio-technical regime may be said to be dominant in the sense that it monopolises the means of coercion, which in the context of the socio-technical system of urban transport, for example, may include formal transport planning and engineering procedures, infrastructure and vehicle design standards, laws, regulations and requirements imposed on vehicle operators and passengers, and the like. To the extent that actors within a socio-technical system consider an existing regime a legitimate authority, i.e. they submit to its foundational social and socio-technical imaginaries, and the means of coercion these give rise to, such a regime may be said to be hegemonic. Note, however, that the extent to which a socio-technical regime, much like a political-economic one, may be said to be dominant and/or hegemonic is a matter of degree.

Taking seriously the perpetual coevolution of semiosis and structuration behind the constant production and reproduction of relatively dynamically stable social and socio-technical formations, then demands that accounts and explanations of socio-technical inertia (or indeed change) are adequate both at the level of the semiotic and the extra-semiotic.

Such analysis is enabled via the CPE's concepts of strategic selectivities, specifically structural, discursive, disciplinary-technological and agential selectivities. These designate mechanisms that serve to selectively privilege some actors and actions and interact to favour the re-production of existing socio-technical configurations, while challenging the production of novel, alternative ones.

These strategic selectivities are expressions of a further central heuristic element informing the CPE, which has not been previously introduced: the *strategic-relational approach*. The strategic-relational approach crucially presents a heuristic conceptualisation of the structure and agency relation, which understands structure and agency as part of a duality, but insists on their analytical separation and the examination of "structure in relation to action, action in relation to structure" (Sum and Jessop, 2013, p.49). In view of the shortcomings identified in connection with the MLP's reliance on Giddens' structuration theory (see Chapter 3) the strategic-relational approach points to another aspect of fruitful crossover between the MLP and CPE as is detailed in the following section.

5.2. Structure and agency in CPE: The strategic-relational approach

As has been outlined in Chapter 3 of this thesis the MLP's conception of how structure and agency interact to produce social change and inertia has been made to rest centrally on Giddens' structuration theory. However, as Section 3.3 made clear, Giddens' notion of the duality of structure has been criticised by several researchers for its analytical conflation of both categories.

As Dean (1994) points out, Giddens' duality of structure employs a reductive conception of social agency. It reduces social agency to human agency by conflating the hypothetical action scope of hypothetical human subjects with the courses of action available to specific individuals in given social action contexts. As a result, Dean (ibid., p.9) argues, the concept of the duality of structure forms "an unstable amalgam sliding between a structure whose effectivity knows no limits and a form of agency that knows no determination".

Archer (2000, p.6) similarly critiqued Giddens' concept of the duality as within it "[structure and agency] cannot be untied and, therefore, their reciprocal influences cannot be teased out". She further suggests that this fundamentally limits the duality's "utility in practical social research" – a problem that may also be constraining the analytical usefulness of the MLP in its current formulation. For purposes of analysis, Giddens, and similarly researchers employing the MLP, are disposed to temporarily ignore the one for the purpose of analysing the respective other. Sum and Jessop (2013, p.48) point out that what is lost through this respective isolation of agency from structure and vice versa is an account of the reflexive ability of agents to strategically navigate their structural context in pursuit of their individual ends and of how structures differentially privilege some actions and actors over others.

Recognising these shortcomings of conventional attempts at overcoming the structure-agency duality Jessop (2005, 2001, 1990) developed the so-called strategic-relational approach (hereafter SRA). The SRA, similar to Giddens structuration theory, understands structure and agency as distinct, yet interconnected, analytical categories rather than natural forms, i.e. structures are understood to only exist within particular action contexts while agency can only be exercised within structured contexts. Thus, in contrast to other approaches, which take either structure or agency to be the primary explanans of actual events, the SRA understands the structure-agency relation as fundamentally recursive and tendential in nature and thus attributes causality to reside in their relational interaction at certain conjunctures. As a logical consequence the SRA explicitly investigates "structure

in relation to action, action in relation to structure, rather than bracketing one of them" (Jessop, 2001, p.1223). To do so it treats structure as strategically-selective, by investigating the extent to which a given structure strategically privileges "some actors, some identities, some strategies, some spatial and temporal horizons and some actions over others" (Sum and Jessop, 2013, p.49). It further asks in how far such strategic selectivities are inscribed into structures both in terms of their content, form and operation. On the other hand, the SRA treats actors as structurally-constrained, though fundamentally able to reflect on their structural context and strategically navigate this context through what they deem appropriate actions. For this purpose, the SRA asks whether actors at a particular conjuncture reflect on the structurally-inscribed strategic selectivities they are faced with and investigates the extent to which actors "come to orient their strategies and tactic in the light of [...] their 'feel for the game'" (ibid., p.51).

The SRA, then, represents a logical progression from previous conceptualisations of the structure-agency relation starting with the original structure-agency dualism, which counterpoised absolutely structurally determined action with completely free-willed agents facing no external constraints. Giddens advanced from this dichotomy of structure and agency to the notion of a duality of structure and agency, which, though providing a partial solution to the original dichotomy, retains an essentially dualistic quality. Here, structure and agency are so tightly implicated with one another that analysis can only be carried out by temporarily ignoring one or the respective other moment of the duality at any given time. The SRA eventually moves to a true dialectical duality by proposing to examine both structure and agency in relation to each other (see Table 5.1).

	Structural component	Agential component
Structure-agency dualism	Structure as absolute external constraint	Agency as completely free-willed action
Duality of structure	Structure emerges as a consequence of agents' enactment of existing social structure	Agency enacted by agents who are partly socialised by existing social structure
Strategic-relational approach	Structure characterised by inscribed strategic selectivities that act to privilege some actors and actions (i.e. some forms of agency over others)	Agency enacted in the form of strategically calculated action oriented towards structurally inscribed selectivities

Table 5.1 Structure and agency beyond structuration theory (adapted from Jessop, 2005, p.41)

To do so the SRA establishes the analytical categories of structurally-inscribed strategic selectivities and structurally-oriented strategic action (see also row three in Figure 5.2). Both categories clearly posit structure in relation to agency and agency in relation to structure. The concept of strategic selectivity accounts for the fact that structures do not constrain or enable all actors and actions equally, in all places and at all times. The notion of structurally-oriented strategic action in turn recognises actors' differential capacity to read and exploit the structural selectivities.
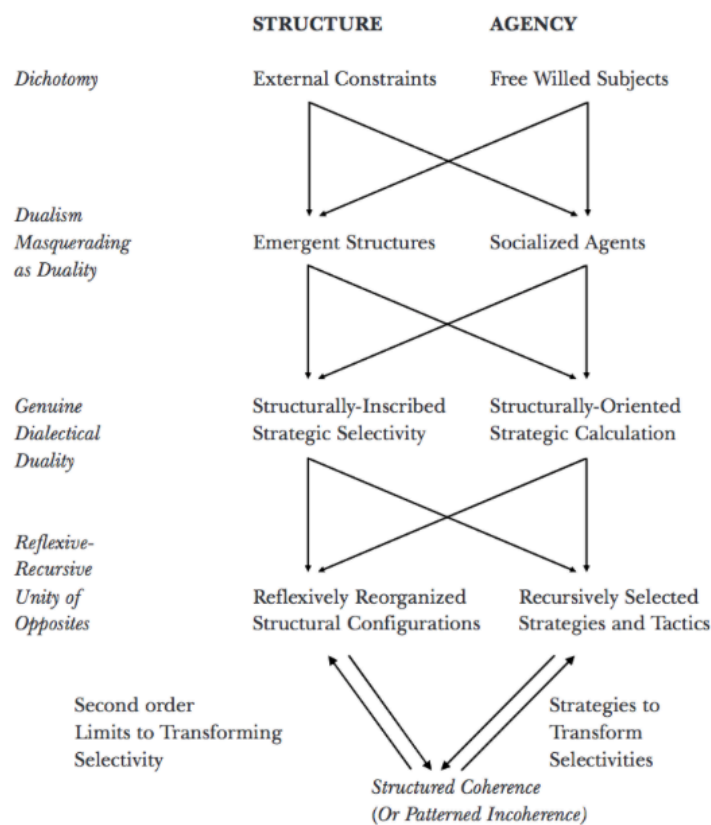
Figure 5.2   Strategic-relational approach to structure and agency (Source: Jessop, 2005, p.50)

Row four of Figure 5.2 conceptualises the results of recursive interaction of structural selectivities and structurally-oriented action over time. Reflexive reorganisation of structural configurations tends to occur in response to continued structurally-oriented strategic action while action strategies and tactics tend to be recursively selected according to their resonance with structurally inscribed selectivities. Actors' continued enactment of recursively selected strategies and tactics in continuously reflexively reorganised structural contexts, in turn, produces what Jessop (2005, p.51) terms "'[structured] coherence' (or stability)" in row five. That is, structures and agency form relatively stable

relations of co-dependence and mutual reproduction. Structurally-inscribed selectivities sediment (themselves) by privileging actors and actions that recursively reproduce the given structure and its inscribed selectivity. However, the continuous coevolution of structure and agency is a source of perpetual novelty and variety in strategies and tactics and, as a result, in the structural configurations they address.

Connectedly, the SRA articulates very clearly how the relational interaction of structure and agency in particular moments in time can give rise to the reflexive reorganisation of structural configurations and the recursive selection of action strategies and tactics over time. Geels (2004) appears to recognise the significance of both processes for understanding socio-technical change and inertia to some extent as suggested by his notions of 'actor structuring' and 'social learning', respectively (compare Figure 3.4). However, Section 3.3 of this thesis noted that within the MLP in its present formulation the link between everyday structure-agency interactions and longer-term actor structuring and social learning processes, remains essentially black-boxed.

From an SRA perspective, however, both processes must be recognised as centrally mediating *and* mediated by actors' everyday efforts at complexity reduction via semiosis and structuration. Figure 5.3 below seeks to illustrate this by reimaging Figure 3.4 to draw out how structure and agency interact recursively as mediated by the partial transformation of institutional contexts (~ actor structuring) and agents' strategic learning (~ social learning) brought about as the intended and unintended effects of previous rounds of structure-agency interactions.
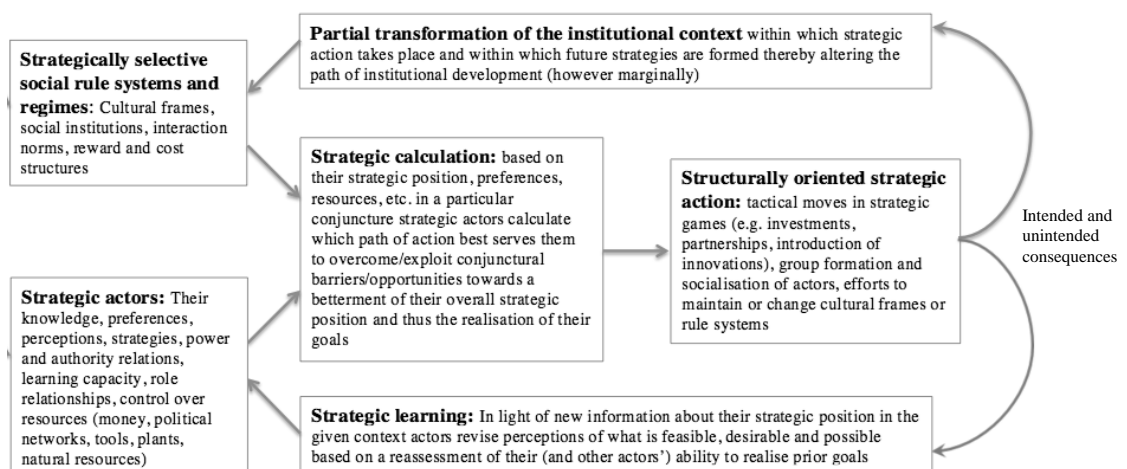
Figure 5.3   Structure, strategy and agency: A strategic-relational perspective on transition dynamics (based on Geels, 2004, p.908; Hay, 2002, p.131)

130

In conclusion, the SRA is centrally concerned to draw out the significance of

> *"the strategic context of action and the transformative power of actions. In these terms, structure consists in differential constraints and opportunities that vary by agent; agency in turn depends on strategic capacities that vary by structure as well as according to the actors involved." (Jessop, 2016, p.55)*

In this sense, the SRA is in stark contrast "with the more usual mainstream approach that regards structure as equally constraining or facilitating for all agents." (ibid.)

MLP – SRA crossover: Practical and philosophical considerations

As the above sought to show the SRA may be said to resonate with, complement and refine the MLP in various important respects. For example, the SRA's notion of structural selectivities interacting recursively with strategic agency to produce relatively 'structured coherence' over time has evident resonance with the MLP's characterisation of the socio-technical regime as a "semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce various elements of socio-technical systems" (Geels, 2011, p.27).

Itself a refinement of Giddens' problematic duality of structure, the SRA, may be seen to offer an, in various ways, improved conceptualisation of the structure-agency relation underpinning the MLP. In what follows the thesis considers the practical and philosophical expediency of a potential MLP-SRA crossover.

Practical considerations

In practice, adoption of the SRA offers multiple advantages to previous conceptualisations of the structure-agency relation (compare Chapter 3.3) within the MLP:

Firstly, and contrary to Giddens' duality, the SRA is suitable for capturing the potential of a given structure to act simultaneously constraining on one actor or action whilst enabling another at a given moment in time. Due to its inscribed concern for temporality, it can account for the possibility of a "short-term structural constraint for a given agent" providing a structural opportunity in the longer term, given a shift in strategy by that agent (Jessop, 2008, p.42). Being able to analytically explore the differentially constraining and enabling effects of the various elements that constitute a socio-technical regime via the SRA may yield valuable insights into transition dynamics.

Secondly, the SRA treats actors as reflexive regarding their position and interests in a strategically selective structural context and able to learn from any feedback received on strategies they pursued. In consequence, the heuristic works with a conception of agency that can and does transform structures through action. In the context of socio-technical transitions and the MLP such an account of agency can make salient opportunities for the "creation of new resources, new rules and new knowledge" and ultimately the genuine "rearticulation of constraints and opportunities" in a given socio-technical system (ibid.).

Thirdly, the SRA heuristic is characterised by an explicit concern for the spatial and temporal dimension of structures and agency (Jessop, 2005, p.51). It teases out the 'structural' moment of the duality as encompassing all "elements in a given temporal-spatial context that cannot be altered by a given agent" (Jessop, 2008, p.42). Simultaneously it establishes an 'agential' moment comprising all those elements of the particular spatio-temporal context, which may be altered by a given actor. Hence, the SRA makes room for and necessitates more explicit attention to the (changing) spatial and temporal dimensions of transition processes, which, it has been suggested, has been lacking in many transition accounts to date (Coenen et al., 2012; Genus and Coles, 2008; Hodson and Marvin, 2010; Lawhon and Murphy, 2012; Markard and Truffer, 2011; Raven et al., 2012; Shove and Walker; 2007; Smith et al., 2005).

Furthermore, the SRA systematically draws attention to power and political dimensions of socio-technical transition processes via its dual focus on both the strategic selectivity of structures and actors' differential capabilities to read and exploit these selectivities. Both the role of power and politics have received increasing attention of late, but remain under-articulated within the MLP framework and transition narratives (see e.g. Coenen et al., 2012; Lawhon and Murphy, 2012; Meadowcroft, 2011; Raven et al., 2012).

Crucially, and in comparison to the MLP in its current formulation, the SRA is not primarily concerned with the longue durée of social and socio-technical change. Instead, it is focused on the very micro-level origins of long-term structural change: the interactions of structure and agency in particular transition moments under explicit consideration of the historical specificity of these moments. The SRA does so by examining specific moments (conjunctures) in change processes according to the concrete action barriers and opportunities they pose for specific actors or actors groups. Connectedly, an MLP-SRA crossover offers not so much a means for generating superior accounts of transition processes, but rather a means to generate accounts of the everyday

micro-moments of socio-technical change that can complement narratives of the longue durée of transitions, which the MLP has focused on to date.

In conclusion, the SRA offers many practical benefits, specifically in terms of extending the MLP's usefulness in the context of currently ongoing transitions and specifically transitions with strongly normative and politically contested ambitions for more sustainable systems of production and consumption.

Philosophical considerations

However, whilst the practical usefulness of an MLP-SRA crossover may be evident it must be made to rest on sound philosophical foundations to avoid eclecticism (Geels, 2010). Geels (ibid., p.504) previously outlined the ontological bases of the MLP and its potential for crossover with other research traditions and schools of thought, and particularly with concepts and methods from the domains of cultural studies, political economy and economic sociology (among others). And whilst Geels cautioned against the flat ontology of actor-network theory (see e.g. Latour, 1987) and the micro–focus of practice theory (see e.g. Shove et al., 2012; Shove et al., 2009), which may "clearly complicate crossovers of relationism with the MLP" (Geels, 2010, p.507) this need not strictly prohibit a crossover with the SRA, as a fundamentally relational approach.

The SRA, as CPE more broadly, rests on a critical realist understanding of the world as ontologically stratified (see Chapter 4.2). Based on its combination of ontological realism and epistemological relativism, proponents of critical realism (see e.g. Archer et al., 1998; Jessop, 2005) have described it as offering an effective 'underlabouring' philosophy for a wide range of academic theories. It is understood to 'underlabour' other theories in the sense that rather than generating methods and concepts itself it is primarily concerned to "examine, critique refine and reflect on the ontological, epistemological, methodological and substantive presuppositions" underlying various other theoretical traditions and schools of thought (Sum and Jessop, 2013, p.9). This is precisely what a crossover of the MLP with a critical realism based literature and heuristic such as CPE and the SRA is offering: a means to enable investigation of the causal mechanisms that condition often-referred to concepts, such as coevolution, complexity and heterogeneity. And, though Geels (provisionally) describes the causal mechanisms at the heart of the MLP as a mix between evolutionary variation, selection and retention, and interpretivist notions of shared meanings and sense-making (Geels, 2010) this conception is in no way weakened by a crossover with a critical realist SRA. Instead, the SRA constitutes a means of adding

ontological depth to the MLP's investigations into structuration and agential meaning and sense-making and how each relates to the other both at any given moment in time as well as in the production of change over time. In this respect, then the SRA may pose a natural successor to the Giddensian notion of the duality of structure and a means of extending the MLP's analytical utility specifically for the study of ongoing transition processes.

Rather than challenging structuration theory, evolutionary economics and sociology of technology as the original theoretical foundations of the MLP, CPE, together with the SRA, offer a deeper theoretical underpinning. Transition studies' MLP in its original formulation combined evolutionary economics and sociology of technology to emphasise the role that culture plays alongside material factors in shaping the coevolution of society and technologies. Adoption of CPE, as facilitated by the SRA heuristic, allows the MLP to "start one step before" the coevolution of culture and materiality and enables transition researchers to interrogate

> *"how normative orders emerge discursively, which discourses become hegemonic, how certain norms and values become articulated with the interests of relevant social actors and how they may become condensed in institutions." (Hauf, 2016, p.36)*

Figure 5.4 below depicts the revised theoretical foundations of a critical MLP.
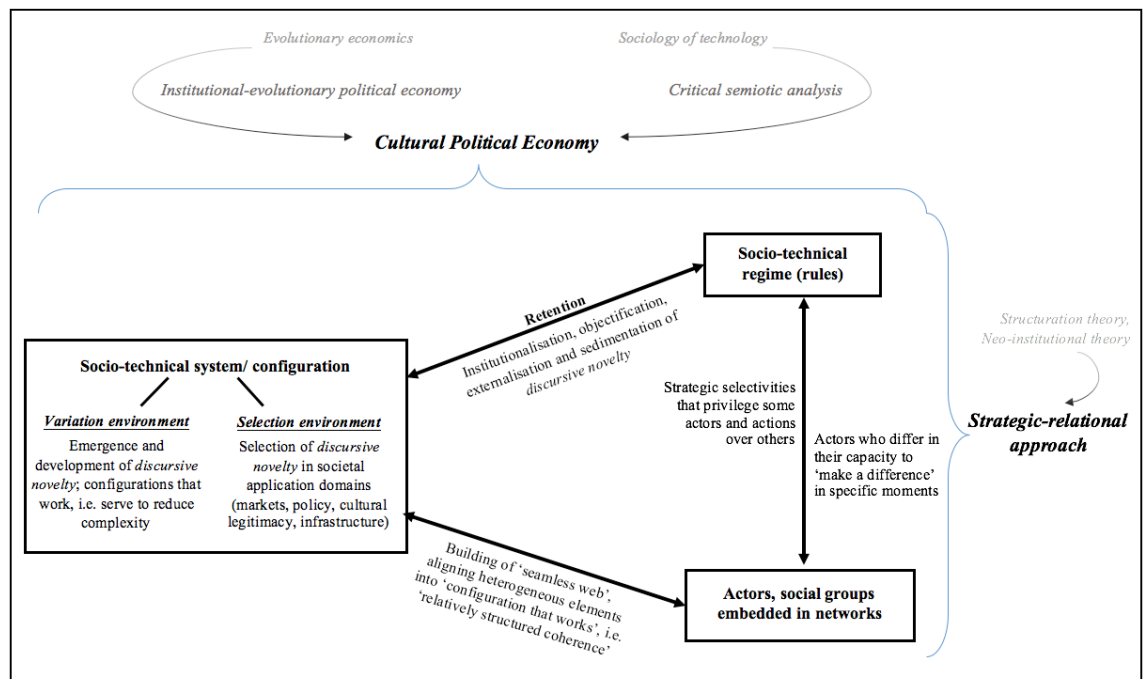
Figure 5.4   MLP-CPE crossover (Adapted from Geels and Schot 2010, p.53)

CPE is, thus, positioned as a broader theory that enables investigation of socio-technical change and inertia as the coevolutionary result of social actors' fundamental need for complexity reduction via semiosis and structuration. To enable such investigation the MLP-CPE crossover further adopts the SRA (in lieu of Giddens' structuration theory) as the basis for conceptualising how structure and agency interact to give rise to co-evolutionary patterns of path dependence or path shaping.

Wider implications of critical (realist) transition scholarship

Resting fundamentally on critical realist assumptions, the articulated MLP-CPE crossover has profound implications for what can be known about the real world 'out there' and how such knowledge may be acquired.

Specifically, the MLP-CPE crossover commits transition researchers to the critical realist conceptualisation of reality as ontologically stratified. The causal complexity arising from this ontological depth of reality contrasts strongly with successionist and configurational models of causation. These, respectively, locate causal powers at the level of variables or clusters of key attributes that are recurrent across a family of similar cases (Pawson, 2008). In contrast, critical realists would argue that such empirically observable regularities and patterns in variables and attribute clusters are the result of *emergence*. They arise due to interactions between real causal mechanisms at deeper levels of reality, which may at times reinforce, counter or cancel one another out. Crucially, what is observed at higher levels of reality, despite arising from the interaction of causal mechanisms at deeper levels of reality, is irreducible to said mechanisms.[34]

Recognising the implications of emergence, transition research utilising the developed MLP-CPE crossover must acknowledge the potential for causal non-linearity, and thus *multi-* and *equi-finality* (George and Bennett, 2005). Such causal complexity is also what ought to inform transition researchers' pursuit of better, as opposed to ultimate truths. If

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[34] Morgan (2007, as cited in Van Heur, 2010, p.424) formalises the essence of emergence as the circumstance: "(1) that some substance, entity, property or system β is dependent for its existence upon some other substance, entity, property or system α; (2) that dependency implies some form of co-variance where fundamental changes in α mean fundamental changes in β; and (3) that the form, operation and consequences of β cannot be reduced to α. Thus, though (1) and (2) imply some form of relation that may perhaps be conceptualised as non-constant conjunction, or irregular, and/or multiply realisable causation, (3) makes the form of that relation conceptually problematic because irreducibility implies some form of disjuncture between α and β such that β cannot be translated, explained or predicted from α alone."

the same empirical phenomenon can be brought about in multiple different ways (equi-finality) or the same course of action in equivalent contexts can lead to different outcomes (multi-finality), then any one actor's ability to posit objective laws and mechanisms underlying reality is limited to approximating better explanations.

By that same token, neither inductive nor deductive reasoning are reliable approaches for generating knowledge about causal mechanisms driving transition processes given the assumed ontological depth and complexity of reality. Instead, a critical realist transition research relies on *retroduction* to generate causal arguments. Such a retroductive research approach essentially poses the question "what must the world be like for 'x' to happen?" (Sum and Jessop, 2013, p.9) and necessitates a continuous spiral movement between empirical observation and further theory-building and refinement in an effort to move "from knowledge of manifest (empirical) phenomena to knowledge of the underlying structures and causal mechanisms that generate them" (ibid.).

The theorisation of empirical transition phenomena is, therefore, never final. Instead, the goal of critical realist transition scholarship must be to refine existing and formulate ever new concepts and theory in order to generate insights of increasing ontological depth about given empirical phenomena.

The above described retroductive and continuous development of knowledge links directly with a further implication of applying a critical realist MLP-CPE crossover in the context of transition research: the central contention that all knowledge of reality is *historically contingent* and all engagement with reality fundamentally *conceptually mediated*.

This historical contingency arises from the circumstance that any engagement with the world (including scientific investigation) is as much enabled as it is constrained by the knowledge, concepts, and practices existing prior to it. Take the specific case of scholarly engagement with the world. What can be known about the world at a given moment in time is partially mediated by previously established concepts, theories, methods and tools that guide investigation and enable discovery and articulation of new insights. In this sense, existing knowledge and scientific categories and theories simultaneously act to open as well as limit a researcher's field of vision.

A degree of historical conditioning and path dependency is then shaping not only the development of material and social reality, but also of scientific theories and methods developed to study said reality.

This concept- and practice-dependence of social structures (see also Sayer, 1992), in turn, informs critical realists' fundamental commitment to reflexive scientific practice. In this sense, and particularly as "scientific concepts slip over into common sense", critical realism recognises social scientists as just another category of social actor "complicit in the constitution of the social world they describe" (ibid.). They are not external, objective bystanders of the social phenomena they study, but, from a critical realist perspective, active stakeholders of them.

Recognition of the concept-dependence of social structures imposes on transition researchers as social scientists a duty to remain vigilant regarding the ways in which vocabularies, concepts, frameworks and theories developed to describe and study a transition phenomenon may impact on and change that very phenomenon in ways that necessitate refinement or discarding of the very vocabularies, concepts, frameworks and theories originally developed. That is, they may be taken up and used by stakeholders of ongoing transitions, whether this is actively promoted and facilitated by members of the academic transition community or not. Inevitably, transition scholars themselves come to play a more active role in the narration and production of current and future transitions via their research outputs. Indeed, from a critical realist perspective they may be considered social actors on par with the other stakeholders engaged in socio-technical change processes (albeit in a different capacity).

By that same token, transition researchers must recognise their own scientific practice as concept-dependent. That is, it is both simultaneously enabled and constrained by an array of concepts, theories and practices that are being taken for granted, though ultimately historically-contingent, i.e. they were produced to refer to the state of a transition process at a certain time and in a certain place. However, the state and shape of that transition process may have since changed precisely because of the influence of the concepts, theories and practices articulated to study it in the past. The concepts, theories and practices, however, may not have changed in a similar fashion. And, while this need not impact on their general usefulness, transition researchers must at all times reflexively question what aspects of a transition phenomenon a particular vocabulary, concept, framework or theory helps illuminate, and what aspects of the phenomenon it obscures.

The historically-contingent nature of scientific methods and insight in light of their potentially very real impact on the social world in turn motivates critical realisms' fundamental emancipatory ambition. If concepts of and knowledge about the social world remain at all times historically-contingent, provisional and incomplete with no single

actor, including social scientists able to claim privileged access to or knowledge of the social world this ought be reflected in social scientific claims and ambitions. This suggests that transition researchers rather than practicing their craft at a distance from the transitions they are researching ought to develop and advance concepts, theories and explanations in ways that encourage their employment and application by transition stakeholders themselves and enable emancipatory insight to be gained.

Engagement with and critical reflection on these matters is becoming even more pressing as transition scholarship has shifted its research focus from generic transitions of the past to highly normative sustainability transitions of the present and future, and from mere description to explanatory theorising and active shaping of transition processes. However, systematic and reflexive engagement with these fundamental changes in circumstance and responsibility of transition scholarship has yet to take place and filter through into the theory and practice of transition research.

Transition researchers interested in a productive engagement with ongoing transitions towards sustainability must, therefore, make critical reflexivity central to their engagement with socio-technical change. This requires, firstly, that transition scholarship reflexively inquire also "into the social world of the scientist, the scientific practice within which she is working, and the subject-matter she investigates" (Hartwig, 2007, p.232). To do so transition researchers ought to question critically (a) the unspoken values and assumptions inherent in the very transition vocabularies, concepts and theories they themselves employ; (b) how taken-for-granted values and assumptions underlying these vocabularies, concepts and theories may bear on their observations, interpretations and theorisations of transition phenomena in the real world, and (c) how this may act to further the conservative normative and political agendas of dominant social (and socio-technical) forces.

Both inward-facing as well as outward-facing reflexivity must, consequently, be part and parcel of a genuinely critical transition research, i.e. a transition research that is interested in facilitating the disruption of dominant, unsustainable socio-technical systems of production and consumption in favour of more benign, but marginalised ones. Such critical and reflexive engagement with sustainability transitions and their politics poses a twofold challenge: it requires transition researchers (a) to question taken for granted normative and political agendas inherent in established transition vocabularies, concepts and theories and (b) to make clear their own normative aims vis-à-vis the social world.

138

Resolute engagement with issues of normativity and the politics of transitions is, of course, not entirely unproblematic. On the one hand, it calls into question much practically-oriented transition work, such as transition management literature, which has long been criticised for its normatively naïve managerial approach to socio-technical transitions (see also Section 3.1).[35] On the other hand, it is questionable whether and to what extent transition research's fundamental acknowledgement of coevolution and path dependency, (particularly in view of the emergence and lock-in of unanticipated and potentially unintended novel practices and institutions), is reconcilable with strong normative commitments to some socio-technical solutions over others.[36]

In order to escape such stringent requirement for the exposition of normative and political commitments in the face of complex societal problems this thesis advocates that transition studies engage more explicitly with critical theory (beginning, e.g. with Horkheimer's 2011 [1973] seminal essay). Such a critical 'turn' would not require extensive declarations of researchers' normative and practical-political persuasions. Instead, critical transition scholarship can primarily seek to unmask politically or normatively biased and thus false or less true accounts of transitions rather than positing to generate true or best accounts of transitions. It would then merely require a minimalist normative standpoint (Sayer, 2009), which it is possible to satisfy even in the context of complex, or wicked, societal problems, such as sustainability transitions.

Building on critical realist ontological and epistemological assumptions, the thesis seeks to articulate a starting point for a genuinely critical sustainability transition research. A sustainability transition research that focuses its intellectual efforts on questioning the dominance of existing socio-technical regimes by uncovering the implicit logics, narratives and assumptions that underlie them and drive their re-production. And, a sustainability transition research that nonetheless aspires to remain fundamentally unbiased towards any particular socio-technical futures over others. In this sense, a critical transition research cannot and should not seek to establish the normative desirability of specific socio-technical configurations in absolute terms. Instead, it can and should focus

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[35] Reflexivity has been posited as central to the theory of transition management (Voss et al., 2006). Yet, the approach's concern with reflexive governance remains largely within the constraints of a pre-defined political agenda whose underlying normative and political assumptions are rarely questioned (Popa et al., 2015; Shove and Walker, 2007, 2008).

[36] As posited in the Collingridge dilemma (1980) the impacts of a technology cannot be predicted in their entirety until the technology is fully developed and widely adopted by which point it has become embedded to such an extent that strategic interventions with the view to control or change it become difficult (see e.g. Urry, 2004).

on questioning the dominance and hegemony of some such socio-technical configurations vis-à-vis possible alternative, and specifically more sustainable states of the world.

5.3. Mobilising the MLP-CPE crossover for critical transition research

So far, Chapter 5 has pointed out how a crossover of the MLP with CPE and the SRA can sharpen the view of transition researchers for (i) how structure and agency interact at any given moment in time, and (ii) how sense- and meaning-making and structuration co-evolve over time to produce socio-technical change and inertia. The following section now lays out how the MLP-CPE crossover can inform a critical transition research perspective that can be employed in the study of ongoing transitions towards more sustainable systems of production and consumption, specifically in the urban transport sector.

Centrally, a CPE perspective on transitions in urban transport invites researchers to question how the dominance and/or hegemony of a socio-technical regime in urban transport is both produced and perpetuated via structural, discursive, disciplinary-technological as well as agential selectivities.

Secondly, and in connection with the above, a CPE perspective on urban transport transitions further leads researchers to consider whether, to what extent and how different transition stakeholders

> *"take advantage of this differential privileging by engaging in 'strategic context' analysis when choosing a course of action. In other words, to what extent do they act routinely or habitually, as opposed to evaluating the current situation in terms of the changing 'art of the possible' over different spatiotemporal horizons of action?" Jessop (2016, p.55)*

Of course, all transition actors or, indeed, social actors more generally, undertake such strategic analysis of their action context very routinely as part of their everyday decision-making processes. However, the more routinely such context analysis is undertaken, the more likely it is that the courses of action chosen as a result yield to, rather than critically question, the sedimented discourses informing them and the strategic selectivities inscribed in them. In contrast, conscious strategic context analysis may further the critical questioning of existing selectivities and the sedimented discourses underlying them. Therefore, what is

> *"[a]t stake in the critique of [socio-technical] domination are the effects of the structuration of social relations and how they operate in biased ways 'behind the backs' of the relevant agents. Of interest is how discursive,*

structural, technological and agential selectivities are condensed to form specific dispositives that help to secure hegemonies and dominations. […] At special interest here is how these selectivities reproduce specific semiotic, social, institutional and spatio-temporal fixes that support the reproduction of economic, political and social domination" (Jessop and Sum, 2016, p.108)

The central purpose of such critique is of course to yield emancipatory insight that can benefit specifically marginal socio-technical interests in their pursuit to bring about socio-technical change. To enable such critique of dominant and hegemonic social, including socio-technical, formations Jessop and Sum (2016) most recently articulated an eight-step approach to critique, which this thesis mobilises to illustrate a CPE-informed empirical study of an ongoing transition in the urban transport sector. Based on Jessop and Sum's approach to critique, Chapter 6 articulates a methodology and research design that can guide critical study of a currently ongoing socio-technical transition in urban transport based on the theoretical crossover of transition theory and CPE presented so far.

METHODOLOGY

Having outlined the key literatures informing this research and articulated a crossover combining socio-technical transition literatures and CPE, *Chapter 6*, in turn, presents the methodology and research design that mobilises the developed crossover for empirical research. The chapter explains the selection of case study as a suitable research approach and outlines reasons for why the ongoing efforts towards re-establishing cycling as a mainstream mode in London's road transport system were deemed a suitable case to study. After discussing the use of document analysis and semi-structured expert interviews as key data collection methods, the chapter turns to describe in detail how data gathered via both methods informs two distinct, but connected analyses conducted in the study of the London cycling case.

6. METHODOLOGY AND RESEARCH DESIGN

Chapter 6 presents a research design suitable to addressing the research questions of this thesis (see Chapter 1). The chapter outlines how the critical realist assumptions underlying the articulated MLP-CPE crossover necessitate concrete methodological and research design choices made in the context of this thesis. The chapter identifies case study as a suitable research methodology and justifies the selection of the empirical research subject – the transition to more utility cycling in London, UK.

The chapter further explains data sources and methods of data collection utilised before outlining how analysis of the collected data proceeds in two steps. On the one hand, Analysis I is focused on establishing the London cycling case as a case of a socio-technical transition and cycling as a niche within the London road transport sector. Analysis II, on the other hand, seeks to elaborate a critique of socio-technical domination in London's road transport sector as a factor mediating the potential transition to more utility cycling on London's roads. Chapter 6 outlines data sources and collection methods as well as how key concepts from the literatures reviewed are operationalised to inform gathering and analysis of the data for each step of the analysis. To conclude, the chapter considers limitations of the presented research methodology and design.

6.1.   Selecting a suitable research approach

As suggested at the close of the previous chapter, the critical realist philosophical assumptions informing this thesis (see also Chapter 4.2) significantly impact empirical transition research via the proposed MLP-CPE crossover. A very concrete way in which they do this is in guiding the formulation of a suitable research methodology.

Specifically, they clash with positivist methodologies, such as experimental, quasi-experimental and analytical survey research. The combination of realist ontology and relativist epistemology underlying critical realism further is not suited by strongly interpretivist methodologies, such as ethnography and phenomenological research (Gray, 2014, p.29) making them less practicable methodological choices, in turn.

Instead, and in light of the central and shared assumption and appreciation of generative causation and complex emergence that characterises both the critical realist philosophy of science and socio-technical transition research (Geels and Schot, 2010), any approach chosen to investigate the case of an ongoing socio-technical transition process at the urban

scale must be able to capture and account for the complexity and situatedness of the researched phenomenon by researching it in its real-life context.

Action research

Action research (AR) is one such approach suited to researching phenomena in their real-life contexts. As the term suggests, action research, as pioneered by psychologist Kurt Lewin in the 1940s (see, e.g. Lewin, 1946; as cited in Adelman, 1993), differs from other methodologies in that it alternates between phases of action and phases of research. This often involves a cycling from initial research of a social phenomenon and diagnosis of the need for intervention, on to planning and implementation of an intervention before ultimately evaluating its impacts on the original issue investigated.

Action research, therefore, differs from other methodologies in that its express purpose is to enable action in the real world. This in turn is an ambition shared by significant parts of the transition studies field as reflected in the more interventionist agenda of transition frameworks such as strategic (policy) niche management and transition management. Indeed, this recognition has meant that action research approaches are receiving increasing attention in the transition literature (see, e.g. Audet, 2014; Audet and Guyonnaud, 2013; Wittmayer, et al. 2014).

However, given the strongly critical realist foundations this thesis rests on a note of caution is advisable. While critical realism fundamentally aims at facilitating critique and social change, it is also profoundly suspicious of the kind of universal knowledge and truth claims generally informing concrete normative interventions by 'knowing' researchers (or any other stakeholder groups for that matter). More to the point, critical realism contends that all knowledge is historically and geographically specific and, therefore, a single, objective and universal reality that is knowable and accessible to all actors cannot exist. This recognition further calls into question powerful social actors imposing their interpretation of reality on other competing or marginal interests via supposedly universal truth or knowledge claims. In consequence, critical realism as a philosophy of science sees itself as unable to generate the kind of knowledge and insight that may give rise to concrete normative claims or necessitate practical normative interventions in the real world. More to the point, it denies the very possibility of the same. Connectedly, a generic action research approach that does not consider these issues is deemed to be incompatible with the research philosophical orientation of this thesis.

Far from excluding action research per se the critical realist's emancipatory ambition may instead demand a more refined action research design such as *participatory action research* (PAR). PAR differs from basic AR in that it grounds and anchors the action research process through early and continuous involvement of a wide range of social actors (Campos et al., 2016). Much like the critical realist philosophy informing this thesis PAR assumes a positivist ontology "in arguing that there is a 'real' reality out there" while also articulating a more constructivist epistemology in acknowledgement "that as soon as we attempt to articulate this [reality] we enter a world of human language and cultural expression" (Reason and Bradbury, 2006, p.7) that is historically and geographically specific. The co-construction of problem definitions and corresponding solutions should, therefore, involve a range of relevant actors from the get go, rather than at later stages of solution implementation. By doing so, PAR seeks to avoid unduly privileging some knowledge forms or problem interpretations, such as those of 'knowing' researchers, as more objective or universal. In connection with this, it is evident that PAR shares critical realists' concern for the role of unequal power relations with respect to the identification of social problems and requisite solutions, i.e. in the formulation of universal truths and knowledge that can be acted upon normatively (Baum et al., 2006). Underpinning AR's interventionist ambitions with a critical realist sensitivity may, therefore, qualify them from normative to emancipatory in nature and yielding in turn something akin to PAR.[37]

In conclusion, and in alignment with this thesis' critical realist philosophical orientation, PAR demands to be locally grounded and seeks to embrace the notion of a complex reality that may not be directly accessible or known by any single actor.

However, conducting successful PAR also demands that the researcher deploy significant resources in the face of serious research practical challenges and ethical risks. On the one hand, designing and facilitating genuinely participatory research demands that PAR researchers are intimately familiar with the individuals and stakeholder communities they work with while also appreciating that there is significant heterogeneity of values and interest within single interest groups (Cornwall and Jewkes, 1995). Understanding differences of interest, beliefs, values and power among potential research participants is

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[37] Scholars such as Greenwood and Levin (2007) continue to use the term AR to refer to fundamentally collaborative participatory action research that is critical of and departs from the more 'expert-led' AR originally pioneered by Kurt Lewin (1946; as cited in Adelman, 1993). However, to avoid unnecessary confusion the thesis will use the term PAR to refer to any AR that emphasises early and continuous involvement and collaboration among a variety of stakeholders to a social problem.

important as the practical conduct of PAR will inevitable require the project to align itself more or less with some communities or interests rather than others. This can have significant impact on the success of research itself as alignment with powerful and resourceful interests, such as regime actors, may facilitate the undertaking of research, while risking "manipulation of the research according to the agendas of the powerful" (ibid., p.1673). On the other hand, aligning with marginalised niche actors and, therefore, working outside of dominant power structures may not only hamper access to important decision makers of the regime, but also undermine the emancipatory agenda of the research itself by perpetuating the marginalisation of niche goals and actors (ibid.).

Likewise, PAR brings with it important ethical challenges. It demands the relationship between "the researcher and the researched" to be one of "symmetric reciprocity" between real and equal "thinking-feeling persons" neither of whom are assumed to have privileged access to reality, but "diverse views on the shared life experience" (Borda, 2001, p.30). The close and trusting working relationships required for such research are not easy to come by and demand much time to be established (Pratt, 2007). PAR can be costly to conduct while also requiring significant, and perhaps prohibitive, time and effort commitments not only from the research but also from potential participants.

Therefore, identifying suitable and willing participants and establishing a level of intimate familiarity with them, their relations to one another, respective interests and values may itself require a more detailed study prior to initiating any PAR process. This is particularly necessary if researchers' prior knowledge and formal documentation of the phenomenon or social problem of interest is limited.

In conclusion, PAR, though it offers a suitable approach for the purposes of this PhD research in theory, is not considered practicable given the significant time and resource requirements associated with this methodology. In addition, the researcher's limited experience conducting primary qualitative research prior to PhD research made the adoption of a research approach as sophisticated and demanding as PAR inadvisable at an early stage of research and in view of substantial research ethical implications.

Case study

An alternative viable approach, though much less interventionist in ambition compared to action research, is case study. Case study offers a prime research strategy to "examine (a) a contemporary phenomenon in its real-life context" and in cases when "(b) the boundaries

between phenomenon and context are not clearly evident" (Yin, 1981, p.59). Flyvbjerg (2013) further highlights its suitability for generating accounts of the unit of study – the case – that have particular depth in that they comprise more detail, variance, and richness.

The choice of case study as a suitable research strategy in the context of this thesis is further supported by multiple reasons. Firstly, and as pointed out by Morgan (2012, p.668) case study allows for the investigation of the bounded whole rather than a single element of the same. A case study of urban transport innovation may, therefore, focus on, for example, various elements of the urban road transport system as a whole and in interaction, rather than focusing on a single variable. In the context of this thesis, a single case study allows for the investigation of the structure-agency dynamics playing out between institutions and actors across niche, regime and landscape levels and their integration into a holistic account the production of change and stability in urban transportation systems.

Secondly, case study lends itself to the exploration of research questions, which, owing to the inherent complexity of the phenomena they address, remain at all times somewhat open-ended. The approach of case study does not require the outlines and boundaries of the investigated research object to be strictly evident at the outset, but instead allows for them to emerge gradually over the course of the research (Yin, 2014; Morgan, 2012). This is in line with the critical realist perspective adopted by this thesis, which demands a research method that allows for the discovery and description of unexpected and emergent features of the research object. In connection with this Morgan (2012, p.671) argues that case studies are primarily vehicles "of discovery, not justification". Rather than a method for testing hypotheses, case studies serve the "formation of evidence-based concepts, … the development of measurement structures, [as] places where types are defined and kinds isolated, where phenomena might be revealed and theory developed" (ibid.; see also Eisenhardt, 1989). This aligns with the thesis' interest in interrogating how structure-agency dynamics impact on on-going transitions in urban transport.

Thirdly, and as emphasised by Yin (2014, p.12), the case study is a form of empirical inquiry that is particularly suited to the investigation of complex social phenomena that are (as yet) hard to investigate in terms of formal modelling or laboratory experimentation. The critical realist socio-technical perspective on urban transportation innovation processes adopted in this thesis presupposes them to exhibit a level of spatio-temporal specificity that escapes more formal modes of scientific and particularly quantitative

enquiry. Therefore, case study presents an approach to explore these processes in considerable detail within their real-world context.

A fourth point regards the multiplicity of admissible sources and forms of evidence case study research characteristically allows for and even requires. Research methods range from qualitative interviews and statistical enquiry to historical and ethnographic methods. Again, in line with the complexity and open-endedness of the problem field of this thesis, a useful research design must allow for the discovery of a wide variety of aspects that shape the innovation process in urban transportation. These may include material-infrastructural and technological aspects as well as immaterial discursive or institutional components. Investigation of these demands that different methods are admissible to access relevant data points.

Finally, and in a more pragmatic vein, the use of case study in the context of this research is also supported by the long tradition the approach has in the fields of innovation and transition studies (see e.g. Geels, 2002; Schot, 1998; Smith, 2006) as well as in research focusing on the urban realm (e.g. Robinson, 2008; Ward, 2010).

A challenge associated with case study is the fact that there exists much variation and few formalised guidelines in terms of designing and conducting case study in practice. As Stake (2008, p.443) points out eloquently, case study "is defined by interest in an individual case, not by the methods of inquiry used". This flexibility of case study as a research strategy allows researchers to exercise much freedom in terms of translating their research interests and questions into a practicable design. On the other hand, it also demands that case study researchers reflect deeply and openly on the reasons informing their design choices to enable outside scrutiny and replicability of the research. In the past, the method has often been discounted out of hand for yielding supposedly "informal and undisciplined research designs … subjective conclusions, non-replicability and causal determinism" (Gerring, 2007, p.93). However, these are risks rather than necessary outcomes of case study and can be mitigated by researchers documenting and being maximally transparent about all aspects of their methodological and research practical choices. This, of course, is the gold standard of any research no matter what approach it utilises.

Selecting a research approach

Having considered two alternative research approaches – action research and case study – and their respective merits and challenges this research proceeds via case study.

And, though beyond the scope of this thesis, action research should nonetheless be considered as a viable option for further investigation of the phenomenon following initial research via case study (see also Chapter 9). As Campos et al. (2016) highlight, establishing a group of researchers (or facilitators) and engaged social actors may at times be the intended purpose of the very first in several cycles in a PAR design. As such, it is easy to conceive of the case study research presented in this thesis, which seeks to establish the outlines of the phenomenon or social problem under investigation, diagnosing a need for action and identifying relevant actors and stakeholders, as one element in such a first PAR cycle. To complete the cycle, the results of this research in turn may further be used to engage relevant actors and to establish "relations of trust and legitimacy […] between researchers and participants" (ibid.) in order to conduct genuine participatory action research.

This thesis will return to evaluating the practical usefulness of the case study insights developed in the context of this research for future PAR research in the final chapters following presentation, evaluation and summary of empirical research findings.

6.2. Rationale informing case study design choices

Having settled on case study as a suitable empirical research approach the following sections outline concrete details of the case study design and the rationale underlying it.

Drawing on Thomas and Myers' (2015, p.56) definition this thesis considers case study as a research strategy focusing on the

> *"analyses of persons, events, decisions, periods, projects, policies, institutions or other systems which are studied holistically by one or more methods. The case that is the subject of the inquiry will be an instance of a class of phenomena that provides an analytical frame – an object – within which the study is conducted and which the case illuminates or explicates."*

This definition of case study is slightly evolved from previous definitions in that it highlights the subject and object division that may usefully guide the process of choosing "the individual unit of study and the setting of its boundaries, its 'casing' to use Charles Ragin's (1992, p.217) felicitous term" (Flyvbjerg, 2013, p.169).

According to Thomas and Myers (2015) every case study design involves a number of key choices, including the identification of both a research subject and object, a research approach (as guided by the underlying purpose of the research) and suitable research

methodological choices, which in turn may be applied in a single- or multiple-case design. The proposed sequence for this process is illustrated in Figure 6.1 and guides the development of the case study design informing this thesis. To justify design choices informing this research the chapter considers each aspect of the design process in turn, beginning by outlining the choice of subject and object of case study.
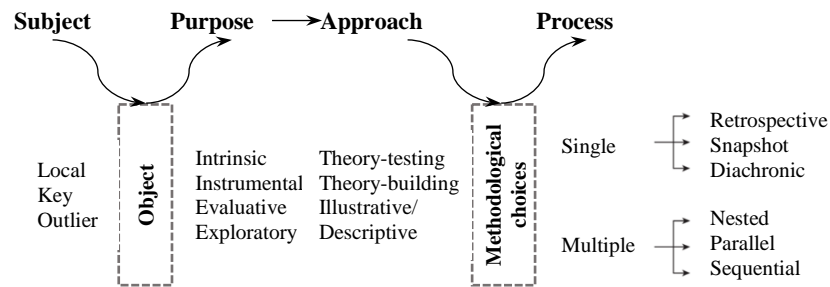
Figure 6.1 A typology of case study (recreated from Thomas and Myers, 2015, p.64)

Identifying subject and object of case study

In line with Thomas and Myers' (2015) definition the *subject* of case study is the case itself – a "practical, historical unity" (ibid., p.55), whether an emerging social group, a historical period, a multi-national organisation, an educational policy or a governance process. In turn, the *object* of the case study provides the theoretical lens through which that subject is studied.

Research for this thesis set out from the broad topic of innovation towards more sustainable urban transport (see Chapter 2). Review of academic literatures further led the thesis to view urban transport innovation through the lens of the socio-technical and sustainability transition literature. The *objects* of research to be illuminated through case study are *socio-technical innovation* and specifically *sustainability transitions*.

Further review of the transition literature in Chapter 3 suggested shortcomings in the theorisation of transition processes, specifically with regards to establishing the micro-level causes of socio-technical inertia and generating instructive insight on how to address these causes. Therefore, Chapter 4 introduced cultural political economy as a literature that grounds the relative coherence and dynamic stability of dominant social formations in the coevolution and recursive interaction between actors' sense- and meaning-making and structuration efforts. Chapter 5, in turn, articulated a crossover between transition

literature and its MLP framework, and CPE and the SRA to enable critical engagement with socio-technical regimes as configurations whose dominance and dynamic stability is both semiotically and structurally conditioned. Application of the crossover in the context of case study, in turn, is intended to test the usefulness of an explicitly critical approach to the study of ongoing sustainability transitions for gaining instructive empirical insight into ongoing transition processes. This rationale centrally informed the choice of the empirical research subject of this thesis: the aspired to *transformation of London into a cycling city*, as an example of an ongoing sustainability transition in the urban transport sector.

To summarise, the case study object – socio-technical transitions – provides a helpful conceptual framework through which to view the processes involved in transforming London into a cycling city. Conversely, findings from the empirical study of the London case may usefully contribute to the refinement of socio-technical transition theory and frameworks.

Beyond this, case study of the ongoing changes in London's road transport sector and its aspired transition to more utility cycling is thought to offer potential insights not only for places similar to London. In pointing towards issues beyond the obvious financial and political challenges to be anticipated when pursuing a transition to cycling such case study could benefit localities similar to London as well as those presently lacking requisite funds and political will. Greater London is further constituted by 32 distinct local authorities and the City of London, all of whom oversee transport policy making and planning for their share of roads outside of the Transport for London Road Network (TLRN) over which Transport for London has authority. Given the variability of social, political-economic and geographic make-up both within and across boroughs there is scope for a wide range of transition barriers and opportunities to be observed within the single case of London.

On the other hand, case study of London's (potential) cycling transition may also be understood as what Thomas and Myers (2015, p.56) term a *local case*. It presents itself as a particularly suitable research subject due to the author's familiarity with the city, including the local institutional setting, culture and language. This familiarity with the research context allows for the study of London's ongoing cycling transition – the actors, processes and outcomes involved – at a level of detail that would not otherwise be feasible in a comparably unfamiliar context particularly in light of the time and general resource constraints of PhD research. The selection of a local knowledge case further provides the opportunity to monitor and dissect the case closely at all times. This closeness is of clear

benefit considering that the investigated socio-technical change process was and still is continuing to unfold. Close physical proximity to the researched phenomenon is further useful when gathering data. Rather than having to set up research interviews well in advance and to fit with the time and scheduling constraints of a field trip, interviews can be scheduled at participants' convenience over an extended period of time. This flexibility in the phase of data gathering also allows for research to follow the leads of interviewees and approach additional relevant participants in the study as research. The selection of London cycling governance as a local knowledge case can enable case study research of a quality and depth - and an account of the complexity of the case - that may not otherwise be feasible.

Purpose of and approach to case study

Following from the above, the proposed case study design is best characterised as having an exploratory purpose. It seeks to study, or explore, the empirical usefulness of the critical transition perspective articulated in Chapter 5. Specifically, it is designed to test the suitability of the socio-technical transition lens and its strategic-relational extension for critically assessing cases of ongoing transitions to sustainability in the urban transport sector and yielding insight that can enable more strategic action by marginal transition stakeholders. Therefore, the approach taken by this research is one of theory-testing, rather than theory-building or atheoretical description.

Case study design

To enable testing of the MLP-CPE crossover and to develop a critical perspective on the cycling transition in London research proceeds based on a *parallel*, *nested* design (see Figure 6.2), which examines multiple units constituting the larger case. It recognises London cycling governance as subject to a multi-level, networked governance process in which Mayoral transport strategy is translated into practice on the one hand by TfL who are responsible for the Transport for London Road Network (TLRN), i.e. the network of strategic roads in the capital. On the other hand, Mayoral strategy informs transport policy and practice in the 32 boroughs and the City of London, which constitute the Greater London region and are responsible for non-TLRN roads within their borough

boundaries.[38] To this end boroughs regularly produce Local Implementation Plans, so-called LIPs, detailing how they plan to translate the Mayoral transport strategy into practice within their borough boundaries. These LIPs, in turn, form the basis for the allocation of transport funding by TfL (GLA, 2010).

TfL – the overarching regional transportation authority – and the multiple local authorities are distinct, yet interdependent transport decision makers at the local level. As such, they are important subunits of the London case, which respectively require investigation to enable better understanding of the dynamics of the cycling transition at the Greater London level. However, since not all 32 boroughs and the City of London could reasonably be surveyed given the resource constraints of PhD research, fieldwork focuses on three local authorities: the selected boroughs of Greenwich, Lambeth and Southwark. All three boroughs are located in South London and are majority Labour-governed authorities. They are purposefully chosen due to the researcher's familiarity with the three boroughs, their geography and political situation, key cycle routes and recent as well as upcoming cycling related projects in each borough. Having a sound understanding of these factors was expected to be of significant benefit when asking interviewees to reflect on their experience as stakeholders in concrete local transport planning and practice processes. It was further felt that the potential for discovering diversity even among a sample of boroughs sharing some key locational and political features could be very instructive for understanding the overall case of London.

Beyond the Greater London and borough level, governing change in the urban road network and road transport system also relies on policy cues and funding from the UK national government. Increasingly, EU and international policymakers also recognise their interest and ability to influence – largely discursively – national and sub-national policy-making and practice on hyperlocal modes, such as cycling, as part of wider ambitions to reduce the environmental impact of urban transport activity as arising in the context of the global climate change agenda. In addition, a growing number of diverse and vocal local and supra-local interest groups and grassroots actors are seeking to influence the transport governance with an attention on cycling and other vulnerable modes in London and the UK more broadly. This includes cycling campaign groups, such as the London Cycling Campaign, Sustrans, Cycling Britain as well as groups with broader interests in the

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[38] Of course, the Greater London region is itself reliant on funding from the national UK level as well as receiving policy cues and financial resources from UK, EU and international levels, all of which will be considered as contextual factors in this case study.

sustainability of transport arrangements, such as 20's Plenty (a group campaigning for 20mph speed limits on residential and urban roads across the UK), Road Peace and the more self-explanatory Campaign for Better Transport.

In recognition of this diverse field of marginal and mainstream actors this research draws on a broad range of actors involved to varying degrees in the governance of cycling in London across local, regional, national and international scales. Figure 6.2 seeks to represent the case design as a nested, parallel study of multiple units constituting and impacting on the case of the London cycling transition.
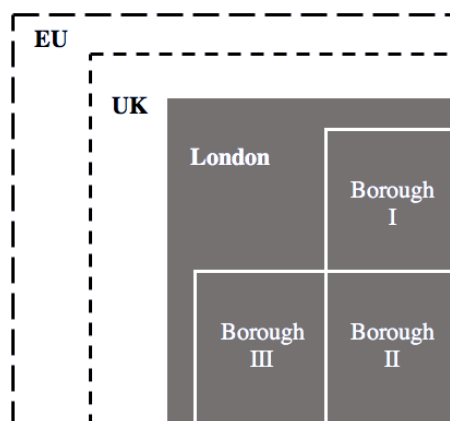
Figure 6.2   Graphic representation of nested, parallel case study design

Methods of data collection chosen

To gather empirical data on these various sub-units of the case and the historical specificity of their relationship to one another the thesis draws on two key data collection methods: *documentary analysis* and *semi-structured expert interviews.* The following section, in turn, introduces the two methods chosen to enable data collection across these multiple scales and actors, before Section 6.3 outlines how both methods inform the two-part analysis of the case, in more detail.

Documentary analysis

Documentary analysis is deemed necessary to gain a general overview and understanding the historical specificity of the multi-actor networks and multi-level arrangements shaping governance of London's road transport sector and the provision for cycling within it. Document types consulted in the context of this thesis include academic journal publications and books; Greater London Assembly and local authority policy and strategy

documents, press releases, meeting minutes, and the like; public sector reports; professional standards and design manuals as well as online and print media accounts.

As a method of data collection, documentary analysis is particularly relevant for the task of establishing a multi-level, historical account of the development of cycling policy and practice in London. This, in turn, requires consideration of London cycling policy and practice as embedded within wider road transport policy and practice, and influenced by developments at the UK national as well as the EU level. Therefore, scope of texts considered for documentary analysis was broadened further to include also documents originating at UK and EU level.

Engagement with such a broad range of sources further served to provide the author with a sound knowledge of key issues relating to cycling and general transport policy making and practice across time and different geographical scales. Acquisition of this knowledge was crucial in enabling the researcher to engage productively with interviewees exhibiting a high level of expertise on these matters (see next section). In this context, documentary analysis further enabled identification of relevant interviewees as well as informing the formulation of a schedule of questions for later semi-structured interviews. Finally, the insights gained from documentary analysis were crucial for triangulation of interview data and vice versa. Semi-structured interviews in turn form a second key qualitative method of inquiry in the context of this research as explained below.

Semi-structured expert interviews

In the context of this thesis, expert interviews were deemed a particularly relevant method for several reasons. According to Van Audenhove (2007), they are a unique method granting researchers fast access to very specific information, particularly in fields that may be relatively new or unknown to them at the outset of a study. Expert interviews also offer knowledge that often could not be gained any other way due to the knowledge being specific to a given expert in the role that they fulfil (generally, but not necessarily in a professional capacity). Specifically, the method is interested in experts' technical knowledge *as well as* the 'know how' and 'know why' they rely on to effectively enact their technical knowledge within their roles. In this sense, interviews with experts seek to generate insight into interviewees' (i) technical knowledge, e.g. of formal technical standards, laws, regulations and operational processes bearing on their field of action; (ii) their process-related knowledge, e.g. of processes, interactions and routines in which they may be directly involved; and (iii) their interpretative-evaluative knowledge, i.e. their

subjective interpretations of the relevance of their actions and the rules and beliefs, ideas and ideologies underlying them (Van Audenhove, 2007, p.8; Littig, 2013, 2008). Consequently, the status of 'expert' is best understood as a relational term that is not assigned to individuals based exclusively or even primarily on their professional credentials as a signifier of the technical expertise they hold. Instead, their expert status also derives from their practical expertise and ability to bring their expert knowledge to practical effect. The more effective experts are at translating their expertise into action the more likely they are to structure the conditions for action by other actors. This, of course, makes them more relevant actors to interview when seeking to understand the role of agency in socio-technical transition processes.

Drawing parallels to the crossover framework of MLP and SRA, regime actors may be characterised as those experts with significant formalised and recognised technical knowledge. The formalised and recognised nature of their technical knowledge confers a certain relational power to these regime actors vis-à-vis actors who do not hold or are not recognised to hold similar expert knowledge. The expert status of regime actors in turn is also established and made durable in structural forms as regime actors often occupy positions of institutional power within the existing socio-technical regime. The combination of both, in turn, enables them to shape the strategic action context for others, such as niche actors, by contributing to the creation, reinforcement or dissolution of strategic selectivities that advantage some actors and actions while disadvantaging others. Of course, niche actors have in theory a similar ability to enact or counteract strategic selectivities. However, their ability to do so is significantly limited as they often find themselves in positions of relatively limited relational power vis-à-vis regime experts.

While Littig (2013) suggests that experts become the focus of interviews because their expertise and knowledge has practical consequences out there in the world, this research proposes that even niche actors may reasonably be ascribed expert status and may, therefore, become the subjects of expert interviews. As such, it is important to keep in mind that expert status is not an objective trait, but a quality that is relationally ascribed to interviewees based on the researcher's particular research interests (Bogner et al., 2009; Littig, 2013). From a transition perspective, the knowledge niche actors rely on to navigate and facilitate the growth of niches into regimes is of great relevance for understanding the dynamics of socio-technical change and inertia even at stages where the expertise of niche actors has as of yet had only limited consequences in the real world. After all, as a niche

matures niche actors may be said to become (more or less successful) experts of the niche and eventually – following a potential successful transition – experts of a novel regime.

What might such niche expertise entail? On the one hand, and since one of the purposes of niches is to enable learning and knowledge creation (Rip and Kemp, 1998, p.382), niche actors may be said to develop and build up significant specialised technical knowledge of a socio-technical innovation over time. On the other hand, and as a niche matures, it increasingly comes into confrontation with the regime, niche actors may also be said to build up tacit 'know how' and 'know why', i.e. significant *phronetic knowledge* (Flyvbjerg, 2013) of how to engage productively with their action context as delimited by rules, regulations and norms of the regime. Such phronetic knowledge may include, for example, knowledge of how to exploit favourable selectivities of the regime or subvert or circumvent unfavourable ones in order to grow and scale the niche. Such knowledge may initially be less formalised or codified than what is traditionally recognised as expertise by actors outside of and within the niche. Nonetheless, it is likely to form a constitutive part of any socio-technical niche from which a new socio-technical regime may arise if and when that niche scales up and comes to replace an existing socio-technical regime.

In addition to experts' objective technical knowledge the interviews also aim to enable a better understanding of the perceptions, beliefs and ideologies informing interviewees' interpretations of their action context and their actions – whether routine or otherwise – within the same. In other words, the expert interview is not strictly interested in the expert as an individual, but in the function of the expert as a representative of particular stakeholder groups and/or decision-making structures involved in the networks and processes governing cycling. As such, the expert interview seeks to gain an understanding of the underlying beliefs and rationalities informing the expert's actions and interactions within the structures and networks involved in governing the cycling transition in London. Through the expert interview process the researcher can to some extent reconstruct the 'know how' and 'know why' that underlies experts' actions and interactions, which cannot be gained from documentary analysis alone.[39] As such, semi-structured expert interviews

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[39] In this sense the expert interview bears similarity to the elite interview, a common form of interview in political sciences (see e.g. Richards, 1999). The elite interview focuses on interviewees of high social standing and with associated privileges under the assumption that these allow them to influence political outcomes more than other members of the population. However, the expert interview in contrast is interested in individuals whose expertise is relationally defined and thus independent of them having widely accepted high social standing. Littig (2008) thus categorises elites as a special sub-group of experts

are adopted as a complementary method of data collection, intended to triangulate as well as enrich insights gained from the analysis of written documents.

As already mentioned, preparation and conduct of expert interviews itself benefitted from insights gained through documentary analysis. The process of documentary analysis was helpful in identifying relevant experts as potential interviewees. With the help of information gained from document review a list of potential participants was established. Specifically, interviewees were selected based on their involvement in the governance of cycling in London. Interviewees' relevance for the research was variously inferred from:

(a) Their occupancy of positions (or proximity to people in positions) that command formal powers relevant to London cycling provision and the governance thereof (e.g. elected officials scrutinising transport policy and strategy);

(b) Their level of expertise on London cycling provision and the governance thereof as a consequence of the professional qualifications they hold and/or the professional roles they occupy (e.g. local authority officers, qualified transport consultants);

(c) Their belonging to, and participation and status in active stakeholder groups with an interest in London cycling provision and the governance thereof (e.g. director of active mobility lobby group, co-ordinator of local campaign group);

(d) Their recognition as knowledgeable and/or authoritative voices on London cycling provision and the governance thereof (e.g. cycling bloggers, transport journalists).

An initial pool of interviewees focused on participants at the borough level chosen purposefully based on their relevance and expertise as established via document analysis. Further interviewees were identified through snowballing based on their names being repeatedly mentioned in the course of interviews or specifically highlighted as relevant actors to speak to by other interviewees (Cresswell, 2009). Purposeful sampling and snowball sampling are at times deemed problematic sampling strategies, particularly in the context of positivist research designs. However, they are considered appropriate in this context as the research seeks to interview experts, i.e. the most relevant, knowledgeable

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holding significant and recognised expert knowledge as well therefore occupying positions of power in decision-making processes.

and representative stakeholders of different groups and decision-making structures, rather than a randomised sample of individuals representative of different stakeholder groups.

The stakeholder groups consulted in the context of this research included politicians; transport policy, planning and engineering professionals; local authority officers; campaigners and charities; business representatives; law enforcement; as well as actors from traditional and social media. This diversity of stakeholders interviewed was deemed crucial to reconstructing the transition towards cycling within the urban transport system as a distributed process shaped and mediated by "all kinds of actors and practices: technological, economic, political, and cultural" (Rammert, 2002, p.175).

Local Members of Parliament (MPs) were not considered for the research for two key reasons. On the one hand, the constituency boundaries of London MPs do not neatly align with local authority boundaries, with some MPs' constituency spreading across two boroughs. On the other hand, MPs tend to weigh in on transport matters mostly on an issue-basis rather than engaging with local transport policy making and practice in a sustained manner. Consequently, this thesis did not strategically pursue interviews with MPs though it remained open to doing so if MPs were being mentioned as important stakeholders to consider by other interviewees.

Likewise, technology users, i.e. cyclists were not explicitly consulted as a stakeholder group in and of itself. And, while many of the participants interviewed identified as regular cyclists, they were not expressly interviewed based on their experience as cyclists but rather based on their respective status and experience as active stakeholders in processes mediating the socio-technical transition to more utility cycling in London.[40]

Interviewees at geographical scales beyond local borough level were also selected, specifically at the Greater London regional level, the UK national level as well as the supra-national level of the EU. At Greater London level research again sought to identify and interview the most relevant representatives of different stakeholder groups including government actors, transport authorities, cycling campaign groups, transport practitioners, policing and enforcement representatives as well as media and business representatives.

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[40] Research conducted by the DfT, TfL and other organisations has documented the changing demographics of cyclists in London and their experience of cycling in the capital in sufficient detail for the purposes of this thesis and reference to relevant documents will be made in the analysis.

On the one hand, this was done in recognition of local transport decision-making as subject to a multi-level governance process. On the other hand, this choice echoes the heuristic of the MLP. Interviews, particularly with mainstream actors of the transport governance processes at Greater London level intended to shed light on dynamics of the *regime* while additional interviews with key actors at UK and EU levels were intended to shed light on *landscape* developments (more on this in Section 6.3).

To be clear, assigning these interviewees to the regime and landscape levels does not imply that different levels in the MLP are equivalent to different geographical scales. Rather, interviews with actors at UK- and EU-level were conducted to primarily shed light on developments at scales and levels that influence governance processes at the Greater London and borough level less directly as they take place at scales, which are both at a geographical as well as a political distance from the locus of the cycling transition process under investigation. Connectedly, they involve actors without the concrete interest or the ability to directly influence the transition process under investigation, particularly in the short term. Consequently, actors at, for example, the EU-level were not interviewed in light of their ability and interest to directly intervene in the London cycling transition. Instead, they were interviewed in view of their ability to speak and reflect on developments at the scale of the European Union as important contextual, i.e. landscape developments, which, though they may not have a concrete structural impact at local geographical scale, may certainly have a more direct impact on actors' sense- and meaning-making at other geographical scales. In addition, (transport) policy making at national and international levels is very much an input factor in terms of shaping landscape dynamics. Therefore, a small number of additional interviews were conducted at the Greater London level, the UK national and the European Union level.

Overall the research draws on 40 interviews (see Table 6.1) conducted between April and December of 2015. Initial contact with interviewees was made via email including a participant information sheet. Upon agreeing an interview time and date all participants received advance electronic copies of the following documents: the consent form to be signed during the interview and an indicative schedule of questions. Appendix B contains examples of an email requesting participation in the research, as well as of the information sheet, indicative schedule of questions and consent form provided to research participants.

The schedule of interview questions was informed by the thesis' research questions (Chapter 1) and based on the SRA sought to elicit information on the structural, agential, discursive and disciplinary-technological selectivities mediating the London cycling

transition. The first draft schedule was piloted in three semi-structured interviews with different stakeholders i.e. a cycling campaigner, a council officer, and a councillor. Experience and feedback from these interviews allowed for the interview guide to be further refined, though it was not changed in substance. The schedule includes questions aimed at generating insight on interviewees' specific roles and experiences in London road transport governance and the provision of cycling. The questions are set out to establish how interviewees view the current status and potential future of cycling in London as well as what barriers and opportunities they see for re-establishing cycling as a mainstream mode on London's roads. Based on the thesis' interest not only in interviewees' conscious knowledge and expertise, but also in their phronetic 'know how' and 'know why' some questions are also formulated to elicit participants' reflections on concrete experiences of bringing cycling-related policy or infrastructural change to fruition. These questions sought to elicit information on interviewees' phronetic knowledge and expertise in reading, understanding and navigating perceived barriers and opportunities for action.

Interviews themselves began with the researcher reiterating the purpose of the research to participants and obtaining their formal consent to participate by asking them to sign the consent form. All interviewees consented to being recorded with transcripts of their interview provided to them in return. Interviews were then recorded using a digital voice recorder of the type Olympus WS-832 and recordings immediately transferred to a secure computer hard drive via in-built USB. Following file transfer all interview recordings were transcribed using a free off-line application called Transcriptions for Mac (Haselberger, 2015) to ensure security of participants' data.

	No	Role	Identifier
EU	1	Campaigner	EU-1
	2	EU representative	EU-2
UK	3	DfT officer	UK-1
	4	Transport consultant	UK-2
	5	Transport consultant	UK-3
	6	Transport consultant	UK-4
	7	Transport consultant	UK-5
	8	Transport consultant	UK-6
	9	Campaigner	UK-7
	10	Parliamentary representative	UK-8
Greater London	11	Campaigner	GL-1
	12	Campaigner	GL-2
	13	Campaigner	GL-3
	14	MET Police Sergeant	GL-4
	15	TfL Officer	GL-5
	16	TfL Officer	GL-6
	17	London Councils officer	GL-7
	18	London Assembly Member	GL-8
	19	London Assembly Member	GL-9
	20	Journalist	GL-10
	21	Campaigner and blogger	GL-11
Greenwich	22	Local campaigner	RBG-1
	23	Council officer	RBG-2
	24	Seconded consultant	RBG-3
	25	Council officer	RBG-4
	26	Council officer	RBG-5
Lambeth	27	Local campaigner	LBL-1
	28	Council officer	LBL-2
	29	Council officer	LBL-3
	30	Former council officer	LBL-4
	31	Elected councillor	LBL-5
	32	Elected councillor	LBL-6
Southwark	33	Local campaigner	LBS-1
	34	Local campaigner	LBS-2
	35	Local campaigner	LBS-3
	36	Council officer	LBS-4
	37	Council officer	LBS-5
	38	Former council officer	LBS-6
	39	Elected councillor	LBS-7
	40	BID representative	LBS-8

Table 6.1   List of interviewees across different geographical scales

In total, the 40 interviews yielded more than 38 hours of interview recordings with interview durations ranging between 20 and 100 minutes. Most interviews were conducted face-to-face, though four participants were interviewed via Skype due to geographical distance or scheduling constraints not permitting a meeting in person.

Figure 6.3 summarises how the research design choices discussed up to this point reflect on the case study typology offered by Thomas and Myers (2015).
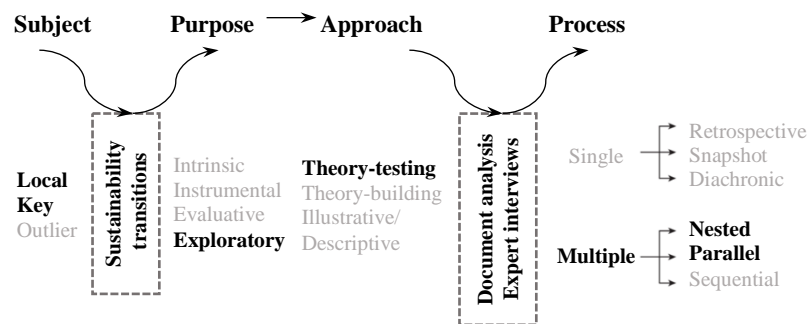
Figure 6.3   Overview of case study design choices (adapted from Thomas and Myers, 2015, p.64)

Having outlined basic research design choices above, the following Section 6.3 explains how the MLP-CPE crossover articulated in this thesis informs empirical research of the London cycling case.

6.3.   Articulating a critical perspective on London's cycling transition

Analysis of the London cycling case proceeds in two steps:

Chapter 7 focuses on establishing the transition character of the ongoing changes in London's road transport system and, connectedly, the niche character of the socio-technical configuration existing around the mode of utility cycling in London up to and including the period of primary data collection from March 2013 to April 2016. To this end, the first element provides a long-term historical, multi-level perspective of the changing status of utility cycling in the London road transport system as embedded within national and supra-national transport policy landscapes.

In a second step, Chapter 8 studies the specific period from March 2013 to April 2016 in this ongoing London cycling transition process in more detail. The aim of this analysis is

to reveal how structural, discursive, agential and disciplinary-technological selectivities perpetuate socio-technical domination in the London transition case. This second analysis highlights specifically how these mechanisms operate at the level of everyday action and interaction to create barriers (as well as opportunities) for strategic action by stakeholders seeking to re-establishing utility cycling as a mainstream mode in London's road transport system.

Analysis I: Establishing a multi-level perspective on London cycling

Research process, methods of data collection and concepts mobilised

Following previous authors' claims that cycling constitutes a sub-regime of the road transport sector, step one of the analysis evaluates whether this holds true for the case of cycling in London. Therefore, Chapter 7 examines and presents evidence that suggests it was appropriate to consider cycling a niche in the London road transport sector at the time of primary data collection.

As pointed out previously 'transitions', 'niches' and 'regimes' are not objective, natural categories existing out there in the world. They are conceptual rather than a natural categories whose existence could be empirically verified and definitively proven. All of them are Weberian 'ideal-typical' constructs "arrived at by the analytical accentuation of certain elements of reality" (Weber, 2012 [1904], p.273). As such, their "conceptual purity […] cannot be found empirically anywhere in reality. It is a utopia" (ibid, p.274). Rather they offer conceptual tools that allow the analyst to determine "in each individual case the extent to which this ideal-construct approximates to or diverges from reality" (ibid.). Consequently, their suitability for describing empirically observed phenomena has to be demonstrated. Therefore, the changes currently underway in the London road transport sector have to be satisfactorily 'cased', i.e. they have to be shown to represent the case of a transition. This requires assessing to what extent it may be appropriate to speak of a socio-technical configuration having formed around the transport technology of the bicycle. And, to what extent this socio-technical configuration can be described as marginal, or perhaps even niche, in the sense that it exists in subordination to and competition with a dominant socio-technical regime in the road transport sector.

Analysis I initially provides an overview of the historical development of cycling. This is particularly relevant and significant for the case of the bicycle since cycling has previously diffused successfully and, connectedly, has a richer history, both in policy and practice

terms, than more radically novel technologies often considered in the context of transition studies. This historical review specifically focuses on the practical and political role of cycling (i) at the UK national level, from around the 1930s to April 2016, and (ii) at the Greater London level, from 1999 to April 2016. April 2016 is the end of this historical review as it presents the end of primary data collection, which coincided with the election of a new Mayor of London and thus a potentially significant turning point. The documents informing this research include existing academic publications, policy documents, national and local-level government reports, transport statistics, and the like. Study of these documents, in turn, sought to identify and re-trace trends in the physical presence of cycling as a mode on UK and London roads as well as in its significance in the context of policy-making at both the national and Greater London scale, over time. This element of the analysis serves to establish to what extent a socio-technical transition of cycling from a niche into a regime may be said to have already occurred since the invention of the bicycle as a technology in the late 1800s.

The extent to which utility cycling may be considered a niche, regime or sub-regime within London's road transport sector is, however, not only a matter of how it is positioned materially and politically, as measured by historically changing mode share statistics and treatment in policy documents. The relative dominance or subordination of utility cycling, i.e. its niche- or regime-character is also relationally constituted vis-à-vis competing road modes, particularly motorised ones.

Therefore, a second key element of the analysis assesses how utility cycling is made sense of and attributed significance relative to other modes within the wider road transport sector. Such assessment, in a first step, requires examining in what ways and how coherently cycling is made sense of at the Greater London level. To this end, the discourse and contents of the Mayoral Cycling Vision (GLA, 2013a), as the strategic document guiding Greater London cycling policy-making and provision from 2013 onwards, are examined.

The assessment is further enriched via analysis of the cycling strategies published by three local authorities – Lambeth, Southwark and Greenwich – in the south of London, between 2013 and 2016. This is necessary in recognition of the fact that, while the Mayor sets out an overall transport strategy for the Greater London region, local authorities at borough-level retain significant responsibility and power in terms of how they translate the Mayoral vision into their own local transport policy and practice. In this respect, such analysis is crucial for understanding how consistently and coherently the Mayor's ambitious regional

level strategy has filtered down and been re-articulated at the borough level. The assumption here is, of course, that the more discourses around cycling at the level of both the regional authority and different borough-level authorities converge the more likely it is that practical efforts to improve the provision for cycling at both levels converge and act in concert to deliver the overarching vision for cycling in London.

This step of the analysis draws on cycling strategy and policy documents as well as existing academic literatures that have traced the discourses and imaginaries, which have informed cycling policy-making and practice to date. The policy and strategy documents considered, specifically at the London level, include the Mayoral 'Vision for Cycling in London' (GLA, 2013a) and cycling strategies published by three selected boroughs – Greenwich, Lambeth and Southwark. These documents are studied to identify commonalities and difference in the themes, discourses and imaginaries that Greater London and local borough authorities invoke in discussing cycling provision within their specific territorial boundaries. Expert interviews conducted with representatives of the respective authorities in Greenwich, Lambeth and Southwark as well as at Greater London level further serve to enrich this aspect of the research and triangulate its findings.

However, it does not matter how coherently and consistently visions for cycling are articulated via policy and strategy documents across the Greater London regional and local borough scale if these visions and the discourses they invoke do not resonate with the discourses shaping policy-making and practice in the road transport sector more broadly. After all, cycling remains one amongst a number of modes vying for space and consideration in the road transport system. Connectedly, it is important to note that, from a CPE perspective, transportation as such does not have an objective and natural purpose. Rather the meaning and purpose of transport activities, and in this context specifically road transport activities, must be recognised as semiotically and discursively constructed. How road transport is made sense of and what purpose and meaning is attributed to road transport activities in collective discourses significantly shapes rationales of planning, design, maintenance, etc. of the road transport system. In this sense,

> *"CPE not only asks about the structural and institutional forms, in which social practices are subjected to norms and routines, but also about the symbolic-cultural forms, discourses and imaginaries that flow into the constitution of such institutional forms." (Hauf, 2016, p.51)*

In a second step, one must, therefore, also consider to what extent the cycling discourses, as exemplified in the strategy documents examined, resonate with imaginaries and

discourses that have informed developments in the road transport sector over time and across scales. To this end the research sets out to reconstruct ideal-type discourses and imaginaries that have historically shaped and continue to shape planning and practice in the road transport sector, both at the Greater London level and beyond.[41] The aim here is to understand the relative relevance and significance of cycling discourses within these broader imaginaries and discourses guiding road transport sector developments. Based on this, the research seeks to infer the relative significance of utility cycling vis-à-vis other road modes in terms of realising the dominant strategic purposes the road transport sector is semiotically and discursively being constructed as serving. The rationale for doing so is as follows: cycling constitutes one among a number of modes competing for road space. If discourses invoked in and informing cycling policy-making resonate with dominant discourses and imaginaries shaping the development of the broader road transport sector then cycling advocates can more reasonably expect to be able to shape and influence developments in the road transport sector in the interests of utility cycling.

Based on the extent to which discourses and imaginaries of utility cycling resonate and align with dominant road transport sector imaginaries and discourses, it may, in turn, be more or less appropriate to speak of utility cycling as a niche, regime, sub-regime or counter-regime of the road transport sector.

Earlier chapters have laid the groundwork for this third element of Analysis I: Chapter 2 outlined four competing ideal-typical discourses that have informed developments in the UK road transport sector to date to varying degrees. Specifically, Chapter 2 identified the predict-and-provide discourse, the transport demand management discourse, the sustainable transport discourse and the smart transport discourse in some detail. To further enrich this preliminary discussion of road transport imaginaries and discourses Chapter 7 examines transport policy and strategy documents published across the borough, Greater London, UK and EU levels to examine the relative coherence and dominance of these four imaginaries at the different levels. In addition, this element of research also draws on published academic sources that have traced historical changes in the imaginaries and logics underpinning UK road transport policy-making and practice broadly. In line with

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[41] This element of the research has some similarity with Fünfschilling and Truffer's (2014) research, which distinguishes three competing institutional logics in the Australian water sector. In contrast to Fünfschilling and Truffer who construct their water sector logics largely from scratch, the thesis draws substantially on a rich array of existing academic publications concerned with the (changing) imaginaries informing the UK road transport sector to reconstruct historic and emergent ideal-type imaginaries.

both transition literatures and the CPE literature, replication and resonance of similar road transport imaginaries and discourses across scales (and sectors) is understood as indicative of the strength, dominance and ordering power of specific discourses and imaginaries.

It is important to note, again at this point, that these discourses and imaginaries are established as ideal-types, meaning they are conceptual constructs unlikely to match empirically observed reality exactly. Instead, different historical periods in UK road transport policy-making and practice are likely to reflect a mix of some or all of the four ideal-typical imaginaries identified rather than a single imaginary finding pure expression at any moment in time. The purpose of their analysis in the context of this thesis is specifically to identify and trace the changing mix of discourses and imaginaries shaping the UK road transport sector and to assess whether and to what extent some are dominating others.

The insights gained from (i) the review of historical and recent trends in the physical presence of cycling and its political significance in the London and wider UK context, and from (ii) assessment of the discursive resonance of cycling with the imaginaries and discourses guiding the road transport sector more broadly, combine to illustrate the current status of cycling within London's road transport sector more accurately. It enables 'casing' of the ongoing changes in London's road transport sector as a socio-technical transition.

Based on the above described elements, Analysis I concludes by formulating a imprecise multi-level perspective of the current moment in the London cycling transition. The MLP, as presented earlier on in Chapter 3, serves in this context as something akin to a conceptual map and a map of an idealised transition process. As such, it presents the researcher with conceptual constructs – ideal-types – on the basis of which the analyst is more or less able to 'case' the ongoing changes in London's road transport sector as a transition process. Specifically, it allows the analyst to 'map' historical changes in the practice of and provision for utility cycling, and in its relative significance as an element of the wider London road transport sector onto the MLP heuristic. This involves the analyst weighing the relative strength and significance of the mode of utility cycling vis-à-vis other road modes in an effort to more accurately 'case' cycling as either a niche, regime, sub- or counter-regime of the road transport sector. Through this, Analysis I serves to pinpoint the current moment in the ongoing cycling transition more precisely.

Figure 6.4 illustrates the above articulated research process while Table 6.2 provides an overview of the key concepts mobilised in the context of Analysis I.

Once the transition character of the ongoing changes in London's road transport sector has been established and the stage to which this transition may be said to have progressed up until April 2016, is identified, Analysis II turns to examine the short-term dynamics characterising a specific and recent period in this transition process. The goal of this second element of analysis is to identify and critically assess mechanisms that serve to perpetuate socio-technical domination and variously hinder and facilitate socio-technical inertia and change in the short-term and at the level of day-to-day action and interaction.
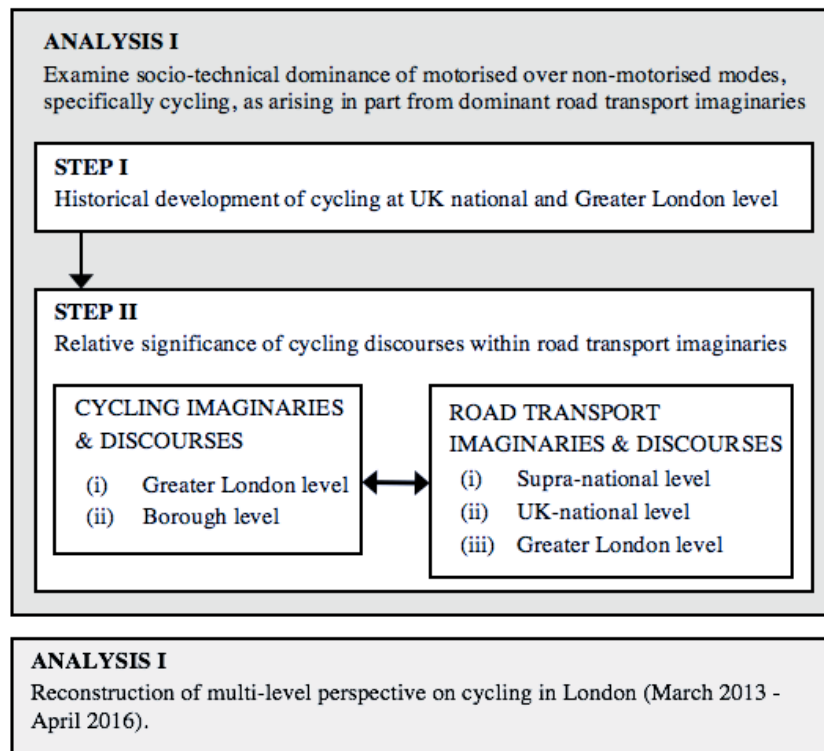
Figure 6.4 Analysis I: Research process

	Definition of concept	Effects/indicators	Data sources
Regime	"A shared, stable and aligned set of rules or routines that guide the behaviour of actors on how to produce, regulate and use energy, transportation, food production or communication technologies" (Schot, et al. 2016)	Semi-coherent, relatively stable and configurations of shared values, norms, rules and practices regulating the provision, management and use of the London road transport sector.	Secondary literature, document analysis, interviews
Niche	"A niche is a space in which radical solutions that compromise the logic of incumbent regimes are being developed. Compared with regimes, the actors in niches are few, their interrelations sparse, the focal technology immature and the guiding rules in constant flux." (ibid.)	Emergent, unstable configurations of values, norms, rules and practices shared among a smaller group or actors seeking to challenge the regime and influence the provision within, management and use of the London road transport sector.	Secondary literature, document analysis, interviews
Landscape	"Exogenous macro-events and trends (such as wars, migration, urbanization and totality of infra-structures) that shape the dynamics between niches and regimes, but are not affected by the latter in the short or mid-term." (ibid.)	Events, trends, actors and their actions at other scales, which have no direct strategic interest in or influence on the provision, management and use of the London road transport sector.	Secondary literature, document analysis, interviews
Imaginary	"An imaginary is a semiotic ensemble (or meaning system) without tightly defined boundaries that frames individual subjects' lived experience of an inordinately complex world and/or guides collective calculation about that world." (Sum and Jessop, 2013, p.165).	Configurations of "genres, discourses and styles" constituting "the semiotic moment of [the] network of social practices" governing provision within, and management and use of London's road transport sector (Sum and Jessop, 2015a, p.31)	Literature review, document analysis

Table 6.2 Analysis I: Concepts, indicators, data sources

Analysis II: Critique of socio-technical domination

Analysis II, in turn, is intent on investigating what conditions socio-technical inertia and change at the micro-level of the London cycling transition. To this end, Analysis II focuses on a specific moment in the transition process and one that is relatively short compared to the 30-40 year windows commonly advised in the context of retrospective transition case studies. The focus is specifically on the period from March 2013, the date that the London Mayor published the London cycling policy, to April 2016, just prior to the 2016 Mayoral election on May 8th.

Rationale for choice of timeframe examined

As already pointed out in Section 6.2, the London case suggested itself as a particularly interesting case to study due to the significant political and financial commitments that the Mayor of London had made to the mode of the bicycle in March 2013 via his Vision for Cycling in London. However, this progressive cycling vision was called into question in connection with the deaths of six cyclists on London roads within a fortnight in November 2013. Then-Mayor Boris Johnson responded by reassuring the public about the statistical safety of cycling in London and sought to further remind all traffic participants of their responsibility to drive and ride safely. This message was further underlined via the deployment of Metropolitan Police officers to 166 key junctions "to hand out advice to anyone seen putting themselves or other road users and pedestrians at risk" (BBC, 2013a). Though intended as an even-handed response, in combination with Johnson's resistance to even consider a rush-hour ban on heavy goods vehicles (HGVs) whilst lamenting cyclists' use of headphones while riding, his language and actions were perceived as a form of 'victim blaming' rather than demonstrating recognition of cyclists as more vulnerable road users.

This period of time, further confirmed with the benefit of hindsight, may be said to have constituted a moment of disruption, high uncertainty and, consequently, high importance for the overall long-term transition process. It set the tone for high levels of scrutiny and pressure from campaigners, advocates, activists and practitioners on the London road transport regime and the way in which it accommodates utility cycling both in the years up to the 2015 Mayoral election and since. Meanwhile trends in key indicators, such as observed increases in the number of cyclists seriously injured, slowing growth in trip share in the years 2013-2014 and 2014-2015 as well as a seeming lack of progress in the delivery

of the Mayoral cycling vision, suggested socio-technical change was slow to materialise, despite the apparent political will and financial resources made available.

As such, this thesis considers the period from March 2013 and April 2016 a key moment in the London cycling transition process, investigation of which may offer significant insight into the scope and role for agency in ongoing transitions to more sustainable urban transport systems. Moreover, it was recognised as an opportunity to focus particularly on transition stakeholders advocating for cycling in various capacities regarding the barriers they encounter in terms of affecting socio-technical change as well as how they encounter, read and enact these barriers. In this sense, the interest of the thesis is in the strategic interaction between niche and regime, or between marginal and dominant interests in London's road transport sector.

Research process, methods of data collection and concepts mobilised

This is where Analysis II turns towards articulating a critique of socio-technical domination in the context of the London cycling transition. To this end, Analysis II mobilises CPE concepts and the SRA to identify selectivities inscribed in the London's road transport regime and illustrate how these act to privilege the use of and provision for motorised modes and transport practices over utility cycling. On the other hand, this critique of socio-technical domination also examines how these selectivities, insofar as they exist, are encountered, read and enacted by cycling advocates seeking to strategically bring about socio-technical change in the London road transport system.

To enable the above, the first stage of Analysis II is focused on examining the role of dominant socio-technical imaginaries in the road transport sector in the reproduction of "one or more durable structured forms of social domination that serve particular interests" (Jessop and Sum, 2016, p.107) as manifested, for example, in the form of policies, laws, regulations, practices as well as material infrastructures, technologies and the like. In connection with this, the social and material foundations sustaining dominant socio-technical imaginaries of London's road transport sector, as outlined in Chapter 6, are examined. Specifically, the analysis hones in on how the dominant socio-technical imaginaries and discourses of the road transport sector are produced and reproduced via structural, discursive, disciplinary-technological and agential selectivities.

To do so the analysis relies to a great extent on document study to trace and identify these selectivities. Key documents in this context include secondary literature as well as policy and strategy documents, government publications, regulations, handbooks, published

meeting minutes, traditional and social media texts, and the like. These are studied with an eye to uncovering asymmetries in the way that genres, styles, and discourses that are either employed or reported on within these documents act to enable some actors and interests to shape the provision, maintenance and use of the London road transport system while challenging the ability of other actors and interests to do the same. An example of a structural selectivity, i.e. a structurally inscribed selectivity that cannot be altered by any single actor or group of actors within a given period of time, in the context of the London cycling case arises in connection with TfL, as the overarching regional transport authority, being formally ascribed the powers for traffic signal management across Greater London (TfL, n.d.). This constitutes a significant structurally inscribed selectivity that acts to privilege the strategic road transport-related interests of TfL and the Greater London region over that of local authority interests. Specifically, the selectivity acts to enable TfL to exercise significant control over traffic flows through Greater London including on local authority controlled roads, thereby privileging to some extent the transport-strategic interests of the Greater London region over those of borough-level local authorities. This structurally-inscribed arrangement, conversely, imposes a burden on local authorities to accept and align local road transport management and provision to a significant extent with TfL's transport-strategic interests for the wider region as realised in part through traffic signal management. Of course, this need not mean that TfL traffic light management necessarily conflict with local authorities' transport-strategic interests. Nonetheless, it has to be recognised as giving rise to a strategic selectivity, which systematically privileges the strategic interests of TfL as the executive agency of the regional Greater London Authority over those of borough-level local authorities.

However, selectivities not only manifest in structural, documented and material form, such as in the form of regulations, laws, and policies, the built environment and material infrastructures. They are also experienced, read, enacted or circumvented by social actors. This is where data gathered via the interviews with key stakeholders across the three boroughs and the Greater London level serves to provide further useful information on selectivities acting within the road transport sector and experienced by key actors and cycling advocates when seeking to influence provision for cycling in London in the context of their specific roles in the road transport governance process. Actors interviewed in that respect belong to key stakeholder groups most directly involved in cycling governance at the borough level. On the one hand, this is the council as the local transport authority, with council officers acting as transport practitioners tasked with planning, designing or implementing cycling-related interventions according to local council

strategy and policy as approved by elected councillors. On the other hand, it is local campaigners and interest groups who act as external influencers on the council. They may influence the cycling policy and practice either directly as individuals and groups who lobby or work with councillors and council officers publicly or indirectly as members of the electorate voting for elected members of the council administration. In addition, interviews with actors at the Greater London, UK and EU level interviews further enabled the identification of structural selectivities influencing socio-technical change at borough and Greater London level. These interviews focused specifically on transport and urban planning practitioners, politicians, campaigners and the like, i.e. people who are either cycling advocates, or professionals involved in policy-making, planning and provisioning for cycling, or both. Crucially, all interviewees were asked broad questions regarding their experience of and involvement in transport policy-making and practice for the advancement of cycling. Rather than asking actors directly regarding their experience of structural, discursive, disciplinary-technological or agential selectivities the interview questions sought to generate this information indirectly by asking interviewees to describe and reflect on their own practical experience in the governance of urban transport.

In this context, interviews serve to triangulate to what extent selectivities identified via document analysis are, in fact, significant at the level of everyday practice among the stakeholders are interviewed. Conversely, the analysis also relies on document analysis to trace and establish more firmly strategic selectivities suggested in interviewees' reflections on their involvement in the processes of road transport policy-making and practice within London's road transport sector.

In a further step, Chapter 8 examines specifically agential selectivities of the niche, i.e. alternative imaginaries and strategies articulated and advanced by cycling advocates in various formal and informal roles in the governance of cycling in London. Insights gained from this analysis are intended to provide a fuller picture of agential selectivities at work and how these can be related to observed current and potential future dynamics in the transition to cycling in London. In this sense, the analysis seeks to study and illustrate to what extent agential selectivities, i.e. actors' differential abilities to (i) "read conjunctures and identify potentials for action", (ii) "repoliticise sedimented discourses and re-articulate them", (iii) "invent new social technologies or recombine extant technologies" and (iv) "deploy strategies and tactics that shift the balance of forces in space time" (Sum and Jessop, 2015b, p.134) are enabling or obstructing alternative socio-technical imaginaries, and specifically those underpinning cycling, to take root and facilitate a

transition towards more utility cycling in London. This element of the analysis is similarly informed by knowledge acquired via initial document analysis, though it primarily draws on data gathered via the interviews with representatives of key stakeholder groups from across the three boroughs and Greater London, including: local cycling campaigners, councillors and council officers. Initial document review and insights gained from successive interviews suggested that these were the stakeholders most directly involved in cycling governance at the borough level. On the one hand, this is the council as the local transport authority, with council officers acting as transport practitioners who design and implement transport interventions according to local transport strategy and policy as approved by elected councillors. On the other hand, it is local campaigners and interest groups who act as external influencers on the council. They may influence the cycling policy and practice either directly as individuals and groups who lobby councillors and council officers publicly or indirectly as members of the electorate voting for elected members of the council administration. At the Greater London level, UK and EU level interviews focused on transport and urban planning practitioners, politicians, campaigners and the like who act as cycling advocates. Figure 6.5 illustrates the process outlined. Table 6.3 provides an overview of concepts mobilised in Analysis II.
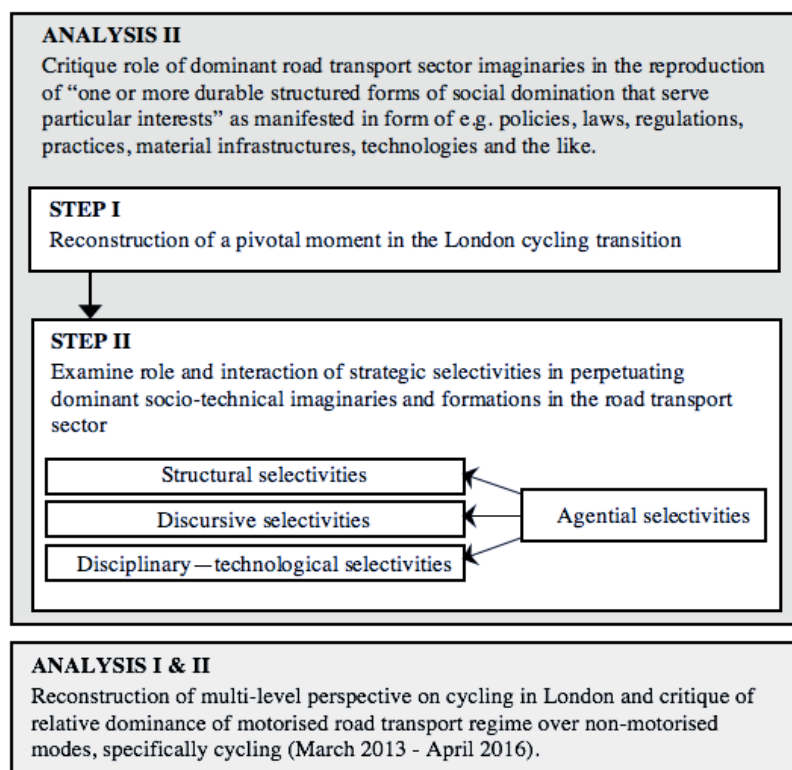
Figure 6.5   Analysis II: Research process

	Definition of concept	Effects/indicators	Data sources
Structural selectivity	"[A]ll structures privilege the adoption, as a condition for success, of certain spatial and temporal horizons of action by those seeking to control, resist, reproduce or transform [them]." (Jessop, 2014, p.205)	"[A]symmetrical configuration of constraints and opportunities" faced by different actors involved in the governance of the London road transport system "as they pursue particular projects." (Sum and Jessop, 2013, p.214)	Primary sources, interviews
Discursive selectivity	"Discursive selectivities limit possible imaginaries, discourses, genre chains, arguments, subjectivities, social and personal identities, and the scope for hegemony, sub-hegemonies, and counter-hegemonies. They privilege some interlocutors, some discursive positionings, some discursive strategies and tactics, and some discursive statements over others." (Jessop, 2014, p.211)	Asymmetrical "constraints and opportunities inscribed in particular forms of discourse" that impact on (1) the extent to which alternative socio-technical transport imaginaries can be articulated, (2) the extent to which different actors involved in the governance of the London road transport system can or cannot articulate alternative imaginaries and (3) the extent to which these articulations "enter intertextual, interdiscursive and contextual fields." (Sum and Jessop, 2013, p.215)	Primary sources, interviews
Disciplinary-technological selectivity	Disciplinary-technological selectivities are complex ensembles of knowledge, orders of discourse, sites and logics of governance and calculated intervention suited to create and/or regulate particular orders of social relations.	"[A]symmetrical effects of […] technologies of measurement, calculation, subjectivation, communication, disciplinary normalization, governmentality, and so on" (Jessop, 2014, p.211) in the realm of urban transport governance in terms of how they produce objects of knowledge/power and subjects 'who know' about these objects and are, therefore, in a position to exercise more or less power over these objects	Primary sources, interviews

	"Agential selectivities relate to actors' capacities to monitor their own actions; learn from experience; integrate social science knowledge into their activities" (Jessop, 2014, p.2012) in ways that enable them to exploit structural, discursive and disciplinary-technological selectivities and 'make a difference' in certain conjunctures	Key actors, who are 'making a difference' at specific conjunctures, i.e. moments in time and place by 'reading' conjunctures and identifying inherent scope for action; to stimulate a review (and re-articulation) of sedimented discourses; to exploit the array of established disciplinary technologies or devising new ones; and to force shifts in the balance of powers.	Primary sources, interviews
Agential selectivity			

Table 6.3 Analysis II: Concepts, indicators, data sources

Eight steps in developing a critique of socio-technical domination

In this sense, Analysis I and II as presented in the previous two sections re-articulate Jessop and Sum's (2016) original eight-step approach to critique of social domination for the critical analysis of *socio-technical domination* in the context of London's road transport sector.

A first step (1) in developing such a CPE-inspired and SRA-enabled critique of the London cycling transition requires acknowledgment of semiosis, or sense- and meaning-making, as one of two key means social actors, including transition stakeholders, rely on to reduce the complexity of their real-world context to a degree that enables them to undertake boundedly-rational, calculated action. The CPE literature review presented in Chapter 4 of this thesis laid out the theoretical groundwork to enable and even necessitate such an acknowledgment. Informed by the critical realist philosophy, it outlined reasons underlying the fundamental complexity of reality and explained why, as a consequence, no single actor can ever expect to be able to fully access or objectively know said reality in all its complexity at any given moment in time. On this basis, Chapter 4 further emphasised the dual role of semiosis and structuration as key means of agential complexity reduction. Chapter 5 concluded the first step in the development of a critique of socio-technical domination. It outlined how CPE can be fruitfully combined with the existing transition literature and specifically the MLP to draw attention to the importance of semiosis alongside structuration in the coevolutionary production of dynamically stable, semi-coherent socio-technical configurations. As such, Chapter 4 and 6 served to

clearly articulate this thesis' acknowledgment of the central role of semiosis in complexity reduction.

Steps (2), (3) and (4) in the development of a critique of the London cycling transition involve the identification and critique of socio-technical imaginaries present in the UK road transport sector. These steps are satisfied via Analysis I in Chapter 7, which identifies and assesses the relative dominance of four competing ideal-typical discourses and imaginaries informing developments in the UK road transport sector. This analysis further examines the extent to which discourses underpinning cycling as a novel socio-technical configuration resonate with the dominant road transport sector imaginaries or whether these imaginaries privilege or favour modes, actors or interests over the bicycle and utility cycling as a mode.

Step (5) of critique, in turn, is one element in Analysis II. It examines the role of dominant road transport sector imaginaries and discourses in the reproduction of *"one or more durable structured forms of social domination that serve particular interests"* (Jessop and Sum, 2016, p.107) as manifested, for example, in the form of policies, laws, regulations, practices as well as material infrastructures, technologies and the like. In connection with this, step (6) focuses on the social and material foundations that sustain dominant socio-technical imaginaries informing developments in London's road transport sector as produced and reproduced via structural, discursive, disciplinary-technological and agential selectivities. A further step (7) examines alternative imaginaries and strategies articulated and advanced by cycling advocates in various formal and informal roles in the governance of cycling in London.

The final step (8) is concerned with questioning the potential and requirements for a successful socio-technical transition, re-establishing utility cycling as a mainstream mode in London's road transport system, to occur. This element of the analysis will be articulated as part of the discussion of findings made via the two analyses conducted. It will consider specifically to what extent discourses underpinning the cycling niche may be able to challenge broader road transport sector imaginaries and discourses and to what extent there exist opportunities for broader actor groups to form discourse and advocacy coalitions to strengthen and sediment niche discourses and imaginaries and their structural and material articulations over time and across geographical scales.

For a summary of the eight steps and how they correspond to different elements and chapters of this thesis compare Table 6.4.

Eight steps in developing a critique of the London cycling transition	Corresponding Chapters	Data sources
(1) Recognise the role of semiosis in complexity reduction via sense- and meaning-making (as opposed to through structuration) and by extension its role in the production of socio-technical configurations in the London road transport sector as concrete-complex instantiations of the need of social actors to reduce the complexity of reality to enable them to 'go on' in the world.	**Chapter 4 and 5:** -Review of CPE literature (Ch 5); articulation of MLP-CPE crossover (Ch 6)	Literature review
(2) Identify socio-technical imaginaries and discourses in the UK road transport sector, i.e., specific clusters of meaning, describe their form and content; and, within these imaginaries, focus on specific arguments, discourses, social practices and so on. **(3)** Develop a critique of the identified socio-technical imaginaries and discourses "based on deficiencies in their internal assumptions, categories, problematization and argumentation, with a view to disclosing empirical inadequacies, theoretical inconsistencies and anomalies, silences, exclusions, contradictions or other defects. […] This step can extend to a moral critique that reveals and evaluates the often implicit ethical and moral values, sentiments, commitments, feelings, spatiotemporal horizons of action, attitudes to the environment and so on, that inform the critiqued" socio-technical imaginaries. **(4)** Identify how the critiqued socio-technical imaginaries and discourses favour or privilege some actors, actions and interests in specific periods and overlook or disregard others. This may be due to uncritical enactment or the strategic and purposeful exploitation of sedimented and taken-for-granted, yet ideologically-biased assumptions about the nature of reality and the relations that constitute it. This is the stage of *Ideologiekritik*.	**Analysis I - Chapter 7:** -Extension of critique of socio-technical imaginaries informing UK road transport sector as introduced in Chapter 2 -Describe how specific imaginaries privilege some modes and road users over others and to what extent this is the result uncritical or, alternatively, wilful enactment of imaginaries	Primary sources, secondary literature, interviews
(5) "Describe the role, if any, of the critiqued [socio-technical imaginaries] in reproducing one or more durable, structured forms of social domination that serve particular interests. This is the stage of *Herrschaftskritik*, i.e., the critique of the various forms and intersections of patterns of social [including socio-technical] domination and, where relevant, domination over nature and the role of the critiqued [socio-technical imaginaries] in creating, selecting, institutionalizing and sedimenting [socio-technical] domination." **(6)** "Explore in turn the social and material bases that sustain the critiqued [socio-technical imaginary], how it has been consolidated, and the discursive, structural, technological, and agential selectivities involved therein. This is the stage of sociological critique, broadly defined." **(7)** Examine alternative imaginaries, interpretations and strategies articulated and advanced by groups with "normative commitments that differ from those articulated, or discoverable, in discourses or [socio-technical] arrangements in question to facilitate the emancipation of subaltern [socio-technical configurations] (and perhaps dominant ones too) from the harmful effects of the pattern of domination (discrimination, exclusion, exploitation and oppression) that is legitimized, naturalized or reproduced through the critiqued [socio-technical configuration]. This involves cognitive, practical and normative concerns with the identities, subjectivities and interests of the forces engaged, or to be mobilized, in relevant struggles for emancipation."	**Analysis II - Chapter 8:** -Assess extent to which imaginaries play a role in reproducing dominant socio-technical forms that serve specific modes and road users -Strategic-relational analysis to understand role of strategic selectivities in sustaining dominant socio-technical imaginaries and their institutional, discursive and material articulations -Examine extent to which selectivities constrain or enable interpretations and actions by marginal groups embracing alternative socio-technical imaginaries	Primary sources, secondary literature, interviews
(8) Recognise that for critique to be effective it needs to be articulated in material and structural form via supportive actors and actor groups committed to the implementation of alternative socio-technical imaginaries and configurations. "This is likely to require a range of struggles oriented to different spatio-temporal horizons of action and mobilising different social forces in processes characterized by trial-and-error experimentation, strategic learning and, eventually fundamental changes in the structural bases of socio-technical domination."		

Table 6.4 Eight steps in developing a socio-technical critique (Adapted from Jessop and Sum, 2016, p.106)

6.4. Limitations of methodology and research design

The closing section of this chapter considers some possible limitations of the methodology and research design as presented above. Specifically, it confronts limitations and challenges commonly associated with case study research and single case study designs in particular. In addition, the section discusses limitations associated with the use of interview methods and qualitative research designs more generally.

Qualitative case study remains a controversial research methodology. It is most persistently challenged on the grounds that case study as a research strategy lacks formalisation and is prone to being executed without sufficient rigour. Its proponents on the other hand laud case study for the exact same reason as it provides social scientists with great flexibility in terms of investigating a phenomenon within and against its wider societal context. Many of the key challenges levelled against case study (and in fact many other qualitative methods) are rooted in critics applying scientific standards of natural sciences to research in the social sciences.

Single vs. multiple case study designs

An example of this is the argument concerning the validity of single-case versus multiple-case study designs, which has been the subject of significant disagreement throughout the history of the social sciences.

Historically, critics of case study research within the social sciences have tended to measure the methodology with the same yardstick applied to positivistic research methods in the natural sciences. Therefore, emphasis was placed on the objectivity of case study findings and their generalisability to larger populations. As pointed out by Flyvbjerg (2013) this is to mistake the purpose of in-depth qualitative case study, which is not to serve the positivist research paradigm of identifying law-like regularities underlying different empirical cases (see also Easton, 2010).

And, while multiple-case study designs hold significant scientific value in terms of allowing for the comparative study of a phenomenon in different contexts and hypothesis-testing research, this does not diminish the value of single-case research designs for primarily exploratory and theory-building research (Morgan, 2012; Flyvbjerg, 2013). As such, it may be said that one design choice does not inevitably preclude the other. On the

contrary, the single versus multiple-case design question may be seen more as a question of sequence rather than an either/or question.

From a purely scientific perspective this research could have been designed as a multiple-case study design. However, the lack of formal theorisation of the structure-agency dynamic in ongoing transitions meant that a significant exploratory and theory-building literature search had to be done before a fruitful comparative design could have been developed. Undertaking to do both in sequence, while not impossible, would have posed a significant challenge in light of the resource constraints of PhD research. Therefore, the research design consciously limits itself to the study of London as a single, embedded case in great detail. However, following conclusion of this single, in-depth case it is easy to see how the design may be fruitfully applied to further cases in other contexts.

Taking a practical perspective and considering the study's emancipatory ambition, insights gathered from in-depth and contextualised study may be much more relevant to research participants than the kind of generalisable insight that may have been gained from contrasting and comparing multiple cases at a more superficial level. The decision for a single case design was, therefore, a conscious choice given the thesis' ambition to produce a case study account that has both breadth and depth on the one hand and the time and resource constraints characterising PhD research on the other hand.

A further reason for the selection of a single- over a multiple-case design was a concern regarding the possibility of studying multiple cases to comparable detail and rigour in a short amount of time. The single case of London had the substantial advantage of posing a very familiar context to the researcher. As such, it allowed the exploration of a case to a degree of detail that on the one hand may not otherwise have been possible across multiple cases in the same timeframe and on the other hand may not have been achievable at all in the absence of a similar level of lived familiarity.[42]

Nonetheless, it must be acknowledged that the single case design poses a limitation of this methodology in so far as the value of single case studies has been challenged particularly on the basis of generalisability and repeatability. The reproducibility of case study research and its findings has often been called into question due to the lack of formalisation of case study as a methodology. While this poses a serious challenge, it is

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[42] In connection with this, it may be said that not only is the research interested in phronetic know-how and know-why of its subjects, but to some extent the research itself lives from the phronetic knowledge of the researcher conducting it.

not an insurmountable one. The lack of formalisation merely places the onus on the individual researcher to outline their research design and processes to a level of detail that would enable others to replicate the study. The thesis has tried to do just that in the earlier sections of this chapter.

A further challenge to case study methodologies in general and particularly single case designs is the criterion of generalisability. While a valid concern in connection with much positivistic experimental research designs, qualitative in-depth case study is not so much interested in empirical, but theoretical generalisation. This means that rather than seeking to establish law-like generalisations at the empirical level, the interest of this thesis is to develop theoretical generalisations in the form of a new and (empirically) useful analytical framework that may in turn generate novel concepts and theoretical insights. The novelty and any potential generalisable quality lie, therefore, in the research process, including the analytical framework, research design and conduct of fieldwork and analysis. And though the present thesis applies this research process to the single case of London the process itself can be reapplied in other contexts and bears generalisable quality in itself.

DISCUSSION OF FINDINGS

7. ANALYSIS I: A MULTI-LEVEL PERSPECTIVE ON CHANGES IN LONDON'S ROAD TRANSPORT SECTOR

The following Chapter 7 is centrally concerned to establish the transition character of the ongoing changes in London's road transport system. In connection with this, the chapter also lays out why utility cycling may appropriately be thought of as a niche within the London road transport sector.

Chapter 7 advances the thesis by addressing the above points on the basis of insights gathered via the empirical research described in Chapter 6. Section 7.1 presents a review of historical trends in the presence and significance of cycling in practical and political terms, both at the UK-national and Greater London level. The Section 7.2 further considers whether there is convergence or divergence in how cycling is made sense of and attributed meaning by key actors in London via an analysis of the Mayoral Vision for Cycling (GLA, 2013a) on the one hand and the cycling strategies published by local transport authorities in three South London boroughs on the other hand. Section 7.3 then moves on to compare discourses and imaginaries invoked within borough-level cycling strategies with discourses and imaginaries shaping the UK road transport sector more broadly. By doing so, the analysis establishes the extent to which the cycling agenda may be said to present a discourse that is in alignment with and thus actively shaping road transport sector developments or whether other interests and logics operate and dominate the development of the sector.

7.1. History of cycling practice and policy-making in the UK and London

The following section presents an overview of the historical significance of cycling at UK national level as well as at the Greater London level.

National level

The importance of cycling at the UK national level has varied historically. Despite mode share in the UK rising to all-time highs with as many as 20 per cent of men and 10 per cent of women cycling to work during the 1930s and 40s (Pooley and Turnbull, 2000), the bicycle remained largely absent from the public policy arena until around 1975 (Aldred, 2012).

This political invisibility was further exacerbated by the strong decline in the material presence of cycling on UK roads. The 1950s and 60s witnessed the proliferation of pro-car policies and a mantra of 'predict and provide' shaping investment and development in the road transport sector to accommodate forecasted rising levels in private motor traffic (e.g. The Beeching Report, 1963; The Buchanan Report, 1963). By 1970, cycling had almost vanished from the transport landscape accounting for a mere two per cent of total vehicle miles travelled across Great Britain (DfT, 2012). Curiously it was during this period that the bicycle first gained political traction connected with growing concerns regarding the environmental impacts of motorised transport (Golbuff and Aldred, 2011).

Following on in the 1980s, the political commitment to cycling as an environmentally friendly transport alternative gradually subsided. At national level, the Conservative Government deemed cycling of little strategic significance. Meanwhile, the public discourse regarding cycling shifted to focus on the vulnerability and dangers associated with cycling in an environment oriented to cater to increasing levels of high-speed motorised traffic (Aldred, 2012).

The 'New Realism' that took over UK transport policy making in the early 1990s (e.g. Goodwin et al., 1991) brought a return of cycling to the policy agenda. Again, cycling was discursively framed primarily as a means to counter environmental and public health concerns associated with rising levels of individual automobility rather than as a desirable transport mode in its own right (Golbuff and Aldred, 2011). The year 1996, in turn, saw a Conservative government launch the UK's first National Cycling Strategy (NCS) with the declared goal of doubling the number of bicycle trips by 2002 (Butcher, 2012a). Responsibility for the strategy's delivery, however, rested largely with local authorities.

In 2000, a new Labour government initially embraced the NCS by requiring local authorities to set out their own strategies towards achieving the ambitious NCS objectives within Local Transport Plans (LTP)[43]. Guidance issued to local transport authorities for the development of the second round of LTPs in 2009 once again abandoned the overly centralistic national target leaving local authorities to set and delivery on their own, locally-specific targets.

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[43] Since the Transport Act 2000 local transport authorities in England, but outside of London, were under a statutory duty to produce a Local Transport Plan every five years. The Transport Act 2000 was further amended by the Local Transport Act 2008, which devolved greater power and responsibility for the monitoring and review of local transport plans back to local transport authorities.

Meanwhile, the years between 2005 and 2011 also saw experimentation with greater and more strategic investment in cycling in a number of ambitious, yet localised pilot programmes. Specifically, in 2005, the Cycling Demonstration Town programme was launched by Cycling England (a DfT-funded independent body promoting cycling in the UK). Over the course of the programme six towns in England spent approximately £10 per head of population annually on cycling for three years. A follow-on programme – the Cycling City and Towns Programme – saw twelve Cycling City and Towns strategically invest a total of over £43 million (plus local match funding) in cycling between 2008 and 2011. Over the same time period, inter-urban and inter-city cycling infrastructure provision grew in the form of the National Cycle Network (hereafter NCN). The NCN expanded in length to a total of 15,000 miles between 2000 and 2012 with support by the sustainable transport charity Sustrans and funding contributions from national and local government, donations and Lottery funds.

Related to the variability in strategic investment in the mode, cycling levels and provision for cycling across the UK varies greatly. And, while a number of localities, including those that participated in above outlined strategic investment programmes, stand out due to high relative mode share, the national mode shares of cycling in terms of trips and distance remain stubbornly at 2 and 1 per cent, respectively (DfT, 2016).

Therefore, it may be concluded that political interest and support for cycling at the UK national level has fluctuated over the decades. However, while some governments attributed greater importance to cycling in their policy-making, direct and strategic intervention in terms of ensuring provision for cycling from the national level remains limited. This is in part attributable to cycling having historically been considered of little strategic national interest due to being a hyper-local mode. However, the commitment of successive UK governments towards greater devolution of powers away from Westminster to local authorities further cemented a largely hands-off approach when it comes to policy-making and provisioning for cycling at the UK national level. In the context of cycling this has meant that local transport authorities have assumed the powers and responsibilities for delivering national cycling strategies or developing their own ambition in terms of provisioning for cycling.

In conclusion, it may be stated that cycling remains a niche mode in the UK road transport sector, both in terms of its mode share, dedicated funding and infrastructure provision as well as its political significance. In this context, however, it is important to mention that the keen efforts of non-governmental organisations, such as Sustrans in the building of the

NCN, together with the programmes piloting localised, but ambitious strategic investment in the mode all served to allow cycling as a mode to build up and maintain a physical and infrastructural presence in the past decades. Particularly, the Cycling Demonstration Towns and Cycling Town and Cities programmes further enabled significant learning and knowledge development and served, in this sense, as important platforms allowing the national-level cycling niche to grow more internally coherent over time.

Greater London level

Discussion of the historical significance of cycling at the Greater London level is limited to the years from 1999 to March 2013, with 1999 being the year that the current London governance framework came into effect with the institution of the Greater London Authority (GLA) Act of 1999.

TERRITORIAL SCALE	MAJOR INSTITUTIONAL EMBODIMENTS AND EXTENT OF POLITICAL CONTROL/INPUT
EU	EU directives focus mainly on regulating transport issues of cross-border significance; cycling as a local transport mode is largely untouched by EU directives due to the subsidiarity principle. Presently, no EU cycling strategy.
EU – UK relations	National states take on independent responsibility to translate EU transport directives into national law; due to subsidiarity principle UK responsible for its own strategy on cycling
UK	DfT sets national transport strategy; directly responsible for state-wide regulatory concerns and modes governed by international treaties, e.g. air, maritime (Shaw, et al. 2009)
UK – London relations	Powers concerning road, bus and part of rail devolved to GLA under requirement that London transport strategy be consistent with UK transport policy (Smyth, 2003)
London	GLA and Mayor have strategic authority; propose cycling policy as part of 'Integrated transport strategy'; TfL (GLA transport body) responsible for implementing strategy
London – Borough relations	Boroughs' local transport initiatives must be consistent with Mayor's overall strategy and be carried out in co-operation with TfL.
Boroughs	Boroughs formulate cycling schemes within LIPs and carry them out in collaboration with TfL

Table 7.1 Scalar architecture of formal institutional transport governance bodies

As indicated by the relations between transport governance bodies at different geographical scales summarised in Table 7.1, the GLA Act stipulates the Mayor and the GLA as the central strategic authority over transport in London. According to the Act the London Mayor is responsible for formulating a London-wide Transport Strategy as a statutory document. London boroughs in turn are required under the GLA Act (1999) to set out how they plan to implement the mayoral transport strategy via Local Implementation Plans (hereafter LIPs). The LIPs further provide TfL with the basis on which it allocates funding to the boroughs for five key categories of transport investment, including principal road maintenance, bridge strengthening, corridors, neighbourhoods and supporting measures, traffic signal modernisation for sites on borough roads and major schemes (TfL, 2017b).

Subject to the London governance framework, cycling in the capital has experienced strong growth in recent years, despite cycling figures stalling at the wider national level. Between 2000 to 2008 London recorded a 99 per cent increase in the total number of bicycle trips made whilst in parallel managing to reduce the number of cyclists seriously injured by 12 per cent (Pucher et al., 2011).

In part this revival of the bicycle has been facilitated through significant political support, such as from former London Mayor Ken Livingstone. During his incumbency from 2000 to 2008, Livingstone announced ambitious goals to promote cycling as an integral mode in the wider transport network including the now up and running bicycle hire scheme 'Santander Cycles' (formerly 'Barclays Cycle Hire') as well as a network of 12 cycle superhighways, construction of which is progressing. This pro-cycling attitude was carried forth and reaffirmed by Conservative Mayor Boris Johnson who entered office in 2008 and was re-elected in 2012. Johnson made his personal commitment to encouraging a 'cycling revolution' known in 2009 via publication of a first comprehensive cycling vision aimed at turning "London into a cyclised city" (TfL, 2010, p.3).

The thesis in turn focuses on the period of time following publication of former Mayor Johnson's "Vision for Cycling in London" in March 2013 (GLA, 2013a). Therefore, while no detailed comparison between the 2010 vision and the 2013 vision for cycling is conducted here, it is worth mentioning that tone and aspiration of the two strategy documents was very similar with both advocating a normalisation of cycling and expounding the benefits of cycling from a transport, environmental, public health as well as economic perspective. A key difference between the two strategies is, however, that the

2013 vision was announced in connection with a £913 million budget to be spent over the ten year window from 2013-2023.

In contrast, the amount of ring-fenced funding allocated to cycling prior to the 2013 Mayoral strategy was rather limited as evidenced in Table 7.2. Total cycling expenditure increased significantly following publication of the first strategy document in 2010. However, as the table indicates, a large proportion of these spending increases are attributable to costs incurred in the running of the public cycle hire scheme, which began operation in 2010 and has since been across London. Its set-up undoubtedly has had an important role to play in popularising cycling and allowing prospective users to trial the bike as a way of getting around the city (see, for example, Goodman, et al. 2014). Nonetheless, it has to be recognised that up until the years 2011/12 a majority of investment in cycling has gone towards schemes primarily targeted at promoting the mode while funds of the provision of dedicated and improvement of existing cycling infrastructures have remained comparatively limited.

	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12
Cycle Hire						0.9	16.9	64.4	41.6
Cycle Superhighways							4.8	21.2	14.9
Better Junctions									0.3
Other schemes [a]	1.3	2.1	3.8	4.8	9.1	9.2	10.2	5.4	5.3
Total cycling expenditure	2.6	5.0	6.8	12.4	19.6	19.9	40.4	99.3	70.8
Borough cycling expenditure	11.0	9.3	15.1	19.0	20.7	24.4	16.8		
Estimated allocation of borough LIP funding to cycling schemes								[b]	10.9

Notes:
a) Includes £8.1 million for Olympic Cycle Network funded by Olympic Delivery Authority between 2008/09 - 2012/13.
b) No breakdown available for year 2010/11 due to transition from ring-fenced funding to LIPs.

Table 7.2 TfL cycling expenditure, funding years 2003/4-2011/12 (Adapted from: GLA, 2012)

Despite limited funding commitments between 2000 and 2013, the absolute number of cycling trips undertaken in the capital increased from 270,000 to 500,000 daily journeys

over the same timeframe (TfL, 2016a, 2013b). And, while motor cars entering Central London in 2000 still outnumbered cyclists by a ratio of more than 11 to 1, this trend has been sharply turned around with a decline in the ratio to 1.7 to 1 by 2014 (GLA, 2016). Connectedly, a reported 'slowdown' in cycling growth for 2012 (TfL, 2013b) and even a pause in the growth of cycling in 2013 (TfL, 2014a) the year-on-year change in the number of daily average cycle stages and trips has since recovered with increases of 10 and 4 per cent reported for the years 2013-2014 and 2014-2015, respectively (see Table 7.3).

As mentioned earlier, this return of growth in cycling numbers in London both in 2014 and 2015 follows the introduction of the Mayoral Vision for Cycling in London in 2013 and the accompanying commitment of significant resources to the improvement of provision for cycling in the capital.

| Year | Cycle stages | | Cycle trips |
	Millions	Year-on-year change %	Millions
2005	0.41	9	0.39
2006	0.47	12	0.42
2007	0.47	0	0.42
2008	0.49	5	0.44
2009	0.51	5	0.47
2010	0.54	6	0.49
2011	0.57	5	0.49
2012	0.58	2	0.50
2013	0.58	1	0.50
2014	0.65	10	0.56
2015	0.67	4	0.60

Table 7.3   Daily average cycle stages and trips in London (Source: TfL, 2016a)

Despite these encouraging figures and the consistent political support for cycling as an important and desirable mode within London's road transport system, the cycling revolution and the broadening of cycling demographics aspired to by former Mayor Boris Johnson in 2010 is slow to materialise. To date, the average London cyclist remains stubbornly middle-aged, male and in employment. Meanwhile, proportions of cyclists among male and female, white, black and minority ethnic Londoners have not significantly changed to date (see Figure 7.1). Food for thought, however, is that ridership among disabled Londoners is reported to have increased since 2013 to such an extent that

there is no difference in proportional ridership among disabled and non-disabled Londoners.

Figure 7.1 data labels: Total (2159): Non cyclists 82, Occasional cyclists 5, Regular cyclists 14. Men (1023): 77, 5, 18. Women (1136): 86, —, 9 (with 4 above). Working (1495): 78, 5, 17. Not working (664): 88, 4, 8. Disabled (499): 83, 4, 13. Non-disabled (1614): 81, 5, 14. White (1613): 82, 5, 13. BAME (546): 81, 5, 14.

Legend: ■ Non cyclists, ■ Occasional cyclists, ■ Regular cyclists

Demographic questions
Base: All – Sept 2015 (online)
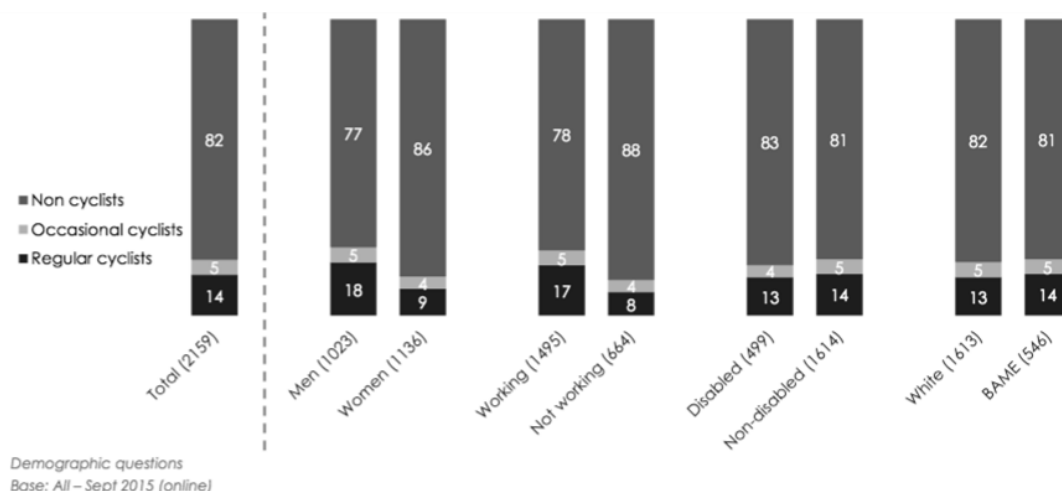
Figure 7.1   Profile of cyclists (2015) in per cent (Source: TfL, 2015c)

Nonetheless, a general broadening of the demographic groups cycling is not yet being observed. This, however, is argued to be crucial in facilitating a genuine transformation of London cycling and to achieve the high level of ridership aspired to. As one interviewee remarked regarding the seemingly modest five per cent mode share target originally articulated in the Mayoral vision for cycling in London (though, subsequently abandoned as an official TfL target):

> *"Five per cent mode share for cycling in London […], and in some respects, that doesn't sound like very much, but it does really mean that we have to get cycling beyond the current sort of situation where it's got a bit stuck and you've got to some extent existing cyclists making more trips and it's not really breaking out of traditional demographics yet." (GL-2)*

This echoes a statement made by Andrew Gilligan, then Cycling Commissioner, during a 2013 London Assembly Transport Committee meeting. He argued that the Mayoral vision

> *"is very much about […] broadening out beyond the traditional white, professional man in his 20s, 30s and early 40s that we have at the moment. Without that, we will not get more women cycling, more older people cycling and more black and ethnic minority (BME) people cycling. Without that, we are not going to see the growth we need." (GLA, 2013b)*

Regular surveys concerning attitudes to cycling in the capital (see London Assembly Transport Committee, 2014, 2012; TfL, 2015c, 2014b, 2013c) further suggest that

perceived safety risks and the fear of collisions in connection with busy traffic conditions and conflict with motorists remain cited as key factors putting Londoners off cycling.[44]

Taking the above outlined historical changes into consideration it can be argued that utility cycling in London has been on a transition trajectory for the past two to three decades underpinned by continuous growth in cycling activity on London's roads and steadily increasing political support for the mode. However, funding allocated to providing high-quality, safe infrastructure for cycling has been relatively limited up until 2013 when then-Mayor Boris Johnson announced a funding commitment of £913 million over the course of ten years from 2013 to 2023 alongside his Vision for Cycling in London.

Limited changes in the demographic profile of regular cyclists, slowing, though continuous mode share increases suggest that utility cycling remains far from having transitioned into the mainstream mode the Mayoral vision aspires it to be. This view is further strengthened by the observation that funding for the mode has up until 2013 been relatively limited and progress in the provision of improved and dedicated infrastructure for cycling correspondingly sluggish. Based on the evidence considered up to this point, the mode is, therefore, more appropriately considered a niche in the wider road transport regime.

The extent to which utility cycling may be considered a niche in London's road transport sector is, however, not only a matter of how it is positioned structurally, via material and discursive practices as measured by mode share statistics and expressed in policy documents. The subordination or dominance of utility cycling, i.e. its niche- or regime-character is also relationally constituted vis-à-vis competing road modes, particularly motorised ones. To enable an assessment of the niche-character of the mode of utility cycling the following two sections focus on assessing how the cycling is made sense of and attributed meaning as one among many modes within the wider road transport sector.

In a first step, section 7.2 examines in what ways and how coherently cycling is made sense of at the Greater London level. This analysis focuses initially on the Mayoral Cycling Vision as the strategic document to guide cycling policy and provision for the Greater London region from 2013 onwards. In a second step, the analysis also considers how consistently and coherently this overarching strategic vision filters down and is re-

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[44] Media reporting on collisions involving cyclists has historically also been cited as discouraging some Londoners from cycling though it is not established to what extent this correlates to the prevalence of collision reports in each survey period (TfL, 2015c).

articulated at the borough level. Here the analysis looks specifically at the cycling strategies put forward by three local authorities – Lambeth, Southwark and Greenwich – in the South of London.

Section 7.3 then turns to examine the discourses and imaginaries that have historically informed road transport policy-making and practice more broadly and considers to what extent the discourses identified in the Greater London and borough level cycling strategies contrast or align with broader road transport sector imaginaries and discourses.

7.2. Semiotic and discursive constitution of cycling in London, 2013-2016

The Mayor's Vision for Cycling in London (GLA, 2013a)

In his 2013 Vision for Cycling in London, then-Mayor Boris Johnson set out very ambitious plans for "substantial – eventually transformative – change" (GLA, 2013a, p.4). In committing to such substantial and progressive change in the provision for cycling in London he further acknowledged that cycling had in the past been treated "as niche, marginal, or an afterthought" rather than an "integral part of the transport network" (ibid.). Changing this, according to Johnson, required that cycling be allotted "the capital spending, road space and traffic planners' attention befitting that [integral] role" (ibid.).

What is notable is the vision's expressed ambition to normalise cycling and to significantly broaden the demographic profile of cyclists to include "more women cycling, more older people cycling, more black and minority ethnic Londoners cycling, more cyclists of all social backgrounds" (ibid., p.5). Targeted engagement of schools and cycle training for school-age children further aims to normalise cycling among younger age groups in the capital. All of this underlines a recognition that "without [broader demographics being attracted to cycling] truly mass participation can never come" (ibid.).

To enable this, specific improvements outlined within the Vision include hard infrastructural measures, such as the revision of select junction layout and removal of gyratories, and the development of cycling routes both along main traffic routes ('Cycle Superhighways') and on back streets ('Quietways') among others. Soft measures proposed by the Vision focus much on increasing the safety of cyclists vis-à-vis other modes, for example, by providing cycling training and cycle safety education as well as developing and promoting targeted health and safety training, standards and accreditation for individual drivers and companies operating vans, lorries and construction vehicles

within the capital. In addition, measures, such as 20mph speed limits were to be considered across London's strategic road network while a competitive funding pot was promised to be made available to expedite the development of more cycling-friendly environments in car-dominated Outer London boroughs, creating so-called 'Mini-Hollands'.

In making the case for more space, consideration and resources to be allotted to cycling, the Mayoral vision discursively paints a picture of a mode (almost) too good to be true. A mode able to reduce air and noise pollution while cutting crowding on public transport as well as improving public health "quite quickly, without the cost and disruption of new roads and railways" (ibid.). In this sense, the vision taps into and perpetuates some of the discursive trends, which Aldred (2012) documented as having shaped UK cycling policy-making since cycling became a matter of policy-making in the 1980s. These discourses, as mentioned in Section 7.1, promoted cycling as part of environmental and public health agendas rather than as a mode with a distinct role within the transport sector. Summarising the main thrust of transport policy-making in the 21st century Aldred (ibid., p.98), thus, stated that:

> *"[c]ar and air transport remained identified with economic gain […] public transport was linked to social inclusion […] while walking and cycling became specifically associated with environmental and health goals."*

To some extent the Mayoral Vision for Cycling in London appears to depart from this view of cycling by establishing the mode on early on as an "integral part of the transport network" that should no longer be treated as a niche or an afterthought (GLA, 2013a, p.5).

Nonetheless, emphases on the public health and environmental benefits of cycling feature prominently throughout the vision. For example, the document promotes the bicycle as, quite literally, a life-saver, more extensive use of which could significantly reduce transport emissions and connectedly play a role in preventing thousands of air pollution related premature deaths in the capital. The vision further extols the mode's positive impact on both physical and mental health, citing it as a means of tackling obesity, improving physical health and fitness and in countering feelings of anxiety and depression.

In addition, established individual and public health narratives are bolstered by new discourses, such as the discourse of cycling as a producer of economic benefits. At the level of the individual these accrue in the form of increased disposable income enjoyed by regular cyclists. At an aggregate level cyclists' improved fitness and health level are said to decrease public health expenditure and boost workplace productivity. The vision further

holds out the prospect of further economic benefits accruing to local high streets and neighbourhood shops due to being more heavily frequented by cycling residents.

Another distinct discourse emerging more clearly within the Mayoral cycling strategy is that of cycling as an effective tool for place-making. Rather than emphasising abstract environmental benefits, such as pollution reduction this discourse positions cycling as a means to bring "new life and vitality to underused streets" (ibid., p.9) and even "a tool to tackle social and environmental challenges at the community level" (ibid., p.31), for example, by enlivening quiet side streets that may otherwise invite crime and anti-social behaviour.

As such, the vision seeks not only to 'market' the mode to potential users, but also to give individuals reluctant to get on a bicycle themselves reasons to endorse the transformation of London, including their local neighbourhoods, into a more cycling-friendly environment. Likewise, the vision also addresses committed motorists suggesting that more bicycles on London's roads mean "less traffic […], less competition for a parking place and fewer cars in front of [theirs] at the lights" (ibid., p. 5).[45] The vision thereby serves to present cycling also as an essential means to (1) broaden and preserve mode choice in London, and to (2) aid the continued smooth functioning of the London transport system so that it may "meet the enormous demands that will be placed on it" in light of anticipated population increases and growth in economic activity (ibid., p.7).

Discursively, cycling remains constructed as substantially subservient to the functioning of London's road transport sector (and the transport system more broadly) on the one hand. And on the other hand it remains firmly positioned as apart from strategic transport policy-making and embedded within broader environmental and public health agendas. There it is effectively constructed as serving to remedy some of the negative externalities arising from the way in which the road transport sector (and the London transport system more broadly) continues to function. As such, the language of the Mayoral Vision for Cycling in London, despite the ambitious and progressive commitments expressed by it, remains largely within the confines of existing cycling policy discourses (Aldred, 2012). To the extent that new discourses have been added, these tend to focus on the value of cycling as

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[45] Of course, such a hypothetical reduction in motor traffic due to modal shift from cars to bicycles in the short term must be expected to induce rebound effects in the form of additional demand for individual motorised traffic over the long term, in line with Jevons' paradox (see Chapter 1).

a means of alleviating externalities arising from other, specifically motorised, road transport sector modes and the mobility practices they enable.

Of course, many of the claimed benefits of cycling if realised could have tangible, positive effects on the lives of aspiring and existing cyclists as well as those who will never cycle. However, it is noteworthy that cycling remains being made sense of and attributed meaning and value in the context of a broader imaginary that leaves the rationalities of the existing transport system and its associated externalities essentially uncontested, thereby also acting to perpetuate these rationalities and the hierarchy, within which cycling had up until the publication of the Vision been treated more like a "niche, marginal, or an afterthought" than "an integral part of the transport system" (GLA, 2012, p. 5).

While the vision sets out a strategy for cycling across the Greater London region, it acknowledges that its realisation relies in large part on cooperation and productive partnerships with the boroughs. As already pointed out, TfL only holds direct powers and responsibilities regarding the management of the TLRN - a mere five per cent of London's roads. Given London boroughs' diverse socio-economic profiles, geographical differences and differential access to various transport modes and services. It is reasonable to expect individual boroughs to diverge in terms of the significance they are likely to ascribe to cycling in terms of achieving their respective transport and broader strategic aims. As such, it is important to compare and contrast the overarching Mayoral cycling vision with its reception at the borough level and its translation into locally-specific cycling strategies.

Borough cycling strategies

As already outlined in Chapter 6, the three boroughs investigated in the context of this research are the London Borough of Lambeth, the Royal Borough of Greenwich and the London Borough of Southwark. All three are considered Inner London boroughs by statute, that is, they belong among the twelve Inner London boroughs corresponding to the administrative boundaries of the former County of London. These boundaries were redrawn via the London Government Act 1963, which in 1965 replaced the County of London with the county of Greater London comprising the 32 London boroughs and the City of London (see Figure 7.2). Furthermore, all three boroughs investigated are located south of the River Thames and are majority Labour-governed authorities.
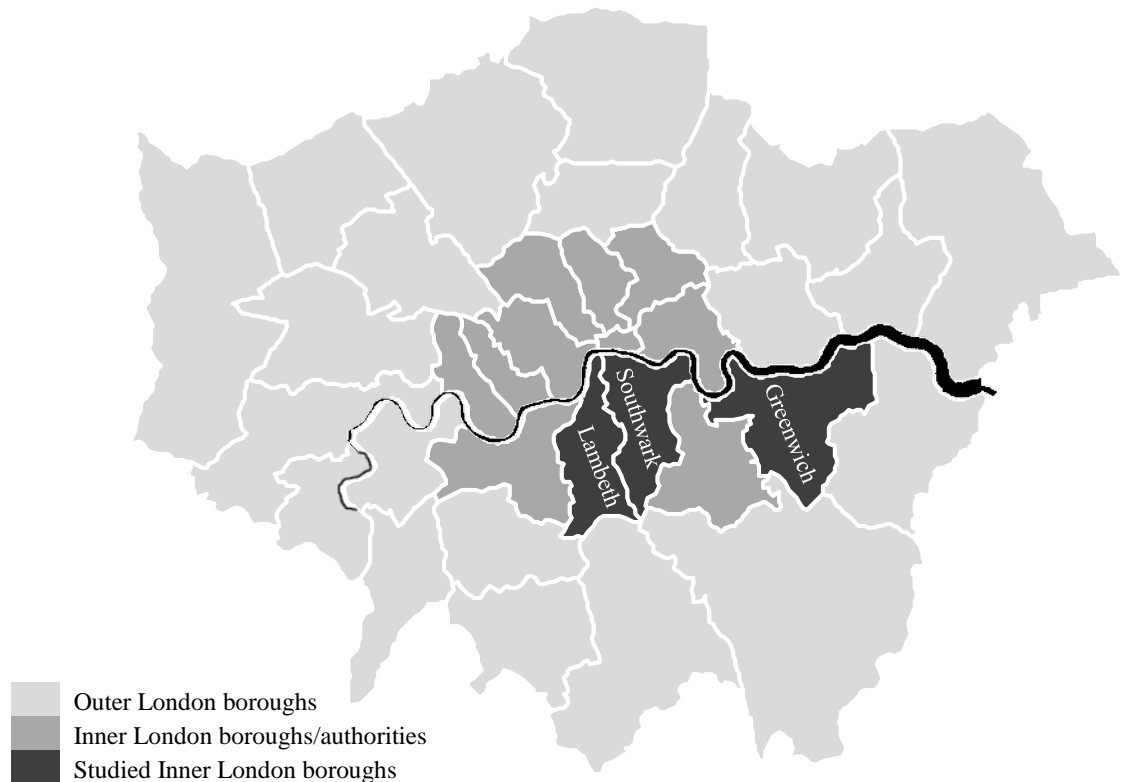
Figure 7.2 Map of 32 Greater London boroughs and City of London (adapted from GLA, 2014a)

Despite these similarities, the three boroughs also have distinct characteristics and differ significantly in terms of how they make sense of and attribute meaning to the utility cycling as a mode within their local transport system. The following sections introduce each local authority and provide a brief overview of key contents and discourses distinguishing their respective cycling strategies (see also Table 7.4 for an overview of key data points contained in each of the three borough cycling strategies as well as the Mayoral cycling strategy).

London Borough of Lambeth Cycling Strategy (LBL, 2013)

The London Borough of Lambeth is the largest of the three boroughs in population terms. It is home to around 318,000 inhabitants (3.7 per cent of London's overall population) and an estimated 169,000 jobs are located within the borough (2.3 per cent of London jobs). Similar to other Inner London boroughs, car ownership is low with a total of 58 per cent of households not owning a car (compared with an average of 42 per cent across the Greater London region). Connectedly, individual motorised transport accounts for only 21

per cent of trips originating in the borough, while around 5 per cent of trips are undertaken by bicycle, a trip share that is significantly above the London average of 2 per cent (TfL, 2016b).

Lambeth was the first council out of the three to publish its own cycling strategy in August 2013 following publication of the Mayoral cycling vision in March of the same year. In its strategy, Lambeth sought to put itself at the forefront of the cycling agenda in London spurned on undoubtedly by existing high ridership as underscored by Lambeth's status as the London borough with the third highest percentage of residents regularly commuting by bike (5.7 per cent) according to 2011 Census data (ONS, 2011). Connectedly, and reflecting the significant existing political will and consensus within the borough the council bill their cycling strategy as detailing "a vision to become the most cycle-friendly borough in London" (LBL, 2013, p.1).

Discursively, Lambeth, therefore, sets out a very ambitious and visionary strategy emphasising the universally beneficial nature of a more cycling-friendly borough. Here, the strategy clearly links cycling to the place-making agenda positing that a "place that is good to cycle in is a place that is good to live in" (ibid., p.4). Therefore, making Lambeth "the most cycle-able borough" could also make it "the most liveable borough", whether for existing or aspiring cyclists as well as residents unlikely to get on a bike themselves (ibid.). It further highlights the economic benefits connected to the promotion of cycling in the borough, whether in the form of "new employment opportunities in bike workshops and cafes", via productivity increases achieved by fitter and healthier employees, or due to cost savings accruing to the health services for whom the "burdens of obesity and other illnesses related to inactive lifestyles" will be reduced (ibid.).

The strategy clearly addresses the residents of Lambeth laying out a vision for cycling and for enabling participation in cycling for everyone. In connection with this, the language of the vision is much more aspirational and even somewhat utopian, rather than the more technical, value-free tone generally encountered in transport strategies (see also Aldred, 2012). For example, the expressed vision for the borough is to make Lambeth "the most cycle-friendly borough in London where 1-100 year olds feel safe to cycle" (LBL, 2013, p.5). The mode share aims articulated by the vision similarly express an aspiration more than a realistic aim. The strategy sets mode share targets for the borough at 15 and 20 per cent of all trips being made by bike by 2015 and 2020, respectively.

	Greater London Authority (GLA, 2013a)	London Borough of Lambeth (LBL, 2013)	Royal Borough of Greenwich (RBG, 2014)	London Borough of Southwark (LBS, 2015)
Title	The Mayor's Vision for Cycling in London - An Olympic Legacy for all Londoners	Lambeth Cycling Strategy - A vision to become the most cycle-friendly borough in London	Royal Borough of Greenwich Cycling Strategy	Southwark's Cycling Strategy - Cycling for everyone
Published	March 2013	August 2013	April 2014	June 2015
Size	33 pages	22 pages incl. appendices	22 pages incl. appendices	62 pages incl. appendices
Vision	*"London will have a network of direct, high-capacity, joined-up cycle routes" making "London's streets and spaces […] places where cyclists feel they belong and are safe" in an effort to "'normalise' cycling" and "making it something" which "people, of all ages, races and backgrounds, and in all parts of London" feel comfortable doing. Thereby the vision and connected "policies will help all Londoners" and enable "[c]ycling will transform more of our city into a place dominated by people, not motor traffic."*	*"Lambeth will be the most cycle-friendly borough in London where 1-100 year olds feel safe enough to cycle." (LBL 2013, p.5)*	*"Royal Greenwich's vision for cycling in the Borough is for 'more cycling, more often, and even more safely'. That vision flows through this strategy and associated objectives, actions and targets." (RBG 2014, p.4)*	*"In Southwark, cycling will be for the many, not the few - the natural choice for getting from A to B. Whatever your needs, you will find an attractive route and one that does not involve sharing the road with large vehicles or fast moving traffic. We will increase the number of people who cycle, cycle trips and reduce the number of cyclist casualties. The improvements we will deliver will make Southwark a better place for all of us." (LBS 2015, p.1)*
Baseline	3.9% commuting by bike (ONS, 2011)	5.7% commuting by bike (ONS, 2011)	2.4% commuting by bike (ONS, 2011)	7.1% commuting by bike (ONS, 2011)
Targets	1.5m cycling journey stages/day by 2026 A target of 5% of all journey stages by 2026 was abandoned in 2015 as mode share target deemed no longer appropriate "as it is changeable due to population influx" (TfL, 2015a)	Trip share: 15% by 2015 20% by 2020	Trip share: 5% by 2026 Cycling to work: 9% to 2026 Cycling to school: 7%+ to 2026	Trip share: 10% by 2025/26 Cycling to work: 15% by 2025/26 Cycling to school: 10% by 2025/26 Collisions: 44% reduction by 2020; reduction in absolute terms after 2020 and 'Vision Zero' long-term

Table 7.4   Overview of contents of Mayoral and borough level cycling strategies and baseline cycling data from 2011 census

To achieve this, the strategy sets out ten strategic aims relating to both soft and hard measures to promote and enable cycling in the borough: these mirror many of the commitments made in the Mayoral Vision for Cycling in London, including, for example, encouraging a broader population of Lambeth residents to cycle though training, incentives and better routes, increasing provision of cycling training for school-age children and improving "road user behaviour via education, training and enforcement" (ibid., p.15). In addition, the strategy also includes more locally specific proposals, such as increasing network permeability of active modes while restricting motorised through-traffic on residential streets, and providing secure cycle parking throughout the borough.

However, the strategy includes little in the way of a timeline or concrete plan to which the articulated ambitions and aims are to be delivered. This further strengthens the perception that the document is primarily intended to position the borough as committed to cycling without outlining many concrete actions or detailing envisaged timeframes for delivery of the strategy. While on paper, and in contrast to Greenwich and Southwark's strategies, this may appear to suggest a half-hearted commitment to cycling, interviews revealed that dynamics in the borough of Lambeth were such that the strategy articulated an ambition that was generally agreed upon across councillors and council officers. The strategy was seen primarily as a means of expressing this shared ambition for cycling in the borough than a tactical tool to encourage councillors to commit themselves to supporting more progressive transport and specifically cycling policy and practice. Illustrating this, an interviewee described the degree of agreement regarding cycling as follows:

> *"Politically, […] almost all of the cabinet members are cyclists. They will come to meetings with their bike gear and stuff so you- it kind of creates an atmosphere where you know that you are not lobbying and having to argue first principles. You're actually [...] preaching to the converted and they're talking about how you make it work rather than trying to have an argument about why it should be done. So, it's sort of already moved on to the next step with them." (LBL-2)*

Royal Borough of Greenwich Cycling Strategy (RBG, 2014)

The Royal Borough of Greenwich, though the largest of the three boroughs in size, is the smallest in population and employment terms with a total 269,000 inhabitants (3.1 per cent of London's overall population) and 83,000 of London jobs (1.6 per cent of London jobs) located in the borough. Car ownership is at a similar level as the Greater London average, with 42 per cent of households not owning a car. Connectedly, the mode shares for cycling and motor vehicle use differ from those reported in Lambeth and Southwark,

with cycling making up only 2 per cent, while individual motorised transport accounts for a total of 44 per cent of the overall mode share of trips originating in the borough (TfL, 2016c).

In contrast to Lambeth and Southwark's cycling strategies the Royal Borough of Greenwich distinctly emphasises the need for the cycling strategy to contribute to the overall regeneration and growth strategy of the borough by creating an environment within which both businesses and residents can thrive (RBG, 2014, p.2) and by prioritising cycling infrastructure interventions that "provide improved access to employment opportunities" (ibid., p.4). In this sense the strategy clearly reflects the priority of redressing longstanding socio-economic challenges the borough continues to face since its manufacturing sector and employment base declined drastically following the Second World War.

Connectedly, it is also notable that the tone of Greenwich's cycling strategy is much more pragmatic than visionary, with objectives and aims expressed in a neutral, if not corporate, language that emphasises the need for the cycling strategy to support broader borough objectives. This undoubtedly reflects the more modest mode share (1 per cent) cycling claimed at the time the strategy was published. Council officers interviewed confirmed this, arguing that rather than radical the strategy sought to be

> *"realistic. […] we could have said 'We'll transform every single bit of road space to prioritise bikes over cars at all points in the borough'. I think with a one per cent mode share that is difficult. Hopefully by the end of this strategy we'll have got to five per cent and the next strategy that follows on from that can be a more radical document that tries to get to ten or fifteen per cent."* (RGB-5)

Therefore, rather than articulating a future vision of cycling in the borough as the Greater London, Lambeth and Southwark strategies may be said to do, Greenwich anchors its ambitions for cycling much more firmly in the present, in part by linking them to existing broader strategic commitments of the council. Consequently, the cycling strategy primarily attributes meaning and significance to the promotion of cycling as a way of (1) supporting the anti-poverty, regeneration and growth agendas by way of enabling improved access to employment; a means of (2) contributing to the Greener Greenwich agenda by reducing per capita carbon emissions; and finally a vehicle for (3) promoting behavioural change and generate improvements in public health across the borough.

In contrast to the Lambeth strategy, Greenwich's strategy document outlines in much more concrete detail a number of infrastructure and behavioural change interventions that are to be delivered across three phases of the lifespan of the document from 2014/15 to 2022/23. The document further points out how these programmed interventions contribute to the realisation of the strategies objectives. Finally, the strategy sets out a range of indicators to monitor progress towards the realisation of this cycling strategy.

This indicates, perhaps, the degree to which political support for and commitment to cycling in the borough is made dependent on it aiding the achievement of broader strategic objectives, such as regenerating of the borough, increasing economic opportunity for its residents and balancing public budgets. Council employees interviewed acknowledged this, suggesting that though the "need to encourage cycling is pretty well accepted" (RBG-2) and there exists "generally very good political support within the council for cycling schemes" the council has "to be realistic as well", partly in recognition of the fact that "there are bigger fish to fry in terms of balancing the budgets" (RBG-4).

London Borough of Southwark Cycling Strategy (LBS, 2015)

Finally, the London Borough of Southwark shares a border and similar socio-economic profile with the borough of Lambeth. The borough is home to a total of 303,000 inhabitants (3.5 per cent of overall population of London) and a total of 262,000 of jobs (4.9 per cent of London jobs). Like Lambeth, Southwark a high percentage of households in the borough do not own a car (58 per cent) and the mode share of individual motorised transport in the borough is correspondingly low at 21 per cent. Utility cycling in contrast accounts for a high relative mode share with 5 per cent of all trips originating in the borough being undertaken by bike (TfL, 2016d).

Published in June 2015 and, thus, last out of the four documents considered, the Southwark Cycling Strategy is also the most thorough, incorporating more detailed technical information on the network analysis undertaken to inform the formulation of the strategy document. A draft of the strategy was developed following a three-day workshop, which brought a group of Dutch and Danish consultants to Southwark to work with council officers and a range of key stakeholders regarding provision for and promotion of cycling in the borough ('Kickstand Sessions', June 2014). Following this event a draft strategy was formulated and consulted on publicly to inform the final strategy document.

Similar to Lambeth's strategy, it is notable that the Southwark strategy is written in a language that has the potential to engage a broad audience, including residents and non-

residents, whether they are cyclists or non-cyclists, or technical experts or lay people. In this sense, the Southwark strategy was "quite a break from what is normally produced, where [strategies] are quite technical documents" as one of the council officers interviewed explained (LBS-4). The interviewee further explained that this was a purposive choice to enable a process of public consultation that not only sought to generate feedback on the proposed strategy, but also gave space for people outside of the formal transport policy-making process to put forth ideas and suggestions that can actively shape the strategy. In this respect, not only the strategy document, but also the process of its production departed from traditional transport police-making processes, since

> *"usually when you put a document out for consultation it's almost like a final version and so your feedback is either in support or not in support and not really identifying sort of new ideas. Whereas what we were after were the new ideas and we asked people- […] 'You're the experts. Tell us what's wrong with our roads and how we can improve that.'" (LBS-4)*

Like Lambeth, Southwark is thus seeking to collaborate with and engage residents and specific stakeholder groups continuously throughout the process of delivering the borough cycling strategy. Overall, the strategy nonetheless reflects much of the same discourses invoked in the other strategy documents examined. The borough of Southwark presents itself as equally ambitious as the Mayoralty in its aim to make cycling "a genuinely inclusive mode of travel" (LBS, 2015, p.3) and "the natural choice for getting from A to B" (ibid., p.4). Similar to the cooperative council of Lambeth, Southwark acknowledges the need to engage with, consult and listen to ideas as well as concerns locals may have with regard to cycling interventions to be proposed in connection with this strategy.

In contrast to Lambeth, however, Southwark accompanies its strategy document with insights from the technical analyses that informed initial formulation of the strategy as well as a more detailed delivery plan for the measures articulated within the strategy. In this sense, Southwark's document presents middle-way between the approach taken by Greenwich and Lambeth respectively. As such, it offers both an ambitious and visionary strategy the delivery of which is nonetheless underpinned by a schedule of concrete planned and costed infrastructural and behavioural interventions.

The discourses invoked within the Southwark strategy similarly seek to build support for cycling amongst as diverse a range of stakeholders as possible. The strategy does so by highlighting "the direct economic and social benefits" connected to the prioritisation of cycling. Here the strategy invokes specifically favourable cost-benefit ratios of

investments in cycling and provides a range of economic advantages resulting from cycling investment including, for example, increased productivity of employees cycling regularly, possible reductions in "healthcare and social costs", and even the "positive impact [of cycling infrastructure] on property prices" (LBS, 2015, p.15). In addition, it also highlights the role of cycling as a means for promoting social inclusion and more equitable socio-economic and health outcomes in the borough.

Contrasting the four visions of cycling in London

Taking the above information together it may be said that there remains some significant variability in the form, content, ambition and tone of cycling strategies articulated across London.

Nonetheless, the discourses invoked in each of the three borough-level cycling strategies, as well as the Mayoral Vision for Cycling in London, are noted to be broadly similar, focusing largely on discourses that have also been important historically (compare Aldred, 2012). Emphases are placed on cycling as a healthy transport activity that can not only benefit the mental and physical health of the individual rider, but also contribute to broader public health benefits if undertaken in lieu of more polluting motorised transport.

Two discourses, which are not in themselves novel but certainly more coherently articulated than in the past, focus on cycling as an economically valuable transport activity and cycling as able to play a significant role in place-making. Both highlight the range of social, environmental and economic benefits that all residents - from staunch motorists, to aspiring and committed cyclists – could potentially enjoy in a more cycling-friendly borough. As such, both discourses may be seen as representing efforts to build broader alliances in support of cycling. They do so by arguing for the creation of environments in which anyone feels safe to cycle, without insisting that anyone has to take up cycling.

Crucially, all four strategies consider cycling largely outside of broader (road) transport strategic aims. And, since cycling remains one among many modes competing for space and consideration within the road transport sector, the strength and ordering power of the imaginaries and discourses invoked in support of cycling at the Greater London and borough level can only be understood in relation to their relevance within the wider discourses and imaginaries ordering road transport sector policy-making and practice. In recognition of the above, the following section 7.3 considers to what extent the cycling discourses, as exemplified in the strategies examined, resonate with imaginaries and

discourses that have informed developments in the road transport sector over time and across scales.

Findings support the view that cycling is made sense of and attributed meaning largely as marginal alongside more dominant motorised modes in the road transport sector. The analysis particularly points towards the strength of efficiency and high-mobility discourses, which underpin dominant imaginaries of road transport as a key means to facilitating the increasing mobility of goods and people and assuring the economic vitality of cities and regions. By contrast, utility cycling, as a relatively low-speed and short-distance mode with to-date limited application in the commercial transport sector is perceived as having little to contribute to efficiency-led, high-mobility road transport imaginaries whose currency is speed, distance and volume. Instead, utility cycling has been largely considered as an environmentally friendly, low-impact mode whose widespread use may offer beneficial public health impacts. In this sense, utility cycling does resonate with sustainability discourses, which have also been firmly established in the road transport sector. However, as the below analysis shows, these have been systematically subordinated to those focusing on efficiency across time as well as geographical scales.

7.3. Discourses and imaginaries of the road transport sector

UK level

As already hinted at in Chapter 2, the UK road transport sector has seen the rise and influence of a range of different narratives vying to guide and order road transport policy making and practice. Section 2.1 specifically pointed out narratives concerned with the relationship between transport and the economy, transport and sustainability, transport and technology and transport and long-term social equitability.

These narratives converge to give shape to a number of more or less distinct ideal-typical road transport sector discourses and imaginaries. Some of these discourse are well documented within academic transport research, which observed and discussed, for example, a shift in discourse from 'predict and provide' (also 'facilitating infrastructure supply' or FIS) to transport demand management (TDM; also demand-side management or DSM) in the UK context in the 1990s.

Without reiterating too much of what has already been discussed in Section 2.1 of this thesis, it can be stated that historically the 'predict and provide' logic has long dominated transport policy making and practice in the UK (Docherty, 2003). In fact, road transport strategy and policy language up until the 1989 Road Programme argued for the need to invest in the widening and extension of the UK Strategic Road Network (hereafter SRN) to accommodate forecasted increases in road traffic levels so as not to compromise underlying economic growth (Vigar, 2002; see also Table 7.5).

It was not until the early 1990s, that the sustainability of the 'predict and provide' approach was called into question, ostensibly due to a growing recognition that rising (private) traffic levels and resulting congestion posed a risk to the UK's economic vitality and future growth. Meanwhile, the building of additional infrastructure was also recognised as likely leading to further increases in travel demand and associated negative environmental impacts. This change in narrative led to a profound re-assessment of public spending on transport and specifically more scrutiny regarding the traffic-inducing impact of road building projects and more investment into expansion and integration of public transport services. However, as Banister (1999) pointed out, this shift may also have been motivated to some extent by a need to reduce public sector expenditure on transport. According to Banister (ibid.), this calls into question to what extent the UK was indeed moving towards a new logic of seeking to actively manage transport demand and restrict supply in the road transport sector.

The 1994 Road Programme and the 1996 Government report "Transport: The way forward" (DoT, 1996) connectedly articulated a need to rebalance the economic benefits incurred from increased road transport provision with the social and environmental costs generated as a result (Vicar, 2002). Crucially, however, these publications also reflected a hitherto lacking recognition that growth in road traffic demand needs to be actively managed and constrained to achieve such re-balancing.

However, where the Labour Government's 1998 "New Deal for Transport" (DETR, 1998) emphasised integrated transport planning, technological improvements and more radical demand management approaches, such as road user charging and parking levies, a transport white paper published by the same administration (DETR, 2000) only two years later once again highlighted the need to also expand infrastructure. Specifically, the white paper outlined the need to widen 360 miles of the SRN, build new bypasses and major trunk roads and catch-up on a road maintenance backlog, albeit in combination with rail and public transport investments intended to deliver increased choice without

compromising economic prosperity or the environment. In connection with a shift of transport planning responsibilities and powers from national level down to regions and localities, however, this period in UK transport planning has been characterised as one that sent profoundly mixed signals: Bulkeley and Rayner (2003) observed in connection with this that local authorities, in the absence of a coherent national level strategy and faced with the possibility of "damaging [their] economic competitiveness *vis-à-vis* neighbouring authorities", found themselves embracing demand management policies targeted at promoting voluntary modal shift over more radical, hard demand management policies, such as pricing mechanisms. The result was a weak new realism, "in which the potential of demand management measures to serve a more radical agenda [was] lost" (ibid., p.50).

Therefore, it may be said that a pure or even a pronounced transport demand management logic never came to replace the original predict-and-provide logic. Instead, a hybrid logic took its place, which engaged with growing concerns regarding the sustainability of increasing mobility and traffic levels while insisting on the need to ease congestion to accommodate future traffic growth as the inevitable by-product of desired economic growth and prosperity (Vicar, 2002; Docherty, 2003).

The Coalition Government's 2013 publication "Action for Roads – A network for the 21st century" (DfT, 2013a) once again highlights renewed investment in roads and road transport as a key political commitment if the UK is to "retake the lead in the global race" of economic competitiveness (DfT, 2013a, p.15). As such, it has been argued to constitute a substantial return to 'predict and provide' – an assertion the DfT (2014a) itself countered contending that

> *"Investment in roads is not an outdated approach of predicting and providing for all future traffic growth, irrespective of cost and environmental and social impacts. The [National Policy Statement] very clearly rules this out. It is about sensible and sustainable development, where there is a strong justification, based on a rigorous consideration of all the costs and all the benefits."*

Therefore, it is clear that transport and mobility and, connectedly, the provision of relevant infrastructure are still considered essential to the generation of economic growth across local, regional and national levels. In contrast to previous 'predict and provide' logics, however, the provision of new transport infrastructure is to be constrained based on simultaneous concerns to limit public expenditure. Limited public financial resources are, therefore, to be allotted only to transport investment projects for which a satisfactory business case can be made via favourable cost-benefit ratios. This approach was further

underlined with the publication of the 2015 Road Investment Strategy (DfT, 2015), which once again heralded a 'step-change' in investment in the SRN to increase capacity and ready the network for future economic and resulting traffic growth.

In this sense, recent road transport strategy and policy publications suggest that discourses and imaginaries informing road transport sector developments have remained largely unchanged. They may further be seen as emblematic of the rise of a new discourse alongside the previous hybrid logic mixing 'predict and provide' and demand management logics. The new logic in the mix is a techno-optimist discourse, which substantially underpins the smart transport agenda outlined and critiqued in greater detail in Chapter 2. This agenda focuses on smartening road transport through the implementation and exploitation of networked information and communication technologies. Solutions include low-carbon propulsion technologies in combination with autonomous, sensor-enabled vehicle technologies as well as generous use of ICTs to measure, model and optimise transport flows across all modes in real-time. The express mission of this techno-optimist logic is the exploitation of technological means to maximise mobility levels while minimising negative externalities generally associated with such high mobility levels.

Therefore, although the mix of discourses operationalised in the transport sector is evolving, there is still a single dominant imaginary centrally underpinning it. The imaginary of increasing road transport and mobility levels as both central ingredients in the promotion of economic growth and inevitable results of the aspired economic vitality of cities, regions and the nation state. Rather than calling into question or altering the underlying fundamental rationale of transport provision, the changing mix of discourses to some extent enables continued adherence to this single dominant imaginary having underpinned road transport sector developments for so long. While technological innovation has long been invoked as a means of dealing with the externalities of road transport activity (see also Table 7.5) this argument has grown into a more distinctly articulated techno-optimist smart transport discourse in connection with the broader smart city imaginary.

Policy statement	Defining logics	Conception of environment
1989 Road programme	Forecasts of inter-urban road traffic suggest the need for widening existing roads and building new roads to effect 'step change' in the roads programme. Such traffic growth is largely determined by growth in the economy, congestion will result; roads are needed to alleviate that. Public transport will not solve problems of inter-urban traffic growth.	Environmental effects are an unavoidable by-product of inevitable traffic growth Measures relating to noise and visual intrusion can mitigate impacts. The technical fix is the most appropriate solution, "the best way of curbing carbon dioxide emissions from motor vehicles is to increase engine efficiency" (DoT, 1990, p.2, as cited in Vigar, 2002,p.85)
1994 Road Programme	Emphasizes that a 'balance' needs to be struck between economic, environmental and social issues.	Greater emphasis on local air quality and amenity and global ecological conditions. Recognizes the principles of sustainable development.
1996 Transport: The Way Forward	Continues emphasis on achieving 'balance'. Suggests need for inter-urban road-building whilst emphasizing externalities of transport use.	For environmental reasons the need to influence "the rate of traffic growth" (DoT, 1996, p. 24) is recognized.
1998 A new deal for transport	Suggests the public want change, localities are best placed to deliver an 'integrated' transport system within a 'new realist' framework broadly defined by central government.	Recognizes full range of environmental externality effects. Recognizes the need to tackle traffic levels.
2000 Investment Strategy	Emphasis on investment to provide choice.	Full environmental effects recognized but travel demand will increase as a result of many of the measures.
2013 Action for Roads	Need to counteract historic under-investment in road infrastructure as "continued growth of the economy and population together with improvements to the fuel efficiency of vehicles, means that traffic in many areas will rise in coming decades." (DfT, 2013a, p.5). Need to invest in maintenance and upgrade of existing infrastructure, and add capacity "to help the economy grow" (ibid.). Recognition of important technological changes ahead, but acceptance that traffic levels will necessarily rise.	Recognition that transport activity has significant environmental impacts both at a local and a global scale. Need for additional investment in existing infrastructure and building of new infra-structure rationalised as crucial to enable management and mitigation of environ-mental impacts of transport and in light of expected growth in motor traffic levels. Technological improvements both in terms of engine and fuel technologies as well as infrastructure technologies anticipated to facilitate management of high traffic levels while minimising environmental impacts.
2015 Road Investment Strategy	Continues language of 2013 Action for Roads document and emphasis on need to counteract historic underinvestment in light of projected growth in road traffic levels. Assuring high levels of mobility of goods and people, by alleviating congestion and smoothing traffic flow via infrastructure and technological investment, and thereby tackling sustainability of transport sector.	Continues language of 2013 Action for Roads document: recognition that transport activity has significant environmental impacts both at a local and a global scale. Language of strategy document suggests that environmental concerns and challenges are shaping road transport sector: on the one hand, extreme weather will point towards vulnerabilities and weaknesses in the network thereby stimulating network development in ways that minimise future disruptions. On the other hand, relies on existing UK and EU level legislation to promote market-based technological innovations to reduce environmental impact of expected growth in road transport activity.

Table 7.5 The changing logics of transport policy 1987-2001 (based on Vigar, 2002, p.85) and 2013-2015 (own addition)

In fact, its growing popularity alongside established discourses of the road transport sector can be explained based on it offering a discursive means of squaring the circle. It emphasises technological innovation as a means of maximising the efficiency with which existing transport infrastructure can be utilised whilst simultaneously allowing for the reduction of inevitable negative externalities accompanying such a strategy. In short, it has given credence to the idea that continued reliance on and promotion of transport-facilitated economic growth and prosperity is inherently compatible with the need to fulfil self-imposed commitments to redress the negative environmental and social impacts growing traffic and mobility levels have both at the local and the global scale. However, in light of the problematic of efficiency-induced rebound effects (see Chapter 2) it should be clear that 'smart' technology-based solutions alone only ever offer temporary fixes when it comes to addressing the externalities resulting from growing transport activity. Of course, it can only be speculated what the long-term impact of smart transport technologies on the overall road transport sector sustainability will be. Nonetheless, it is evident from the above discussion that the smart transport discourse serves to perpetuate, and certainly does not challenge, the dominant imaginary that suggests the need to accommodate increasing mobility and transport activity in order to foster efficiency infrastructure use and thereby support economic growth and competitiveness.

By contrast, a much less dominant discourse has continued to emerge to challenge the imaginary equating rising mobility levels and growth in transport activity with economic development and prosperity. This sustainable transport discourse emphasises the social and environmental unsustainability of continued provision for growing use of motorised modes, instead promoting accessibility, via integrated transport and land use planning, over sheer mobility. The concern for the economic, social and environmental sustainability of growing transport and mobility levels underlying it certainly also informed the transport demand management discourse of the 1990s. However, as mentioned in earlier paragraphs, the logic of demand management never gained dominance, but rather merged with the 'predict and provide' logic into a hybrid logic committed to increasing mobility while minimising its negative externalities. And, although the significance of sustainability concerns within the transport sector has certainly grown, it is notable that particularly the economic sustainability of road transport sector developments has on balance remained prioritised over considerations of their long-term environmental and social sustainability. This, however, remains problematic particularly where transport prices fail to accurately reflect the marginal social costs of given transport activities.

Techno-optimist logic
('Smart transport')

Values	(Economic) efficiency, high mobility, facilitating economic growth, modernity
Mission	Maximise mobility, minimise externalities
Technologies	Hard and soft measures: low-carbon transport technologies; real-time data; networked ICT
Main actors	Local authorities, multi-nationals, consultants
Expertise	Technological/technical, economic
Org. form	Transport planning/provision via (business-led) private-public collaborative forms
Funding	Government – competitive

Transport demand management logic
(TDM)

Values	National welfare, sustainability, social equitability, protecting economic growth
Mission	Managing mobility demand to restrict externalities
Technologies	Hard and soft measures: limit infra-structure; use of pricing and coordination mechanisms
Main actors	Local authorities, planners, 'experts'
Expertise	Governmental, technical
Org. form	State-provided and regulated public good
Funding	Government – non-competitive

Sustainable transport logic
('Avoid-shift-improve')

Values	Sustainability, accessibility, equitability
Mission	Maximise accessibility, minimise need for travel; shift to active or shared low-impact modes
Technologies	Hard and soft measures: low carbon, shared transport; land use planning; TDM
Main actors	Communities, NGOs, planners, scientific
Expertise	Communal, networked
Org. form	Participatory planning of transport as public good
Funding	Government – non-competitive

Hybrid logic

In competition

'Predict and provide' logic
('Predict and provide')

Values	Modernity, national welfare, high mobility, individuality/ privacy
Mission	Satisfying forecasted mobility demands
Technologies	Hard, supply-oriented measures: infrastructure supply and mode choice
Main actors	Local authorities, engineers
Expertise	Economic, technical
Org. form	State-provided and regulated public good
Funding	Government– non-competitive

——— Dominant logic

——— Counter-hegemonic logic
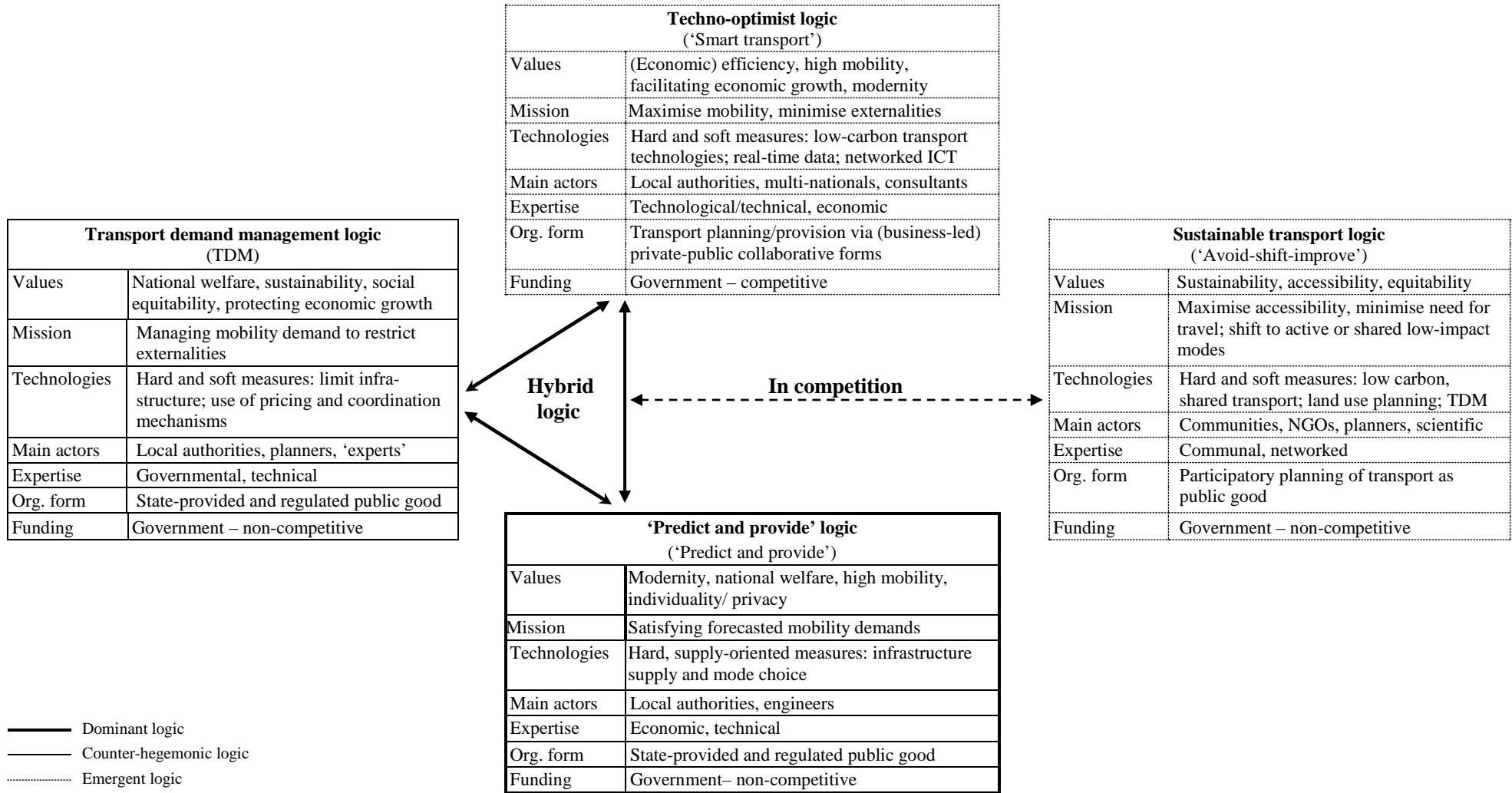
········· Emergent logic

Figure 7.3   Competing logics in the UK road transport sector

The sustainable transport discourse, which has grown more coherent and prevalent within academic transport research, is part of an alternative imaginary and one that fundamentally challenges the imaginary that positions increasing transport and mobility of goods and people as prerequisites for economic growth, competitiveness and prosperity. Instead, the sustainable transport discourse highlights the extent to which social and environmental costs of existing dominant transport sector arrangements and practices are not adequately captured by transport's economic costs. The extent to which economic development and resulting increases in mobility and transport activity levels experienced produce genuine and sustainable societal benefits must, in consequence, be questioned. This, in turn, necessitates calling into question how transport has been made sense of and attributed meaning to date and across scales and sectors (see also Figure 7.3 on the previous page for an overview of the competing ideal-type discourses in the UK road transport sector).

However, the imaginary and discourses positioning transport and mobility of goods and people as prerequisites for economic growth and competitiveness continue to dominate not only the UK road transport sector. Their dominance is further both conditioned and enhanced by their prevalence across scales as well as their resonance with economic growth and efficiency discourses operating in other sectors. The following sections of Chapter 7 illustrate this by showing how the imaginary and discourse of transport as a facilitator of economic development operating at the UK national level interact with imaginaries and discourses at work at local as well as supra-national levels.

Greater London level

At the sub-national level, the imaginary and discourses of transport as a facilitator of economic development work, of course, directly via national level policy expressly articulated to guide regional and local transport policy-making and practice. However, the imaginary may also be seen to work through structurally-inscribed statutory requirements, such as the one placed on local authorities via Section 16 of the Traffic Management Act (TMA) 2004 (HM Government, 2004, p.7). The Act specifically stipulates that:

> *(1)   It is the duty of a local traffic authority to manage their road network with a view to achieving, so far as may be reasonably practicable having regard to their other obligations, policies and objectives, the following objectives –*
> *(a)   securing expeditious movement of traffic on the authority's road network; and*
> *(b)   facilitating the expeditious movement of traffic on road networks for which another authority is the traffic authority.*

(2)   The action which the authority may take in performing that duty, includes, in particular, any action which they consider will contribute to securing –

(a)   the more efficient use of their road network; or

(b)   the avoidance, elimination or reduction of road congestion or other disruption to the movement of traffic on their road network or a road network for which another authority is the traffic authority; [...]

Echoing this duty to ensure "the expeditious movement of traffic" (ibid.), the former London Mayor Johnson instituted a policy of *smoothing traffic flow,* billed as "broad approach to managing road congestion, improving journey time, reliability and predictability" in an effort to mitigate "congestion impacts of population and economic growth" (GLA, 2011, p.199). And though promoted as a means of smoothing flow of all traffic, including pedestrian and cycling traffic, (see Policy 6.11 of the London Plan 2011; GLA, 2011) the policy did not offer concrete principles according to which conflicts between different road user groups ought to be arbitrated. Given the connection the policy establishes between smooth traffic flow and the mitigation of factors impeding economic development and the capital's ability to cope with population growth, it has further been argued that the policy has served to privilege the predictable flow of motorised modes over the interest of non-motorised modes on London's roads in practice (see for Campaign for Better Transport, 2012). An interviewee working as a transport consultant across the UK confirmed this assessment having observed that local authorities'

> *"statutory duty to ensure that traffic moves smoothly and freely [...] constrains the ability to put in some of these more ambitious schemes that might actually start to get more people cycling and out of their cars" (UK-2)*

While this does not mean that motor traffic flows are privileged at all times and in all circumstances, it illustrates the relative dominance of the discourse and imaginary that sees increasing transport activity and specifically motorised road transport as an inevitable factor in enabling economic development across the Greater London region. This is further underscored by a general preference for a light-touch approach when it comes to addressing the negative externalities of existing, dominant practices in the road transport sector, with demand management tools, such as road-user charging aimed at restricting or even reducing motor traffic levels being considered largely as a last resort (see GLA, 2011; 2016). The economic sustainability of road transport sector activities connectedly appears to be prioritised over their long-term social and environmental sustainability, also at the Greater London level.

EU level

Transport policy at EU level

Detailed analysis by Dyrhauge (2013) suggests, that similar dynamics have also been shaping supra-national policy making at the level of the EU. Tracing the extent to which sustainability concerns have figured into EU transport policy over time, the author finds that concerns regarding the sustainability of mobility levels within the EU were first articulated via the 1992 Transport White Paper. This White Paper echoed very much the 'demand management' discourse that also became popular in the UK in the 1990s. At an EU-level it arose partly in recognition of the environmental impacts generated by Trans-European Transport Network (TEN-T) infrastructure projects. These projects themselves may be interpreted as the result of a 'predict-and-provide' policy that diagnosed the need for transport infrastructure investments as a means of enabling the mobility of people and goods within the EU. However, Dyrhauge (ibid., p.140) also points out the EU's inability to steer and regulate transport policy towards the search for "alternative solutions to road congestion […] under the subsidiarity principles (introduced in the Maastricht Treaty in 1992)", which places the competence for this firmly with the member states. However, simultaneous processes of deregulation and market opening pursued by the EU Commission as a central element in establishing a Single Market have served and continue to serve to motivate increases in motor traffic levels across Europe.

Dyrhauge (2013, p.146) shows that at the supra-national level of the EU the discourse around sustainable transport and mobility are similarly subordinated to "the demands of the Single Market" and calls for more efficient transport and fuel technologies instead of demand management approaches. Dyrhauge (ibid.), therefore, concludes that "the market, with its focus on efficiency and technological advancements, retains its hegemonic position, leaving little room for the environment" or concerns regarding social equitability of transport outcomes for that matter.

Connectedly, cycling has long been of little strategic interest within the policy-making at European Union level. This is again due to cycling having long been considered a local mode, and, therefore, of little relevance to the central European Union project of strengthening the Single Market and enabling mobility across national borders. Furthermore, responsibility for cycling policy and strategy has remained firmly at the national level, line with the subsidiarity principles. In connection with London's cycling transition, this means that

> *"under these principles of subsidiarity, the European Union can only take action [...]when something can't be achieved at the national, regional, local level. [...] And so, this background principle of subsidiarity is really, really important and is one of the reasons why the EU doesn't do lots of things, particularly on local issues. Because you could say, well, you think of the UK and the London boroughs, the city with the Greater London Authority and the national Government is perfectly capable of doing whatever they want on cycling." (EU-2)*

Cycling policy at EU level

Since 2015, however, a number of EU institutions, including the European Parliament[46] and EU Member States' transport ministers[47] as well as the Committee of Regions,[48] have called for the development of an EU-level roadmap or strategy document for cycling. European cycling advocacy groups, and in particular the European Cyclists' Federation, have since developed and consulted on a draft cycling strategy since published in mid-June 2017 (ECF, 2017) in an effort to promote the inclusion of an EU Cycling Strategy in the 2018 work programme of the European Commission.

Recognition of the need for policy leadership at supranational level with regards to the promotion of cycling as a cheap and socially equitable, healthy and environmentally sustainable mode of transport has also been echoed by global organisations, such as the United Nations. The most recent more strategic effort at this level has been the 2014 official commitment by the Transport, Health, Environment Pan-European Programme (THE PEP) managed by World Health Organisation (WHO) and the United Nations Economic Commission for Europe (UNECE) to develop a Pan-European Master Plan for Cycling Promotion.

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[46] European Parliament resolution; 9th September, 2015; Report on the implementation of the 2011 White Paper on Transport: taking stock and the way forward towards sustainable mobility, point 64, Available at: http://www.europarl.europa.eu/sides/getDoc.do?type=REPORT&reference=A8-2015-0246&language=EN

[47] Declaration on cycling as a climate-friendly transport mode, produced following an informal meeting of EU ministers for transport. Available at: http://www.eu2015lu.eu/en/actualites/communiques/2015/10/07-info-transports-declaration-velo/07-Info-Transport-Declaration-of-Luxembourg-on-Cycling-as-a-climate-friendly-Transport-Mode---2015-10-06.pdf.

[48] See draft opinion of the European Committee of the Regions – An EU Roadmap for Cycling, Available at: https://ecf.com/sites/ecf.com/files/Projet%20d%2527avis%20du%20Comit%C3%A9_COR-2016-01813.docx

7.4. Discussion of findings

The identified historical trends in cycling policy-making and practice as well as the convergence of how cycling is semiotically and discursively constructed across both the Greater London and borough scales supports the view that utility cycling is indeed in transition to becoming a more mainstream mode within London's road transport sector.

On the one hand, its physical presence has significantly increased in the timeframe since the establishment of the GLA in 2000. On the other hand, increasing political commitments have been made to the mode since, culminating in the publication of the Mayoral Vision for Cycling in London in March 2013 and accompanied by a funding commitment of £913 million to be spent on cycling between 2013 and 2023. The perception that this was a process of intentional socio-technical change was further strengthened in interviews with one stakeholder remarking that he had

> *"never seen in thirty-odd years as a transport planner serious sums of money spend deliberately to build a mode, which is exactly what is happening in London at the moment. [...] London believes that more cycling is good so we are going to spend more money definitely to build that mode share." (UK-4)*

To understand the dynamics of these ongoing change processes in the London road transport sector better and pinpoint more precisely the present status of the transition the analysis examined the relative significance of cycling as one among many road transport modes by comparing and contrasting cycling discourses and broader road transport sector discourses and imaginaries.

The analysis of the Mayoral Vision for Cycling in London and the cycling strategies of the three investigated boroughs indicates a convergence in the discourses and imaginaries through which cycling is made sense of and attributed meaning in the London context. And though it also evidenced variability in terms of the tone, contents, and ambition these strategies articulate, by and large, they were found to emphasise the usefulness of cycling as a mode that can positively impact individual as well as broader public health outcomes, contribute to the generation of significant economic benefits and help make boroughs and the city as a whole a more liveable and equitable place. Thus, the discourses invoked in support of cycling investment remain broadly within the confines of historic discourses relating to UK cycling policy as examined in detail by Aldred (2012).

Subsequent analysis of discourses and imaginaries of the wider road transport sector showed that the discourses invoked to justify and promote investment in cycling at the

Greater London and borough level reflect predominantly social and environmental sustainability discourses. While these have been gaining currency within road transport policy-making since the 1990s, they remain largely subordinate to dominant road transport sector discourses and imaginaries, which continue to advocate increasing levels of transport activity and mobility as essential to economic development across local, national and supra-national scales.

By contrast, the evidenced significance and resonance of dominant road transport discourses linking transport and mobility growth to economic growth and prosperity across territories and governance scales is indicative of their relative dominance over environmental and social sustainability discourses present in the road transport sector, though not as resonant across scales and functional systems. Therefore, while alternative discourses, such as public health and environmental sustainability discourses may exist and be invoked in connection with the governance of cycling they are not as strong and resonant as the imaginary linking transport and mobility increases with economic development. As such, these subordinate discourses are presently less powerful and conducive to challenging the motorised road transport regime and bringing about structural change for the benefit of cycling.

Connectedly, cycling remains framed largely as a mode that sits alongside of the dominant motorised road transport regime, and one whose promotion may serve to alleviate negative externalities, such as congestion, pollution, and low levels of physical activity associated with the regime. Notably, however, all cycling strategies examined also sought to directly emphasise economic gains to be realised via promotion and further development of the mode. These include, for example, reductions in public health expenditure, increases in trade for local businesses as cyclists shop more locally and people-friendly environments attract a greater number of residents and visitor, and growth of the cycling industry itself.

Nonetheless, the sustained commitment from policy makers overseeing the governance of the London road transport system, and the regime of motorised transport within it, suggests that the dividing line between niche and regime in this case (as in many others) is not easily drawn.

In fact, this may be an indication of the transition process having already progressed to a more advanced stage. Given that the Mayor has articulated a Vision for Cycling in London the cycling niche may be said to have already permeated into the regime to some an extent. Indeed, stakeholders interviewed said as much. Speaking of the progress cycling

advocates had made in terms of raising the profile of cycling on the Greater London transport agenda, one interviewee pointedly remarked that

> *"there is an extent to which I would say, you have now knocked that door down, […] Now you need to stop shouting outside, cross the threshold and come in and see what's next- Now what do we do?" (UK-4)*

However, from a sense- and meaning-making perspective, even though cycling is discursively being presented as an integral part of the broader road transport system now, it continues to be attributed a subordinate and auxiliary role relative to the regime of motorised road transport. Specifically, it is attributed meaning as a mode that can mitigate externalities arising from motorised road modes and is in this context judged as aligning with broader dominant road transport sector imaginaries of increasing and increasingly frictionless mobility in pursuit of economic growth and development.

Despite this, it must be recognised that the studied moment in the London cycling case represents an advanced stage of an ongoing transition process: cycling has become the subject of political discourse at GLA and borough level. This may variously be construed as (i) the niche discourse of cycling having successfully *'colonised'* the existing road transport regime or, less optimistically, as (ii) niche discourses having been *'appropriated'* by actors of the road transport regime (Fairclough, 2003). Of course, the reality is that one cannot occur without the other. The re-contextualisation of a socio-technical configuration and its associated discourses involves both actors working to colonise existing social, institutional or organisational fields with the new discourse as well as actors in established, dominant social, institutional and organisational fields appropriating that new discourse. To better understand the dynamics of the studied moment of this cycling transition and assess the potential for this transition to be successful in the long run then demands more detailed consideration of the power relations shaping niche and regime actions and interactions.

To aid this, a multi-level perspective approximating the moment in the ongoing transition may be reconstructed as follows:

Landscape level

This research considered dynamics at the level of supranational, EU and national level governance as providing the backdrop of Greater London and local borough level transport policy-making and practice. This was done in recognition of the fact that, while

support (whether political or financial) for cycling at these levels may not directly and strategically impact on local cycling provision at the Greater London and borough level, it is, nevertheless, likely to have positive signalling effects.

At EU level, cycling as a transport mode had historically not been of strategic relevance to the European project. Due to the mode being rarely used for cross-border mobility it was largely seen as a local mode, responsibility for which remained firmly at national and sub-national level in connection with the subsidiarity principles. Since 2015, however, calls for an EU cycling strategy, or 'Roadmap for Cycling' have been voiced by multiple EU bodies. And in June of 2017 the European Federation of Cyclists put forward a draft cycling strategy to urge the European Commission to take on the task of formulating an EU cycling strategy as part of its 2018 work programme.

Meanwhile, the support for cycling at UK national level has historically been inconsistent in that positive discursive commitments to cycling were matched with the devolvement of responsibilities and powers for cycling policy-making and concrete interventions to local authorities. Connectedly, limited long-term and ring-fenced funding was made available by successive UK governments to support the widespread development of cycling infrastructure at the local level. However, more recent favourable landscape developments at the national level have included two large-scale, longer-term demonstration programmes providing localised investment in cycling to study the impacts of sustained investment in cycling on mode share in a total of 18 cities and towns between 2005 and 2011. Furthermore, as fiscal austerity was adopted as the overarching governmental credo following the 2008 Global Financial Crisis, the UK Government turned to consider "the strength of the economic case for cycling and walking" investments across national and local levels. This led to a review of evidence published in November 2014 (Davis, 2014), collating evidence of the economic, social and environmental benefits and consistently high ratios of return on investment generated by cycling and walking schemes.

With both evidence and first-hand experience of the potential returns on sustained investment in cycling mounting a further favourable landscape development took place: In July of 2015 an amendment to the 2015 Infrastructure Act was enacted, imposing a statutory duty on UK Secretary of State for Transport to set out and regularly review a long-term Cycling and Walking Investment Strategy (hereafter CWIS). The long-awaited strategy was, finally, published in April 2017 (DfT, 2017) and sets out a first national level funding commitment to increase cycling and walking across England. Specifically, it

articulates a target to double cycling, as measured by estimated total number of journey stages cycled annually, from 0.8bn (2013) to 1.6bn cycle stages (2025).

Based on this broad-brush analysis it may be said that favourable landscape developments have been under way in the recent decade and developments across various geographical scales and levels of transport governance. These landscape developments appear to have gained further momentum since 2013 and suggest significant convergence towards greater cross-scalar recognition of cycling as a mode that could have positive impacts on the economically, environmentally and socially sustainable development of local transport systems. As such, these landscape developments present a positive context for the further development and consolidation of locally existent cycling niches as well as stimulating the opening up of windows of opportunity for their break-through into existing road transport systems and their challenge of dominant motorised road transport regimes.

Regime level

Key actors governing the London road transport sector include the Greater London Authority, led by the London Mayoralty, which formulates the overall London transport strategy, TfL, as the London transport authority, and the 32 London boroughs and the City of London, responsible for implementing mayoral strategy. All of these are considered key actors involved in the governance of road transport sector planning and practice in London and, by extension, with the production and reproduction of the dominant motorised road transport regime. As such, these may be said to constitute regime actors.

As highlighted in earlier sections, the approach of London road transport policy-makers to cycling has been consistently more coherent and positive than at the national level. Specifically, the years since the publication of then-Mayor Boris Johnson's first cycling strategy in 2010 have seen increasing levels of funding committed to the provision for cycling in the capital. Published in 2013, Johnson's second Vision for Cycling in London (GLA, 2013a) further set out a number of more ambitious strategic investment programmes. These include, for example, Quietways (backstreet routes for leisure cyclists and those not confident enough to ride on main roads), Cycle Superhighways (cycle paths along main traffic routes, which are to be segregated where this makes sense) and Mini-Hollands (competitive funding programmes for Outer London boroughs to redesign town centres for more active travel). To realise these plans, the Mayoralty for the first time committed significant funding to the mode – a total of £913m over the 10 years leading up to 2023. In addition, the creation of the post of the London Cycling Commissioner in

2012 (held by Andrew Gilligan from 2013 to 2016) as well as the establishment of the Metropolitan Police Cycle Safety Task Force are further evidence of the road transport sector's reorientation with respect to the role of cycling in London vis-à-vis the motorised road transport regime.

To enable delivery of the London cycling vision TfL has recruited a large number of new staff with specific expertise and experience regarding cycling since publication of the vision. Interviews conducted with some of these TfL staff members suggest that many of them are not only transport professionals with specific expertise for cycling, but also regular cyclists, self-confessed cycling advocates, and even active cycling campaigners.

Interviews with local borough officers and councillors similarly support the conclusion that a growing number of cycling advocates are occupying key roles within the formal road transport governance structures and processes underpinning the production and reproduction of the dominant motorised road transport regime. These developments may variously be interpreted as evidence of the cycling niche being appropriated by the regime or as indicative of increasing colonisation of regime-related structures and processes by niche actors and interests.

However, it remains important to note that the governance of London's road transport sector more broadly remains significantly shaped by imaginaries and discourses that favour high levels of mobility for people and goods as a means of assuring the economic vitality of cities, regions, and nation states – and thus the production and reproduction of the dominant road transport regime. In connection with this, it is arguable to what extent the appropriation of the cycling discourse by dominant, formal stakeholders of London road transport governance structures and processes is intended to help prop up and perpetuate the dominant motorised road transport regime by mitigating some of the externalities associated with it.

Despite this, strong policy and funding commitments to the mode of cycling at the level of the Greater London Authority, TfL and the boroughs may be seen as evidence of 'cracks' in the regime of motorised mobility dominating London's road transport system. On the one hand, these cracks may be interpreted as the result of deliberate action by incumbent actors to adopt cycling as a component mode of the London transport regime; furthermore to do so in a controlled way that can strengthen the dominant motorised regime against pressures arising due to further population growth and the need for continued transport-facilitated economic development. On the other hand, these cracks also pose as windows of opportunity for niche actors to put further pressure on the existing

regime and force incumbent actors to adjust transport policy and planning practices to further accommodate cycling to an extent that seriously challenges dominant road transport imaginaries and discourses. In fact, and as Chapter 8 will demonstrate in more detail, the analysis undertaken suggests that niche actors have to some extent already colonised the regime and are acting as cycling advocates from within it.

Niche level

At the level of the London cycling niche it may be said that the mode has experienced a renaissance in recent decades. In connection with rising levels in ridership, utility cycling has enjoyed consistently growing levels of political support from the level of the Mayor and the Greater London Authority. Building on this presence and stable political support since the establishment of the GLA the cycling niche may be said to have grown more internally coherent in recent decades.

This is evidenced by way of multiple divergent factors:

From a technological-material perspective the bicycle is of course a very mature transport technology, the successful diffusion of which has led to the establishment of dominant designs and the formation and sedimentation of a range of social practices relating to the mode. In fact, one could speak of a dominant regime of practice existing within the cycling niche itself. Interviewees indicated as much when suggesting that there exists a dominant way of

> *"thinking of cycling in terms of the cycling [that can be seen] on a day-to-day basis, which is mostly male dominated and it is helmets, and heads down and fast and coming out of nowhere in lycra. [...] So, [the challenge is] campaigning for a mode of transport or a style of transport that doesn't actually exist yet."(GL-11)*

From an actor perspective, in turn, it is notable that a lively and diverse landscape of individual activists and campaigners as well as advocacy groups has grown at the London level. Some of these are campaigning and lobbying on behalf of cycling as a mode, while others are more actively engaged in transport governance processes across local borough, Greater London and UK national scales. Campaign groups include the London Cycling Campaign (LCC) and its borough-level affiliate groups, Sustrans London, Living Streets, 20's Plenty, Wheels for Wellbeing, and Stop Killing Cyclists. All of them are concerned with various aspects of the cycling experience in London and are active across different geographical levels and governance scales. Some, such as LCC and Sustrans London have established track records in delivering infrastructural and behavioural interventions to

enable and promote cycling, therefore going beyond mere campaigning in their activities. As a consequence, groups, such as Sustrans London and the LCC who are also involved in the delivery of London infrastructure networks and training programmes may be said to have been straddling the niche-regime nexus for some time. By contrast, Wheels for Wellbeing, a charity originally set up to provide opportunities, training and support for disabled people keen to cycle, has since also moved into campaigning for recognition of the bicycle as a mobility aid and to broaden our cultural understanding of what a bicycle looks like and who can cycle. Others, such as Stop Killing Cyclists, have primarily focused on organising large-scale protests – so-called die-ins – in the immediate aftermath of cycling fatalities in an effort to call attention to the need for safer cycling infrastructure.

From a network perspective, the niche has experienced the growth of a range of formal and informal forums and platforms facilitating network building, learning and knowledge exchange processes across the Greater London region and beyond. On the informal side of the spectrum niche actors exchange information and expertise via blogs as well as communicating and promoting specific information relating to specific cycling, campaign and protest events via Twitter, Facebook and similar social networks. Interviews with stakeholders confirmed these social media forms as important sources of information and communication among cycling advocates. This aligns with other existing research examining the rise and role of social media in cycle advocacy (see, for example, Aldred, 2013; Golbuff, 2014). At an intermediate level of formality there exist numerous smaller-scale events and seminar series hosted by London academic institutions, Transport for London as well as by campaign groups, which serve knowledge creation, exchange as well as networking purposes. At a higher level of formality an increasing number of formal cycling conferences are springing up at borough and Greater London level. Amongst these, the annual Hackney Cycling Conference, now in its sixth year, stands out as having established itself as one of the most important cycling conferences nationally facilitating knowledge and good practice exchange across campaigners, practitioners and academics.

All of the above have served to consolidate the cycling niche by providing cycling advocates with forums in which they were able to build interpersonal relationships and networks for building up and exchanging knowledge and expertise on a variety of issues, including technical design and engineering knowledge, campaigning insights, and the like. Crucially, these forums have also offered important spaces outside of formal transport governance contexts in which cycling advocates of a variety of backgrounds could come together some of them campaigners others transport planners and engineers with and

without official roles in the formal processes governing London's road transport sector. As such, these forums and networks may be seen as instrumental in facilitating exchange across a previously more rigid divide between actors of the cycling niche and individuals and organisations involved in the formal governance of the London road transport sector and thus more closely associated with the production and reproduction of the dominant road transport regime.

In institutional terms, utility cycling in London has particularly very recently experienced successes. These include, for example, the publication of the London Cycle Design Standards (hereafter LCDS; see TfL, 2014c). These have been developed to provide extensive guidance on cycle network planning and infrastructure design, compliance with which is now a formal requirement for all LIP-funded borough level cycling interventions (TfL, 2015b).

The articulation and publication of the LCDS as binding standards represents an important step in the institutionalisation of cycling design knowledge and good practice, and thus in the sedimentation of cycling as a mainstream mode on par with motorised modes for which such standards and guidelines have long existed. However, it is worth noting in this context that the standards themselves have been published and enforced by TfL in its function as allocator of transport funding across Greater London boroughs. As such, the LCDS are also to a significant degree associated with the regime of which TfL, as the overarching transport authority of the region and a nodal actor in the production and reproduction of the dominant motorised road transport regime, is a key constituent. In this sense, the example of the LCDS serves as another illustration of the progressive blurring of the dividing lines between niche and regime, and connectedly as an indicator of the advancement of the cycling transition.

Overall, the London cycling transition may, therefore, be said to be progressing well as interests of the cycling niche are finding increasing consideration within London's road transport sector and vis-à-vis the dominant motorised transport regime. As already mentioned, this is occurring as a result of a dialectical process that involves both the colonisation of the regime by cycling advocates and interests; as well as the appropriation of these actors and interests by the regime. The colonisation of regime contexts, such as TfL and borough level councils by cycling advocates is encouraging. On the other hand, the continued framing and discursive construction of cycling as an auxiliary mode in the broader road transport sector whose significance is defined in relation to the motorised regime, whose externalities cycling is to alleviate, is concerning in this context. It suggests

that there are also significant efforts being undertaken by the regime to appropriate and reconfigure the cycling niche in ways that are not in outright contradiction with the imaginaries, discourses and practices presently dominating road transport policy-making and practice in the London context. Following Geels and Schot's transition pathway typology (2007; compare Table 3.2), the case of cycling in London may, therefore, be described as following one of two possible trajectories: the (i) transformation pathway or the (ii) reconfiguration pathway.

However, more conclusive categorisation is only possible in retrospect and demands an assessment of the extent to which the niche may be said to have re-shaped the regime in its own image, or vice versa, at a point when the transition process may be deemed substantively concluded.

This, however, is not the primary concern of this thesis, which seeks instead to point out potential barriers and opportunities for a more radical transformation of London's motorised road transport regime by the cycling niche. Doing so demands closer attention to the dynamics and mechanisms shaping the ongoing transition at the level of everyday action and interaction. To this end the following Chapter 8 examines the structural, discursive, technological and agential selectivities characterising current transition dynamics in London more closely to illustrate how these serve to privilege the reproduction of the existing motorised regime, and are at times circumvented, exploited or indeed subverted by actors in the interests of the cycling niche.

8. ANALYSIS II: CRITIQUE OF SOCIO-TECHNICAL DOMINATION IN LONDON'S ROAD TRANSPORT SECTOR

The previous Chapter 7 established the transition character of the ongoing efforts to promote more utility cycling in London's road transport sector. It did so on hand of historical trends in the presence of cycling on London's roads as well as on hand of trends in the discursive treatment of cycling across time and scales. The chapter found that though utility cycling has been experiencing a renaissance both materially and politically it remains made sense of as a mode subordinate to dominant motorised road transport modes. In addition to its conventional promotion as a mode offering individual health and economic benefits to riders, it also continues to be presented as a means for remedying the externalities of inevitable rises in motorised mobility levels. Seen through a socio-technical transition lens, cycling was, therefore, ascribed the status of a niche of growing significance vis-à-vis the regime of motorised mobility in the road transport sector.

The analysis further found that a dialectical process of colonisation of the regime by the cycling niche as well as an appropriation of the cycling niche by the regime may be said to be taking place. Understanding whether the cycling niche may be able to genuinely transform the regime of motorised road transport, or whether the regime is more likely to strengthen its dominance by reconfiguring itself to incorporate niche interest requires more detailed examination of niche-regime interactions. Specifically, it demands a critique of the socio-technical dominance of the motorised road transport regime vis-à-vis the cycling niche. Chapter 8 delivers such a critique by presenting an analysis of the structural, discursive, disciplinary-technological and agential selectivities that act to privilege its (re-)production and to challenge a more radical breakthrough of the cycling niche.

To contextualise this analysis the chapter initially paints the picture of a moment of profound contradiction in the London transition process that occurred in November 2013. A moment which cycling advocates successfully construed as a crisis in London's road transport regime. It was in this context that London cycling presented itself as a suitable case to enable study of strategic action barriers and opportunities for successful socio-technical change in an ongoing transition.

8.1. November 2013: A moment of crisis opens a window of opportunity

As Chapter 7 made clear, the publication of the Mayoral cycling vision in March 2013 and associated funding commitments sought to signal a step-change in terms of how key stakeholders of the London road transport regime engaged with the mode of cycling and, connectedly, with the agenda and interests of the cycling niche. In hindsight, the publication of the Mayoral Vision for Cycling in London can further be reconstructed as the beginning of a more pivotal period and the opening of a window of opportunity for niche actors and interests in the ongoing transition process.

This pivotal period arose specifically in connection with the deaths of six cyclists within short succession between 5th and 18th of November of 2013 (BBC, 2013b). Drawing on the language and concepts of CPE and transition literatures, the following section reconstructs this period as a moment of contradiction and crisis that opened a broader window of opportunity for the re-establishment of utility cycling as a mainstream mode in London's road transport system.

Reconstructing a moment of crisis in London's road transport regime

Transition studies and the MLP see 'windows of opportunity' for socio-technical change as arising largely from external shock and changes at the landscape level. The CPE literature, in addition, would also emphasise the inherent improbability of dynamically-stable, semi-coherent socio-technical configurations serving as consistently reliable means for complexity reduction in dynamically changing environments. From a CPE perspective, such windows of opportunity, therefore, arise necessarily also as a result of the inherent improbability of complexity reduction via mechanisms of enforced selection inscribed in semi-coherent dynamically stable socio-technical orders (see Chapter 4, 'The improbability of complexity reduction via enforced selection').

In line with the CPE literature, windows of opportunity in ongoing transition processes may be explained as arising at times when the objective external reality, dominant narratives that evolved to master this reality (social discourses) and established ways of enacting (social practices) this discursively constructed reality no longer align well. That is, dominant narratives and social practices that could in the past be relied on to reduce the complexity of reality are no longer useful to make sense of and enact said reality. Such misalignment between objective external reality and the way it is construed and enacted, can give rise to serious contradictions thereby opening windows of opportunity for

alternative ways of construing and enacting said reality as theorised in the transition studies literature. These contradictions, in turn, offer the possibility of alternative problem definitions via new or existent, yet still marginal social discourses. If actors can exploit these windows of opportunity by assembling useful and resonant configurations of alternative imaginaries, discourses and social practices.

It is important to note, however, that the way in which such objective events may give rise to contradictions and windows of opportunity for the breakthrough of alternative socio-technical configurations is fundamentally mediated through discursive construction. Through discursive construction, moments of contradiction become construed as moments of crisis that call into question the continued usefulness of established socio-technical configurations as effective means of complexity-reduction.

From a CPE perspective then, the 'crisis' that affected London's road transport sector following the deaths of six cyclists in quick succession in November 2013 may be reconstructed as brought on not purely by the deaths as objective, external shocks to the socio-technical system of London road transport.

Rather, the crisis in London's road transport sector could be effectively constructed as such in part due to regime actors' efforts to establish the cycling discourse as a new dominant discourse to inform road transport provisioning in London. However, following the publication of the Mayoral Vision in 2013 the regime was perceived to not follow the change in discourse with an equivalent level of material work to bring about the promised changes in the perceived cycling experience in London. Things came to a head in November 2013 when six London cyclists were killed within a fortnight in accidents involving motor vehicles.

Again, on the one hand, the source of the crisis, i.e. the death of six cyclists, was an objective, externally and materially constituted event. On the other hand, however, it is important to recognise the extent to which the regime itself had discursively created the conditions that enabled these fatalities as objective, material events to give rise to a larger window of opportunity, which in turn could be seized by cycling advocates to advance the interest of the cycling niche.

Specifically, a window of opportunity opened (and niche actors, in turn, were able to exploit this opening) due to a misalignment regime actors themselves had created between what they discursively positioned as a progressive and radical transformation of London's road transport system to accommodate much broader demographics of cyclists on the one

hand and the slow changes in the material reality of provision for cycling on the other hand. Andrew Gilligan, the Cycling Commissioner of London at the time, admitted to the slow pace of change during a meeting of the London Assembly Transport Committee one month after the events of November 2013. Arguing that the changes required for a radical transformation of London's road transport system "cannot happen overnight" he, nevertheless, recognised that since the publication of the Mayoral vision in March of 2013 things had got to

> "this point where the euphoria [has] worn off, the honeymoon [has] worn off and there [is] still an interval before we actually [see] physical progress on the street" (GLA, 2013b)

The deaths of the six cyclists in short succession, in turn, brought attention to this lack of progress in delivering the radical cycling vision articulated seven months prior. However, Gilligan also diagnosed at the time, that the observed lack of progress on London's roads

> "is not because of a lack of political will. It is not because of a lack of official will at TfL. It is not because of a lack of money. We have enough of all three of those. [...] It is to some extent because of a lack of capacity. There just are not that many people in the UK who can design really good cycling schemes and we are hiring most of them. We are hiring an extra 128 people to help deliver the cycling programme." (ibid.)

As such, the perceived lack of progress was not merely a matter of interventions needing time to take their proper effect or due to the time that actual material delivery of planned infrastructural interventions inevitably takes. Rather, seven months into the life of the vision, its realisation remained fundamentally slowed down and obstructed by a lack of qualified personnel to carry out the necessary design, engineering and planning works.

It is conceivable in this context, that had the Mayor and TfL owned up to the reasons underlying the slow progress in terms of bringing material, infrastructural change to London roads, they may have been able to limit the ability of niche actors to construe these contradictions between discourse and materiality as a crisis in London's road transport sector as a socio-technical system. Instead, however, the Mayor reacted by returning to what was perceived a regressive and conservative discourse. Specifically, his language and actions following the deaths emphasised the mutual responsibility of motorists and cyclists to adhere to the rules of the road, thereby placing what cycling advocates perceived as an equal burden on a fundamentally unequal, i.e. more vulnerable mode.

This served to emphasise the contradictions between the way cycling was discursively constructed within the Mayoral Vision and how it was being 'practiced' by the regime in reality.[49]

Stakeholders of the cycling niche, in turn, were able to successfully seize the window of opportunity thus created. Specifically, they undertook strategic efforts to discursively construct the deaths of the six cyclists in November 2013 as evidence of fundamental misalignments and contradictions between the progressive cycling ambitions regime actors had articulated via the Mayoral Vision and the material reality of cycling on London's roads. Notably, a campaign group that did not exist prior to November 2013 was instrumental in this effort. Under the provocative name of 'Stop Killing Cyclists' the group organised a 'die-in' on 29th of November 2013, which was attended by an estimated 1000 people (BBC, 2013c). The die-in was modelled on Dutch road safety protests of the 1970s and involved protesters lying down in the busy junction in front of the TfL headquarters to stop traffic and call attention to the recent cycling deaths. The protest sought to discursively construe regime actors as complicit in the deaths of the six cyclists

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[49] An interesting question in this context, though one that goes beyond the remit of this thesis, relates to identifying where the pressure for the regime to 'take up' cycling in such a wholesale and progressive way as articulated in the Mayoral vision came from - particularly given the regime's evident lack of required expertise to deliver said vision and the considerable time it took to recruit the required expertise.

In the London case, cycling was clearly taken up (discursively) by the regime at a time when general resonance of the cycling discourse was still relatively limited both at the local borough level as well as the national level and supra-national level (though exceptions in the form of small, localised cycling niches existed). However, the appropriation of the cycling discourse may itself be understood as an effort of the regime to adapt and avert contradictions and crisis within the regime from arising. As such, the underlying motivation driving change in the London road transport sector is not to make the existing socio-technical configuration around motorised modes better per se, but rather to make this motorised regime more resistant to crisis. Crisis here is defined based on the purposes of motorised transport in the London context, which, as previously established, is primarily economic in nature, i.e. moving people, goods and services to enable continued economic development. Population growth and resulting congestion pose clear challenges to the smooth operation of the London road transport system and, therefore, risk crisis in London's road transport system, and by extension in its economic system in the short term.

As such, the appropriation of the cycling niche by the regime itself represents an active effort to adapt the regime to make it more crisis-resistant: as the analysis of discourses guiding cycling and road transport policy-making in London in Chapter 7 pointed out, the regime construed the appropriation of the cycling niche also as motivated by a need to address externalities of the motorised transport regime, which were threatening the regime's long-term sustainability (e.g. congestion = hampers economic development and urban liveability) and, therefore, its long-term ability to deliver on the meaning and purpose attributed to it (transport = economic development and urban liveability).

and to call upon the Mayor and TfL to prioritise and devote greater resources to improving the safety of cycling in London and received broad media attention. It has since become a regular response to mark individual cycling fatalities on London's roads via the staging of a die-in and vigil for the victims shortly after the event and at the very site of the accident.

Via discursive efforts, such as these die-ins, niche actors were able to wrestle some of the power over how cycling is made sense of and attributed meaning within the London road transport sector from the regime. This further put cycling advocates and niche actors in a stronger position to contest and actively shape how cycling was being made sense of, attributed meaning to and ultimately enacted by the regime in the period following the November 2013. In this sense, the events of November 2013 and the period following thereafter may well prove crucial moments in shaping the long-term transition trajectory in the London cycling case by tilting the balance of power to discursively construct cycling vis-à-vis motorised modes ever so slightly towards the niche. Of course, it remains to be seen to what extent the motorised road transport regime may act to undercut this development by appropriating and shaping the London cycling niche in ways that strengthen rather than weaken its continued dominance in London's road transport sector.

Despite the window of opportunity opened in late 2013 cycling advocates and stakeholders of the cycling niche, nevertheless, continue to face significant challenges in terms of actively reconfiguring the motorised transport regime. This is in part due to the continued dominance of the regime relative to the cycling niche as produced and re-produced via strategic selectivities of structural, discursive, disciplinary-technological and agential nature. As explained in Chapter 4 and 6, these arise in connection with the increasing sedimentation and institutionalisation of imaginaries in the form of discourses, practices, institutions, norms, laws, regulations, and so on. The more these imaginaries are taken for granted as providing accurate representations of reality the more they are likely to be reproduced largely unquestioned and uncontested over time, which leads to their increasing sedimentation and eventual articulation in institutional and material form. The more sedimented these imaginaries are, the more they coevolve with and become inculcated in other discourses, practices, institutions, materialities and so on to form broader social, and specifically socio-technical configurations. The increasingly unchallenged reproduction of these imaginaries via the uncontested re-enactment of discourses, practices, institutions and materialities within which they are inculcated in turn serves to privilege the reproduction of the broader socio-technical configuration of which there are constitutive elements of. That is, the increasing sedimentation of imaginaries and

discourses in institutional and material forms serves to selectively privilege actors, interest and actions that reproduce the existing socio-technical order. In this sense, the sedimentation of imaginaries gives rise to strategic selectivities inscribed in different elements of a given socio-technical configuration that act to privilege the reproduction of said configuration.

The following section presents instances of structural, discursive and disciplinary-technological selectivities operating in the context of the London cycling case and explains how these selectivities act to perpetuate the dominance of motorised modes in London's road transport system. By that same token, the analysis also discusses examples of how these selectivities are encountered, circumvented or exploited by the cycling advocates interviewed, thereby shedding light on agential selectivities at work.

8.2. Strategic-relational analysis of the London cycling case

Structural selectivities and agential responses

The first type of selectivity to be considered are structural selectivities, or more precisely structurally inscribed strategic selectivities. Recall from Chapter 6 that a structural selectivity is defined as a selectivity that establishes an asymmetry in terms of the action opportunities and barriers faced by different actors and interests. Such a structural selectivity is inscribed virtually in all structural and institutional arrangements as they inevitably privilege the pursuit and realisation of some actions and interests by some actors over those of others (see Table 8.1, as partially replicated from Chapter 6).

	Definition of concept	Effects/indicators
Structural selectivity	"[A]ll structures privilege the adoption, as a condition for success, of certain spatial and temporal horizons of action by those seeking to control, resist, reproduce or transform [them]." (Jessop, 2014, p.205)	"[A]symmetrical configuration of constraints and opportunities" faced by different actors involved in the governance of the London road transport system "as they pursue particular projects." (Sum and Jessop, 2013, p.214)

Table 8.1 Structurally inscribed strategic selectivity

It is important to note, however, that structural selectivities exist only insofar as they are reproduced through social action. The action constraints and opportunities they present to different actors are, therefore, not immutable, but may change and be changed over time.

An example of a structurally inscribed strategic selectivity identified as acting in the context of the London case study arises from the way in which the governance of transport matters is organised across the UK national, regional and local levels. The transport governance structures are such that the UK national government has more recently acted to devolve transport-related powers and responsibilities largely to the regions and, in the case of London, to the GLA and the Mayor via the GLA Act 1999. This Central Government act stipulates that the power and responsibility to articulate the overarching transport strategy for the Greater London region rests with the GLA and the Mayor. It further sets out that each London borough is required to produce a LIP that lays out what transport interventions a local authority plans to undertake within its territory to support the overarching Mayor's Transport Strategy (hereafter MTS). The GLA then receives transport funding from national government to allocate to TfL as the regional transport authority. And TfL, in turn, is tasked with utilising the received central government grant for the provision of transport services spanning the Greater London region in accordance to the MTS. Beyond this, TfL is also charged with administrating and allocating central government funding to the London boroughs based on the LIPs boroughs are required to produce in support of the MTS.

The structurally inscribed selectivities arising from these arrangements are evident. The GLA Act 1999 (HM Government, 1999) clearly allocates the power and responsibility to articulate an overarching transport strategy for the Greater London region to the GLA and the Mayor. The act further lays out that each local borough council is to set out a LIP detailing proposed local transport interventions in support of the MTS. The GLA Act 1999 thereby serves to limit the ability of boroughs to articulate and pursue transport strategic aims and actions not in alignment with the MTS. As such, the strategic actions and interests of the GLA and Mayor for the broader Greater London region are structurally privileged over those of local authorities. Boroughs' compliance with the strategic transport objectives set out in the Mayoral Transport Strategy is further ensured via the LIPs process, which requires boroughs to submit detailed three-year plans outlining the transport interventions they seek to implement in support of the MTS and the funding they require to do so. Subsequently they are required to submit annual spending submissions

to report on projects and interventions to be delivered in a given year towards realisation of a previously set out LIP (TfL, 2017b).[50]

The selectivity, thus, assigns greater strategic and policy-making powers to the GLA and Mayor, while the responsibility for their execution rests primarily with TfL and the boroughs. For stakeholders of the cycling niche this selectivity creates a complex challenge in terms of articulating and promoting their interests across the various scales.

Connectedly, another significant structural selectivity arises from the democratic process itself, and, specifically, electoral cycles. These may be seen to bear a risk for niche interests as changing actors in key road transport related decision-making roles are likely to frustrate efforts to steadily build support for a socio-technical niche over the long-term. As such, the electoral cycle may be seen as imposing a structural selectivity that serves to privilege the allocation of political capital to well-established socio-technical interests, such as the motorised transport regime, and, therefore, the perpetuation of the status quo in the long term.

Insights gathered via interviews with cycling campaigners across various different roles suggest that the two structural selectivities outlined pose significant challenges in terms of bringing key factors needed to realise ambitious cycling interventions into alignment.

Speaking about the challenge of influencing political agendas across national, regional and local levels, an interviewee at EU-level with detailed insight into the cycling campaigns running in various European countries including the UK, cautioned that "it can take an entire political cycle to get change" (EU-1). As such, he emphasised the need to start campaigning early and consistently, as

> *"by the time you get to an election or by the time you get to an annual budget cycle it's too late. You can get incidental money. You know, you get crumbs from the table.[…] And you don't have a voice in the room unless you've built a relationship with the key civil servants and stakeholders in the previous four or five years, where they will talk to you as opposed to anybody else […] And in a complex structure, like a very complex city with multiple stakeholders it takes a long time to get enough people in the consensus […] And that investment in those relationships is what we hear consistently from our most successful campaigners, our most successful groups across Europe." (ibid.)*

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[50] In this sense, the LIPs process operates as a configuration of disciplinary technologies that serve to enforce and monitor compliance of local authority transport investment with broader strategic plans for the Greater London region.

Drawing comparisons to other national contexts the interviewee further offered an example from the United States,

> *"another kind of poor-cycling country, [where cycling advocates] are investing in relationships with senators and secretaries of state and government-level congress men now, who might be voting on a federal budget in two, three, four or five years' time" (ibid.)*

A UK-level advocate interviewed pointed out further that 'being in the room' is not only necessary to make your interests heard and forge relationships with key decision-makers. Rather, it is also an indispensable means in building an understanding of the complex organisation and operation of transport governance processes, as a stakeholder outside of these processes.

> *"That's why it's important to be on these forums and in these groups […] You suddenly realise 'Oh, there's a whole other layer I didn't know about'. But if you don't know about that, I don't know how you-, unless you are in that world, I don't know how you find out." (GL-1)*

Reflecting on her own experience, she went on to point out that particularly for small advocacy organisations and individuals, the challenge is

> *"being at enough meetings and in enough places, really […]. Yeah, that's the hardest thing, it's having the influence at the right level. And the fact that 32 [London] boroughs have 32 planning departments and 32 sets of blinking standards." (GL-1)*

As such, the process of influencing local, regional and national level cycling policy can be "painfully slow and painfully frustrating if you are an advocate" (EU-1). For some advocates interviewed, on the other hand, it is this challenge that motivates them to get involved and persist. One campaigner likened it to "the Rubix Cube of how do you get 'this' to happen, given that there is 'that' constraint" (LBL-1), suggesting a quality of playfulness and intellectual challenge to the process of cycling advocacy.

Campaigners and advocates on the outside of mainstream transport governance processes, however, are not the only ones reporting the challenge of aligning key decision-makers and necessary resources to bring about progressive change for cycling on London's roads. Cycling advocates occupying roles within the regime continue to face similar challenges in terms of aligning the resources and support from key actors needed to deliver socio-technical change for cycling. Talking about the task of delivering end-to-end Cycle Superhighways on TLRN roads that cross a number of borough boundaries and intersect

with various borough-managed roads, a TfL employee emphasised the challenges around having to get

> *"boroughs talking to their neighbours, […] to get them talking to TfL where they cross TfL roads and […] to have that political will. And all those things are happening at different levels at different times in different organisations."* (GL-4)

Another TfL employee, reflecting on previous experiences at local authority level, suggested that

> *"as a borough officer, which I was for many years, you are waiting for it all to be aligned. You're sat there going 'I can do it, I can do it, but I need to align it. I need the right boss there, you need the right stakeholders asking, you need the right councillors there, you need the right committee. All these and as soon as you're signed up you go: 'Right! And I've got- Oh, no! I've got no money now though!'"* (GL-5)

To be sure, aligning support and resources from multiple stakeholders and the input of various professionals to enable the implementation of an elaborate transport infrastructure intervention within a given period of time and budget presents a challenge for local authorities no matter whether it is a cycling-specific or a motor traffic-focused intervention. This points to a broader challenge of managing and maintaining transport infrastructure efficiently across multiple scales and stakeholders. An interviewee sought to illustrate the complex, regime-internal negotiations involved in delivering cycling improvements as part of broader road interventions, explaining that

> *"you've got one set of officers who tend to be the transport policy, transport engineering side who will want to use a maintenance budget to [carry out a cycling intervention]. And then you got the asset manager who says 'Well, you know, […] I've got a road, it's worn out, I want to take off the top 100mm, put it back, and move on. Road done. And I've costed on that basis and I don't want to go and make that [cycling] intervention' […] One thing that has helped over the last few years was the move from 1-year capital planning to 3-year capital planning, you know, because it wasn't unheard of for us with a 1-year capital resurfacing programme to go into a street, resurface and then the following year the transport policy team, who, finally, got approval from TfL for their cycling works to be going into the same street a year later and then putting in cycling infrastructure. […] Ideally, you go in there, you do the street and you'd leave it as fit for purpose for the next 40 years, including the cycling infrastructure and all the rest of it. It's a long way from that. That's the perfect solution, you know."* (LBS-6)

Agential responses

Through strategic-relational analysis of interview transcripts and supplementary documents this research identified strategies employed by cycling advocates, including niche actors, such as campaigners, but also transport professionals acting within the regime, in response to agential, discursive and disciplinary-technological selectivities they encountered. As outlined in Chapter 4 and 7 (see Table 8.2) such strategies and tactics constitute evidence of agential selectivities, i.e. agents' differential abilities to read and circumvent, exploit or subvert the structural, discursive or disciplinary-technological selectivities facing them in specific action contexts. The following analysis focuses on evidence of agential selectivities in response to the above outlined structural selectivities.

	Definition of concept	Effects/indicators
Agential selectivity	"Agential selectivities relate to actors' capacities to monitor their own actions; learn from experience; integrate social science knowledge into their activities" (Jessop, 2014, p.2012) in ways that enable them to exploit structural, discursive and disciplinary-technological selectivities they face in specific conjunctures to 'make a difference'	Key actors, who are 'making a difference' at specific conjunctures, i.e. moments in time and place by 'reading' conjunctures and identifying inherent scope for action; to stimulate a review (and re-articulation) of sedimented discourses; to exploit the array of established disciplinary technologies or devising new ones; and to force shifts in the balance of powers.

Table 8.2 Agentially inscribed strategic selectivity

An important agential strategy taken on by cycling advocates within the political sphere entails exploitation of the structural selectivity arising from the democratic process and, specifically, electoral cycles. In connection with this, a number of cycling advocates in the London context recognised that the campaign for cycling among politicians and other key decision-makers must not start after an election, but rather it has to begin prior to it.

To achieve this both cycling advocates positioned within the regime as well as those who find themselves largely on the outside of formal transport governance processes sought to ask key decision-makers governing London's road transport system to pre-commit themselves to support more and better provision for cycling on London roads.

Among cycling campaign groups as stakeholders operating largely on the margins of the transport governance process this involved large-scale and strategic campaigns to

persuade political candidates, themselves campaigning for electoral support, to make concrete cycling-related pre-election commitments.

Specifically, the LLC successfully ran two key campaigns using this strategy starting with the 'Love London – Go Dutch' campaign (LCC, n.d.-a), which in the lead up to the 2012 election for the Mayor of London targeted leading Mayoral candidates to commit to delivering on three key demands for cycling in their mayoral term. These included (i) implementation of "three flagship *Love London, Go Dutch* developments on major streets and/or locations", (2) assurance that "all planned developments on main roads" controlled by the Mayoralty will be completed to a standard that increases safety for walking and cycling in these locations, and (3) assurance that the Cycle Superhighways programmed to be delivered are finished to higher quality and safety standards (LCC, n.d.-b). The campaign was further flanked by a petition signed by 40,000 people "asking the mayoral candidates to pledge to make London more liveable for everyone by making […] streets as safe and inviting for cycling as they are in Holland" (LCC, n.d.-a).

Having achieved a campaign commitment from Boris Johnson, who would ultimately be re-elected to the positon of Mayor of London in 2012, the Love London, Go Dutch campaign was deemed a success and a similar follow-up campaign was deployed two years later in the context of the 2014 local council elections across London. This second campaign titled 'Space for Cycling' targeted some 7,000 candidates seeking to be elected to positions as councillors in the various boroughs of London and asked each of them to support a specific cycling intervention in the local area within which they were seeking election (LCC, 2014). Out of a total of 1,850 council seats up for election in 2014 the campaign managed to secure Space for Cycling campaign commitments from 862 councillors, ultimately elected (LCC, n.d.-c)

Stakeholders interviewed across the Greater London level and specifically one London Assembly member agreed that cycling had

> *"risen up the political agenda […] partly thanks to the London Cycling Campaign, their Love London - Go Dutch campaign at the last Mayoral and Assembly election and then the Space for Cycling that they ran very successfully at the borough council elections. (GL-9)*

At a practical level, however, council officers, as those who would be tasked with delivering the cycling commitments made by councillors, cautioned that it was unrealistic for all of them to be implemented. One officer specifically suggested that, while he would

"love for all these things to happen. [...] One or two of them might, but if we were to do all of them, well (a) we don't have the resources and (b) it would involve councillors just saying to their residents 'Look, we're doing it' whether they like it or not." (LBL-4)

This was echoed by another officer who agreed that the Space for Cycling campaign

"was very effective in many ways. It got lots of councillors signed up, but then there's the question of deliverability in a four-year political cycle. And this ultimately comes down to money." (RBG-5)

Despite these expected barriers in translating campaign asks into practical interventions on London roads, various stakeholders interviewed suggested that there was inherent value in the campaigns having managed to put out "a very clear statement of what the goal was and what the benefits would be" (GL-2). In this sense, one council officer suggested, the campaigns had served to significantly reduce disagreement among campaigners regarding the goals for cycling in London thereby enabling them to put out a more coherent message to

"councillors, politicians and engineers who didn't want to make changes [for cycling and] were able to sort of use a divide-and-rule tactic saying 'Some cycle campaigners don't want this, they want that and other one's don't want this. So, we don't know. We don't know what you want! So, we're just not going to do anything.' And that's kind of eliminated, which is constructive." (LBL-3)

A similar strategy operates also at the level of the regime in the form of the cycling strategies published by the Mayor and individual boroughs. While, of course, an important tool to demonstrate leadership, these documents also serve to pre-commit regime actors, including the Mayor, councillors and local and regional transport authorities to the delivery of concrete cycling interventions or the pursuit of broader strategic targets for cycling. In this sense, both the pre-election cycling commitments generated via the two LCC campaigns and the articulation of cycling strategies act as a form of positive *self-binding mechanism* (Buchstein, 2013; Elster, 2000) regime actors impose on themselves with the aim of mandating certain future actions.

As such, particularly borough-level cycling strategies fulfil a crucial role in articulating cycling ambitions shared across the council and binding politicians, for whom "what's possible is driven by the election timetable" to some extent (LBS-6). As such, various interviewees at the level of borough councils agreed that the strategy essentially acts to pre-approve the interventions articulated within it in principle, thereby speeding up the

approval process when concrete plans and programmes for their for implementation are being developed. A Greenwich officer suggested specifically that since the council had approved the cycling strategy

> *"the general thinking has been 'It's in there so it's already been approved in principle' so […] that's giving you the approval to consult on a scheme." (RBG-5)*

Other officers further highlighted the value of the published strategy as a means of holding political leadership to account and a document that they could point to

> *"and say 'Well, hang on, we're committed to this! […] And actually maybe I should use it more for that, 'cause really I guess that's what it's there for in a way." (LBL-4)*

Discursive selectivities and agential responses

Structural selectivities, such as the ones outlined above, in turn, operate in interaction with other kinds of strategic selectivities. A second type of selectivity to be considered in this context is that of discursively-inscribed strategic selectivities, or discursive selectivities for short. These operate to limit and constrain both what kind of socio-technical imaginaries and discourses can be articulated and expressed as well as who is authorised to articulate and express these, in what ways and through which media (see Table 8.3).

	Definition of concept	Effects/indicators
Discursive selectivity	"Discursive selectivities limit possible imaginaries, discourses, genre chains, arguments, subjectivities, social and personal identities, and the scope for hegemony, sub-hegemonies, and counter-hegemonies. They privilege some interlocutors, some discursive positionings, some discursive strategies and tactics, and some discursive statements over others." (Jessop, 2014, p.211)	Asymmetrical "constraints and opportunities inscribed in particular forms of discourse" that impact on (1) the extent to which alternative socio-technical transport imaginaries can be articulated, (2) the extent to which different actors involved in the governance of the London road transport system can or cannot articulate alternative imaginaries and (3) the extent to which these articulations "enter intertextual, interdiscursive and contextual fields." (Sum and Jessop, 2013, p.215)

Table 8.3 Discursively inscribed strategic selectivity

A specific example of a discursive selectivity acting in the context of the London cycling case arises directly from the dominant road transport and cycling imaginaries and discourses presented in Chapter 7. The dominant imaginary and discourse identified continues to emphasise the need for frictionless transport and mobility of goods and people as a means of facilitating competition, economic development and ultimately prosperity at UK national, Greater London regional and local borough level. As argued in said chapter, the fact that this imaginary and discourse operates across governance scales and geographies, including also the supra-national EU level, further enhances its resonance and dominance. This dominance and resonance is both the reason and consequence of the largely unquestioned and uncontested acceptance of said imaginary as an accurate representation of reality, i.e. the acceptance that continued economic growth requires increasing and increasingly frictionless mobility of goods and people. By virtue of its largely uncontested acceptance and reproduction across scales it also serves to limit the scope for the articulation and enactment of discourses and imaginaries that envisage and promote alternative and competing measures of and mechanisms for human development. In the context of the London cycling case this has become perhaps most apparent on hand of the timing of the appropriation of the cycling discourse. It is no accident that the Department for Transport in 2012 moved to commission a "report to re-assess the strength of the economic case for cycling and walking during a time of fiscal austerity" (Davis, 2014, p.8). The embrace of the cycling agenda at the UK national level may connectedly be seen as motivated significantly by a recognition that investment in the mode "is likely to provide low cost, high-value options for many local communities" and options that provide benefits in the form of improved health outcomes for individuals, cost savings for the NHS as well as "for the transport system as a whole, and for the economy through more efficient use of our transport networks." (Davis, 2014, p.6). The agenda of cycling is connectedly embraced as means of enhancing local and national economic competitiveness in two ways: (1) by increasing the efficiency of transport systems and (2) by reducing the level of public sector expenditure required to achieve this efficiency improvements. At the London level a shift to cycling was similarly promoted as a measure to "help mitigate the congestion impacts of population and economic growth" (GLA, 2011, p.199) in acknowledgment "that well-designed [cycling] schemes can deliver benefits far greater than their relatively modest costs" (GLA, 2013a, p.7).

The replication and resonance of this imaginary and associated discourses across geographies and scales of governance from the Greater London to the EU level itself attests to the discursive selectivity arising from it. Following Sum and Jessop (2013) such

discursive selectivities act to limit the scope for alternative transport imaginaries and discourses to be thought, articulated or enacted while privileging the pursuit of transport strategies and developments whose aims and objectives resonate with established, dominant discourses and imaginaries. The evident lack or weakness of imaginaries and discourses of economic and human development that are not fundamentally rooted in the need for economic growth broadly, and transport- and mobility-facilitated economic growth specifically is, in connection with this, telling.

With the discursively-inscribed selectivity privileging reproduction of road transport sector imaginaries and discourses that link transport and mobility increases to economic growth and development these imaginaries and discourses become increasingly sedimented and taken for granted as accurate representations of the dynamics informing reality. And, the more they are taken for granted as objective truths about the world the more they become embedded and inculcated within the institutional and material forms of a given social, or specifically socio-technical order.

Agential responses

Interviewees, whether transport professionals operating within the regime or cycling campaigners on the fringes of said regime, showed themselves to be quite aware of these discursive trends in road transport policy making and resulting selectivities. Two transport consultants practicing in London and across the UK reflected on the fit of cycling within these discourses suggesting that

> *"in the late 1990s there was a kind of push towards [cycling] and towards sustainable transport and that was steadily watered down in the early part of the decade. And then, you know, during the recession it all kind of- You know we used to do a lot of environmental audit work and all of that kind of work just fell away, because the emphasis now is on growth and growth in the eyes of most people means pushing more cars and lorries around the country. So, […] there is quite a lot of money going into cycling at the moment, but fundamentally we are pursuing this kind of growth agenda, which is high carbon consumption and quite far away from the sort of idealism of the 1980s and 90s." (UK-6)*

Connectedly, they suggest, the case for cycling has more recently been made increasingly on the basis that

> *"it's good for jobs, it's good for reducing absenteeism, it's good for- There's a lot of reasons. It's not just fluffy and nice to do. There are some, you know, monetary benefits. And that was done I think, because this growth agenda to try to make the link." (UK-5)*

Actors in support of the cycling niche may, therefore, be said to be strategically exploiting the discursive selectivity inherent in the dominant discourses of people and goods mobility as a means to economic growth for the benefit of cycling. This includes working creatively within the transport investment appraisal technologies of economic cost-benefit valuations to make the case for cycling. As mentioned previously and as documented in a review published by the DfT (Davis, 2014) this led to the development of new indicators and ways of quantifying in monetary terms the environmental, social and health benefits that accrue from the promotion of cycling and walking. For example,

> *"noise values draw on evidence of the impact of noise on house prices; greenhouse gas emission values use prices from the EU Emissions Trading System and estimates of the costs of meeting Government carbon targets; and values of health are derived from people's willingness-to-pay to reduce the risk of accidents, injuries and death." (DfT, 2014b, p.22)*

To some extent these insights have already been formalised and institutionalised, for example, via updates to the WebTAG[51] process – the governmental web-based Transport Analysis Guidance – which provides local authorities with guidance on how to put together business cases for transport infrastructure schemes (DfT, 2014c).

Apart from seeking to exploit these discursive selectivities arising from the dominance of the economic growth discourse, niche actors at the fringes or outside of the road transport governance processes have also identified promising ways of strategically subverting the dominant economic growth and development discourse to promote cycling.

A particularly interesting example in this context are the growing advocacy efforts of charities and campaign groups advocating for inclusive cycling, particularly on behalf of disabled cyclists. A prominent example of such an organisation is the London-based charity Wheels for Wellbeing, which started out in 2007 to provide equipment and cycling sessions for people with various kinds of disability. In addition, the organisation has since moved into advocating and campaigning for the needs of disabled cyclists on the road with much early success. A councillor interviewed, spoke of the realisation that she "had

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[51] WebTAG "defines all the inputs required for an appraisal and the current values of the standard parameters such as time savings, accident cost savings etc. At the heart of any such appraisal is the forecast of traffic with and without the scheme so that a comparison can be made with scheme against a base case of what would be the situation if no scheme were adopted" (Vickerman, 2017, p. 2).

never ever considered disability when […] thinking about cycling" (LBL-5) until meeting the group and of her strong conviction since that what disabled cyclists want is not

> *"just to cycle around a velodrome. They want to be able to cycle on the streets. So, when as a council and TfL etc. when we put in measures, which are meant for cycling we need to include those types of cyclists too." (LBL-5)*

Connectedly, an interviewed campaigner for disabled cyclists highlighted cycling as "quite a radical and subversive tool for promoting disability equalities" in the sense that

> *"there is a quite powerful message to be put out there when a visibly disabled person cycles on the street it really challenges people's perception of disability. It's…instead of, you know, sort of people seeing a disabled person and feeling a bit sorry for them or staring, but very few people do that, but, you know, having sort of very sort of negative feelings people are really positive: 'Come on! Wow!' or kids go 'Oh mom I want one of those!', you know. You never say that about a wheel chair or a walker or a crutch or, you know. So, it flips things on its head." (GL-1)*

Conversely, disabled cyclists themselves subvert and force a radical reconsideration of taken-for-granted conceptions of "what a cycle looks like and what a cyclist looks like" (ibid.). As such, disabled cyclists and adapted bicycles have a powerful role to play in broadening the cultural understandings of wider society and in challenging outdated notions of cycling and cyclists that continue to dominate road transport policy making and practice.

From a behavioural change perspective the disabled cycling lobby then poses a potential powerful ally to cycling advocates within mainstream road transport policy making, who, as is the case in London, continue to struggle to significantly broaden the demographics of regular cyclists beyond the archetypal 'middle-aged, male in lycra', or MAMIL for short. Speaking of their efforts to enable disabled people to cycle a campaigner pointed out the "radical potential" for a profound cultural shift, for if "we get the least likely people to cycle on bikes, on cycles […] what's stopping anybody else?" (GL-1). In connection with this, campaigners for disabled cycling have recognised particular potential for powerful alliances with parent and cargo cyclists relying on adapted cycles to carry children or goods, respectively, as well as with older cyclists and children cyclists who share requirements for additional safety and mobility limitations.

And to some extent, campaigners for disabled cycling have already had some significant successes in terms of advocating for more inclusive standards and design guidance for larger bicycle types, such as tricycles, hand cycles, cargo bikes, trailers, tandems, and so

on: the London Cycle Design Standards (TfL, 2014c), the Welsh Design Guidance for Active Travel (Welsh Government, 2014) and most recently amendments to the Design Manual for Roads and Bridges (Highways England, 2017) incorporate design guidance to accommodate cycle types with dimensions that do not match those of a conventional bicycle.

Beyond their impact on mainstream road transport policy making and practice advocates for disabled cycling have also recognised their potential as a powerful ally to cycling advocates and campaigners more broadly, for "[w]here disabled cyclists can go everybody else can, too" (GL-1). And so, as the interviewed campaigner pointed out further, what disabled cyclists

> *"are saying reinforces what all cyclists are saying, except we are the only ones who have the Equality Legislation behind us […] So, actually we can, though we are potentially talking for a very small number of cyclists, we have a very big impact to make on infrastructure." (GL-1)*

As such, the advocacy and lobbying power of disabled cyclists is underpinned by legislation in the form of the Equality Act 2010, which serves to legally protect individuals from discrimination and imposes a duty on public sector bodies to

> *"consider all individuals when carrying out their day-to-day work – in shaping policy, in delivering services and in relation to their own employees."*
> *(HM Government, 2015)*

As a piece of legislation, the Equality Act 2010 presents a structurally inscribed selectivity that imposes on public sector bodies, such as local authorities who manage and maintain transport and cycling infrastructure, a duty to provide this infrastructure in ways that do not exclude or discriminate against disabled cyclists. Advocacy efforts by and for disabled cyclists, and by and for inclusive cycling can connectedly play a significant role in subverting emergent cycling discourses that focus on the role of the bicycle as a mere auxiliary mode and tool for mitigating the negative externalities of motorised transport. Within the inclusive mobility agenda, by contrast, the bicycle is recast as a uniquely mobilising mode and a potential mobility aid (not unlike wheelchairs and mobility scooters) as "[m]any disabled people find cycling easier than walking" (Wheels for Wellbeing, 2018).

In this sense, the legal duty the Equality Act 2010 imposes on local authorities and public bodies to provide cycling infrastructure that does not exclude or discriminate against

disabled cyclists serves to lend strong support to voices demanding more than minimal re-allocation of road space to cycling. As such, the Equality Act 2010 and the connected duty to provide for inclusive cycling infrastructure may also act to challenge and subvert dominant interpretations of local authorities' statutory duty to secure "the expeditious movement of traffic on the authority's road network" (HM Government, 2004, p.7).

Uniting mainstream cycling campaigners and campaigners for disabled cycling around the discourse of inclusive cycling, therefore, has the potential to yield a powerful discourse coalition (Hajer, 1993) and advocacy coalition (Sabatier and Jenkins-Smith, 1999) in the call for more and better space for cycling. Such an alliance is further central to achieving a more radical transition to re-establishing cycling as a mainstream road transport mode, and one that can potentially provide mobility for even more people of all ages and abilities.

A final form of selectivity operating in the context of the London cycling case is that of disciplinary-technological selectivities discussed in the following section.

Disciplinary-technological selectivities and agential responses

Disciplinary-technological selectivities

As stated previously (see Table 8.4) disciplinary technologies are complex configurations of knowledge and associated mechanisms and technologies of calculation, measurement and control that serve the strategic intervention in and governance of social relations.

	Definition of concept	Effects/indicators
Disciplinary-technological selectivity	Disciplinary-technological selectivities are complex ensembles of knowledge, orders of discourse, sites and logics of governance and calculated intervention suited to create and/or regulate particular orders of social relations.	"[A]symmetrical effects of […] technologies of measurement, calculation, subjectivation, communication, disciplinary normalization, governmentality, and so on" (Jessop, 2014, p.211) in the realm of urban transport governance in terms of how they produce objects of knowledge/power and subjects 'who know' about these objects and are, therefore, in a position to exercise more or less power over these objects

Table 8.4 Disciplinary—technologically inscribed strategic selectivity

Transport investment appraisal via cost-benefit analysis

A first concrete example of a disciplinary technology operating in the context of the London cycling case are dominant investment appraisal technologies, such as cost-benefit analysis (hereafter CBA) that demand the quantification of costs and benefits incurred by competing transport schemes in monetary terms. To do so standard CBA

> *"focuses primarily on traffic, since user benefits dominate the welfare gains through time savings and lower accident costs, plus congestion and reliability effects." (Vickerman, 2017)*

In this sense, CBA also strongly reflects dominant transport sector discourses that emphasise the need for increasing and increasingly frictionless mobility to facilitate economic growth and competitiveness. Or, more to the point, CBA and similar appraisal methods were precisely articulated to function as tools for regularising and disciplining transport appraisal and investment decision-making processes in ways that ensure selected transport interventions deliver best 'value-for-money' in as defined by dominant road transport sector imaginaries and discourses.

Inscribed in these technologies are multiple selectivities. On the one hand, they act to privilege investment in modes whose costs and benefits are readily quantifiable. On the other hand, and by virtue of their technical nature and knowledge intensity, they serve to establish some actors as skilled users of these technologies and as qualified or expert voices in transport investment decision processes. By that same token, however, the same technologies also act to exclude actors unfamiliar with them or unskilled in their use as 'unqualified' voices from infrastructure investment decisions. As such, evident selectivities arise.

For example, actors, such as transport professionals make and communicate their case for new road infrastructure schemes using established and recognised appraisal methods. This is in part due to the resonance and effectiveness of these technologies and the discourses they rest on within the established urban transport governance regime. In part the use of these appraisal methods and technologies may even be formally required as is the case in the London context where proposed infrastructure projects need to lay out detailed business case, largely in line with the "national methodology as prescribed by the Department for Transport's (DfT) web based appraisal guidance WebTAG" (TfL, 2013d).

From a CPE perspective, planners would comply with these prescribed methods and technologies with the intention of reducing uncertainty regarding appraisal inputs and

procedures, and ultimately appraisal outcomes. Thereby these regime actors both act on and re-enact established and recognised appraisal methods and guidelines as forms of disciplinary technologies reinforcing the selectivities inscribed in them. Other actors stemming from outside of that profession who instead seek to promote schemes and modes whose benefits are not readily expressed in economic, monetary terms, by contrast, face obvious barriers in terms of making a persuasive case for the investment in such schemes and modes. This has in the past applied, for example, to the mode of cycling and active modes more generally as acknowledged by London Cycling Commissioner Andrew Gilligan in a meeting of the London Assembly Transport Committee where he agreed that:

> *"there are sometimes difficulties […] in measuring cycle schemes by traditional benefit cost ratio (BCR) type metrics, because not all the benefits are immediately quantifiable [while] some of the disbenefits are all to quantifiable." (GLA, 2014b)*

A TfL representative attending the same meeting further pointed out that the TfL-required

> *"type of business case assessment and valuation, even with its faults, … [does allow TfL] to identify journey time reliability benefits, safety benefits, the benefits in terms of improved journey flow to other users and overall using the recognised business case methodology." (ibid.)*

These are, however, not necessarily the most compelling benefits cycling schemes offer. For example, benefits arising from potential modal shift generated by investment in cycling infrastructure cannot be adequately quantified in monetary terms in the context of the business case valuations TfL requires. This is in part because of the fact that "[TfL] modelling […] assumes that there will be no modal shift whatever", which, while "a standard artefact of modelling […] is one of the reasons why traditional indicators do not always capture the full benefits of cycle schemes" (ibid.).

It may, therefore, be said that the current structurally inscribed requirement for business case evaluations relying in part on the established appraisal methodology of CBA gives rise to a disciplinary-technological selectivity that systematically privileges schemes for motorised modes in the context of which these procedures and measurements were developed.

At the very least it is evident that cycling schemes are systematically disadvantaged by this appraisal methodology as it remains heavily skewed towards valuing traditional indicators, such as travel time savings and journey reliability (Laird, et al. 2014). Schemes entailing the re-allocation of significant road space from motorised transport to the bicycle

may in connection with this be valued as not producing significant times savings, or indeed negatively affecting the travel time and journey reliability for motorised road modes. This is not only a selectivity inscribed within the methods and technologies utilised for transport appraisal. It is also a rationale that remains deeply embedded in the thinking of transport professionals, as one interviewee suggested:

> *"I am an engineer by trade, by education. So, you go through engineering as a career, and you're shown all these amazing tools to deal with things like water and transport and modelling for cars and vehicles and stuff, and you get that embedded in your brain for years and years and years. And so, you come out of training with this perspective that's very difficult to change. Even the more kind of forward-thinking, for example, modelling people or signals people they still live in this frame of mind 'Yeah, cycling is good, but if I put it in it's going to stop traffic'. And traffic is sacrosanct." (GL-3)*

Agential responses

Mitigating against this selectivity inscribed in CBA as a disciplinary technology requires the creative effort of the evaluator, e.g. by inferring the monetary value of health benefits of a cycling scheme on the basis of estimated cost savings to the public health service or quantifying the monetary value that decreased absenteeism has on economic productivity. Other times, as suggested in the case of modal shift generated by a cycling scheme, crucial benefits may simply not be quantifiable in full as long as current modelling approaches are unable to account for these.[52]

In connection with this, two transport consultants interviewed emphasised that, in addition to the stringent CBA facilitated ex-ante evaluation of transport investment proposals, more systematic and rigorous ex-post evaluation needed to become the norm in the transport sector in order to establish a sound evidence base for future transport investment decisions:

> *"Actually, with transport we do a lot of ex ante evaluation- appraisal to make the case, develop the business case […], but the ex-post evaluation is very limited as to what works and it depends what your objectives are as to what works, but in terms of sort of economic objectives, we might be able to measure the number of people cycling after an intervention, but then linking that back to jobs growth or increases in productivity, for example, or increases in housing stocks and housing completions is very difficult because the relationship between transport and wider objectives is often quite indirect- Incredibly important, but indirect. So, I think there is a lack of evidence more*

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[52] Established modelling approaches, thus, have themselves significant disciplinary-technological selectivities inscribed in them

broadly, but not just at the planning stage, but also at the evaluation stage."
(UK-2)

Vickerman (2017, p. 2) points out in this context that the focus of CBA, as a technology of transport investment appraisal, is

> *"primarily on traffic, since user benefits dominate the welfare gains through time savings and lower accident costs, plus congestion and reliability effects. [However,] the key question remains as to whether such time savings can be reinvested into welfare producing activities and, particularly when it comes to business travel savings, into productive activities."*

CBA, therefore, takes travel time savings as a short-hand for potential economic gains to be realised from transport investment based on the assumption that the regained time is re-invested in productive activities. A recent literature review, however, suggests that the empirical evidence base supporting the impact of investment in motorised modes on local economic development is mixed (What Works Centre for Local Economic Growth, 2015). As such, Vickerman (2017, p.7) concludes that:

> *"Much of the investment for growth argument in transport projects depends on a balance between hard evidence and perception. Often perception gets in the way of the hard evidence leading to claims about economic transformation and job creation that are hard to justify. The claim that major transport investment can rebalance the economy is often justified by the observation that the economy is unlikely to be able to be rebalanced without investment in transport. But that does not imply direct causality from the investment to the rebalancing; transport is an enabling factor, often an essential enabling factor, but not necessarily the core cause of the change."*

This suggests that the reliability and usefulness of these appraisal methodologies ought to be questioned more fundamentally, rather than them being accepted and promoted as producing reliable and conclusive judgments on what constitutes valuable transport investment choices. In connection with this, one may also question what kind of economies different transport investment appraisal methods support.

Agential responses to the selectivity inscribed in CBA as a transport appraisal method, to date, however, have mostly focused on articulating novel ways to quantify the benefits of active modes in monetary terms. Connectedly, there is a danger that this re-enactment of CBA by cycling advocates reproduces the disciplinary-technological selectivities inscribed in it as well as strengthens taken-for-granted road transport sector discourses and imaginaries that underpin it. As such, exploiting the CBA-inherent selectivities to promote cycling may be productive in the short-term, but stand in the way of more

comprehensive and radical socio-technical transitions, including change in the fundamental imaginaries and discourses driving road transport sector development, in the long-term.

Cycling advocates interested in promoting more radical socio-technical change in the road transport sector (for the benefit of cycling) should, therefore, seek to engage also in practices that circumnavigate or subvert the dominant appraisal methodologies more directly. This could be done by engaging with discourses and actors that question the reliability and representativeness of CBA findings. Furthermore, cycling advocates, especially those professionally involved in providing for cycling, should focus greater efforts on experimenting with and articulating innovative means and measures to evaluate the beneficial and potentially transformational impacts of cycling interventions ex-post. This could enable establishment of a sounder evidence base for future investment in cycling as well as serve challenge continually overstated benefits from investment in motorised modes.

Formalisation and institutionalisation of planning and engineering knowledge

A further example of a disciplinary-technological selectivity operating to privilege the perpetuation of the motorised road transport regime is linked to the strongly institutionalised and professionalised nature of traditional road transport planning and engineering knowledge and expertise. In fact, this institutionalised and professionalised knowledge and expertise arose in coevolution with tools of measurement and control, such as CBA.

In the context of transport planning and engineering for motorised modes an abundance of guidelines, standards, methodologies and good practice have long been formalised. This formalised knowledge and expertise can further be acquired via widely recognised professional transport qualifications. This includes accredited undergraduate and postgraduate transport engineering and planning degrees taught at higher education institutions as well as the range of certified professional development courses offered by dedicated professional associations, such as the Institute of Highway Engineers (IHE), the Chartered Institute for Logistics and Transport (CILT) and the Chartered Institute of Highways and Transport (CIHT), Institution of Civil Engineers (IHE).

As such, traditional road transport planners and engineers may be seen to constitute a profession that has formalised and institutionalised its "highly specialist and complex, but codifiable" knowledge and practices, e.g. through the formation of

252

"professional associations that regulate occupational practices by selecting and rejecting members, by defining educational standards and providing training programs, and by establishing codes of conduct and supervising daily conduct." (Noordegraaf, 2013, p.765)

Countries such as the Netherlands, Denmark and Germany have a longer tradition of formalising and codifying cycling-specific technical engineering and planning knowledge and good practice. The German Road and Transportation Research Association (FGSV), for example, has been publishing regular technical Guidelines for Cycling Facilities (Empfehlungen für Radverkehrsanlagen, for example FGSV, 2010) since 1982.[53] However, given the long decline in the presence of cycling on UK and London roads since the 1950s and its relatively low mode share across the UK limited thought has historically been given to the mode from an engineering and planning perspective. Cycle design guidance issued by the DfT at the national level, for example, is limited to a Local Transport Note published in October 2008 (DfT, 2008).

This lack of central leadership in promoting the articulation and formalisation of up-to-date cycling-specific design guidance within the UK is of practical relevance to the London case in two ways. On the one hand, the absence of formalised and institutionalised standards and good practice has long left traditional, mainstream transport planning and engineering professionals with little guidance to draw on. As one interviewee put it

"We just haven't got a design manual that deals with problems. there isn't something you can point to say 'We've got this kind of roundabout; how do you get people cycling across it?'" (GL-11)

Illustrating the challenge on hand of the highway engineering profession, he argued further that engineers

"won't always be clued up about something that is not even on their radar. They are just going to be looking at the manual and doing what it says. Not every highway engineer is going to be pushing the envelope looking at things that other countries are doing." (GL-11)

This has concrete consequences for the provision of cycling vis-à-vis motorised modes, for which readily available standards and manuals exist, which act to privilege implementation of road transport interventions that give greater consideration to

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[53] A variety of German publications regarding cycling-specific technical expertise, research and good practice examples have bene translated into English and are accessible online at https://nationaler-radverkehrsplan.de/en/literature/research/cycling-expertise, a website supported by the German Federal Ministry of Transport and Digital Infrastructure.

motorised modes over the safety and comfort of cyclists. Connectedly, the interviewee pointed out further that

> *"the big challenge [is] getting these kinds of simple designs from other countries into the British manual so that your average- your bog-standard highway engineer can just do it automatically. It will just happen, rather than it having to be fought for or having to have a sympathetic engineer or politician in charge of the process" (GL-11).*

Secondly, the lack of emphasis on cycling infrastructure design standards and good practice as part of professional transport qualifications produces transport professionals whose ability to plan infrastructure interventions that do justice to all road modes is limited. Interviews conducted with transport professionals suggested that this is indeed the case and prevents transport professionals from building up cycling-related expertise and experience through practice at the local level. One interviewee specifically pointed out that achieving "high-quality infrastructure on the ground" was "one of the things that local authorities really struggle with" (UK-5) and suggested further that

> *"one of the reasons why we don't see more high-quality infrastructure is […] actually because of the capacity within local authorities to design, but also to get those schemes through and up and running and that's a real issue. If you think about things like the design of roads more generally or, you know, design of airports and airplanes we've had, you know, engineers with decades of experience, they are highly-skilled. One of the reasons why we don't get good cycling infrastructure more often in England is because we simply don't have people with the skills to do it all around England." (UK-3)*

Speaking candidly about his own profession of transport planning, another interviewee suggested that he felt compelled to respond to increasingly fervent political commitments to deliver vastly improved cycling environments by saying:

> *"'You don't want us to be building these kind of things, because we're not good enough at it'. And I still see schemes coming forward from bright people and you just think: 'You've never ridden a bike, have you?'" (UK-4)*

The apparent shortage of transport professionals with qualifications and experience in terms of planning, designing and engineering high-quality cycling interventions has also been evident in the London context. Following publication of the ambitious London cycling vision and related large-scale funding commitments by the Mayor, TfL encountered a major challenge in terms of recruiting the necessary personnel with the formal expertise and experience to realise the Mayoral Vision. Andrew Gilligan, the Cycling Commissioner at the time, had to concede as much at a meeting of the London

Assembly Transport Committee in December 2013. Pressed regarding the slow pace of change in terms of cycle-safety on London's roads following the deaths of six cyclists in November 2013 he suggested that

> *"[t]he reason that things are taking the time that they are taking is not because of a lack of political will. It is not because of a lack of official will at TfL. It is not because of a lack of money. We have enough of all three of those. It is for two other reasons. It is to some extent because of a lack of capacity. There just are not that many people in the UK who can design really good cycling schemes and we are hiring most of them. We are hiring an extra 128 people to help deliver the cycling programme." (Cycling Commissioner Andrew Gilligan in GLA, 2013b)*

As Gilligan further indicated, the shortfall was mitigated through large-scale recruitment of new staff. A long-term TfL employee working on cycling remarked in the context of a 2015 interview for this research that

> *"there was about three people working in cycling in London when I started. […] But it was all campaigning and nobody really doing it like at a professional level. There was borough cycling officers, but by and large they were normally part-time positions for people nearing retirement […]. And it's gone now to 200 people at TfL alone working on cycling specifically." (GL-5)*

However, TfL's recruitment drive following the publication of the Mayoral Vision for Cycling in London may have further compounded a similar shortage of cycling-related planning and engineering skills and experience at the borough level. Multiple transport professionals interviewed in the context of this thesis reported having changed jobs or being in the process of changing jobs from a local authority to TfL. This, undoubtedly influences the ability of already constrained borough councils to plan and implement ambitious cycling interventions that challenge the status quo on borough roads.

It may be said that key actors across niche and regime have already taken note of the lack of standards and design guidance. Locally, the Scottish Government published a guidance document 'Cycling by Design' in 2010, and a revised version in 2011 (Transport Scotland, 2011). In 2014, Sustrans published 'Handbook for cycle-friendly design' endorsed by the ICE, CILT and the Transport Planning Society (Sustrans, 2014). In 2014, the London Cycle Design Standards followed (TfL, 2014c) alongside the Welsh Active Travel Design Guide (Welsh Government, 2014). February and May of 2017 further saw the publication of cycling-related amendments to the Design Manual for Roads and Bridges, published by Highways England (Highways England, 2017).

Responding to the lack of formalised and institutionalised cycling-specific professional standards and qualifications, the IHE launched a Professional Certificate for Cycling Infrastructure in 2013 (IHE, 2013). July of 2014, in turn, saw four key associations of the transport professions – IHE, CILT, ICE and CIHT– issue a joint commitment to develop a programme of professional standards, guidelines and qualifications in relation to cycling infrastructure planning and provision (IHE, 2014). In October of the same year CIHT further published a guidance document titled "Planning for Cycling" (CIHT, 2014). The backlog of transport professionals without cycling-specific expertise and experience, however, is likely to frustrate delivery of high-quality cycling interventions for the foreseeable future, particularly at the local level. Speaking from personal experience as a local authority transport officer, one interviewee suggested specifically that cycling was

> *"such a specialist area, you need people who have got that knowledge and experience and who are very passionate and interested in getting things done, because it still […] meets a lot of resistance and if people are not passionate about delivering it they probably just put their hands up and say 'Ah, this is too difficult. I give up!'" (LBL-4)*

And even where expertise, experience and passion are present at the local level the battle for cycling may not automatically be won. For example, one council officer interviewed highlighted variations in cycling-related expertise and ambition across different transport functions in local authorities as stumbling blocks. He specifically spoke of generational and cultural differences between transport planners and highway engineers as a source of friction when it comes to planning and delivering high-quality cycling interventions. In his view,

> *"a lot of transport planners are aspirational. They want to see – and for good reason – they want to see more sustainable transport. There's a cultural difference. They want to see more sustainable transport, and they'll be younger, they'll be, you know, graduates or whatever, and they'll have these sustainable transport aspirations. People who implement tend to be traditional engineer-types who may be on average slightly older and will have come from a cultural background where they would have been designing to implement highways schemes to [accommodate] a lot of motor traffic. […] So there is a potential tension between the aspirations of the planning side and the realities of how to implement things. And to be fair those realities are inevitable." (RBG-3)*

Another interviewee emphasised the role of austerity-induced local authority funding cuts in challenging the delivery of an ambitious cycling strategy. Specifically, a self-imposed recruitment freeze left the council unable to

"recruit staff that were needed [to deliver the borough's cycling commitments]. And so there has been actually a gap between, you know 'There is the strategy. Yes, we actually have funding to deliver stuff, but there is a recruitment freeze on at the moment'. And that seemed to be a recent road block, that, you know, you kind of go 'Well, we got this money to spend within this period of time, but there is a recruitment freeze so we can't get the people in, but we can employ a consultant, but that will cost more and...' - Arrrgh!" (LBL-1).

Agential responses

Cycling advocates and niche actors recognised the lack of UK-specific institutionalised and formalised cycling-related standards and professional qualifications as problematic early on.

This recognition led to the formation of a variety of informal and formal forums for dissemination and exchange of knowledge, experience and good practice relating to cycling at the London level and beyond. On the informal side of the spectrum cycling niche actors engaged and continue to engage in uni-directional information exchange via dedicated online blogs[54], which scrutinise, for example, cycling policy and proposed infrastructure designs as well as sharing information, such as cycling related research, statistical trends and international good practice. Aside from blogs multi-directional social media exchanges and networking takes place via Twitter, Facebook and similar social networks. At an intermediate level of formality there exist numerous smaller-scale events and seminar series hosted by London academic institutions, campaign groups or even Transport for London. These forums focus on knowledge exchange and collaborative development of a common knowledge base among a diverse audience including academics, practitioners and activists. At a higher level of formality an increasing number of formal cycling conferences are springing up at borough and Greater London level as well as beyond to similarly promote knowledge exchange and networking among niche and increasingly across niche and regime actors. All these knowledge exchange and networking practices have served the increasing organisation and formalisation of cycling related expertise and knowledge production within the niche and beyond. From the perspective of campaigners and advocates this knowledge base is essential in terms of enabling scrutiny of ongoing road transport sector developments.

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[54] For example, 'As Easy As Riding A Bike' (https://aseasyasridingabike.wordpress.com), 'The Ranty Highwayman' (http://therantyhighwayman.blogspot.co.uk) and 'Cyclists in the City' (http://cyclelondoncity.blogspot.co.uk),

Individual transport professionals as well as a number of select professional transport organisations who may be more appropriately thought of as actors operating within the existing road transport regime have further played key roles in the articulation and dissemination of cycling-specific knowledge, standards and good practice. Connectedly, these actors have established themselves quite organically as key experts and important nodal actors straddling the divide between niche and regime. On the one hand, they are generally cycling advocates and, therefore, close to niche interests. On the other hand, they have both mainstream transport planning and engineering qualifications and extensive experience of undertaking cycling-specific planning and engineering tasks, which makes them recognised and desirable sources of expertise also from a regime perspective. Interviews further revealed that the increasing organisation and amassed expertise of these actors has already led to a blurring of dividing lines between niche and regime. Individuals interviewed with respect to their professional roles within the urban road transport governance regime often also self-identified as cyclists and cycling advocates or campaigners, in addition to their professional roles. As such, they play important roles in driving socio-technical change from within the regime.

And, although activists and campaigners without a formal professional background in transport are unlikely to participate in the articulation and institutionalisation of standards and guidance directly, they have shown themselves to be very aware of the need to press for and influence as far as possible the articulation of such standards. They may do so, for example, by responding to consultations and calls for evidence. Others may pursue a more strategic route, as suggested in conversation with one campaigner who explained that:

> *"what we are trying to do is to affect the main guidance and the main standards and then it's up to [the transport profession] to keep up with their own professional guidance […] What I am trying to learn and then influence is: What are the mechanisms for training? Who are the professionals […] along the chain?', because there is a heck of a lot of them, with all different roles and really quite crucial each time. What professional guidance do they get? What standards are they having to follow? How […] do they know when things have changed? And all of that…That's the kind of the thing that we need to influence." (GL-1)*

A specific agential response to the lack of cycling-related design standards and guidance has further been observed at the local authority and borough level. Recognising the limited experience of designing for cycling at the local authority level council officers across different boroughs spoke of having approached the process of development new cycling

schemes in novel ways. Specifically, council officers saw a need for cycling interventions on the basis of broader public consultation through a form of community-led design.

An interviewee explained the difference between traditional consultations and engagement-led design as follows:

> *"There is community consultation that just 'This is what we're going to do. Do you like it: Yes or No?'. And how horrible is that? Community engagement is 'This is what we want to do? You have option A, B and C, which one would you like?'. Community-led design is 'Look, this is what we would like to do, or this is the ambition, but what are your problems? What would you like to do?'. And in some cases, you end up doing things that are radically different, but still achieve the same aims." (GL-3)*

On the one hand, council officers explained that they undertook this kind of early and interactional stakeholder engagement to enable them to better understand the needs of the local community as they relate to intervention proposed. On the other hand, it enabled them to reduce the risk and cost associated with extensive planning, designing and programming work being undertaken on a proposed cycling intervention that may fail to receive the necessary support from the public and electorate at consultation stage. This last point appeared to be a particularly significant motivating factor in recognition of the fact that investment in cycling remains far from universally supported, which, as one interviewee explained is due to:

> *"public attitudes. Because so few people were brought up cycling- that's the big difference between us and Europe. In Europe everyone thinks like a cyclist even when they are driving a car. Here everyone thinks like a driver even when they are cycling. That takes a generational turn and that's kind of where we are." (GL-4)*

Connectedly, interviewees at multiple councils reported undertaking non-traditional and in some cases more comprehensive public engagement processes to ensure that resulting interventions would be well-received by the local community and encourage positive shifts in general attitudes to and uptake of cycling. Importantly, these engagement processes and resulting interventions not only acted to facilitate infrastructural change at the level of the community. They also posed significant learning opportunities for council officers in terms of how to engage productively with residents around proposed changes and to gain valuable outside input into their own work. One interviewee suggested that

> *"As a transport practitioner myself it's really rewarding to kind of get involved in that process and having to take a backseat and having really to*

> *listen to them, not going in there to convince them about your- 'Because I am the expert, I did five years of training' […] - No, they live there." (GL-3)*

For some the learning has resulted in a broader reorientation of their professional practice, such as in the case of a Southwark council officer who explained that

> *"as an officer it's changed the way that I work. So now, instead of doing a lot of research initially, I am much more willing to just go out and talk to people and find out what the real issues are and then do the research […] It's almost […] looking within the borough first for the ideas and then looking outside, whereas before as an officer I would have looked externally first, come up with some ideas and then consulted on that, whereas it's completely shifted the way that I work" (LBS-4)*

In Greenwich, council employees experienced similar learning from the consultation-based process through which they developed their cycling strategy. One interviewee specifically reported that they were using the experience

> *"as a template for other transport-related strategy. […] So, for example, we used that template of process for our parking strategy, last year and we are using that same thing in other areas. The flood risk strategy is using that similar sort of process. It's been- clearly not replicating exactly, but that process of having a good evidence base, communicating, consulting and then adopting and then feeding back" (RBG-2)*

This change in how consultation and engagement is practiced at the level of the borough may, of course, also be motivated by increasing financial constraints, both due to limited cycling budgets as well as due to stark reductions in council resources under the broader austerity agenda. These changes do not appear to have been fully pre-meditated by the stakeholders interviewed. Nonetheless, they suggest that beneficial, if unintended, socio-technical changes are occurring at the level of mainstream road transport governance processes in connection with boroughs' efforts to strategically increase cycling provision and ridership at the local authority level.

8.3. Discussion of findings

Chapter 7 initially presented evidence suggesting that a dialectical process of colonisation/appropriation is underway in the London transition process, with the London road transport regime being colonised by niche actors and interests, while the regime was itself observed to be appropriating niche interests and actors. The chapter connectedly diagnosed a blurring of the niche-regime divide making it challenging to designate

different stakeholders as niche or regime actors. Recognition of this challenge is echoed by other researchers in the field who consequently emphasise "the need to avoid overly schematic analyses on which business and government actors are attributed to the 'regime' and civil society is equated with 'niche' agency" (Avelino, et al., 2016, p.560). The designation of an actor as part of the regime or the niche is ultimately based on and reflecting the analyst's assessment of an actor's relative position of power and ability to facilitate or inhibit a socio-technical transition.[55]

In recognition of the blurring of the niche and regime divide, and in connection with the perspective taken in this thesis, the analysis of the relative power and ability of transition stakeholder to influence a given socio-technical transition process should instead focus on identifying concrete selectivities inscribed and operating in a given moment during and ongoing socio-technical transition. As Chapter 8 has shown, such analysis serves to draw attention to the relational constitution and workings of power in ongoing processes of socio-technical change. Findings suggest that cycling advocates across niche and regime engage in more or less strategic context analysis and calculation to enable them to variously exploit, circumvent or subvert selectivities, which privilege the reproduction of the dominant motorised transport regime, to further the interests of the cycling niche.

As such, the study of selectivities has served to emphasise that power is not an objective, immutable characteristic held by some transition stakeholders, e.g. regime actors, over others, such as niche actors, who 'lack power'. Rather it demonstrated how some actors, actions and interests are privileged by selectivities inscribed in the dominant socio-technical regime, while also highlighting evidence of agential selectivities at work in identifying, exploiting, circumventing or subverting encountered structural, discursive and disciplinary-technological selectivities. In addition, the notion of selectivities emphasises the role that the increasing sedimentation, institutionalisation and uncontested reproduction of certain socio-technical imaginaries plays in strengthening the dominance of existent socio-technical configurations, while challenging the articulation and enactment of alternative socio-technical imaginaries and configurations. The analysis of

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[55] While Chapter 7 closed by approximating a multi-level perspective and designating certain actors in the London cycling case as part of niche or regime, it also clearly acknowledged that the dividing lines are blurring. It is important to remember that the multi-level perspective is and remains a heuristic device, i.e. it offers a framework of ideal-typical concepts that are unlikely to find pure expression in reality. Nonetheless, it is evident from the approximate multi-level perspective articulated in Chapter 7 that it enables a useful, if coarse characterisation of ongoing change dynamics in the London cycling case.

selectivities acting in the context of socio-technical transitions processes can draw attention to the unquestioned imaginaries, discourses, practices, institutional forms that act to privilege the perpetuation of dominant socio-technical configurations and obstruct transition to new socio-technical orders.

By identifying individual selectivities that act to 'prop up' specifically undesirable and unsustainable socio-technical regimes, transition stakeholders, including transition researchers, can engage in more strategic analysis of ongoing transition processes to identify potential ways of exploiting, circumventing or subverting existing selectivities in their interest. On the other hand, identifying specific selectivities that act to perpetuate a given socio-technical regime can also usefully inform the strategic pursuit of similar institutional and material forms that enact similarly selectivities, though favouring the consolidation and perpetuation of a particular socio-technical niche.

This was illustrated by way of analysis of the London cycling transition case. The analysis conducted identified a number of different strategic selectivities operating in the London case during the period of primary data collection between March 2013 and April 2016.

Connecting Analysis I and II, Chapter 8 showed, specifically, how the dominant road transport sector imaginary of transport as a means to foster growth and economic development discussed in Chapter 7 gives rise to a strong discursive selectivity. On the one hand, this selectivity is being relied on by regime actors to discursively reconstruct cycling as a mode integral to the continued smooth operation of the wider road transport sector. On the other hand, analysis also suggested that cycling advocates are increasingly drawing on this discourse to make the case for improved cycling provision. This points to an agential selectivity at work, in the sense that cycling advocates have recognised and are now exploiting this discursive selectivity to advance the mode of cycling by similarly constructing the value and purpose of cycling to some extent within the narrow parameters of economic and monetary gains (e.g. public health expenditure savings, congestion relief, reduced absenteeism, etc.) that may be realised via promotion of the mode. The discursive selectivity identified and discussed is in this sense recognised and exploited both by regime actors and advocates of the cycling niche to re-establish cycling discursively as a significant mode on London's roads and one that is worthy of increased investment.

The strength of this discursive selectivity and the degree to which it has been sedimented and institutionalised was further illustrated by examination of a concrete disciplinary-technological instantiation of said discourse. The specific example considered concerns

CBA as a dominant method in transport investment appraisal. The analysis presented evidence that suggests that some of the interviewees spoke of the constraints the CBA method historically posed in the context of making the case for more investment in active modes, and here specifically cycling. In particular, the CBA method was argued to have been developed around motorised modes and as such places significant emphasis on the welfare gains accruing directly to the user of a transport modes, while discounting broader societal benefits that are less readily quantifiable in monetary and economic terms. These criticisms are further supported by a growing range of academic research and evidence reviews that similarly point to the to-date limited empirical evidence base linking transport investment to local economic growth (Laird, et al., 2014; Vickerman, 2017; What Works Centre for Local Economic Growth, 2015) as well as arguing for the need to rebalance the appraisal methodology to consider broader environmental and societal benefits arising from transport investment (Martens and Di Ciommo, 2017; Næss, 2006; van Wee, 2012).

A discussed agential response in this context are cycling advocates' efforts to approximate the economic benefits accruing from investment in cycling via proxy-measures, such as the economic impact of cycling-related public health improvements have on public health expenditure, workplace absenteeism, and the like. This presents a suitable way for cycling advocates to read and exploit the disciplinary-technological selectivity inherent in the CBA method. Nonetheless, it should be recognised that such exploitation of a strategic selectivity, while beneficial for the promotion of cycling in the short term, also serves to reproduce CBA as a recognised method for transport appraisal (alongside the dominant imaginaries and discourses inscribed in these selectivities). It may thereby contribute also to the reproduction of the broader motorised road transport regime of which this appraisal method is a constitutive element.

A more promising way forward to promote a more radical transformation of London's road transport sector in favour of more utility cycling would likely have to entail a significant effort to actively subvert dominant road transport sector imaginaries and discourses. Here, the analysis pointed out a significant opportunity and need to build broader as much as deeper discourse and advocacy coalitions uniting individuals and organisations in pursuit of, not necessarily identical, but certainly complementary values and goals across different governance scales. The research highlighted specifically an opportunity for cycling advocates to build broader alliances that include structurally more powerful interests, such as the lobby for disabled cyclists. These potential allies may be said to hold more structural power due to being furnished with a legal right and claim to

inclusive (and likely more generous) public cycling infrastructure via the Equality Act 2010. Meanwhile, the cycling community must similarly recognise itself and act as an ally to the causes of other adjacent groups and their issues. Consider, for example, the fruitful overlap between childrens' mobility, the mobility of the elderly and of disabled people. Bicycles can play an important role in enabling higher levels of independent mobility for members of all three demographic groups. Conversely, providing infrastructure and a road transport environment that encourages and sufficiently considers the needs of road users whose mobility is impaired within the current transport system can ultimately increase the attractiveness of the bicycle as a mainstream utility mode for a broader demographic while also increasing overall safety for other road users. This prospect may be made more palatable and enticing when these different causes are recognised or purposefully considered as complementary niches within what may perhaps be thought of as a broader global socio-technical transition towards more equitable and sustainable urban transport systems.

Thus, disabled cyclists, parents, children and the elderly must also be recognised as a pool of potential allies in the broader pursuit of better conditions for active modes.

Achieving such improved provision for cycling and other active modes is necessary to foster a more radical cultural shift in London's road transport system as well as a shift to a new discourse of transport as a means of facilitating inclusion, social equitability, active lifestyles and more liveable neighbourhoods and communities for all. This need of course not exclude economic considerations. However, transport investment decisions should no longer be made to rest primarily on their presumed beneficial impact on economic growth and development as a(n unreliable) proxy measure for broader human development and quality of life in urban contexts and beyond.

While the analysis pointed out a number of promising agential responses to each of the selectivities discussed, it is important to note that these represent still largely isolated agential selectivities. Concrete instances in which these agential selectivities serve to 'make a difference' in the ongoing cycling transition may be identified at specific moments in time and place. However, to what extent these diverse instances of agential selectivities can stabilise and come to be reproduced in such a way that they may aggregate and coevolve to form novel socio-technical configurations with stable inherent logics that can ultimately challenge the existing dominant socio-technical regime of motorised road transport, is a matter that can only be judged in retrospect once the transition has progressed much further. It is certainly clear, that at this point in the transition process the

elements of the dominant socio-technical regime discussed here[56] remain strongly aligned and internally coherent. Together the structural, discursive and disciplinary-technological selectivities discussed may therefore be said to form "a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions" (Foucault 1980, p.194) together constitute the regime or a dispositive, in the language of CPE (see also Section 5.2). This regime or dispositive of selectivities enforces the relatively stable production and reproduction of the dominant motorised road transport regime and was shown to challenge the ability of cycling advocates across niche and regime to articulate and enact alternative imaginaries and social practices. For example, to make the case for investment in cycling both discursively and via recognised appraisal technologies cycling advocates were shown as having to reconstruct the meaning and significance of cycling in reference to economic-monetary discourses that are not primarily drawn on by actors to make sense of and impose meaning on the social practice of cycling.

To the extent that the exploitation of said selectivities works to reproduce said selectivities, exploitation of selectivities may not be the best way to promote radical socio-technical change towards more sustainable systems of production and consumption in the long term. In fact, niche stakeholders' reliance on exploiting encountered selectivities instead of actively seeking to circumvent or subvert them may in the long run serve to skew overall transition dynamics towards a reconfiguration pathway (see Table 3.2) that sees the motorised road transport regime reconfigure itself around the cycling niche to preserve its overall power and dominance over the long-term and prevent more radical socio-technical change.

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[56] As relating, for example to the structural organisation of transport governance as a multi-level process subject to democratic processes and electoral cycles; the domination of transport sector narratives by imaginaries and discourses linking mobility and transport with economic growth and development; the reliance on transport appraisal technologies such as CBA; the existence of bodies of formalised and institutionalised planning and engineering knowledge as collections of various disciplinary technologies.

CONCLUSION

9. CONCLUSION

This thesis sought to contribute to ongoing research efforts regarding socio-technical and sustainability transition phenomena. Specifically, the thesis set out to investigate the role of micro-level structure-agency interactions in the production of socio-technical change and inertia. The ambition in doing so was twofold: on the one hand, initial literature review suggested a need to identify and critique mechanisms that serve to perpetuate dominant, yet unsustainable socio-technical systems in the urban transport sector. On the other hand, the thesis was motivated by an ambition to enable transition stakeholders to engage more strategically in ongoing transition processes to more sustainable systems of production and consumption. To enable strategic research of these matters Chapter 1 set out an overarching research question and three sub questions to guide the researcher. The following section seeks to answer each in turn.

9.1. Addressing the research questions posed

Having undertaken the research proposed and discussed resulting findings in the previous two chapters, the following section returns to the original research questions motivating this thesis.

To remind the reader, the central question motivating investigations for this thesis asked:

What is the role of micro-level structure-agency interactions in the transition process and how do these dynamics contribute to the stimulation or obstruction of radical socio-technical change towards more sustainable urban transport futures over time?

In order to address this overarching research question the thesis investigates a number of sub-research questions more specifically:

(i)   *Do all transition actors face a common structural context, i.e. the same action constraints and opportunities?*

(ii) *If yes, do different actors pursue different action strategies in this common structural context and why?*

(iii) *To what extent and why are some transition actors and their actions more successful in given moments or periods of a transition?*

To answer sub question (i), the research drew on insights from the CPE literature. Specifically, the thesis established that while transition stakeholders may face a shared structural contexts, they do not necessarily face the same opportunities and barriers for action within said context. On the one hand, the structural context, which actors face at any given moment in time, results from actors' previous efforts to structure a fundamentally complex reality and to enable them to act within this complex reality. Actors' structuration efforts, in turn, reduce the complexity of reality by reducing the scope for actions that are compossible, i.e. not inherently contradicting the existing social relations in a given period in space and time. As such, social actors' efforts at structuring a fundamentally complex reality serve to produce shared structural contexts. These structural contexts have, however, inscribed in them certain discursive, disciplinary-technological and structural selectivities that serve to privilege some actors, interests and actions over others so as to reduce the scope for compossible actions. Thus, the structural contexts shared by different transition stakeholders inevitably privilege the actions and interest of some of these stakeholder over those of others.

In answer to sub question (ii), it may further be said that the ability of different transition stakeholders to exploit or circumvent the strategic selectivities inscribed in a given structural context is also mediated by agential selectivities, i.e. transition stakeholders' differential abilities to read and enact these inscribed strategic selectivities. Factors that may impact on actors' differential ability to identify, read and enact these strategic selectivities are varied and may include, for example, transition stakeholders' differential personal or professional experiences, their differential mastery of particular discourses or social practices, or their varying personal values or psychological dispositions, etc. All these impact how different transition stakeholders encounter and make sense of a given structural context. Of course, this is likely to result in different actors interpreting the same structural context in different ways.

As such, it may be said that, while shared structural contexts for action exist, they do not present identical action constraints and opportunities for every social actor or transition stakeholder. On the one hand, the selectivities inscribed in them privilege action by some and discourage action by other transition stakeholders. Beyond this, transition stakeholders are also differentially skilled in reading, interpreting and enacting their structural context.

In answer to sub question (iii), it may be stated that the success of some transition actors in a given structural context is both structurally and agentially mediated: on the one hand,

different actors, their actions and interests may be inherently privileged by the selectivities inscribed in a certain structural context. These actors are, thus, more likely to be able to act successfully within a given structural context to realise their interests. On the other hand, actors whose interests and actions do not align or even contradict the selectivities inscribed in a given structural context are consequently placed at a relative disadvantage and may not be able to realise their interest without challenge. A further factor impacting on actors' differential level of success in terms of pursuing a specific action or interest in a given structural context is their differential ability to read and enact the selectivities inscribed in this given structural context. Consequently, strategic selectivities that prevent a given actor from realising his or her intended action at one moment in time, may come to be realised as opportunities for action over time and as actors "come to orient their strategies and tactic in the light of [...] their 'feel for the game'" (Sum and Jessop, 2013, p.51).

On the basis of these insights, the overarching research question of this thesis may be answered as follows: tracing and understanding micro-level structure-agency interactions, i.e. transition stakeholders' exercise of agency within a given structural context, is crucial in understanding how socio-technical change and inertia are mediated at the level of everyday action and interaction. Of course, analysis of the structural, discursive, disciplinary-technological and agential selectivities operating during a given transition period may not enable predictions of how an ongoing transition will unfold or offer concrete action recommendations for transition stakeholders. Nonetheless, such analysis draws attention to the ways in which socio-technical dominance is reproduced via the (re-)enactment of taken-for-granted imaginaries, discourses, and practices and highlights opportunities for how socio-technical dominance may be challenged or subverted by radical imaginaries, discourse and practices.

For the case of the London cycling transition, the research highlighted specifically an opportunity for cycling advocates to build broader alliances that include structurally more powerful interests, such as the lobby for disabled cyclists. These potential allies may be said to hold more structural power due to being afforded a legal right to inclusive (and likely more generous) cycling infrastructure in line with the Equality Act 2010.

On the other hand, the analysis suggested that cycling advocates' efforts to make the case for more cycling investment via dominant CBA methodologies of transport appraisal, while yielding successes in the short term, must be recognised as perpetuating a disciplinary-technological selectivity that has to date systematically privileged investment

in motorised modes and continues to serve the reproduction of the motorised road transport regime. Cycling advocates with an interest or involvement in these technical aspects of transport investment appraisal may instead seek to contribute to already existing forums and networks focused on critiquing dominant CBA methods and developing alternative appraisal technologies.

A further insight gained from the analysis relates to the need to further promote the articulation of cycling design and engineering standards as well as the development of recognised cycling-specific professional qualifications. This is particularly important to ensure that the aspired 'cycling revolution' does not remain a localised phenomenon in the UK, but rather can spread throughout UK towns and cities made possible by infrastructures and environments that are safe and enjoyable to cycle in.

9.2. Contributions made

Broadly speaking this thesis makes a contribution to ongoing discussions in the field of transportation research and practice. Specifically, it has aligned itself with a growing number of voices who challenge the orthodoxy of discourses linking increasing and increasingly frictionless mobility to the generation of economic growth and development (see Chapter 2). This orthodoxy may also be seen as underpinning the urban development concept of the smart city and the growing promotion and reliance on ICTs and other technological transport innovations to reduce the externalities arising from increasing levels of motorised mobility. As this thesis sought to argue early on, technological innovation can only be part of the answer in addressing these externalities and the pressing sustainability challenges they give rise to at the urban scale. In connection with expected rebound effects on technology-induced efficiency savings, it is, however, to be expected that short-term sustainability gains realised, for example from the introduction of more fuel efficient engines, the smoothing of traffic flows via real-time traffic signal management or the platooning of autonomous vehicles to maximise road capacity, are likely to be negated in the long run as individual behaviours and wider social practices adapt to take efficiency savings into account. As a consequence, the thesis pointed towards the need to consider a dual social and technological approach to innovating urban transportation systems and to consider genuine demand management policies packaged together with technological improvements and strategic infrastructure investments.

To this end, the thesis sought to investigate innovation in the urban transport sector from a socio-technical innovation perspective and through the specific lens of socio-technical

transitions to more sustainable systems of production and consumption. This socio-technical transition literature draws attention to the coevolutionary development of society and technology and offers insights for understanding the relative stability and perpetual reproduction of dominant socio-technical regimes, such as the motorised road transport regime. At the same time the transition literature has increasingly turned to examine how the relative stability of dominant yet unsustainable socio-technical configurations may be challenged to enable the breakthrough of alternative and potentially more sustainable socio-technical configurations. However, as a literature review identified early on, transition research remains reliant on the retrospective study of past transition processes in search of generalisable insights that may also be of benefit in engaging with or even managing ongoing and future transitions to more sustainable systems of production and consumption.

This is where this thesis has sought to make a central contribution by seeking to articulate a theoretically sound framework for studying the micro-level structure-agency interactions of ongoing transition processes so as to enable the generation of emancipatory insight for stakeholders of these ongoing transition processes. To this end the thesis set out to articulate a crossover between sustainability transition literatures and the literature on cultural political economy and to apply the resulting crossover framework to the case of an ongoing transition towards more utility cycling in the London road transport system.

Since undertaking work for this thesis, other authors have successfully adopted political economy literatures to invigorate sustainability transition scholarship, particularly in relation to a transition to cycling (Jensen, et al., 2017). Yet others have shown a similar interest in (and optimism for) a transition to more utility cycling in the London context (De Boer and Caprotti, 2017). This thesis complements and adds to these studies making contributions both to transition and cultural political economy literatures, as well as yielding additional practical insights as the following sections outline:

Contributions to sustainability transition literature

Firstly, by bringing insights from cultural political economy to bear on the transition scholarship, the thesis was able to theoretically ground socio-technical transition research and specifically the multi-level perspective further. Fundamentally, the thesis did so by reconceptualising socio-technical regimes as relatively complex instantiations of social actors' central need to overcome the fundamental complexity of reality. In reference to the CPE literature the thesis further articulated the dual and dialectical role of two modes

of complexity reduction – semiosis and structuration – in the coevolutionary production of such socio-technical regimes (Chapter 5). Connectedly, it emphasised the need for transition frameworks, such as the MLP, to pay equal attention to both agential sense- and meaning-making, and structuration efforts to understand how these perpetually coevolve to reproduce existing dominant socio-technical configurations or produce alternative and innovative ones. In this sense, the thesis offers a sounder theorisation "of what is coevolving with what, how intense [the] process [is] and whether indeed there is a bi-direction of causality" (Malerba, 2006, p.18).

Secondly, the thesis extended the analytical usefulness of the MLP by questioning its reliance on Giddens' structuration theory and offering Jessop's strategic-relational approach to structure and agency as an alternative (see also Chapter 5). By doing so the thesis provides the MLP with a perspective on the structure-agency relation that is able to account for (a) the potential of a given structural context to act as simultaneously constraining on one actor, action or interest while enabling on another and (b) the differential ability of various transition actors to read and enact these structural constraints and opportunities successfully. As a consequence, the crossover allows transition researchers to analytically explore and capture the differentially constraining and enabling effects of socio-technical regimes and their constitutive elements. This is thought to enable scholars and transition stakeholders to gain valuable insights into the micro-level dynamics conditioning change and inertia in ongoing transitions. In this context the thesis contributes to an existing research agenda (see, for example, Fünfschilling, 2014, Fünfschilling and Truffer, 2016, 2014) concerned to 'open up the black box' of structuration processes to theorise how these result from micro-level interactions of structure and agency.

Thirdly, by drawing on the CPE literature and the SRA specifically, the thesis brings a focused attention to the role and relational constitution of power in socio-technical transition processes via its dual focus on both the strategic selectivity of structures and actors' differential capabilities to read and exploit these selectivities. As such, power in transitions (as in any other social context) is not a characteristic inherent to any specific actors on account of their structural position or the resources available to them. Rather, power must be understood as always relationally constituted via the interaction of structurally inscribed selectivities that act to privilege some actors and actions over others, and agential selectivities that describe actors' differential abilities to read and successfully enact the structural selectivities they are facing. This CPE-informed conceptualisation of

power in socio-technical transition thereby contributes to recent engagements of transition scholarship with the role of power and politics within the MLP framework and specific transition narratives (see e.g. Coenen et al., 2012; Lawhon and Murphy, 2012; Meadowcroft, 2011; Raven et al., 2012).

Subsequent application of the modified multi-level perspective to the empirical case of the ongoing cycling transition in London further served to support the augmented framework and its value for the study of ongoing socio-technical transitions. The modified MLP (see p. 125) highlights specifically the interplay between semiosis, as agential sense- and meaning-making, and structuration and the varying significance of both modes of complexity reduction at different stages of the transition process. Exploration of the London case study via the modified MLP showed the framework as useful in bringing attention to the varying role of agency and structure in mediating the actions of various transition stakeholders by focusing analysis on operant discourses and practices, whether novel or sedimented.

More specifically, study of the London case demonstrated how the modified MLP brings into focus the theorised differential action opportunities and barriers faced by various stakeholders of the London cycling transition within a broadly shared transition context. Connectedly, empirical case study via the modified framework drew out differences in the ways in which a range of transition actors, from campaigners to politicians and practitioners at local authority level read, understood and enacted the same transition process and context differently. This further served as a practical example of how different transition stakeholders, based on their variable positioning within the transition process faced differential structural, discursive and disciplinary-technological selectivities respectively facing them in their efforts to promote socio-technical change to re-establish the bicycle as a mainstream transport mode on London's roads.

Study of the London case over a period of time from a critical event in November 2013 to April 2016 (against the backdrop of a brief review of the historic development of UK and London cycling policy) served to anchor analysis of the case via the MLP. Here the framework helped in reconstructing the still ongoing London cycling transition from the unanticipated deaths of six cyclists within short succession as a moment of fracture to the relatively structured complexity of the London road transport system. The resulting moment of relatively confined, yet unstructured complexity opened a window of opportunity for the re-politicisation of previously sedimented road transport sector discourses that cast cycling as a mode subservient to the motorised road transport regime.

The case provided a clear illustration of the theorised variation in discourses and practices across different transition stakeholders vying for control over the discursive construction of the event as either a perhaps more manageable crisis *in* the existing socio-technical system or a somewhat more profound crisis *of* said system.

The investigation of a range of discursive and material practices of cycling advocates both within niche and regime in turn served to highlight how such variation, whether intended or unintended, may disrupt or challenge dominant, sedimented discourses and practices. An illustrative example of this was presented on hand of how CBA has come to be amended over time based on productive novelty being selected, reproduced and retained, e.g. through codification in professional accounting practices. This process of co-evolutionary variation, selection and retention eventually to structuration in the form of sedimented, unquestioned discourses, imaginaries and practices being enacted and re-enacted

As such the case study illustrated the use of the modified MLP in focusing the researchers' eye on the production of socio-technical change and inertia as respectively mediated by the continuous enactment of novel and re-enactment of established discourses and practices by individual transition stakeholders.

Contributions to cultural political economy literature

Though the focus of this thesis was to enrich sustainability transition research by drawing on the CPE literature, it may be said that research presented here also makes a contribution to the latter.

Specifically, the thesis hopes to bring the SRA as a useful alternative conception of the structure-agency relation to the attention of a broader audience. To date, the heuristic remains largely at home within the academic fields of state theory and political economy. However, as Jessop (2009a), as one of its key proponents, has made clear (and as the thesis has hoped to show), the SRA is suitable for much broader application by researchers interested in investigating issues of social change and inertia broadly, and of socio-technical change and inertia, specifically.

Empirical contributions

Via the empirical case study of the London cycling transition the thesis also made a number of empirical contributions.

On the one hand, the thesis reconstructed a substantial, though by no means comprehensive, multi-level perspective on the historical transition process towards more utility cycling on London roads. In contrast to other studies of the London cycling transition published to date (De Boer and Caprotti, 2017), the thesis has sought to also present cycling and London road transport policy-making more broadly, as embedded in a multi-level governance structure. In connection with an analysis of dominant road transport sector discourses at these various level, the thesis was further able to highlight how the strength and ordering power of dominant socio-technical imaginaries and discourses may be expected to multiply if these discourses and imaginaries resonate across geographical and governance scales, as was shown to be the case in the example of the London cycling transition.

Secondly, the thesis interviewed a broad range of stakeholders in the ongoing London cycling transition. And, while some of the insights gathered, for example from transport practitioners, may come as no surprise to other transport practitioners, it is assumed that by way of examining selectivities encountered by a diverse array of stakeholder types the thesis offers a more well-rounded and holistic view on the various barriers obstructing a radical cycling transition in London. It is hoped that where these insights provide new information for a potential reader (and transition stakeholder) they may come to encourage a productive dialogue across stakeholder groups.

Thirdly, the analysis of selectivities in Chapter 8 served to point out particularly fruitful agential responses to strategic selectivities privileging the motorised road transport regime. Based on these a number of recommendations can be made specifically with regards to the building of broader advocacy and discourse coalitions at the level of campaigning. At the level of transport practitioners the analysis suggested a need for more comprehensive efforts to question and replace dominant transport appraisal methodologies resting on a shaky evidence base. Similarly, transport professions must coordinate to foster the development of professional qualifications relating specifically to planning, designing and engineering for cycling. Again, these findings are unlikely to be new to the stakeholder groups concerned. However, cycling campaigners may well recognise that lobbying professional transport associations for more certified and accredited professional cycling-related education is as much in their interest as lobbying their local councillors for more political commitment to the mode. Likewise, behavioural change practitioners working for TfL may well recognise that promoting the safety and comfort of cycling for disabled, elderly and children cyclist in London could enable them

to achieve the broader cultural shifts inevitably needed to make the London 'cycling revolution' a reality.

In conclusion, and in closing the loop to the smart city concept, which served as the original starting point for this research, it may be emphasised once more that this thesis, on hand of the empirical case study, illustrated and highlighted the need for dual social and technological innovation to bring about more sustainable urban transport futures. Specifically, it did so by clearly drawing to attention how existing, dominant transport modes and associated technologies are deeply socially embedded and sedimented in the sense that they are material manifestations and embodiments of dominant discourses, imaginaries and social practices.

The engagement of truly smart cities with the topic of innovation should reflect this in two important ways: Firstly, and in recognition of possible rebound effects on purely technologically derived efficiency savings, the 'smartness' of a city ought to be a measure not merely of how technologically advanced it is. Rather it ought to be a measure of how well a city is able to sustain essential and desirable processes of production and consumption long-term, while minimising their negative environmental, social or economic impacts – whether or not this is enabled by innovative material-technological means or not.

Secondly, and in light of the theoretical and empirical evidence presented by this thesis, smart cities ought to recognise that moving, for example, towards smarter, more sustainable transportation systems and practices is not a matter of replacing existing technologies alone. Rather it is a complex innovation challenge that requires critical interrogation also of the discourses, behaviours, attitudes, and values these technologies embody and enable, and by which their own production and use is enabled. It is here that cities may demonstrate true intelligence by moving beyond the pursuit of technological innovation for its own sake and towards an understanding of innovative technologies as means through which more radical and foundational change may be pursued. Away from dominant, though ultimately unsustainable and towards more benign systems of production and consumption.

It is hoped that this thesis through presenting a framework that calls for a more socially and technologically considerate engagement with innovation may contribute to a possible shift in how (smart) cities and society more broadly value and pursue innovation.

Limitations of the research carried out

Although, the above summary suggests that the research design managed to address the central questions this thesis set out to answer and realise anticipated contributions, it is an indispensable requirement to also consider limitations of this research. However, while these limitations must be openly presented and potential criticisms encountered, they need not be taken as negating the contributions made by this thesis.

A first clear limitation of this research is its consideration of a single empirical case – the cycling transition in London – at a single point in time during this transition process. On the one hand, single case studies have long received mixed reviews as means for scientific discovery. Studying the ongoing cycling transition at a single point in time, on the other hand, may also be considered problematic since transitions are generally thought of as long-term processes playing out over the course of 40-50 years.

Both criticisms undoubtedly pose valid challenges in terms of the generalisability of generated research findings. However, it is at this point important to once again emphasise that the research presented here was not designed to generate such generalisable insight or clear recommendations for action. Instead, as has been made clear from the start, this thesis set out to make an existing transition studies framework – the MLP – fit to enable more critical, emancipatory transition research. As such, the thesis' primary research contribution lies in the articulation of a crossover research framework drawing on two distinct literatures – socio-technical transition literature and cultural political economy literature – and subsequent application of this crossover framework to an example case – the case of London's ongoing cycling transition. The resulting crossover framework was shown to be useful in drawing attention to structural, discursive and disciplinary-technological selectivities that serve to privilege the reproduction of the dominant motorised road transport regime while challenging the further break-through and establishment of utility cycling as a mainstream mode on London roads. These strategic selectivities are, therefore, clearly implied both in the facilitation and obstruction of long-term large-scale socio-technical change towards utility cycling becoming once again a mainstream mode on London's roads.

The focus on a single case at a single point in time not only challenges the generalisability of research findings, but also their reproducibility. This challenge is further compounded by the fact that socio-technical transitions towards sustainability, much like any other 'wicked' social problem, must be assumed to be changing shape over time, as much due

to the interventions of social actors as due to the investigations of social scientists. While this indeed poses a challenge in terms of the reproducibility of the research findings at hand, this is not a concern that is particularly central in the critical social science tradition within which this research has explicitly positioned itself. There, the quality and usefulness of research findings would perhaps be more aptly judged based on their resonance with and usefulness to relevant social actors, in this case the stakeholders of the ongoing cycling transition in London.

In connection with the above, a second key limitation of this research arises from its explicitly critical, emancipatory ambition. An effective critical social science should not stop at merely critiquing the status quo, but should rather move beyond mere critique by actively engaging relevant social actors in an effort to challenge and ultimately overcome said status quo. The thesis may be said to stop short of this. It sought to generate insight and knowledge that can be useful for social actors, such as marginal stakeholders in London's cycling transition, to enable their more strategic engagement in and navigation of the complex socio-technical change processes involved. However, the thesis did not inquire into the practical usefulness of the formulated crossover heuristic and the research insights it generated for actual stakeholders of the London cycling transition.

It must at this point be stated that further steps could have been taken to inquire into the practical usefulness of the framework and research findings to actual stakeholders of this ongoing transition. This could have been done, for example, via explicit consultation of all or some of the individuals originally interviewed to understand to what extent these transition stakeholders consider the insights on the structural and agential selectivities at play in the context of the ongoing cycling transition as relevant and practically useful for their continued strategic engagement in this ongoing transition. Secondly, stakeholders could further have been introduced to the MLP-CPE framework to establish to what extent they themselves may find this framework useful to apply to understand their strategic action space in different moments of the ongoing transition.

Due to concerns about the manageability of such a comprehensive and full-circle research design this step was not included in the initial research design for which ethical approval was sought and granted. As fieldwork progressed it became further evident that the time constraints of PhD research would not permit for the original research design to be amended or extended in order to seek approval for and conduct another round of data collection and analysis post-hoc.

It is in the nature of PhD research, and social scientific research more generally, that the nature and scope of an original research brief shifts shape as data is collected and new insights are generated. However, the time and general resource constraints require researchers to take a pragmatic approach to possible amendments to an original research design. However, this has not prevented the author from thoroughly considering how this initial PhD research may be developed further in the future. Some ideas for this are presented in the subsequent section discussing *'Avenues for further and future research'*.

Avenues for further and future research

As outlined above the research on hand has successfully combined the MLP framework of transition research with the SRA as developed in the context of state theory and cultural political economy. In doing so, the thesis has to some extent opened the black box of structuration to investigate the role of micro-level structure-agency interactions in mediating socio-technical change and inertia in large-scale, long-term transition processes. In line with the critical realist notion of scientific research, however, this does not leave us with final insights or ultimate truths, but rather new black boxes waiting to be opened. The question is then, what new black boxes does this research leave behind? The following section of the thesis considers answers to this question by outlining avenues for future research.

Following on from the discussion of limitations of the research design above, a next concrete step to amend and extend the original design may involve its translation into an action research project (see also Chapter 6). Working directly with transition stakeholders and cycling advocates interviewed in the London case study, such an action research project may seek to (co-)elaborate a more practically useful critical transition framework based on the MLP-SRA crossover heuristic formulated in this thesis. Doing so would further contribute to the agenda of moving from the existing approach of academically-curated transition management to a critical transition research that co-produces practically useful insights for the strategic engagement in ongoing transition phenomena together with stakeholders of these processes.

Thematically, the findings of this thesis further suggest a fruitful avenue for future research in understanding the role of individual actors, and the multiplicity of identities they may take on, both within and across niche, regime and landscape levels. In this context, understanding the ability of some actors to deliberately move between and act simultaneously as regime actors and niche advocates to further socio-technical change or

inertia may be seen as crucial in making sense of transitions currently underway or aspired to in the future.

Future research may, therefore, seek to examine to what extent actors who move between roles and positions at the different levels strategically gather knowledge as part of the niche and exploit it to further its appropriation by the regime. Or, vice versa, to what extent actors employ expertise garnered in their role as actors of the regime to further niche interests. To what extent is a transition actor who occupies dual roles as campaigner for the cycling niche and transport planner within the regime able to bring the two divergent types of expertise together in a way that pushes the envelope in his or her professional practice? Are there different types of transition actors, some of whom are more likely to be effective facilitators of socio-technical change than others? What characterises these actors and makes them more effective?

While findings of this research have only hinted at this being a worthwhile topic to study, further investigation of these questions would be in line with and extend the overall ambition of the thesis to call for more attention to the role of everyday action and interaction in driving long-term, large-scale socio-technical change towards more sustainable systems of production and consumption.

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APPENDIX

Appendix A

Example – Contact email

Dear ███████ ,

My name is Fanny Paschek and I am a PhD student at the University of Greenwich. In the context of my PhD research I am investigating the institutional and human factors shaping the transition to more sustainable urban transportation systems and practices. The goal is to gain an understanding of factors and processes facilitating technological and policy change in the context of urban transportation.

I will be conducting research interviews with a number of people in key organisations in relation to cycling policy and practice in various London Boroughs in the coming weeks. Of particular interest in the context of this research is Mayor Johnson's Cycling Vision in relation to cycling policy and practice in different Boroughs and London more generally.

In connection with this, I hope to interview you to discuss your role and work within the ███████████████████████ , specifically in relation to cycling policy and practice in the London Boroughs and Greater London more generally.

I appreciate that you have many competing demands on your time and I am grateful for any time and assistance you are willing to offer with this research. The interview will be approximately one hour long and scheduled at your convenience. For your information, I attach some background information on the research and nature of the participation sought. The project holds significant scope for the sharing of key research findings with you.

I look forward to hearing from you to arrange a meeting at your earliest convenience and am happy to answer any questions you may have in the meantime.

Please also feel free to pass on this request to any of your colleagues or other parties who you think may be interested in participating in this project.

Best wishes,

Fanny Paschek
PhD Candidate, Department of Systems Management & Strategy

University of Greenwich
Faculty of Business
Old Royal Naval College
Park Row
London
SE10 9LS

http://greenwichtransportnetwork.wordpress.com/
Sustainability, Technology and Innovation Research Group
Supply Chain Management Research Group

Please consider the environment before printing this email

Ms Fanny Paschek
PhD Student
University of Greenwich
Department of Systems Management and Strategy
Old Royal Naval College
Park Row, London
SE10 9LS
██████████████

London, 17th April 2015

Dear Participant,

This short letter provides you with the basic background information regarding this research and answers any possible questions you may have regarding my request.

The title of my overall project is *Smart Cities: Transport strategies for sustainable urban futures* and the aim is examining and understanding the agential and institutional factors shaping the implementation of innovative urban transport policies and technologies.

Transportation of goods and people is at the heart of urban life and cities' prosperity. Ensuring high mobility levels and providing and maintaining the necessary infrastructure is a growing public policy concern particularly in the context of dense urban agglomerations. Significant economic, material and spatial constraints in the face of a pressing need to balance urban demands for economic efficiency, environmental sustainability and social equitability, suggest that radical paradigm shifts may be required to help plan for smarter future urban transport.

Bringing together literatures on urban transport, socio-technical innovation and political economy this research investigates the conditions of socio-technical change and inertia in urban transportation systems. Researching across different modes and city contexts the study aims to shed light on how stakeholders of urban transport innovation processes seek to navigate the specific institutional constraints and opportunities they face to bring about change or enforce stability in urban transportation systems.

The project relies on data gathered from policy documents and other written sources as well as primary data collected through semi-structured interviews, surveys or focus groups with transport practitioners and policy makers, as well as business and community stakeholders.

The results of this research are expected to enrich academic literatures, as well urban transport policy-making and practice alike. The yielded insight is expected to improve or in effect '*smarten*' cities by providing relevant decision makers and stakeholders with a tool to map their strategic position, role and opportunities within the wider urban governance network; thereby helping them to exercise their ability to facilitate and shape transition processes towards smarter transportation for sustainable cities.

The output of this research will include a PhD thesis, conference and journal papers as well as case study reports for each of the urban transport cases investigated.

Who is asked to participate?

The participants are individuals involved in or representing urban transport policy making and practice, transport campaigns and public interest groups in a professional capacity.

What will you be asked to do?

You will be asked to participate in a semi-structured interview to understand your perspective and involvement in governance of innovation in urban transport. More information and an indicative list of questions that may be asked will be provided to you prior to the interview should you agree to participate in the study.

When, where and for how long will the research take place?

Interviews are anticipated to last around an hour depending on your availability and will be scheduled and located at your convenience.

Are there any benefits of participating?

The findings of this study will be written up and fed back to you and other individuals and organisations interested in the findings of this research upon request.

How will we maintain your privacy and confidentiality?

All data you provide will remain completely confidential and will be anonymised as far as possible by separating information from details that identify you personally. All data will be processed, transferred and held via secure methods and disposed of securely as soon as no longer required. Upon request we feed back a transcript of the information you provided and incorporate any changes you may request. Any data will be published in anonymised form only. Quotations may be attributed to individuals by their position only; never by their name (see consent form).

How is this research funded and supervised?

This project is funded by a Vice-Chancellor Scholarship of the University of Greenwich, London, UK and is supervised by Dr Petros Ieromonachou, Head of Department Systems Management and Strategy in the Faculty of Business, University of Greenwich.

What if I have questions about the project?

Please contact Ms Fanny Paschek through the detail provided overleaf. Alternatively you may contact my supervisor, Dr Petros Ieromonachou via email at ██████████████████████

It is up to you to decide whether to take part or not. If you decide to take part you are free to withdraw at any time and without giving a reason. If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

Yours faithfully,

Fanny Paschek

Smarter Cities – Strategies for sustainable urban transport futures

The University of Greenwich is committed to the ethical conduct of research. By signing this consent form you confirm that you are happy to partake in this research.

- I agree to participate in this study, which investigates the uptake of innovative urban transport policies and technologies.
- My contribution to this study will be in the form of an interview, which will be recorded and kept securely.
- I have received information about the principles and the procedure of this study and I understand the principles and procedures fully.
- I have had the opportunity to ask questions and discuss this study and have received satisfactory answers to all my questions.
- I understand that I am free to withdraw from this study at any time (until such time as this will no longer be possible, which I have been told), without giving a reason for withdrawing.
- I understand that any confidential information communicated in the interview and related communication will only be seen and handled by the researcher and supervisors and not be revealed to anyone else.
- I understand that results of this study will be published in the form of a PhD thesis, conference papers, journal articles and other academic outputs, although any information provided by myself will be anonymised as much as possible.
- Written work based on the research findings may identify sources, though individuals will never be named, except by their position.
- I understand that my research data may be used for a further projects in anonymous form, but I am able to opt out of this, by ticking here ☐
- I may request a copy of my interview in the form of a transcript. I can make changes if I want, and advise of anything else to be done to protect my privacy.

The findings of this study will be written up and fed back to you and other individuals and organisations interested in the findings of this research upon request.

I confirm that I understand the points above and agree to participate in this research project.

Name (please print):

……………………………………………………………………………

Signed: …………………………………………… Date: …...……………

Signature of Researcher: ……………………… Date: …………………

London Cycling Case Study

The following list of general and strategic questions relates to the governance of cycling policy and practice in London. The questions should be considered indicative and not definitive for the scope of the semi-structured interviews.

I. **Introduction**
1. Tell me about your current role. In what capacity are you contributing to or involved with cycling policy making and practice in [Borough]?
2. Why did you originally get involved? What is keeping you involved?
3. How do you keep informed about cycling related issues and best practice?

II. **Cycling in [Borough/London]**
4. How would you describe the current status of cycling in [Borough]?
5. Describe to me the best-case scenario for the development of cycling in [Borough/London] over the next ~10 years.
6. What would the worst-case scenario for the development of cycling in [Borough/London] over the next 10 years look like?
7. How do you see cycling provision in [Borough] affected by the decisions made in other boroughs and by TfL?
8. What do you think about the Mayor's cycling vision and how it bears on cycling provision in [Borough]?

III. **Governance**
9. On a piece of paper could you map who is involved in the governance of cycling in [Borough] indicating the extent of their involvement/authority/responsibility?
10. Has this changed since you first got involved? How?
11. How are strategic priorities for cycling provision in [Borough] determined?
12. Has this changed since you first got involved? How?
13. How do you relate to [different stakeholders of the governance network]? Are there particular parties and stakeholders you work closely with and others that it is more challenging to find common ground with?
14. Has this changed since you first got involved? How?

IV. **Successes and failures**
15. Tell me about your greatest achievement for cycling in [Borough] to date. How did you manage to realise it?
16. What lessons did you take from this success?
17. Could you tell me about an issue/project/policy that you thought did not work so well?
18. What have you learned from such past failure?
19. What do you find most challenging in terms of making change/improvements for cycling happen in [Borough]?

20. Is there any point you would like to add or go back to?