RESEARCH ARTICLE

Bikes! Camera! Action?: Exploring the Everyday Behaviours of Urban Cycling to Inform Lessons for Infrastructure Planners

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This paper uses a video-based methodology to explore everyday cycling practices in a city that is not well-known for its cycling provision – namely Liverpool, UK. By looking at the way everyday commuter cyclists travel through the city we explore the ways in which they use the spaces provided, what they prioritise, and through video testimony, why. Using Practice Theory to inform our analysis, we suggest that material infrastructure (e.g., clear and consistent signage) and the competences of confidence and understanding are instrumental to the meanings cyclists ascribe to places. In turn, this can be a limiting factor in how cyclists travel through those spaces. This is most evident at the end of journeys, as cyclists transition from roads to shared spaces and pedestrianised areas, and can result in some routes which become "available" to some cyclists, but not others. The paper makes recommendations for transport planners to consider when providing infrastructure for cycling in similar urban contexts.

1. Introduction

Cycling infrastructure is experiencing an international renaissance. The resurgence of interest in "the local" through COVID-19, twinned with more consistent policies to decarbonise urban transport, represents a turning point in international attention towards active travel and the potential for urban cycling (Nurse and Dunning, 2020, Harris and McCue, 2022). This resurgence is able to benefit from the largesse of previous investments in car transport that provide high quality road surfaces and land use precedence for transport (Dunning and Nurse, 2020), meaning that rarely does land need to be purchased to provide cycling infrastructure. Unlike new train lines and motorways, the rights of public access have normally been previously secured and rarely will environmental concerns preclude expansion of cycling infrastructure. Planning for cycling infrastructure should therefore be somewhat simpler than planning many other forms of transport.

Infrastructure planning of this kind is normally conducted by local government within a nationally prescribed "legal, regulatory and financial framework" (OECD, 2004). However, there is clear evidence that a confluence of national government (e.g., fuel taxation) and local government (e.g. traffic calming) actions combine to create positive cycling conditions (Pucher and Buehler, 2008a, 2008b). This often means that cycling infrastructure can be highly varied within, and between, local authorities. This has implications for spatial accessibility and inequity for residents in different locations (Mora et al., 2021, Padeiro, 2022). Whilst some countries apply high standards for cycling infrastructure (e.g., the Netherlands, Denmark) with clear and prescriptive design standards (Larsen, 2017b), many countries do not. Furthermore, there can be a discrepancy between transport planners' perceptions of cyclists' priorities and the everyday experiences of cyclists (Marquart et al., 2020). Whilst there are some notable exceptions (e.g. Cresswell, 2006), there is little evidence that planning infrastructure incorporates the everyday meanings of cycling that influence behaviours and levels of utilisation (Rérat, 2019).

Planners tend to rely on research into attitudes towards cycling (e.g., local and national surveys), indicators of effective demand for cycling (e.g., traffic counts and mobile phone geospatial data analytics – see Spinney (2009)) for a critique of this as transport geography), and standard design templates to plan local cycling infrastructure. However, there is a gap in the evidence of everyday cyclist experiences in locations with limited infrastructure, which could fundamentally shape these interventions. Whilst policymakers and transport planners tend to look to alternative, often exemplar, contexts for inspiration (i.e., the Netherlands again), they can miss the evidence that is closest; the experiences of current regular cyclists in comparable spaces. In this study, we respond to this gap in evidence. Using Practice Theory, and by exploring existing behaviours of everyday cyclists in Liverpool, a city with limited cycling infrastructure, we provide insights into bottom-up evidence for planning cycling infrastructure.

This paper makes three substantial contributions. First, we demonstrate the utility of a novel method for capturing cyclist behaviours in an urban context, which goes some way to addressing the shortcomings of other approaches as identified by Pooley et al. (2013). Second, through this approach, we demonstrate how the meanings of infrastructures (both those designed specifically for cycling, and those repurposed or utilised) are significant for everyday cycling. Thirdly, we argue that local transport planning needs to grapple with these issues in order to plan appropriate cycling infrastructure.

The rest of this paper comprises five parts. We examine the context for cycling in the United Kingdom (UK), as the cultural context for our case study; in this we explore the historical cycling situation in Liverpool and the transition that has taken place through COVID-19, mirroring the situation in many other cities. We then explain our methodological approach to understand cyclists' experiences, utilised within a Practice Theory framework, which we explain in section four. An analysis of cyclist self-recorded videos and reflective interviews is then discussed in detail. Here we identify five themes: mundanity, route choice, impermeable barriers, legality, and end of route transition. In the penultimate section we consider the impacts of these five themes on planning for cycling infrastructure, before a short conclusion recaps the contribution that the paper makes.

2. Cycling in the UK: putting Liverpool in context

Although urban cycling is currently experiencing something of a resurgence within UK transport agendas, when considered against other European nations the UK is not known for its high cycling rates, or support. Following a massive post-war decline in cycling rates as car

ownership became more prevalent and affordable (De la Bruheze, 2000, Oldenziel et al., 2016, Reid, 2017), cycling held a stubbornly low share of the UK's modal split.

Throughout the latter part of the 20th century there was recognition that whilst the car dominated ideas of "progress", cycling would continue to play an important part in modal shares. For example, the New Towns movement included off-road cycleways as part of their transport network. Perhaps the best example of this is Stevenage, which built 23 miles of segregated cycle network in the 1960s (Reid, 2017). Even so, and despite representing contemporary idealised infrastructure, these interventions had minimal effects on cycling rates. Arguably the resurgence of cycling in UK transport policy came as the sustainability movement gained momentum during the 2000s. "Sustainable development" increasingly underpinned the UK Government's planning policy, at the time delivered via the Office of the Deputy Prime Minister (ODPM, 2003) (ODPM, 2003), and "cycling cities" gained £100m of funding to expand infrastructure (British Broadcasting Corporation – BBC, 2008). During this time, London began to expand cycling provision, firstly through its cycle-hire scheme, and latterly through the creation of cycling "superhighways" along strategic routes. There was some tangible success in those places. For example, Bristol's cycling implementation underpinned its hosting of the 2015 European Green Capital award (Ersoy and Hall, 2020), whilst London is now an exemplar for cycling provision. The next acceleration came In the late 2010s, when newly elected Metro-Mayors obtained control over local transport spending, and in many cases would go on to appoint Walking and Cycling Commissioners (Sturzaker and Nurse, 2020). The Metro-Mayors and their commissioners also enjoyed widespread public support – for example 67% and 69% of the public in Greater Manchester and the Liverpool City Region respectively support giving road space to cyclists, even if it means less space for cars (Sustrans, 2020, Sustrans, 2019). This reflects research suggesting that implementation of cycling measures reflects political will (Larsen, 2017b, Cox and Koglin, 2020).

The latest major shift emerged in the wake of the COVID-19 pandemic, and the changes to urban life, which thrust cycling to the heart of urban transport in a way many could not have foreseen at the start of 2020. This came in two stages. The first was when many people opted to cycle during the "lockdown" conditions put in place to respond to the early pandemic, (Nurse and Dunning, 2020, Buehler and Pucher, 2021). The second came when many countries, including the UK, sought to create temporary "pop-up" cycleways to facilitate those willing/able to travel to work by bicycle, minimise the use of cars, and ease the burden elsewhere on the road network (Buehler and Pucher, 2021, Harris and McCue, 2022). However, as urban authorities began implementing planned and "pop-up" cycling infrastructure at a rapid rate, the way in which this is done becomes important and raises crucial questions. Where does it go? What quality is it? Does it meet the needs of all users? To answer those questions, we need to be aware of how users – particularly those who may be new or less-experienced cyclists – use the roads whilst cycling. Whilst there are a wealth of studies centred on international exemplar cities (e.g. Pucher and Buehler, 2008b, Oldenziel et al., 2016, Larsen, 2017b, Larsen and Funk, 2017), and some UK-based exemplars such as London (Latham and Wood, 2015, Aldred et al., 2019) and beyond (Pooley et al., 2013), there remains less research on cycling provision/activity in cities with lower cycling rates. This is perhaps unsurprising, reflecting a broader tendency to focus on "celebrity" case studies (Thrift, 1997), even despite the need to recognise that contexts differ and exemplars may not be transferrable (Sheldrick et al., 2017).

This study addresses that gap through a study of "non-exemplar" spaces who, nonetheless, are making attempts to improve cycling provision. It expands our understanding into places that are not at the forefront of cycling-rates or infrastructure delivery, and can help other places in similar positions. To this end, this paper presents a study of every-day commuting

cycling in Liverpool, UK, inspired by the Practice Theory work of Latham and Wood (2015) and Brown and Spinney (2010).

In selecting Liverpool as a case study, we argue that it represents something of an "ordinary" city (e.g. Buck and Nurse, 2021). At 2%, the Department for Transport (DfT) estimate that the city's cycling modal share is similar to the UK average (DfT, 2019). Yet, given that cycling rates tend to be higher in cities, this belies a historically weaker performance compared to other UK cities (DfT, 2017). This weaker performance, and a modal share that varies little across the city, is, perhaps, a reflection of two factors. The first, is a longstanding shortfall in infrastructure provision which has lagged behind both other UK core cities and European exemplars (Nurse and North, 2013). For much of this period, Liverpool only had two significant pieces of cycling infrastructure: a waterfront cycling path and the "Loopline", a converted former railway line spanning several miles from the north to the south of the city. The second factor was the worst road safety record of any English Metropolitan Borough – with 201 cyclists killed or seriously injured between 2012–2016 (DfT, 2017).

Recently, Liverpool has followed many of the UK trends outlined above. The City-Region has a cycling Commissioner, an actor and campaigner, and has overseen a number of high-profile cycling infrastructure schemes, including outside Lime Street Station (the main rail terminus), the waterfront, and Princes Avenue (the latter of which is a core discussion point below). Importantly, most of this major infrastructure development has been in-or-near to the city centre reflecting a broader pattern of development prioritisation (Parkinson, 2019). There was also some "pop-up" infrastructure installed in the midst of the COVID-19 pandemic. With six routes originally announced in 2020, three were eventually constructed in the North, South, and East of the city, respectively. However, the City Council's commitment to cycling was questioned when, in 2021, the Eastern route on West Derby Road was removed in its entirety.

Liverpool, therefore, presents a useful case study to understand how cyclist perceptions should shape interventions. The city sits at the cusp of a yet-unrealised change. For many commuters using the city's roads, dedicated infrastructure is few-and-far between and, in many cases, did not exist at the time we conducted our study. In this way, the city provides fertile ground to understand how cyclists use roads which are not designed for cycling. What shapes, informs, and determines their route choices and behaviour?

3. Using Practice Theory to frame cyclist activity

Practice Theory can provide a framework for understanding of the social and infrastructural conditions which can allow behaviours to flourish (Shove and Spurling, 2013). Acknowledging other fuller accounts of the literature which settle cycling as a practice (Watson, 2013, Spotswood et al., 2015, Oldenziel et al., 2016, Larsen, 2017a, 2017b, Rérat, 2019), we draw principally upon the work of Reckwitz (2002), and Shove et al. (2012) to frame our analysis. Specifically, this provides the framework to understand the "routinized type of behaviour" (Reckwitz, 2002 p249) that is cycling, and how it intersects with the three core elements of a practice: materials, competencies and meanings. Shove et al. (2012 p.14), goes on to define those elements thusly: Materials are "things, technologies, tangible physical entities and the stuff of which objects are made", in this case, bicycles, roads, physical infrastructure, and so on; competencies reflect the "skills" or "know-how" which a cyclist will use (or potentially, lack) when riding their bicycle; and meanings are the emotional, social, and symbolic significance of the practice.

In deploying this thinking, we must acknowledge and negotiate its limits. In particular, this combination of the three elements means cycling practices may look and feel different in each place (Sheldrick et al., 2017). In this way, we must caution against an over-enthusiastic

policy transfer which becomes shorn of context (Thrift, 1997, Bristow, 2010). However, in exploring cycling in a city without an established cycling culture compared to its peers (i.e., Liverpool), we are in effect studying the absence of established practice and what current practitioners tell us about how it might flourish (Shove and Spurling, 2013).

We must also engage with another crucial element: policymaking. We note Shove's (2014) arguments that the value of Practice Theory is premised on its inapplicability to policy, however we also note Keller et al. (2016) argument that Practice Theory-informed studies have a particular utility in informing policy-makers. To resolve this impasse, we draw upon Buck and Nurse (2021) who identify the actions of others (i.e., policymakers) as a fourth element that informs a practice, and plays a role in resolving some of the original three elements (e.g., providing material infrastructure, supporting training programmes, or creating narratives that instil positive meaning – or indeed not). In doing so, we hold with Keller et al. (2016) that a Practice Theory-informed analysis can support good policymaking by understanding how the actions of policymakers can positively or negatively inform the practice. It is, in this way, that we subsequently deploy Practice Theory – not as a means to analyse policy itself, but rather as a means to understand the daily practices of cycling in the city, to recognise that policymakers do play a central role in how that practice is carried out, and to use those experiences to improve policy-making for cycling.

4. Methodological approach

Our study of every-day commuting cycling in Liverpool is inspired by the work of Latham and Wood (2015) and Brown and Spinney (2010), and their use of video-based methodologies to explore a perceived gap in understanding how "cyclists deal with existing infrastructure configurations" (Latham and Wood (2015 p304) themselves building on the work of Spinney (2010), and Kidder (2012)). To capture this every-day commuting activity, we used a novel approach in which our participant's bicycles were equipped with front and rear-mounted cameras and microphones, and a GPS-based cycling computer to record their journeys. Our approach recognised that previous studies often involved "ride-alongs" to accompany cyclists on their journey, and sought to positively overcome many of the shortfalls of an accompanied ride identified by (Pooley et al., 2013). This largely related to the risk of the observer effect causing an inauthentic experience by altering rider behaviour, but also not interfering with the participant's normal routines pre/post ride. In doing so, we do recognise the trade-offs in this approach, not least the loss of in-person observation by the researcher. At the same time, however, we note how video recordings can also insure against other shortcomings of a researcher-only approach including memory, and their own perceptions of risk.

Following instruction on how to operate the cameras, participants were issued with a simple brief: to cycle their regular commute on their normal route, ideally at the time they would normally travel to/from work, and to record both journeys. Importantly, to capture "normal" behaviour, participants were given no specific instruction on how to behave, and thus to ride in the manner in which they ordinarily would.

To capture the every-day experience of cycling in Liverpool, our study used participants who were existing cyclists with some experience of riding within the city. In pursuing this approach, we recognise that the competencies framed above by Shove et al. (2012) become particularly important in understanding cycling practice. By working with commuting cyclists, it is clear that they would demonstrate a particular level of cycling competence that would take them beyond that of newcomers or outsiders (Nello-Deakin and Nikolaeva, 2021). However, we would align with Aldred's (2013) suggestion, the same cyclist may be simultaneously viewed as competent and incompetent by different observers, including the self.

Using this method, we recorded twelve journeys, achieved through six cyclists recording their inbound and homeward commutes across 2018 and 2019 – a roughly comparable number to Latham and Wood's (2015) original study. Reflecting the discussion of Aldred (2013) above, participants were of varying abilities – from comparatively self-described "novice" cyclists to those with many years' experience – and rode a variety of standard bicycles including folding, touring, mountain, and racing bikes. All participants commuted to/from the city centre. Most travelled entirely within Liverpool's municipal boundaries, whilst two travelled from Wirral, on the opposite side of the River Mersey. For those in Liverpool, some travelled from an area with a (slightly) higher modal share of cycling, whereas one cycled from an area with the lowest model share in the city (and, incidentally, the highest modal share for car-driving). All names used herein are pseudonyms. Five were male and one was female. We accept that the nature of a small cohort of cyclists does have its limitations. For example, it cannot capture the voices of newcomers in the way that others have (e.g. Nello-Deakin and Nikolaeva, 2021), or the larger group of non-cyclists (Mahne-Bieder et al., 2019) which are prevalent in the city. Similarly, though the cohort was proportionally similar to the City's cycling profile in terms of gender split (Xie and Spinney, 2018), it is clear that it is difficult to generalise. Nonetheless, we would argue that the process of capturing the entire ride in this way can provide tentative insights into how cyclists inhabit the material world of Liverpool's roads, navigate it with their competencies, and create their own meaning unaffected by an outside presence.

To delve into this detail, upon returning the cameras, participants were interviewed about their commutes. This interview started by asking participants about any incidents/occurrences that they deemed to be of significance, before discussing their route selection and their overall impression of the ride more generally. When participants discussed experiences around their home, this was on the understanding that only descriptive analysis would be used. Whilst several research projects have used on-bike cameras with surveys (e.g. Gadsby et al., 2021) and sensor data (Zhu and Zhu, 2019) we focused on freedom to cycle anywhere (such that route selection is an everyday experience) and detailed interview responses, in keeping with the Practice. Consequently, we follow Brown and Spinney (2010 p131) who argue that "by allowing riders to talk about their practices in relation to the contexts of their performance, we suggest that video can enable participants to provide more nuanced, situated and richer linguistic accounts of their embodied mobile practices than would otherwise be possible."

5. Results
5.1. Mundanity
Perhaps the stand-out issue from the videos was not a prevalence of incidents, but rather the absence of them across the vast majority of riding time. None of our participants recorded or reported any incidents that they considered to be fundamentally dangerous. This reflects the general statistical safety of cycling. Rather, we observed how within those generally mundane rides, our participants placed greater emphasis on a small number of incidents or moments where they perceived danger. Often these "flashpoints" lasted no more than a few seconds. In almost all cases this could be categorised in three ways. The first centred on material elements (e.g. poor infrastructure such as potholes). The second was competences – though, crucially this almost always focused on the competences of other road users, manifested through things such as "close passes". The third was the interaction between the two – i.e., the behaviour/anticipated behaviour of drivers as participants travelled through a particular area. The latter most commonly occurred at junctions and roundabouts.

When reviewing/discussing the video with participants, many would subsequently concede that the incident they highlighted as dangerous was perhaps not as bad as they first perceived. This is best illustrated by one participant, Joe, who was keen to highlight a segment where he was unsure whether a van would pull out from a side-road or not. However, to an outsider, the video seemingly showed a quiet section of road with little noticeable incident (**Figure 1**). Through discussion, it became evident that this had been the site of previous incidents for Joe and reflected the anticipation, as much as the incident itself. This latter point was something which was common amongst other participants: namely that perceptions of danger were heightened by previous incidents and otherwise safe journeys could be negatively affected by those experiences.

5.2. Route choice
Although the participants came from different areas of the city, there were broad trends in their behaviour. In large part, riders pursued a "pick and mix" approach to their route selection: using advertised routes and dedicated infrastructure for some parts of their journey, and eschewing it for others.

As discussed above, at the time of the study Liverpool's network of cycle infrastructure was not extensive. The National Cycle Network did cover portions of the city but was not comprehensive, and physically segregated infrastructure was minimal. Whilst there was a supporting network of advisory (i.e., painted) cycle lanes, this was similarly not extensive. This in part explains some of the route choices. Most participants took a "direct" route on their commute, and consequently reported using sections of infrastructure when it intersected with their route. This was particularly the case with physical segregated infrastructure. For example, a portion of segregated infrastructure at the Northern end of Smithdown Road – a major thoroughfare to the South of the City Centre – was used by several participants on their journeys (**Figure 2**). This reflected its prominence at the confluence of several routes to/from the city centre, and as the beginning of a segregated corridor connecting to the University Campus. Importantly, this suggested that though Liverpool City Council's (LCC) interventions into segregated cycling infrastructure were limited, they were strategic enough to demonstrate utility.

Figure 1: An empty junction, perceived as a flashpoint (Image source: Author).

In a similar way, participants using elements of the National Cycle Network reported doing so because it intersected with their route, rather than explicitly attempting to use the network. Examples included Simon, whose route across the City Centre partially used NCN route 56 (NCN56). Other cyclists, particularly those self-identifying as "confident", would ignore advertised routes such as the NCN entirely, even if they lived near to them. One example is James, whose route ran parallel to both NCN56 and a section of LCC's advertised "quiet ways" (**Figure 3**), but who directly bypassed them in favour of riding along an arterial "A" road. When questioned, James said that whilst the quiet route "felt safer", it was longer in distance, and could take almost twice as long to navigate due to junctions and busy school run traffic. Thus, James said, he would rather "take my chances" on a quicker route even if perceived to be more dangerous. When examining the map, James was correct, as whilst the quiet route was only approximately 25m longer between the same points (2500m versus 2475m), it had a total of ten 90-degree turns, compared to three on James' preferred route.

Another example of where cyclists spurned advertised routes in favour of a quicker route was in the Princes Avenue area, a busy dual-carriageway boulevard linking the City Centre to

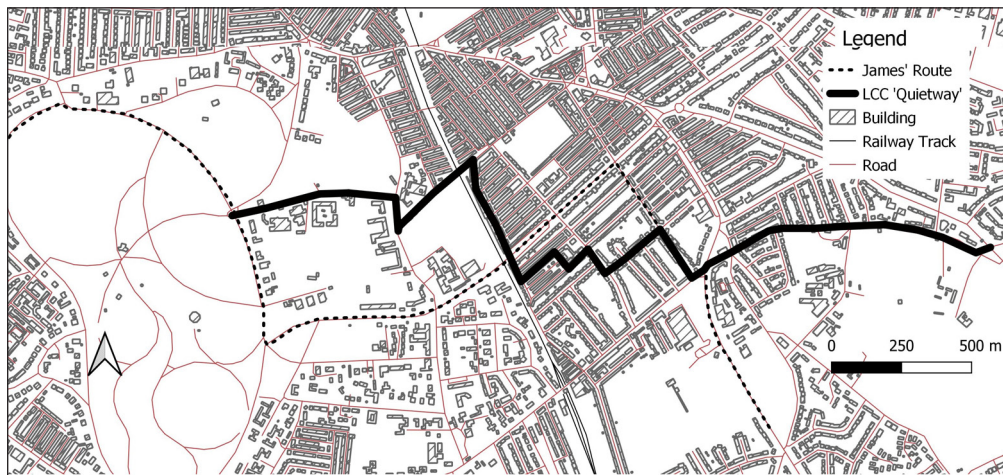**Figure 2:** Cycling on the pavement to access infrastructure (Source: The author).

Figure 3: The "quiet" route versus the direct route. (Map source: Office for National Statistics licensed under the Open Government Licence v.3.0).

Princes Park and Sefton Park (each forming part of NCN56) in the South of the City. Crucially, Princes Avenue was not part of NCN56, which instead ran on the parallel Windsor Street avoiding the busy Princes Park roundabout. Despite this NCN provision, both participants who came this way (Emily and James) left NCN56 to ride down Princes Avenue, avoiding Windsor Street. In doing so, this action took them through Princes Park roundabout, despite both recognising it as a significant flash point. As above, Emily and James both said that the utility of using this road outweighed the safety consideration of a longer route running less than half a mile parallel. However, going further in this instance, James also discussed how, after negotiating the roundabout, Princes Avenue itself felt comparatively safe because of parked cars effectively blocking the inside lane to vehicle traffic, whilst leaving enough space to cycle.

The experiences of James and Emily in particular suggested that they were largely not prepared to trade time-savings of even a few minutes to use a network they would admit was quieter/safer. In other words, for those riders, infrastructure has to go where they need it to go in order to be useful. This aligns with research suggesting that material infrastructure can have little effect in rider route choice, and thus should be targeted where people are more likely to use it (Aultman-Hall et al., 1997, Moudon et al., 2005). This can affect the practice in two ways. First, a failure to facilitate cycling along appropriate "desire lines" can alienate recruits who consistently say that a lack of infrastructure is the main inhibitor of taking up cycling. Second, cycling materials placed in undesired areas, and which subsequently become underused, can undermine broader public confidence –in terms of both monetary value, and where cyclists continue to use other routes despite available infrastructure. This presents real dangers for longer-term responses which seek to expand the cycling network, but face resistance resulting from underuse of earlier material interventions.

5.3. Impermeable barriers

Beyond the interactions with material infrastructure discussed previously, the City Region's impermeable barriers also presented a factor in how our participants selected their route. With few significant hills to speak of, this primarily related to the River Mersey. The Mersey has two road crossings between Liverpool City Centre and Wirral. There are two tunnels – Kingsway and Queensway. The newer tunnel, Kingsway, is permanently closed to cyclists. The older tunnel, Queensway, excludes cyclists between 6am and 8pm on weekdays, with more permissive restrictions at weekends.[1] Therefore, commuting cyclists travelling between the Wirral and Liverpool are left with two practical options: the Merseyrail underground network or the Mersey Ferry. Both options have two downsides, namely the financial and time costs which can diminish the utilitarian benefits of cycling. Both participants who travelled from the Wirral, Mark and Simon, concurred that the train was the worst of the two options. Here, Simon reported that commuting by bicycle during busier commuter hours meant uncertainty over whether he would get his bike onto the train if carriages were full – potentially incurring greater time costs and acting as a disincentive. For Mark, however, though the Mersey Ferry took longer he welcomed the social element of the crossing, the opportunity to be above ground, and the free coffee offered to commuting passengers.

Although there could be some benefits arising from the lack of a material river crossing, in broad terms our participants made clear that this represents a significant barrier – perhaps needlessly so. For example, Mark in particular spoke about how he would willingly cycle through the Queensway Tunnel when operating hours allowed it, emphasising the utility

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[1] https://www.merseytravel.gov.uk/tunnels/.

savings of being able to cycle directly without stopping or incurring cost. However, this should be taken in light of Mark's position as a self-identified competent cyclist, as in doing so he acknowledged there was a long hill. Equally, whilst Mark suggested he had no particular safety concerns, reflecting the discussion above, the fact he referenced safety might indicate that it could be a disincentive to other less-competent riders.

5.4. Legality and illegality
An important element of the study was that participants were asked to cycle through the city as they ordinarily would – ostensibly, to understand how they interacted with their environment as naturally as possible. For the most part, though some participants described being extra-alert at times because of the feeling they were being recorded, most reported forgetting the camera was there. Consequently, the cameras captured a range of rider behaviour. The significant majority of this was entirely unproblematic – again perhaps reflecting the everyday mundanity of cycling as a practice. Riders largely rode within the law and the principles of the UK's *Highway Code*. In this section however, we discuss where riders either broke the law, or perceived that they did so. We consider this across three sections: perceived illegality, "everyday" illegality and "clear" illegality (we will explain this distinction shortly).

5.4.1. Perceived illegality
Perceived illegality is when a participant reported that they felt they were doing something illegal. In fact, however, they were not, and their behaviour was entirely legal.

The most prominent example of this came through Mark and Simon, both of whom had cycled along Church Street – Liverpool's main shopping street – during the course of their commute after crossing the Mersey. Both participants expressed unease at cycling through the shopping street (**Figure 4**), especially as it became busy with pedestrians on their return home. More importantly, both felt that they should not be doing so, but said that this represented the fastest and safest route avoiding Liverpool's busy city centre roads.

In practice, the section of route Mark and Simon took does not exclude cycles, and their presence on Church Street was entirely legitimate. However, both had no idea this was the
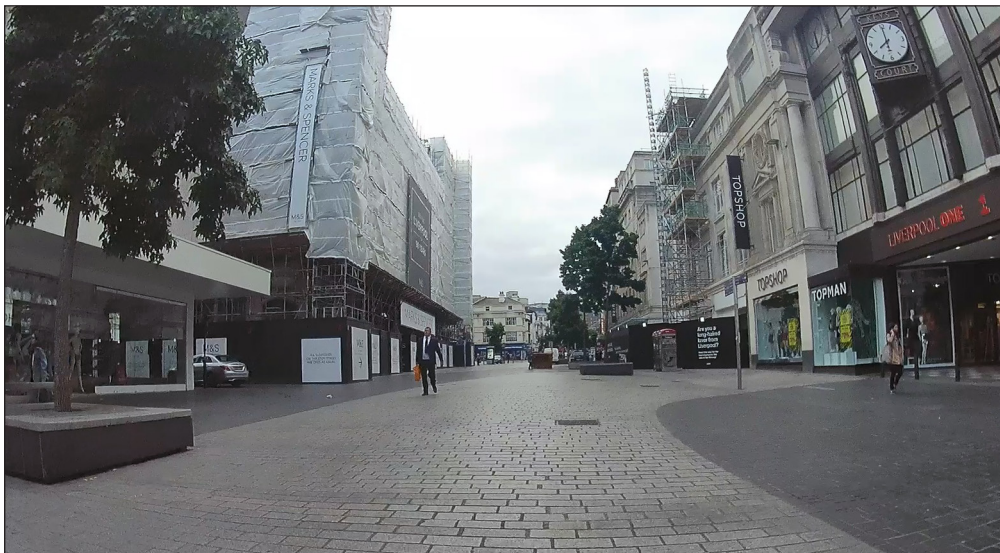

Figure 4: Cycling in a shared space (Image source: Author).

case, and expressed surprise when told. When exploring their video recordings, it is easy to see why they reached this conclusion. Church Street is a pedestrianised shopping precinct, with rising bollards to allow access to service and delivery vehicles. At each end there are signs which indicate that all other motor vehicles are prohibited (although crucially, bicycles are not included in this signage). More importantly, there were no obvious markings (e.g., on the floor) to indicate to other users (i.e., pedestrians) that bicycles may pass through. Indeed, this lack of markings, and the sense that this was pedestrian-only rather than shared space, also contributed to our participant's feeling that they were cycling there illicitly.

This can present an issue in how cyclists perceive the material network that is available to them. This is important given the importance segregated networks have on cycling rates and the willingness to cycle (Hull and O'Holleran, 2014), and becomes particularly important in a city which did not have much segregated network to begin with. In short, whilst some users might use the space, even if they feel they are doing so illicitly, others may be put off from using the space entirely. Here, rather than an enabler of the practice, segregated space can become an unwitting barrier if potential users are unaware that it is available to them.

5.4.2. Immorality, "everyday" illegality and clear illegality

The next kind of behaviour we observed was that which, whilst prohibited by the UK's Highway Code, was perceived by our participants as being relatively minor. Ihlström et al. (2021) describe this behaviour as immoral.

The most common example of this was pavement riding – particularly at the beginning or end of a journey, and especially as participants neared work and would mount the pavement and ride through pedestrian areas for a short distance (i.e., <100 m) to complete their journey. This activity differs from that discussed in the previous section as here there was no implicit or explicit expectation that cycling was allowed in this space. However, this was an element of cycling practice which was almost universally and unproblematically observed by our participants. Indeed, and perhaps even ironically, both Simon and Mark, who both reported unease at cycling in a place that was in fact designated for cycling, were amongst those who had no concerns in cycling in pedestrian areas near to their work.

Perhaps in contrast to the high street, which was perceived as a pedestrian-only space, our participants frequently did not view the space outside their work in the same way. To some, they characterised it as an end of journey space, rather than a through route. In this space, participants did observe that they were in a shared space and altered their cycling behaviour, both slowing down and giving way to pedestrians, and riding in a manner noticeably different to that on the open road. The rationale for riding in this way was best encapsulated by James who said "you would expect to drive into a car park, why wouldn't you be able to do the same with a bike-stand?"

Though we observed no obvious pavement riding elsewhere along main roads, there were a small number of participants who also rode, often briefly, on the pavement near their homes – effectively to ride right up to their front doors. In some cases, this involved practices which are prohibited in the Highway Code (i.e., are illegal) – something we will return in the next section.

Overall, we found that our participants considered this behaviour during the beginning/end of journey phases, especially in spaces where they felt that they could ride their bike without issue. This, we suggest, generates some expectations of a cyclist's individual competences to navigate these situations. However, as we will see later, such competences/willingness to cycle in those spaces are not universal, and the end-of-journey transition can leave some journeys reaching a jarring conclusion.

On the whole we observed few instances of "clear" illegality – i.e., behaviour strictly pro-
hibited in the Highway Code. In particular we saw almost no instances of "red-light running"
– something identified by Fincham (2006) and Johnson et al. (2013) as a frequent criticism
of cyclist behaviour. Beyond this, there were some limited instances of cyclists riding through
yellow lights – sometimes referred to as the "Amber Gamble". In most cases we observed,
participants did not stop at yellow lights because it was not safe to do so in time – behaviour
which is explicitly allowed in the Highway Code.

We observed some instances of participants riding the wrong way down a one-way street,
either against traffic on the road or cycling along the pavement, in order to reach their house.
In these cases, participants would cite a mixture of the time savings and safety benefits from
not navigating a one-way system designed for cars. In one instance, James discussed how
their "house was at the opposite end of a one-way street and to go the full way around would
mean riding up a hill, through a blind T-junction onto a busy main road and then back down
the hill". This, James told us, would probably take an extra two minutes – more than 10% of
his overall journey time. Here, and though the additional danger was a factor, the time sav-
ing was the overarching consideration. This behaviour was not entirely unproblematic, and
James did report some issues of consternation and contestation from his neighbours on occa-
sion, though he claimed he "tried to be considerate" by riding at walking pace.

Reflecting the earlier discussion of pavement riding, this behaviour again demonstrates
issues regarding the end-of-journey transition. In particular, it suggests that in the eye of its
user, the bicycle can chart a middle ground between the vehicular and the pedestrian. This
also speaks to some of the competences of the cyclist, and here we observed cyclists who
perhaps do have the confidence to undertake extensions to their journey, and even navigate
what they perceive as more dangerous routes, but draw on their own competencies to take
and navigate a different lower risk (to them) route. This is not something not endorsed by the
Highway Code, but remains behaviour which some cyclists are nevertheless willing to risk. In
this way, and much like pavement riding, our findings reflect those of Ihlström et al. (2021
p.1) who suggest that even if it is "immoral", this behaviour can often "be regarded as a way
of managing safety and risk, seeking more efficient and comfortable paths of travel, as well as
the outcome of perceiving the infrastructure as ambiguous."

5.5. End of route transition
A final issue we identified occurred during the moments when our cyclists transitioned on/off
their bicycles and became pedestrians. In some cases, we could observe the illegal behaviour
– both clear or "everyday" discussed above – e.g., pavement riding through pedestrianised
zones. In others participants might ride down one-way streets to shorten their route. In other
instances, we observed participants behaving in a way that despite being legal, appeared jar-
ring. For example, both Joe and Emily came to a dead-stop at the point on the road nearest to
their workplace, before dismounting and walking the remainder of their journey.

It is this latter behaviour which presents the most interesting consideration of both the
materials, and competencies of the cycling practice. Here, the transition lacks an obvious mir-
ror with other common transport practices. For instance, a motorist will park their car (e.g.,
in a car park) before then transitioning to a pedestrian role. Elsewhere, bus and train users
will disembark at a bus stop or train station before similarly becoming pedestrians. In these
examples, the switch between modes contains an obvious demarked "transition point".

It could be argued that bicycle parking (e.g., stands, bike shelters) represents the material
counterpart to these places for cyclists. Yet for many reasons, including surveillance (Aldred
and Jungnickel, 2013), this infrastructure can often be located in areas which are perceived
to be for pedestrians. Therefore, in some cases we observed, the transition from cyclist to

pedestrian took place in the road some distance from this physical infrastructure, with the journey from road to parking completed on foot. For others, we saw participants ignoring such boundaries and cycling through these pedestrianised areas to end their journey at the bicycle storage, or the front door of their office building. Those who did so posited rationales which reflected the earlier discussions on legality – arguing that they rode more cautiously, but the utility of riding through these spaces was worth the perceived risk.

Combined, our respondents suggest a fundamental gap in material infrastructure provision. The spaces along which they commute are largely provided for – be it riding on the road, or via dedicated infrastructure – and carry with them their own broadly accepted competences and meanings. Similarly, the material places in which they store their bicycles are accounted for. Yet, there is a wide divergence in how cyclists transition between the two – in part owing to the lack of material space to shape or guide this transition. Thus, we can see behaviour which reflects the varied competences and meanings that the cyclists place on an undefined space. Some view the space as de-facto shared, and feel they have the competencies to navigate it by bike. Others place stricter meanings on the space and opt to not to navigate it by bicycle at all.

6. Analysis and lessons for policymakers

When considered through the lens of Practice Theory, our study of commuting cyclists in Liverpool provides several useful insights about how people travel around the city. In particular, our analysis suggests that, whilst much of the activity draws upon materials and competences, it places a large significance on meanings with regards to how the former are negotiated. In turn, we can now reflect on how these findings might be useful to those planning future material interventions. In doing so we reflect on both issues of quantity (i.e., Where does it go?) and quality (i.e., does it meet the needs of all users?) raised earlier.

Across our study we found that there is a mundanity to a significant proportion of day-to-day cycling. That is, that regardless of the material spaces or competences of our participants, in large part their commutes passed without major event. However, within those largely mundane daily commutes, material provision and competences (including of others) led to short "flashpoints", sometimes lasting only a few seconds, which had the potential to colour perceptions of the whole commute. We observed how the meanings of places determined the ways in which riders would cycle through them. Importantly, we observed how more confident cyclists would justify "immoral" behaviour (Ihlström et al., 2021) such as pavement riding, whilst like (Latham and Wood, 2015) less-confident participants would simply stop at problematic infrastructure and navigate it as a pedestrian, even if this meant potentially placing themselves in riskier positions (e.g., by dismounting on the road). Finally, like Aultman-Hall et al. (1997) and Moudon et al. (2005), we also observed how our participants, particularly those self-identifying as being more confident, often followed the desire line to their destination, even if this meant bypassing material infrastructure provided for cyclists.

This mixture of behaviours thus created divergence in how space was used and how journeys panned out. Going further, it is clear that striking the balance between the needs of more and less-confident cyclists is a major challenge for transport planners – especially those expanding a limited network on a limited budget. Even across our participants, themselves a small sub-set of Liverpool's cyclists, we found there was a range of outcomes and preferences. In this way, short of comprehensive network coverage, interventions which favour one type of rider may not wholly speak to the concerns of others, and may potentially even undermine confidence in those delivering material infrastructure.

Resolving these contradictions is not easy in a short time frame. However, whilst the necessary work of expanding material infrastructure – often seen as the single biggest factor

in encouraging cycling (Hull and O'Holleran, 2014) – goes on, the actions of policymakers remains key to the development, and potential success or failure of the practice (Buck and Nurse, 2021). Based on our findings, we argue that the meanings of cycling are central to the practice, yet consistently overlooked – both where infrastructure is provided, and where it is absent. Across our participants, it was clear that the meanings they ascribed to places determined how they rode through them, or if they rode through them at all. In this way, we offer that by understanding these meanings, and acknowledging that a single space should simultaneously accommodate the needs of a range of competences, we might better achieve infrastructural outcomes that cater to the greatest possible range of cyclists.

7. Conclusion

A video-based study of everyday cycling behaviour in a city, not well-known for its cycling culture, reveals much about how cyclists interact with the city. In some ways, our findings mirror those of others, suggesting commonalities with cities with established cycling cultures. For example, we found that more-confident cyclists would navigate whichever material infrastructure they were presented with and avoid it altogether if inconvenient (Moudon et al., 2005, Aultman-Hall et al., 1997). Similarly, in line with (Latham and Wood, 2015) less-confident cyclists would often stop at problematic barriers. We found evidence of how ambiguities in material infrastructure resulted in what can be perceived to others as "immoral" behaviour (Ihlström et al., 2021), but which was perceived to the cyclist as justified. We found that whilst there were incidents of note during journeys, most attention was given to the beginning and end of journey transitions – in other words how cyclists transitioned from public roads to their place of work/residence. Here, we found that even where material provision is deemed acceptable by cyclists for the duration of their journey, they indicated issues with how they would exit the roads and subsequently enter into what they perceived as more noticeable conflicts with other people – most notably pedestrians. These transitions are seemingly well catered for in other modes, but are left ambiguous when cycling.

   Overall, we found that a video-based approach of this kind allowed us to understand how cyclists move through the city in their own way. In doing so, we were able to observe how small shortcomings in material infrastructure, and the meanings this carried to the individual, became amplified in a way that creates conflict – perceived or otherwise. In this way, one of the clear material challenges for transport planners is to design out such ambiguities and to recognise that, as a practice which has a wide range of skill levels, infrastructure should cater to those of both high and low-confidence in order to be fully utilised.

Competing Interests

The authors have no competing interests to declare.

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