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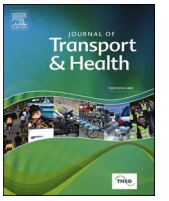

Maintenance of action: A qualitative study of cycle commuting adoption resulting from a cycle loan scheme☆

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ABSTRACT

Introduction: Cycling has multiple health benefits, but its share of commuting mode remains low in the UK. Little is known about barriers and determinants for new sustained recruits to commuting, and few studies have examined new recruits for a sufficient duration to enable habit formation.

Methods: This qualitative study explores the experiences of adults starting or returning to cycle commuting in Bristol to gain insight into the determinants of initiation and maintenance of cycle commuting. Semi-structured interviews with ten participants were conducted on or after returning the cycle, analysed using thematic analysis.

Results: It was found that participants were concerned by safety, the hostile road environment, poor infrastructure, roadworks, weather, hills, theft, and the relative need to be organised. They were motivated by life-transitions and time savings. Health and cost were both motivators and barriers, with the disadvantage being effort required and equipment costs. Workplace culture and facilities were influential. Participants did not feel integrated with pre-existing cyclists, did not easily find the 'joy of cycling', nor integrate cycling into wider routines.

Conclusions: In conclusion, participants' positive feelings could be crowded-out by negative experiences and cultural norms. Health and environmental gains may be limited if participants are already active and/or switching from public transport. While participants reported they intended to continue, maintenance of the activity may not readily continue.

1. Introduction

Regular cycling is good for health (Oja et al., 1991, 2011; Andersen et al., 2000; Celis-Morales et al., 2017) and increasing cycling has the potential to address several global public health problems. Many adults and children undertake insufficient Physical Activity (PA) (Scholes 2016), and obesity is estimated to cost the UK more than £6billion annually (Scarborough et al., 2011). Cycle commuting achieves sufficient intensity and dosage of exercise to contribute significantly to recommended levels of PA (Gotschi et al., 2015; Fishman et al., 2015), and lower weight (Flint et al., 2016).

Although cycling exposes people to risk from motor traffic, the collision rate is less than for pedestrians (Cavill and Davis 2007) and exposure to pollution is less than for car-drivers (Nazelle et al., 2017). Globally, the benefits of Active Travel (AT) outweigh disbenefits

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by 9:1 (Mueller et al., 2015) or 7:1 in the UK (de Hartog et al., 2010). As cycling rates increase, the risk of injury falls (Pucher et al., 2010). Despite positively stated intentions in surveys, behaviour change in relation to both recruitment and retention to cycling face multiple barriers (Tapp et al., 2016; Scheepers et al., 2014).

The Trans-theoretical Model (TTM) of behaviour change theorises moving through a time-ordered sequence of stages of change (Prochaska and DiClemente 1982) based on behavioural intention (characterised by pre-contemplation followed by contemplation), then behaviour (preparation for action, followed by action) and then 'maintenance of action'. West (2005) critiques TTM as rigid about time periods, optimistic about rationality and narrow about motivations. Nehme et al. (2016) critique TTM as inflexible, whereas other theories allow for gradual evolution and/or rapid transition.

The Theory of Planned Behaviour (TPB) suggests interactions between an individual's attitude, subjective norm and external perceived behavioural controls, which together influence intention. That intention then influences behaviour (Ajzen 1991). After action has been taken, focus is needed to 'maintain' the resulting change. The TPB model has been challenged as too focused on individuals and rationality, neglecting the relationship with structural and environmental factors. Bamberg (2013) critiques both TTM and TPB as assuming the need for change and neglecting the role of habit, including in preventing relapse.

Nevertheless, TTM and TPB are conceptual models well-used in cycling related research to understand barriers and attitudes (Jensen 1999; Tapp et al., 2016; Gatersleben and Appleton 2007; Gatersleben and Haddad 2010; Bejarano et al., 2016; Nkurunziza et al., 2012; Dill and MacNeil 2013). Habits and personal norms, and their effects on perceived behavioural control have been found to influence cycling (Gatersleben and Appleton, 2007; Gatersleben and Uzzell 2007, Heinen et al., 2011; Pooley et al., 2011; Thigpen et al., 2015; van Bekkum et al., 2011; Willis et al., 2013).

Redding et al. (2014) found the TTM model is valid for use with sustainable transport but Nehme et al. (2016) critiqued (quantitative) use of the TTM model as likely to undercount the people ready for action-orientated interventions. Diniz et al. (2015) used TTM to guide a controlled intervention in Brazil, but with only short-term effects followed by 'relapse'. Gatersleben and Appleton's (2007) influential study does not satisfactorily segment new cyclists nor acknowledge a "relapse" stage and the need to support the changed behaviour to become habit. The findings nevertheless usefully suggest that not all cyclists, or non-cyclists, are similar to each other. The image of cycling was a problem for most non-cyclists, but, as participants moved through each stage of the process, perceived barriers reduced, and positive attitudes increased. The authors acknowledged that participants did not achieve 'maintenance of action'.

Spinney et al. (2009) suggests that cycling is an embodied and sensory experience meaning quantitative studies focus only on "between A and B … with very little attention paid to the experience … in between" (p817/8). In addition, Mann and Abraham (2006) suggest that rational and/or utility decisions are often (especially for transport) secondary to affective responses. Qualitative studies are able to explore behavioural responses to these complexities (Handy et al., 2014). Bejarano et al. (2016) undertook a mixed methods study of an on-street cycle-hire scheme. They suggested that concentrating only on rational and functional attributes would have resulted in different conclusions to their study, and the inclusion of ethnography enabled consideration of affective reactions.

Much literature focusses on the acquisition of new cyclists rather than retention of new or existing cyclists. Insights into the challenges facing new cyclists in 'maintaining the action' of cycling behaviour are needed to understand why habit may not be formed, and relapse may occur.

Hence, the aim of this study is to explore qualitatively the motivators, problems and barriers for maintaining cycling as a new behaviour. The study sought responses from people taking part in a 'try before you buy' loan cycle scheme. The cycle loan scheme provided access to people who were motivated to start, or return to, cycling, as it offered both e-cycles and ordinary cycles, of a sufficient quality, free for a short period for commuters to try, and provided other forms of support such as help and guidance on equipment and routes to take. The scheme is more fully explained in Section 2.3. These cyclists are therefore in transition between the TTM stages of "action" and "maintenance". TTM has therefore been used as the primary model for the framing of the study specifically because it is exploring more deeply the potential and reasons for relapse between these stages. However, TPB has also been used as a reference theory, principally to assist in generating codes during the analysis of the data.

The rest of the paper is organised as follows: Section 2 discusses the methods; Section 3 presents the results; Section 4 discusses the findings; Section 5 draws conclusions and recommendations.

2. Methods

2.1. Participants

The study took place in Bristol and participant recruitment was via the TravelWest Team, which engages with individuals and organisations to divert commuting away from single-occupancy car-use. The approach adopted by the TravelWest Team is based on the TTM, and supports people to re-consider their transport mode ('pre-contemplation'/'contemplation'), and to take 'action'. A 'try before you buy' loan-cycle scheme is one of the services provided, and, the scheme made approximately 1250 loans of mid-priced cycles and equipment (locks, lights and panniers), in the six years of operation prior to the study. The loans are made on the basis that the cost of a reasonable quality bicycle is a barrier to initiating the practice. 70% of loans have been to women. The loan period is four weeks for a cycle and two weeks for an e-cycle.

Interviews were offered to all participants who borrowed a bike within the timeframe of the study. A total of thirteen people were contacted with ten participants (five female) ultimately taking part. (Interviews were not possible for two people, and the third person did not reply). Two interviewees had cycled regularly in the recent past but had had their cycles stolen, and were using the scheme as a stop-gap. Two others owned a cycle but borrowed an e-cycle. These four participants enhanced the heterogeneity, and could provide

useful comparative insight.

2.2. Design

Braun and Clarke (2013) summarise approaches to qualitative studies. Semi-structured interviews were adopted with interpretative phenomenological analysis, which is suited to research of personal experiences, with small sample sizes offering deeply personal insights (Smith et al., 2009). Thematic analysis within a phenomenological approach is suitable to explore experience, perceptions and understandings, accounts of practice and influencing factors. In contrast to discourse or narrative analysis, it focusses on what was said rather than how it was said. A structured approach to coding, generating and analysing themes can be taken.

The literature was used to generate areas to explore the phenomenon of starting cycling: the personal and structural motivation(s) to cycle (Gatersleben and Appleton, 2007; Tapp et al., 2016; Bejarano et al., 2016), including the role of life transitions such as a change of workplace (Skinner et al., 2007; Chatterjee and Scheiner 2015; Walker et al., 2015), which were considered alongside existing experiences of cycling (Bonham and Wilson 2012) existing perceptions of safety (Mann and Abraham 2006; Aldred and Crosweller, 2015), the purpose of the loan bike (Horton et al., 2007) and current commuting mode and car ownership (Jones et al., 2016).

As not enough is known about retaining cyclists (Tapp and Parkin 2015) the phenomenological experience of riding was explored looking at the whole person and their multiple personal experiences and motivations (McKenna and Whatling, 2007). This was broken down into various factors around convenience, time, distance and weather factors (Parkin and Koorey 2012; Pucher et al., 2010, Sears et al., 2012); culture, of street spaces, workplaces, and personal and interpersonal norms, and their impact on the feelings – and changes to these feelings as a result of embodied, personal experience - of 'being a cyclist', and what it means to be a cyclist (Pooley et al., 2011; Buehler 2012; Aldred et al., 2013; Alvanides 2014).

Given the significant influence of infrastructure and geographical barriers or enablers these were examined (Buehler and Pucher, 2017; Parkin and Koorey, 2012; Pucher et al., 2010; Daley and Rissel, 2011; Parkin et al., 2007) but these were set alongside the influence of household factors and competing daily tasks (Pooley et al., 2011, van Bekkum et al., 2011; Skarin et al., 2017).

Questions were also developed about navigation, bicycle equipment and paraphernalia, the physicality of cycling and the skills needed (Parkin et al., 2007), and the loan scheme and service context because the effect of experiencing good quality cycling equipment is a logical driver of the cycle loan scheme (Bejarano et al., 2016).

2.3. Measures

The standard loan period was four weeks for cycles and two weeks for e-cycles. Loans could be extended, and this was easier in winter when demand was lower. Loanees were able to take their bicycle home, along with quality equipment including lights and panniers, and use it freely during the duration of the loan. This was a scheme that had been operated by Bristol City Council for six years prior to the research, and the aim of the scheme was to encourage more commuting by bicycle. The majority of loanees initially accessed the scheme at their place of work via a 'roadshow' put on by Travel Advisors, alternatively they found out about the scheme through word-of-mouth. The TravelWest team was targeting people at transition points, so roadshows were often held in workplaces that were in the process of moving their physical location. Many new workplaces in the Bristol Council area have reduced car parking capacity compared with previous practice, and this was another reason for the scheme.

The TravelWest Team agreed to integrate questions into their loan administration procedures to identify potential participants. Participants were identified from those that agreed to this invitation to participate, and were emailed introductory materials including the participant information sheet. When people did not respond, one follow up email was sent offering an incentive (equipment available anyway via the scheme). The aim was to interview participants on return of the cycle or e-cycle, which had benefits relating to practicality and immediacy of experience (Cresswell 2007; Silverman et al., 2010; 2011).

2.4. Procedure

Four interviews took place at the time of the return of the cycle. Five interviews took place 1–2 months after the loan had ended. One interview took place five months after the loan had ended. Interviews lasted 25–85 minutes, most were 30–45 minutes.

Interviews were digitally recorded and transcribed verbatim for analysis using NVivo software. The approach was to enable to participants to tell their story with prompting from the interviewer, and so the interviews took the form of a *'guided conversation'*, which was a phrase used during introductions before recording (Smith et al., 2009; Braun and Clarke 2013). The appendix provides the listing of the prompts for guidance. The interview schedule was used flexibly and frequently the topics were covered in an order led by the participant. This style allowed unplanned topics to surface. The same wrap-up questions were asked of each participant, including asking whether there was anything else they wanted to say.

2.5. Analysis

Analysis followed Braun and Clarke's (2013) and Cresswell's (2007) process. The first step was to become immersed in the data by carefully reading the transcripts. Pre-determined questions were disregarded in order to *'hear'* what was said.

Once all transcripts had been coded and checked, a two-tier hierarchy of candidate themes was developed from a clustering of the codes. Some codes were merged due to a high degree of overlap in subject matter, and those rarely used were disregarded. Then all the

transcripts were re-read and recoded (where needed) to ensure codes developed during the initial coding were applied consistently throughout (Braun and Clarke 2013).

A session was held with the TravelWest Team (which routinely captures feedback from loan cycle users through conversation and a short feedback form) to discuss the codes and themes. This session confirmed the themes and findings tallied with the feedback they receive.

Ethical approval was given by the University of the West of England, Bristol. All participants received information sheets and completed consent forms. To preserve confidentiality, potential identifiers such as workplaces, organisations, and other specifics were substituted with bracketed generic descriptors (e.g. [workplace]). Some place names remained where they did not compromise confidentiality.

3. Results

Table 1 provides information on the ten participants relating to their age, household structure, car ownership, loan cycle type and period, approximate commute distance and whether they have recent cycling experience. All participants reported commuting as their principal or exclusive use of the loan cycle or e-cycle.

The first letter in the participant code indicates gender. All participants were White British with the exception of FP2 (Turkish/British) and MP2 (South Korean). Five participants had minimal or no experience of cycling since being children or teenagers. The two participants who had had a bicycle stolen were MP1 and MP3. FP2 and MP2 had recently moved to Bristol, and both had experience of cycling, one in another country, and the other in Cambridge, UK. Both these locations contrasted with hilly Bristol because they were geographically flat, with cycling as a normalised practice.

The analysis resulted in three themes, two of which have sub-themes as shown in Table 2. A number of theory-driven codes were derived from the literature, and a number of codes were derived from the data, for example “shopping”. This ensured a balance between theory and the source data (Spencer et al., 2003), and maintained a focus on the experience of participants. Some of the hypothesised codes were little used or discarded, for example few people were able to describe effects on wider wellbeing or ‘near misses’ (Aldred et al., 2013) and were hence not coded separately, but under a wider code of ‘conflict’. Some codes were used flexibly, for example ‘fitness’ was hypothesised as a motivating factor, but was also identified as a barrier.

The results are now discussed by theme in the order presented in Table 2, namely: action and maintenance of action; materials for action and maintenance; norms of cycling.

3.1. Action and maintenance of action

3.1.1. Motivation

There were ten codes linked with motivations for action and maintenance of action, as noted in Table 2. These logically flow from the first two being linked with life and circumstance, through four more linked with mental and physical well-being, a further two linked with skills, and finally two relating to cost and reliability.

Several participants described a **life transition**, such as having recently moved job and/or house, as a trigger prompting a re-evaluation of commute mode. This could be related to a move to offices in central Bristol with restricted parking (FP1 and MP5), or a changed distance relating to whether it was too far to walk (FP4 and MP3). **Workplace culture** was a trigger, and for some this was management-led.

> *‘I started work here at* [new office space marketed as sustainable] *and we obviously have lots of cycling facilities and try to encourage people to come using sustainable methods of transport.’* (FP5)

Table 1
Participant characteristics.

Code	Age	Household structure	Car owner?	Cycle type	Loan period (weeks)	Approximate commute distance (miles)	Recent cycling experience
FP1	56	Single	Yes	e-cycle	4	5–7	Yes
FP2	30–40	With partner and children	Shared	e-cycle	2	9	Yes
FP3	30–40	With partner	Shared	Step through	11	3–4	No
FP4	24	Shared tenancy	Yes	Step through	8	3–4	No
FP5	18–30	Shared tenancy	No	Folding	10	3–4	No
MP1	25	Shared tenancy	Yes	Hybrid	8	1	Yes
MP2	30–40	With partner and children	Yes	Step through	12	5–6	Yes
MP3	40–50	With partner and children	Shared	Hybrid	8	3–4	Yes
MP4	18–30	Shared tenancy	No	Hybrid	8	3–4	No
MP5	30–40	Alone	Yes	Hybrid	7	3–4	No

Table 2
Themes, sub-themes and codes.

Theme	Sub-theme	Codes
Action and Maintenance of Action	Motivation	i) Life transition; ii) Workplace culture, informal support and facilities; iii) Health; iv) Fitness*; v) Hills*; vi) Accomplishment; vii) Training; viii) Improving skills ix) Reliability; x) Cost*;
	Barriers	i) Hills*; ii) Fitness*; iii) Cost* and cycle mechanics; iv) Theft; v) Safety; vi) Feeling afraid; vii) Conflict; viii) Other cyclists; ix) Weather; x) Distance xi) Organisation; xii) Clothes.
Materials for action and maintenance	Infrastructure	i) Space; ii) Walking to avoid risk; iii) Roadworks; iv) Quiet Routes; v) Legibility; vi) Pavements (i.e. footways); vii) Stress induction; viii) Showers; ix)Parking.
Norms of cycling	Freedom	i) Positive feelings; ii) Quiet routes; iii) City discovery; iv) Freedom; v) E-cycles; vi) Loan duration; vii) Frequency of use; viii) Improved skills.
	Identity	i) Other road users; ii) Multiple viewpoints; iii) Guilt; iv) etiquette of other cyclists; v) Future intention; vi) Being a 'Cyclist'; vii) Trip purpose (including shopping).

Note that an asterisk (*) indicates the code is both a motivator and a deterrent factor.

As well as facilities provided by the employer, culture was also developed based on activities undertaken by the employer, such as inviting the TravelWest Team to talk with employees about commuting options (MP1, FP1 and FP3). **Workplace facilities,** through the provision of **showers**, **parking** and **clothes,** were also factors in initiating and maintaining cycling. Changing clothes was undertaken by some (MP3), but, based on dress-code, was not necessary for others (MP4). There was an important element of a co-created culture **of informal** support for some respondents. This was evidenced through the joy of bonding with colleagues through chatting about such things as the ride and the weather, but it was importantly also about the prevalence of cycling or active colleague encouragement.

> '… *a few women specially who said like they were all cycling and I was like 'oh it's not just a man's thing then' you know and they all did it and they would encourage others to do it, …'.* (FP4)

Health and **fitness** were recurring motivators, and for some, it was the primary factor and was linked with finding the joy in exercise.

'I found the cycling was actually very good … it gave me the joy of exercise again, the prolonged exercise that I used to enjoy.' (MP2).

The ability to integrate exercise into commuting was found to be invaluable (MP4 and FP4), and this could include freeing up time in an otherwise time-pressured life because cycling acted as a substitute for the gym (FP3). Health was an ongoing motivator to maintain cycling. Almost all participants reported improvements to strength and/or fitness, even if they were already fit and practising other sport, and the lifelong-cyclist noted the difference resulting from six months of not cycling (MP1). For some, it was the exercise that was the key motivator that made them '*feel good*' about cycling, but in a '*good way*', even if it still felt '*difficult*' (FP4). Even though **hills** could act as a difficulty, some found them '*good exercise*' and a '*test*' of their fitness (MP3). E-cycle users also reported improved fitness, and this was proved to them when they were not '*worn out*' after returning to ride their own cycle (FP1). The sense of **accomplishment** also helped on-going motivation.

> '… *it's an accomplishment and mental wellbeing as well, it is quite nice cycling home after a day of work and having that time to do physical exercise and it feels quite good'*. (FP5)

Cycle Training is a service offered via TravelWest. Participants rode home after borrowing the cycle, sometimes with TravelWest Team **training** or assistance with **improving skills.** This could include talking through the cycle's features, what the participant would need to do, and possibly giving the loanees a trial run. It even extended to guiding someone home in terms of route finding, and where to micro-position the cycle, for example at a pedestrian crossing. These were described as '*little things*' (MP5), but they were clearly valuable to the participants. The training clearly allowed for cyclists to behave differently and more appropriately than they would otherwise have done.

> '… *I felt like you know if someone was trying to get past me, I needed to move out the way … whereas* [trainer] *was sort of saying to be safe you need to be seen, you need to be in the flow of traffic'*. (FP3)

Others did not feel the need for training, but might instead be supported by the other '*people around*' (FP4) within their work situation.

Journey and parking times were revealed as being often shorter than alternatives, with **reliability** of journey time being identified as a key motivator.

> '… *I've got to do the school run, I'm on a deadline so I've got to get there for 3.15, if I take the bike I know I'll be there on time.'* (FP3)

Cost was discussed by all participants with three quantifying specific savings on bus-fares, and one identifying car-parking and fuel cost savings (MP2). However, the reduced cost was offset by having to spend money on a '*bike and all the accessories'* (FP3), with a recognition that this is *'not cheap'* (MP5). Those now committed to cycling were considering the on-going costs, especially as people appreciated quality cycles and equipment.

> '… *panniers and also the lights those are just little things that are necessary … the additional costs it would be a slight, slight psychological barrier … I really like the mudguards another thing I would have to pay for'* (MP2)

Interestingly, only FP4, MP1 and MP2 mentioned being motivated by environmental factors (viz., air pollution and carbon dioxide emissions). Even then, for FP4, for example, the '*green thing*' was specifically of third-order importance after fitness and time.

3.1.2. Barriers

Some factors that motivate were also found in other ways to act as barriers, and these included the limiting effects of **hills**, with one respondent finding them *'really a killer'* (FP5) and requiring a certain level of fitness. The dichotomy of fitness being both a motivation and a barrier could be experienced within an individual; for example, liking the exercise, but then feeling tired too for other activities.

> 'I do some stuff after work and I get so knackered with cycling that I then can't do like dance classes … …'. (FP2)

As noted above, any benefits in relation to **cost** were net benefits, because there still are costs linked with cycling. As a barrier, these were most manifest in relation to **mechanical repair**, which itself is seen as a barrier, particularly in relation to a personal level of ability to successfully undertake repairs. The fear was that a cycle a respondent bought might become unused as a result of mechanical failure, and e-cycle repair costs were noted as being particularly expensive, with costs of '*£50.00 to start with and that's just for them checking the battery' (FP1)*. There was, however, help with mechanical problems, both in the workplace and *en route* with reports of other cyclists stopping to check if they could offer help: *'if you're off your bike, there are people who will stop and just check that you are alright'* (FP5).

Four codes referred to different aspects of risk. The first of these is **theft, in general and particularly** of e-cycles, which had been experienced by MP1 and MP3 and which resulted in a period of absence from cycling and the need for costly additional home security. **Safety** and **feeling afraid** were other recurring risk related codes for all participants. Four female participants felt scared going downhill. One reported being *'more scared of the downhill than I dislike the uphill'* (FP5) with the problem being the *'feeling of being out of control'*. All participants had experienced fear and actual **conflict** but the general consensus was that most road users '*treat each other with respect'* but that *'some motorists … don't give you enough space when you pass and they can be a bit aggressive'* (MP1). 'Near-misses' with motor traffic were little reported, perhaps because most respondents sought-out quiet routes: '*I try and avoid the roads wherever possible and try and do routes that have lots of cycle-paths and off-road and things like that'* (FP5).

The subject of **other cyclists** was a complex one with some cyclists being helpful while others could be intimidating. While some of the safety concerns were partially overcome by what '*feels like a bit of safety in numbers'* (MP5), on the other hand this could be overwhelming, with the inverse comment being that Gloucester Road is *'completely full of swarms of cyclists … that's almost as intimidating really'* (FP4). One participant had an ankle grazed by another cyclist when she stopped at a red signal but he did not stop, and he shouted at her. Some respondents felt little camaraderie with their fellow cyclists.

> *'I don't kind of feel that I was part of a group, because all the cyclists just seem very much determined on getting from a-to-b, it didn't seem like a kind of shared mentality'*. (MP5)

The final four codes relating to barriers are all concerned with the environment and protection from it. **Weather** was discussed by all respondents and this is compounded by the **distance** that needs to be travelled: some '*don't mind it at all'* (FP2), and this may be because recovery is possible, with people realising that they '*can have a shower'* when they need to (MP3). However, based on experiences, many planned around weather by checking ahead and perhaps taking the bus. Decisions to switch away from the cycle were also linked with compounding feelings based on reduced ability, for example to see properly, during inclement weather: '*if it looks like it's going to be horrible … there was a few times when I got really, really wet and I couldn't see and … that made me a bit nervous … '* (FP4).

Most respondents realised the enhanced level of **organisation** that cycling requires compared with other modes. This was often linked with clothing, and hence related to issues of weather and distance. The organisation required to change and store **clothes** was also described as being inconvenient and time consuming.

> *'The worst thing I think about the bike, any bike is the changing. You come to work you've then gotta … shower, change and then when you go home … you've then gotta go back to your lockers, get all the stuff out, change, put that in the locker, then those gotta be emptied on a Friday'*. (FP1)

There was also the issue of needing to carry personal items in a pannier on a cycle, and the pannier can be less roomy than a car.

> *'[in] a car it's not such an issue you can just chuck everything in it doesn't really matter, whereas with your pannier … I've only got this much space … so I do try now to prepare the day before, which sometimes is a bit annoying"*. (FP4)

A level of organisation was also required for storing the cycle in the limited space at home, and the weight and bulkiness of the e-cycle '*for a girl'* was a problem for FP1. Luggage and domestic or family commitments meant that respondents sometimes needed still to drive, for example because children were *'doing something after school that requires the car'* (FP3).

3.2. Materials for action and maintenance

When asked about what would help them cycle more, respondents talked about the provision of infrastructure both along the route and at the journey end. All participants talked about route infrastructure in relation to the general lack of **space** available for cycle traffic. Rather tellingly every woman in the sample reported **walking to avoid risk** when necessary.

> *'I haven't had a single journey where I didn't get off the bike and walk coz you do have very busy junctions and roundabouts … just for my own safety"*. (FP2)

Proximity of buses is also intimidating, especially for women: *'When the buses are close speed past you that shakes you on the bike'* (FP2). Poor or discontinuous cycle lanes were commented on by both men and women and this was often exacerbated by **roadworks.**

'it's a cycle path, just stops where you can't get on the road'. (FP2).

When people used routes on the highway that were **quiet routes** (that is to say, routes away from large volumes of motor traffic), they were reported as being uncomfortable due to their narrowness and parked cars. **Legibility** on quiet and off-road routes was also problematic and people could lose their way.

> *'I had to look on Google-maps on my phone and the only way to do that safely is to stop the bike which is really inconvenient … perhaps some more symbols on the ground and some signage would help'.* (MP5)

There were different issues when the infrastructure was inadequate because it needed to be shared with pedestrians. There was a sense of a common understanding of the problem of lack of space amongst pedestrians and cyclists, but also of a need to take care.

> *' … pedestrians I find are quite understanding … sometimes when you're not aware or they don't hear you coming you certainly have to be careful'.* (MP3)

Overall, however, the shared infrastructure with pedestrians induced experiences of **stress**.

> *'It's quite busy, you have to make sure not to knock a pedestrian over or be in their way as it feels like certain sections you almost shouldn't really be on there with a bike'.* (MP5)

Journey-end facilities were an important feature of infrastructure, and these could be of variable quality and desirability: a workplace **shower** was broken (FP2), one respondent would not shower (FP3), another disliked unisex changing facilities (FP1), while others enjoyed well-designed provision (MP3, FP4 and FP5).

While workplace **parking** was generally provided, some found it insufficiently secure, for example, to leave the cycle overnight (MP4). No-one talked about problems with publicly available parking, although Bristol City Council did provide thousands of spaces as part of the wider project prior to the study (Bristol City Council, 2011).

3.3. Norms of cycling

3.3.1. Freedom

There was a distinct difference in respondent's emotions between those who were new to cycling and those who were returning to cycling. Those new to cycling were initially afraid and wary, but they had **positive feelings** in the form of relief when the reality of the experience was not as bad as envisioned.

> *'There was in my head 'oh cycling round Bristol is awful … but it definitely hasn't been anywhere near as bad as I imagined'.* (FP5)

On the other hand, those who were returning to cycling experienced immediate positive feelings.

> 'I really like cycling because of it's sort of powering yourself … I don't know it's fun … I was very happy to be back on my bike'. (MP1)

Positive feelings are mostly apparent on **quiet routes.**

> *'You'd get [joy] if you were off road and not having to be thinking about what you're doing next and what's going on around you".* (FP3)

Despite getting lost, FP2 enjoyed the adventure of **discovering the city** in a new way, and the revelations that this brought about previously undiscovered places and spaces.

'Just trying different roads I get to see more of the City it was just that adventure feeling of undiscovered but I'm also going to work … a few times I stopped a few parks I've seen I didn't know existed … it was just beautiful".

And with adventure goes feelings of relief resulting from simply arriving: *'I arrive in work and think 'yes! I'm safe' and I arrive home and think 'I'm still here!''* (FP1). Participants reported enjoying being outside and connected with the city because of the sights and smells.

> *'When you're on a bike you can appreciate the smells of the city, and the sights that you don't notice when you're in a car or on the bus, so I cycle past Marks' Bread … the smell of that is really nice'.* (FP3)

The word '**freedom'** frequently came up, but mainly compared with other modes because of reliability issues (e.g. buses) and enhanced journey speed (MP4). **E-cycles** stand out as being unexpectedly enjoyable (FP2), and gave both the borrowers more confidence in traffic due to their enhanced acceleration and reduced level of effort to maintain a certain speed.

> *'I just couldn't believe, I felt like I was on well like a fairground ride to be honest. I got home with a massive smile on my face … I couldn't wait to use it again'* (FP1).

Most people did not find riding the cycle a problem and quickly became used to it, and **improved their skills**, and this gave them a sense of accomplishment, and this translates into a hope of continuing growing confidence leading to more travel more around the City (MP5).

The **loan duration** coupled with the **frequency of use** during the loan period are important in relation to building reliance and confidence on the cycle, which in turn relates to habit formation.

' … I had it for about a month, six-weeks and it didn't feel like I had it quite long enough to be reliant on it'. (MP5)

FP2 and MP2 did not know about the **training** and were keeping close to the kerb and feeling pinched for space. Conversely, after training, confidence was boosted because of knowledge of rules and entitlements.

'My confidence has changed as I say I know what I'm supposed to be doing … before I would have thought 'oh maybe I'm in the way' because I was seeing it as a driver whereas now I think 'well no I'm entitled to be where I'm supposed to be as a cyclist''. (FP3)

3.3.2. Identity

One respondent encapsulated from her experience the contrast in the identity of cyclists between Cambridge and Bristol by saying that in Cambridge it is a '*way of life*' and therefore in a sense carried no connotations of 'identity', whereas in Bristol she defined the view of cycling or cyclists as being '*so different*' and '*weird*' (FP2). Identity is set in a context of multiple road user identities and many **other road users** were reported as behaving in an aggressive way to people who are cycling.

'There's occasions where cars will just seem to be annoyed that you're on the road and just honk at your or come right behind you for no reason or be quite aggressive'. (MP3)

Participants frequently adopted **multiple viewpoints** including, firstly, the view from 'behind the windscreen'. They understood as a driver themselves *'why people get frustrated'* (FP1). Secondly, they adopted the viewpoint of the pedestrian, and hence were readily able to realise why someone would not *'want a cyclist whizzing past me, scaring me'* (FP2). Participants appeared motivated by **guilt** to behave in certain ways, and they did this by putting themselves in the place of the other road users, while at the same time thinking about their own safety.

'I try and think what the car driver's thinking … I don't wanna hog the road a little bit, but I try to think in a self-protective way but I also try not to be a dick about it … so I just try to look at it from both sides'. (FP4)

This concern to behave appropriately then resulted in frustration if **other cyclists** were seen '*doing things they shouldn't*' (FP3). However, respondents sometimes felt on the receiving end of criticism from **other cyclists**, especially those wearing lycra and cycling at higher speeds. They felt there was an **etiquette** to their behaviour which was not quite fully revealed.

'There's obviously some quite dedicated cyclists who do that journey every day and they're in full Lycra on a fast road-bike … there's a certain etiquette … you get some funny looks, a few cross words'. (MP5)

All participants stated a **future intention** to continue cycling. Three respondents had bought second-hand cycles when interviewed (FP3, FP5 and FP4, who had consciously bought a cycle similar to the loan cycle). However, when asked whether they feel like a '**cyclist'** now, few did, with some maintaining a multi-mode user perspective and others not planning to cycle in their free time (MP3).

'No, I think I'm a cyclist and a driver, and an occasional bus user … some people here … cycle in every day in all weathers. I'm sure they would say they're cyclists." (FP3)

Indeed, few new cyclists were considering a wider range of **trip purposes** beyond commuting for their future use of the cycle. Shopping, visiting friends and the pub were purposes that had already been incidental non-commuting uses for a participant with recent cycling experience (MP1), but most other new cyclists foresaw their cycling as being exclusively for commuting. One e-cycle user was deterred from using the e-cycle for shopping by fear of the battery being stolen (FP1). Two others new cyclists would not shop by cycle (FP3 and FP4).

'If I do need to go grocery shopping, fine I use the car, but I would say cycling is really my preferred [commuting] method now … I feel good about that.' (FP4)

4. Discussion

This section considers the results in relation to the literature and the aim of exploring the motivators, problems and barriers for maintaining cycling as a new behaviour.

4.1. Action and maintenance of action

While barriers and motivators to cycling are widely reported in the literature, this study reveals overlaps between them. For example, fitness and embedding exercise into the daily commute were motivating factors, but participants also found the overall experience was something to be endured as hard work but rewarding as a result. Hills are symbolic of this providing a sense of accomplishment but simultaneously being unpleasant both uphill and downhill, this latter especially for women. Most participants reported already being physically active, potentially limiting the health benefits (Yang et al., 2010), although the daily practice will be beneficial (e.g. Celis-Morales et al., 2017).

Cost, hypothesised as a motivator, doubles up as a barrier; daily cost savings are offset for non-owners by the initial expense of equipment and ongoing maintenance (c.f. Nkurunziza et al., 2012) and theft inhibits people from investing in a quality machine, especially e-cycles, and can cause regular cyclists to 'relapse'.

Several participants switched from buses, and one from walking, again potentially limiting health and environmental benefits (Krizek 2012), which can anyway be overestimated (Yang et al., 2010). Compared with buses and cars, cycling is motivationally experienced as more reliable and usually faster, but this is dependent on traffic congestion and cycle-able distance (typically less than 5 miles, except by e-cycle), and a compact urban footprint (like Bristol).

The bodily experience of hard work and unpleasantness is exacerbated: firstly when participants were forced to change mode when moving offices; secondly by the organisation required to carry luggage and manage domestic constraints, especially for women (Skarin et al., 2017; Steinbeck et al. 2011, van Bekkum et al., 2011); thirdly by adverse weather and the associated need to carry and change clothes and/or shower; and fourthly by the lack of space or quality infrastructure and the resulting feelings of fear and conflict, intimidation from poor motorist behaviours and/or large vehicles. These are all well-rehearsed in public discourse, which has created a self-reinforcing vicious-circle (Horton et al., 2007; Pooley 2013).

For women, walking through dangerous junctions and fear of riding downhill adds to the feelings of having to overcome barriers and unpleasant feelings. The few reported near-misses (in contrast to Aldred and Crosweller 2015) seems to reflect the avoidance of danger described by participants at dangerous junctions and the choosing of quiet, off-road routes; even then they experienced some conflict with pedestrians and other cyclists.

4.2. Materials for action and maintenance

Confidence in riding the machine and coping with traffic improved quickly, especially with formal training. Cycling can be fun, even for commuting, especially on quality, off-road routes separated from pedestrians and motors, and all participants wanted more and better quality and continuity of off-road routes. This is well-researched and accepted (Buehler and Pucher 2017; Parkin and Koorey 2012; Pucher et al., 2010).

4.3. Norms of cycling: freedom

Participants enjoyed being in contact with the open-air and the city and discovering new places. The reliability and independence of cycling, along with the simple pleasures of the practice, offered a sense of freedom. However, this "freedom" was hard to find and maintain; new cyclists, when directly asked, disagreed they "get the joy" described by regular cyclists (Aldred et al., 2013). Positive experiences are undermined by poor infrastructure, roadworks and inadequate legibility for both route-finding and positioning on shared-paths; high-quality cycle-routes were often illegible and hidden-away.

Norming of cycling through workplace culture, self-generated or management-led, is positive especially during life-transitions, which prompt reconsideration of commute mode (Chatterjee and Scheiner 2015), but its impact is reduced by poor parking/changing facilities or when imposed.

Formal training and informal support appear beneficial, although more research is needed (Yang et al., 2010), and a challenge to TPB is precisely that those with low perceived behavioural control accessed training, improving their skills and changing perceived social norms. Participants were often unaware that training (riding and basic maintenance), online journey planning and paper cycling-maps were available.

Several people extended their loan as four-weeks felt insufficient for new habit-formation - some had only ridden once or twice a week limiting the exposure and development of confidence and skills. Commuting is habitual and four-weeks of full-time commuting is the apparent minimum for habit-formation/decay (Walker et al., 2015). Quantitative research of a larger cohort of borrowers and/or formal trainees could generate evidence of the optimum loan period and the role of training in cycling becoming an enduring habit, as well as long-term impact.

Both e-cycle borrowers enjoyed their experiences (albeit both already cycled), travelled further, felt safer and deliberately complemented the motor with their own physical effort, which is in line with Jones et al. (2016) and indicating e-cycles have potential to offer non-cyclists a positive and healthy option. The cost, weight, and fear of theft, of e-cycles was a barrier.

This study has not considered long-term impact. For some, while the experience was positive it had also become a 'bore' (FP4). Others were still more tentative about the future. 'Relapse' is therefore a considerable risk because the changed practice may still represent weak habit-formation (Walker et al., 2015), indeed Gatersleben and Appleton (2007 p308) found positive experiences of "*fitness, being outside and especially having fun were mentioned less*" after two-weeks, although reported satisfaction with journey flexibility and safety improved.

4.4. Identity

Participants exhibited non-binary "ambiguous" identities (Guell et al., 2012) with conflicted and "stigmatised" characteristics; they placed themselves 'behind the windscreen' thereby "managing *other people's identities*" (Aldred et al., 2013 p256) - in this case further including the identities of pedestrians and "Lycra" cyclists. Participants stereotyped cyclist behaviour as deviant and distanced themselves from being a "cyclist" (ibid), expressed by determination to behave with "*etiquette*" (MP5) and not "*be a dick*" (FP4); this is exacerbated by lack of camaraderie between cyclists, who can be intimidating and unpleasant. Even after several weeks' practice, cyclists are seen as "others" - hardened, Lycra-clad, recreational riders - suggesting doubts about the effectiveness of promotions using sport-cycling are valid (Aldred et al., 2013; Leonard et al., 2011; Tapp et al., 2016).

Guilt is theorised as a motivator for behaviour change for people with "pro-social" attitudes incongruous with their current behaviour (Bamberg 2013), but participants experienced guilt as a barrier when undertaking an unusual practice in "*motorised street*

space[s]" (Aldred et al., 2013 p254). In designing and managing city infrastructure it is necessary to consider how cycle paths do not become merely busy and fast, but rather the overall purpose and nature of streets is made healthy.

Participants' motivations and experiences were diverse and complex, often based on habit, emotional responses and "*ambiguous reasoning*" rather than rational choices (Guell et al., 2012 p236), not least as cycling has an "*ambivalent status of 'healthy behaviour'*" (Aldred et al., 2013 p256). Environmental factors were barely mentioned – and only by more committed participants – discounting them as a promotional approach.

Palpable differences exist between the new recruits, whose cycling choices are conscious and compartmentalised, planned events (e.g. for commuting *not* shopping) compared with more experienced 'cyclists' who enjoy it for its "own sake" (Gatersleben and Appleton 2007), and whose cycling is for varied purposes as an integrated feature of everyday life.

As per literature on gender (eg Bopp et al., 2014), women participants all reported safety concerns, including fear of downhill, avoiding dangerous situations by walking in parts and using quiet routes. No-one reported "community" safety fears (except cycle-theft), or any specifically sexist incidents, which is not in keeping with the literature or experience from practice. All three entirely new female recruits sought out support, were encouraged by positive workplace culture and sensitive to poor changing facilities and the challenges of being organised and carrying luggage. E-cycles gave both women more confidence, although their weight may be a problem.

4.5. Limitations

The findings may be limited to the UK, and Bristol's infrastructure and geography (hilliness and infrastructure shared with buses and pedestrians), relatively large cycling rate, emerging cycling culture (Aldred 2012) and relatively positive attitudes (Tapp et al., 2016) may limit the replicability of the findings.

The TravelWest Team surmise that borrowers who give no or minimal feedback will not have used their loan-cycle. Hence, those who did take part may have been self-selecting, such as FP4 "[the scheme] was really important for me and that's why I was so keen to do the interview". The project timing meant nine of the ten participants cycled in the winter, possibly affecting usage frequency and exaggerating the influence of weather.

Findings from early interviews were used to enhance later interviews and this may have limited the range of findings in some early interviews.

5. Conclusions and recommendations

Regular cycling is good for health, and many adults and children undertake insufficient physical activity to help maintain good health. The exercise of cycle commuting contributes significantly to recommended levels of physical activity, even for e-cycle users. Programmes of funding have sought to increase the proportion of people commute cycling, but little is known about the retention of new or existing cyclists.

This study explores qualitatively a 'try before you buy' cycle loan scheme framed around the 'maintenance of action' stage of Prochaska and DiClemente's (1982) Trans-theoretical model. The study involved semi-structured interviews with ten participants on, or after, returning the cycle at the end of the loan period, analysed thematically.

The first theme that emerged was around the motivators and barriers to maintenance of action. Fitness, topography, cost act as motivators and barriers. Motivators include life transition, workplace culture, the sense of accomplishment, and skills acquisition, sometimes through training. Barriers include risk factors related to the environment and the complications of needing to be well organised.

The second theme related to a lack of infrastructure along the route and at the journey end. All the female respondents reported getting off to push their cycles at certain points on their journey because of infrastructure inadequacy.

The final theme was about freedom and identity. The ability to discover the city was a key freedom. Few participants developed the identity of a cyclist and most maintained a multi-road user perspective.

This is the first study we are aware of that explores qualitatively the important stage of maintaining the action of cycling once commenced. We have revealed the potential, indeed probable, fragility of maintaining the habit. This is because of the diverse

Box 1
Recommendations for the practice of operating cycle loan schemes

- Formal training should be provided where required to assist in gaining confidence in riding the machine and dealing with traffic.
- As well as formal training, informal support should be provided as required by participants.
- Actions to assist self-generated and management-led workplace culture that helps the normalisation of cycling should be developed and implemented.
- The period for a loan should be flexible and extendible because different people appear to have different periods over which habit may begin to form.

experiences and difficulties reported. Despite that fact, all participants, to varying levels of certainty, stated their intention to continue cycling. We also revealed evidence of the potential transformative role of e-cycles, which enhance the joy of cycling through reducing the effort required. Overall, the qualitative approach has revealed multiple complicated structural, physical and personal or domestic factors that combine in a complex way to influence the formation of a cycling habit.

Box 1 identifies recommendations for practice for programmes designed to assist people to form the habit of cycling.

CRediT author statement

Ed Plowden: conceptualization, methodology, investigation, formal analysis, writing - original draft preparation, writing - review & editing, John Parkin: writing - original draft preparation, writing - review & editing.

Data availability

The authors do not have permission to share data.

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Appendix. Interview outline structure

Brief personal history of cycling (warm up)

- When did you learn to cycle?
- What are your experiences and history of cycling, including your latest experiences (Bonham and Wilson, 2012)?
- Do you identify with making any transitions in your lifestyle (Chatterjee and Scheiner 2015; Walker et al., 2015)?
- What is your history for bike ownership?

How did your bike loan come about?

- Can you briefly describe how and where contact with and awareness of the scheme came about?
- What purposes do you use the loan bike for? (prompts if required: travel, health, commuting, leisure, curiosity etc.) (Horton et al., 2007)
- Do you have access to a car and how did you previously travel (Jones et al., 2016)?
- What are your motivations for having the loan bike? (prompts if required: intrinsic or extrinsic; time, health, money, environment, transition) (Handy et al., 2011; Parkin et at 2007; Tapp et al., 2016)
- Benefits of or reason for taking a loan bike (e.g. lack of certainty about the initial outlay).
- What type of bike do you have? (prompts if required: electric or other features) (Parkin et al., 2007)
- What will be/has been the length of the loan (post interview follow up if required) (Walker et al., 2015)
- What other services have you used as part of the scheme (prompt if required, e.g. bikeability and awareness training)

Experience of the bicycle and equipment

What have been your experiences of the bicycle and equipment as follows (Bejarano et al., 2016; Gatersleben and Appleton, 2007; Guell et al., 2012; Spinney et al., 2009)

- Riding the machine (gears, brakes, punctures etc.)
- Equipment and 'baggage' (luggage, locks, lights, clothes/weather)
- Human body and physicality
- Frequency/regularity (did it get used, and di that change during the loan?)
- Mechanical experience (especially e-bikes)
- clothes wearing (Aldred et al., 2013)
- battery charging

Physical experience – body/mind (Spinney et al., 2009)

Do you have comments on:

- Fitness (initial and any changes experienced)
- Impact on wider wellbeing

- Appearance and cleanliness ('helmet hair', washing facilities, sweatiness)
- Speed, joy, fun, fear

Physical experience – geographical, infrastructural and weather

What are your experiences of (McKenna and Whatling, 2007; Parkin and Koorey, 2012; Pucher et al., 2010):

- Routes (on- or off-road, separated infrastructure or not, positioning in the road, direct versus quiet routes);
- Wayfinding, route planning, apps, maps and mental maps;
- Pleasant or unpleasant landscape and geography, natural and/or street environment;
- Road and community safety (intimidation, harassment near misses or actual incidents) (Mann and Abraham, 2006; Aldred and Crosweller, 2015)
- Red lights, pavements, one-way streets (Daley and Rissel, 2011)
- Community Safety (darkness, lack of natural surveillance, e.g. on off-road paths)
- Comfort and convenience in general and specifics (e.g. hills, widths, potholes)
- Road positioning (Aldred et al., 2013)
- Storage (at home and work) and other facilities (showers, lockers) (Buehler, 2012)
- Weather, pollution (Sears et al., 2012)

Perceptions and changes

Have any of your perceptions changed about the following:

- Other people on the journey (bikes and foot or in cars) (Aldred et al., 2013)
- Any experience of helpful or harassing behaviour (Aldred, 2012)
- Bike couriers and other professional (e.g. van) drivers (Aldred and Crosweller, 2015; Skinner et al., 2007)
- Other people who do or do not cycle and their behaviours (at home/work and family/friends)
- In groups and out groups (Aldred et al., 2013)
- Changes in own perception and confidence (Mann and Abraham 2006; Gatersleben and Appleton, 2007)
- Future intentions (continue cycling, extend it, buy a bike) (Tapp and Parkin, 2015)
- Benefits (money, time fitness etc.) and disbenefits (fear, out-group etc.)

***Overall experience** (McKenna and Whaling, 2007; van Bekkum et al., 2011; Alvanides, 2014; Skarin et al., 2017)*

- How would you describe the overall experience-was it a big step (Gatersleben and Appleton, 2007; Skinner et al., 2007)?
- Did you enjoy it overall? How did it relate to pre-loan expectations (Gatersleben and Appleton, 2007)?
- Do you feel like a "cyclist" now? (Aldred et al., 2013)
- What might encourage you to bike more?
- What do you think the council or government could do to encourage more people to cycle?
- What do you recommend to people who are taking up cycling?

Is there anything else you want to say?

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