Finding that elusive bell and other issues - experiences from starting to cycle during a pandemic

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ABSTRACT

The Covid19 pandemic has pushed a large number of people to change their mode of transport from (mainly) public transport to cycling, and thus given us an opportunity to study the adoption process of cycling. The paper reports on an interview study with 12 participants who started, or significantly increased, cycling during the pandemic, and utilises the Innovation-Decision Process to analyse the participants' cycling adoption and draw implications. The results show that adopting cycling as a primary mode of transport is a journey of constant reinvention of practices based on positive and negative discoveries, and that equipment (incl. a variety of clothes, bicycles, and bells) is key to overcome the negative discoveries.

The main implication for urban policy and planning is that many measures can be taken to increase adoption of everyday cycling in addition to building more protected bicycle lanes. Examples include 1) develop new equipment more suited for everyday cycling, 2) create meeting points to transfer knowledge on equipment as well as good routes, 3) prioritize cycling at workplaces and other destinations with lockers, indoor storage, etcetera. To influence people to begin everyday cycling, it is also important to address the measures towards 'people who cycle' rather than 'cyclists' as many people do not wish to identify themselves as the latter.

1. Introduction

During the Covid19 pandemic, there has been a great shift in mobility behaviours, in particular since many people have been working from home, and thus, fewer have been commuting (e.g. Abdullah et al., 2021). Moreover, for those who still have had to travel to work, public transport has become a less attractive alternative due to the infection risk posed by the often crowded and closed-off space in buses, trains and trams. In lieu, the bicycle has become an increasingly attractive and viable alternative for many people. Cities around the world have seen an increase in the number of bicyclists, or at least a shift towards many new people who cycle (e.g. Kraus & Koch, 2021; Shamshiripour et al., 2020). In the city of Gothenburg, where this research has been carried out, cycling increased with 8% during 2020 while all other modes of travel decreased (Gothenburg Urban Transport Administration, 2021). Many cities have tried to facilitate this shift through installing pop-up cycle lanes, changing policies on things like on-street parking, city speed limits, etc. (e.g. Nikitas et al., 2021), and speeding up already planned cycling infrastructure initiatives. To make these measures permanent is a crucial part in the necessary transition into a more sustainable urban mobility system.

However, as important as bicycle infrastructure is, there are also other factors that may have an influence of the experience of cycling as means of transport rather than a leisure activity, hereafter called "everyday cycling". Cities are constantly looking for new ways to get more of the citizens to park their private car and take up cycling as an alternative (e.g. Handy et al., 2014). This transition is motivated from a climate perspective, a health perspective, and as a part of a stive to create more liveable cities. Cycling as an everyday mode of transport has very low impact on CO2 emissions. Brand et al. (2021) for instance claim that cyclists had 84% lower life cycle CO2 emissions than non-cyclists in a longitudinal study of nearly 10.000 participants arguing that increased cycling should be a key strategy to reduce greenhouse emissions. Moreover, there are clear health benefits to the individual cyclist, even if one is cycling in congested city traffic (Raza, 2021). There are also health benefits for citizens in general due to virtually zero emissions of, for instance, ozone, particulates, and noise, things that are the constant companion of motorised vehicles. However, increasing the share of cyclists has not been easy. For instance, the city of Gothenburg is still a long way away from reaching its ambitious goals for cycling

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(Gothenburg Urban Transport Administration, 2020) despite much work and political will. Moreover, there is little robust evidence of which interventions can increase commuter cycling, especially in nations with a currently low share of cycling (Stewart et al., 2015).

The Covid19 pandemic and its associated rise in the popularity of cycling has given us a unique opportunity to capture the experiences of new cyclists, as it has made it possible to identify a critical mass of new cyclists who started roughly at the same time. By capturing the experiences of this group of new cyclists, we can understand the hurdles they had to overcome and what made them continue their process of becoming everyday cyclists. Based on their experiences and encountered barriers, we can then hope to identify measures and solutions that can enable or encourage more people to cycle for everyday transport. Thus, the question this paper tries to answer is "What can we learn from people's forced adoption of everyday bicycling during the pandemic that could be implemented to attract new cyclists in a post-pandemic future?"

The paper is structured as follows: first, an overview of the method and analytical framework used is given, along with a short introduction to the context of study. Next, the results are presented in two sections explaining the process of adopting everyday cycling and the reinvention required to manage. These results are then discussed in terms of which implications can be identified for different stakeholder groups who wish to support increased cycling post pandemic. Finally, conclusions are drawn.

2. Analytical framework and method

To answer the question of what could be learnt from people's forced adoption of cycling, an interview study with people who had started cycling or significantly increased their cycling during the pandemic was conducted. Their retrospective narratives were then analysed from a behaviour change perspective using the Innovation-Decision Process. The reasons for doing so are explained below, as well as how the study was carried out and analysed.

2.1. Starting to cycle - a process of adoption

Starting to cycle for everyday transport represents a behaviour change. Behaviour change in general relies on that people have the motivation and intention to change and that they have possibility and ability to enact that change (Ölander & Thøgersen, 1995). There are multiple models describing which aspects determine behaviour change intentions (for an overview see Jackson, 2005), and there are a few staged process models describing the enactment of the change intention in practice (e.g. Stages of Change; Prochaska & DiClemente, 1986, Diffusion of Innovation (Rogers, 1995), the Stage Model of Self-Regulated Behavioural Change (Bamberg, 2013). In the study described in this paper, it is this process of enacting change that we can analyse using the participants' retrospective narratives on starting to cycle as a basis.

The different process-models mentioned all conceptualise behaviour change as a staged process the person changing their behaviour moves through. Using a process-model allows for capturing the time-related aspects of behaviour change, as well as the active effort required by individuals in changing behaviour (Bamberg, 2013). In each of the stages, the person changing must actively engage with a different facet of the change in order to pass to the next stage. Bamberg (2012) describes this as confronting different specific tasks when starting to cycle, like consciously re-evaluating current travel behaviour, or planning the implementation of cycling by organising a bicycle and finding the route etc. In relation to time, Nello-Deakin and Nikolaeva (2021) particularly stress the need to investigate the dynamic temporal aspects of cycling uptake, as the factors that encouraged the participants to cycle in their study tended to change and evolve through time.

A process-view on behaviour change has been applied to the adoption of active travel behaviour before. It has been used to highlight which barriers hinder cycling at different stages (van Bekkum et al., 2011) and to suggest interventions based on information and feedback, targeted at helping presumptive cyclist to move to the next stage (e.g. Bamberg, 2012; Gatersleben & Appleton, 2007). Strömberg et al. (2016) have also studied new cyclists' behaviour change processes when they were the target of a behaviour change intervention, revealing the many adaptations and continued support needed by the cyclists beyond the initial intervention.

In this paper we choose to use the framework provided by Rogers' Innovation-Decision Process to provide structure to the analysis, as it highlights both the dynamic temporal process and activity required by the person, as well how the characteristics of the innovation itself interacts with this process.

2.2. The innovation-decision process

The model of the Innovation-Decision Process is one piece of Rogers' larger framework on the diffusion of innovation which describes how change spreads in society. The Innovation-Decision Process describes the process of incorporating an innovation into on-going practice (Rogers, 1995). An innovation in this case may be any idea, practice, or object that is perceived as new by the person about to adopt (or reject) the innovation. In our case the innovation of interest is the behaviour of everyday cycling, and we use the Innovation-Decision Process to structure the analysis of participants' processes of incorporating transport cycling into everyday life.

Going through the full Innovation-Decision Process means passing through five stages, from initial knowledge of the innovation, persuasion about its benefits, decision to adopt, implementing the innovation (putting it to use), to confirming the decision (see Fig. 1). While the decision to adopt is represented as a separate stage, each stage in the process can be a potential rejection point. For the person to move with the innovation through the process, the innovation should be perceived to have certain characteristics. It should have a *relative advantage* compared to what is being done today, it should be *compatible* with one's needs and values, not be too difficult to understand or use *(complexity)*, its effects should be easily *observable,* and it should be *possible to try* the innovation on a limited basis to dispel uncertainty about the idea and how it works under one's own conditions. Throughout the process the person actively works to gain information to reduce uncertainty about these characteristics – from more general knowledge about the innovation's characteristics, to how-to knowledge to help put it to use, to information that can reinforce that the right choice has been made. The person can also adjust the innovation to make it fit better, called "reinvention" by Rogers. Such reinvention primarily happens in the implementation stage, for example by simplifying the idea or by trying to make the innovation one's own.

2.3. Interviews and analysis

In order to understand people's experiences of the adoption process of everyday cycling, an interview study was conducted with twelve persons who reported that they had started, or significantly increased, everyday cycling during the pandemic (see Table 1). While certainly many people tried cycling to work and rejected the innovation, we decided to interview those who did continue, to try to catch their full experiences becoming an everyday cyclist, including driving forces, barriers, and the ways to overcome them – in order to turn such insights into strategies. The study thus focusses on narratives of individuals' experiences rather than aggregated data and on what made them adopt everyday cycling rather than reasons for rejection.

The process of recruitment, interviews and analysis is described in Fig. 2. The participants were recruited through Facebook ads, where the ad was shown to residents living in the greater Gothenburg area. A screening questionnaire was used to select those interested to participate
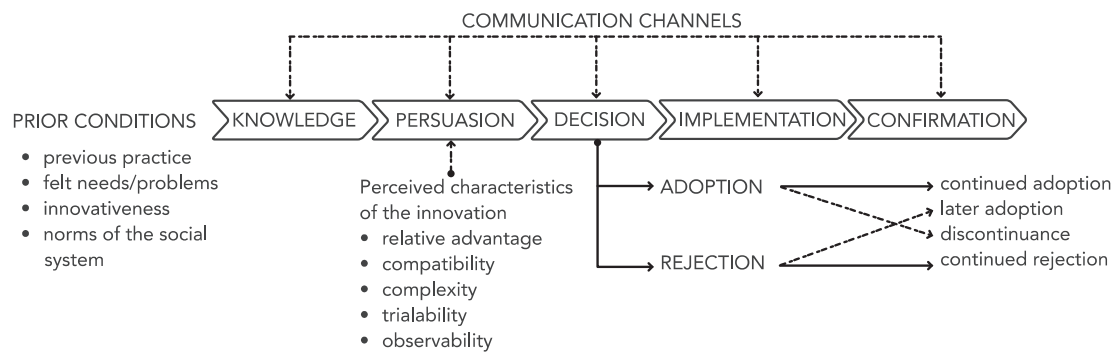
Fig. 1. An adapted version of Rogers' Innovation-Decision Process (adapted from Rogers, 1995).

Table 1
The participants of the study.

Participant	Gender	Bicycle type	Commuting distance (one way)	Profession	Pre-covid cycling/change magnitud
P1	F	Racer hybrid; City bike	11 km	Librarian	Seldom to everyday
P2	F	Traditional ladies' bike	6 km	Nurse	Very seldom to everyday
P3	M	Commuter hybrid; Carbon racer; Mountain bike; Several project bicycles	5 km	Teacher	Not at all to everyday
P4	M	7-speed City bike	10 km	Special needs educator	Very seldom to everyday
P5	F	Commuter hybrid; Gravel racer; Mountainbike "Old bike"	20 km	Librarian	Very seldom to everyday
P6	M	7 speed city bike; Gravel racer	7–8 km	IT	Not at all to several days/week
P7	F	Hybrid e-bike	11 km	Administrator	Only in warm season to everyday
P8	F	Ladies e-bike; Cheap bike	7,5 km	Teacher	Very seldom to several days a week
P9	F	Traditional ladies bike	5–6 km	Student	Only summer cycling (seldom) to 5 days a week
P10	F	7 speed city bike	3 km	Researcher	Very seldom to several days a week
P11	F	Hybrid e-bike	23 km	Nurse	Very seldom to everyday
P12	F	Ladies e-bike (borrowed)	14 km	Engineer	Not at all to a few days a week

Fig. 2. An overview of the method applied in the study, including the recruitment and analysis.

who indeed had started or increased their cycling significantly, rather than those who were just interested in the topic. In addition to questions on increase in cycling during the pandemic, questions about types of bicycles used, style of cycling behaviour in terms of speed, as well as questions on age and gender were posed. However, this additional data was not used as a selection criterium, but mainly to ensure that the selection was somewhat balanced. All interviews were conducted one-on-one via an online meeting platform (Zoom or Microsoft Teams, depending on the participant's preference), and were recorded for later analysis. The interviews lasted between 30 min and an hour with an average of around 45 min. The interviews followed an exploratory semi-structured interview guide, with questions in categories such as;

- Background and cycling behaviour
  o Where do you cycle?
  o Describe your cycling habits
- Motives for cycling
  o Why did you take up cycling?
  o How do you feel when cycling?
- Experiences of adopting everyday cycling
  o What were your experiences?
  o Were there any particular barriers and drivers?
- Identity
  o Do you call yourself a cyclist?
  o What characterises a cyclist?
  o Can you describe your cycling style?

- Infrastructure and interacting with cyclists and other road users
  - What particular situations do you enjoy/dislike?
  - Is Gothenburg a cycling-friendly city?
- The bicycle and its accessories
  - What type of bicycle do you have?
  - What do you like about it?
  - Do you use specific bicycle equipment and why?

The idea was to try and capture as many aspects related to the adoption of everyday cycling as possible.

The interviews were transcribed in part and analysed in two stages. In the first stage of analysis, the interviews were analysed with a thematic analysis, mapping positive, neutral and negative experience across a number of themes, including for example infrastructure, road user interactions, weather and climate, as well as general experiences. In a second stage these experiences were mapped in relation to the

Innovation-Decision Process in order to better explain how the process of adopting the innovation of everyday cycling plays out, including the process of adopting the different tools that cycling requires. Implications for how different stakeholders can support increased cycling in the future where then identified based on this mapping.

2.4. Cycling and the city of Gothenburg

In order to contextualise and make sense of the results, an introduction to the city and cycling context in which the study was performed could be helpful. Gothenburg is the second largest city in Sweden, with a population of 583.000. In the city, approximately 100.000 trips are done by bicycle every day, which constitutes 7% of all trips. The bicycle network is fairly large at 800 km of bicycle paths, although most of it is shared with pedestrians (Gothenburg Urban Transport Administration, 2021). Gothenburg is a very hilly city, situated by the coast and
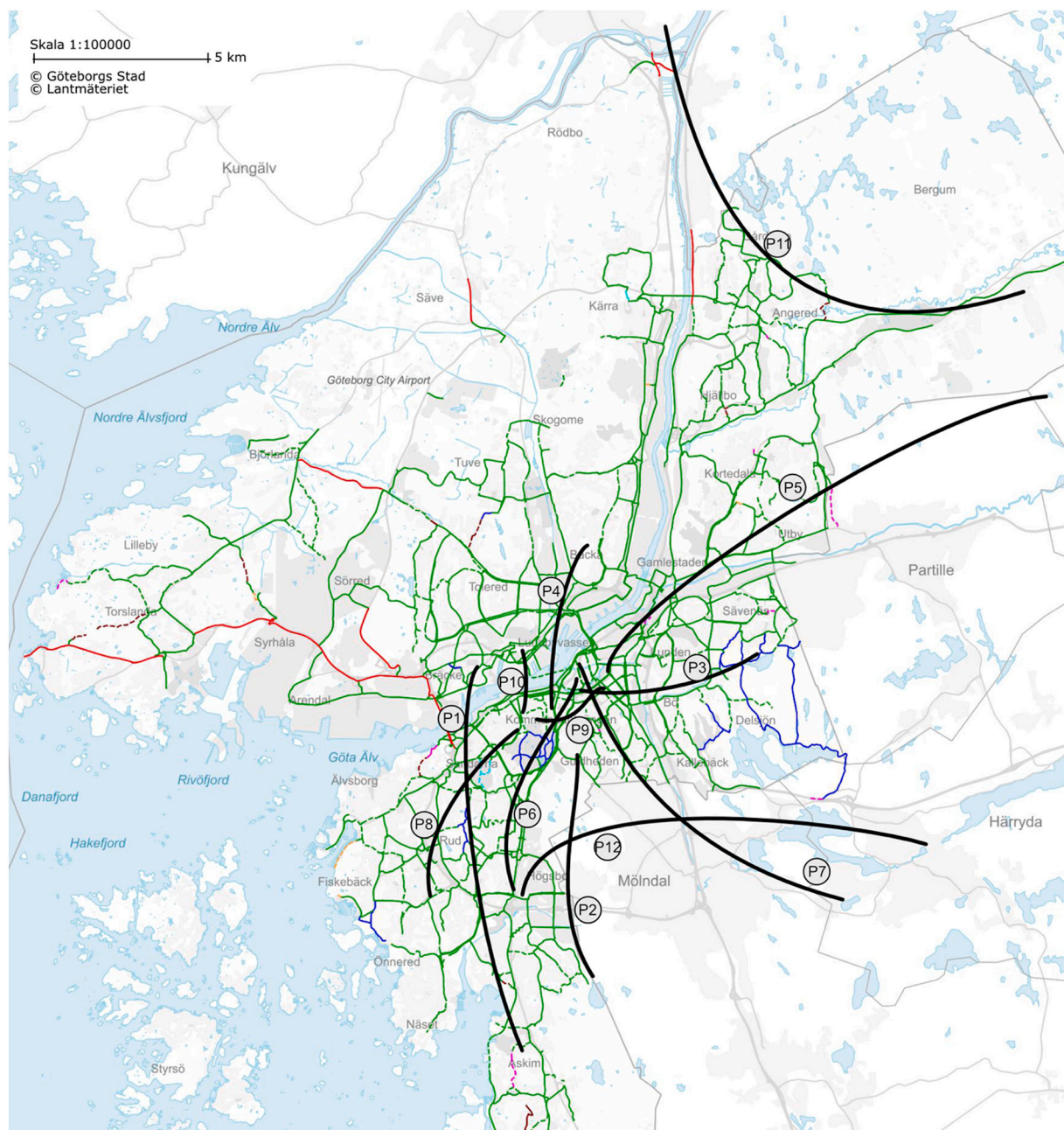

Fig. 3. The bicycle network of Gothenburg with the paths of the participating cyclists.

consequently known as a rainy city. This definitely has an impact on cycling and what could be considered a "normal" bicycle. Compared to for instance the Netherlands, the share of sportier bicycles with a slightly forward leaning riding position and multiple gears is higher. You never see people cycling with umbrellas, a stereotype (not without some truth in it) is that everyone in Gothenburg dresses in rain jackets. During mid-winter, the sun is up for 6,5 h, which means that it is typically dark both going to and home from work. In summer, on the other hand, the sun is up for almost 18 h per day. During the pandemic, no particular changes were done to the cycling network in Gothenburg. Fig. 3 illustrates the bicycle network of Gothenburg, with the typical commutes of the participants plotted to provide a sense of distance, and which areas of the city they covered.

3. Findings

Using the theoretical framework to structure the participating cyclists' experiences, both positive and negative, reveals parallel processes of adoption. There is one overarching process of adopting the activity of everyday cycling, and there are several smaller processes of adopting the tools necessary to carry out the activity of cycling (Fig. 4). The following sections describe the participants discoveries during these two processes respectively.

3.1. The process and discoveries of adopting everyday cycling

Exploring the participants' processes of adopting cycling, we can firstly see that there were multiple contributing reasons that the participants had started cycling, or significantly increased their cycling. The common major driving force was nevertheless the pandemic. All the participants had shifted from using public transport to cycling. They wanted to avoid getting infected when crowding with other travellers on public transport, and many of them feared passing on infections as they worked with vulnerable populations. However, for some, the pandemic coincided with other factors that reinforced the decision to cycle like changing jobs which put their commuter distance in cycling range or being offered to purchase a rebated bicycle via their employer.

3.1.1. The positive discoveries of everyday cycling

For many, the pandemic was that last push needed to finally adopt everyday cycling, or to develop from a 'fair-weather cyclist' to someone who always cycles: *"It was a bit like the penny dropped. I have always been aware that it would be smarter to cycle year-round, but now I got an incentive and it felt pretty easy"* (P9). Even before the pandemic, they considered cycling to have plenty of advantages; they considered it environmentally friendly, good for you, and cheap. But something had stopped them from taking the leap to cycle previously, whether it was fear of bad weather, the perception of the time and effort needed, or lack of equipment. One participant stated: *"before I would have avoided cycling if there was the slightest chance that it might rain during the day"* (P10). The pandemic pushed them to move from persuasion to implementation in the upper process of Fig. 4.

However, once participants had started to implement cycling, they discovered that many of their initial fears were misguided. There was a general consensus among the interviewees that the city actually was much flatter than they previously thought, and that it does not rain at all as often as they thought it did. In this sense, the perceived complexity of cycling was lower than they had anticipated. And even if it did rain, they discovered that was not as bad as anticipated either: *"Now I bike in any weather, it's not hard anymore. Before, when I was a fair-weather cyclist, I thought it would be... the rain and the fear of it being cold, but you actually get warm when you cycle"* (P11). The participants also found that cycling was compatible with their everyday needs, at least for the most part (see Section 3.1.2 on negative discoveries). They mainly cycled for their commutes, but also used cycling to run errands, for grocery shopping and for more leisurely excursions, expanding the types of trips that they cycled over time.

One thing that really stands out in the participants' stories is the joy and the feelings of freedom and empowerment that they experience when cycling. The word 'freedom' was used very often when asked how they felt when cycling, with one participant exclaiming: *"Freedom and happiness! I usually say that when I bike, my soul is jubilant"* (P5). Another participant sometimes felt incredulous, asking *"Am I allowed to be this free? Without a seatbelt, going downhill, I get the feeling I've forgotten something... No, you are allowed to feel this free" (P10)*. With the bicycle, they found that they could go wherever they wanted, whenever they wanted. It offered them the advantages of more freedom and flexibility in both time and route than their previous mode of travel. The fresh air and scenery were also appreciated advantages. One participant described her commute as *"a nice part of the day when one gets to transport oneself between two places and watch some scenery roll by"* (P9), while others changed up their routes to see new parts of the city *"Sometimes I take a detour, it's so easy with an e-bike, to see new places or bike alongside the harbour. So that is also an increase in quality of life"* (P8).

Furthermore, many participants discovered increases in both physical and mental wellbeing: "I feel incredibly alert when I arrive at my workplace and... sure it's tough when I work late and it's minus ten outside, but I feel that my general health status is better now, and I
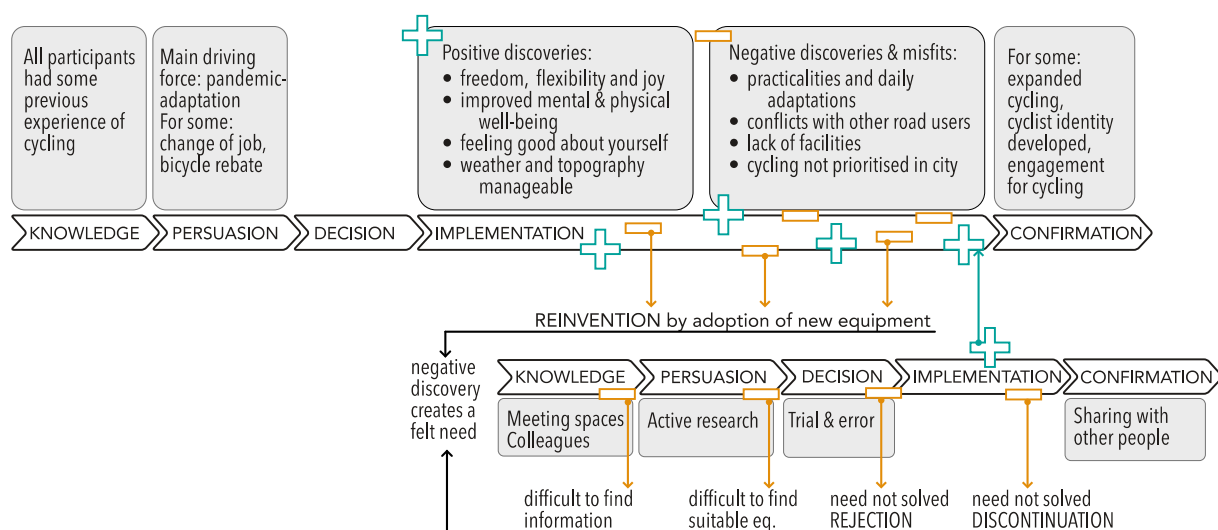

Fig. 4. The participants' experiences in relation to the two innovation-decision processes, and the interrelation between them.

believe it's because of the cycling" (P8). Several described improved fitness levels, weight loss and just feeling stronger and for some getting that "free" exercise was a contributing factor to them starting to cycle when gyms closed during the pandemic. The mental wellbeing and opportunity for mindfulness was an equally important advantage, one participant describing their commute: "It's a nice part of the day to think a bit, decompress, plan the evening activities and things like that; some 'me-time'" (P4). However, this relied on finding a route that was simultaneously perceived as enjoyable, efficient, and safe; together creating a feeling of flow. Some participants mentioned finding this route, aided by colleagues, as positive discoveries: "A colleague of mine asked 'which way do you ride – haven't you tried the Marieholm bridge?' and I got a bit…I didn't even know that it existed!" (P4) or "I used to take the bridge until a colleague said 'You haven't thought about taking the boat?' and I hadn't and it was such a wow-moment." (P10).

Some of the new cyclists interviewed also described the nice feeling of being part of a movement, of people doing good together, and changing the urban landscape for the better. Others talked of the, perhaps more individualistic, feeling of being a good person when they were cycling. The praise from colleagues also contributed to that feeling, some going as far as jokingly demanding to be recognised for their effort. "*I get surprised about the amount of people cycling when the weather is bad. That's my time to be a hero! Look at me! See what a good person I am. At work people may say 'oh you have biked today', that's enough for me.*" (P10).

When the interviews were carried out, all participants had been cycling for around a year and were firmly in the confirmation phase. Almost all the participants said that they would not stop cycling once the pandemic was over, because of the positive discoveries made: "*I probably won't give up my bicycle commute, mainly because I have discovered how much time it saves me*" (P3). For some, cycling had also become something more - a part of their identity or a new hobby. P3 who in 10 months had built a bicycle workshop in the basement, renovated a number of classic bicycles for fun, and bought a racing bike as well as a mountain bike, explained "*from not having biked at all for 8-9 years, it has just exploded*".

In summary, the positive discoveries were mainly that cycling is fun, efficient, and healthy, all adding to the perception of cycling as an innovation full of relative advantages, in particular in comparison to public transport. The positive discoveries and developments throughout the adoption process are summed up in the upper half of Fig. 4. Using the framework of innovation-decision process, we can also see that many positive discoveries could be described as reduced uncertainty in relation to the participants' initial hesitations regarding the complexity and compatibility of everyday cycling. It was not as effortful or difficult as they had thought.

3.1.2. The negative discoveries of everyday cycling

However, as shown in the implementation stage of the upper half of Fig. 4, there were also plenty of negative discoveries in the process of adopting cycling for everyday transport. Several of the issues included in these negative discoveries involve just making it work. As alluded to before, the participants found that cycling matched their needs for the most part, but it required an active process of learning – gaining the knowhow of being an all-year-round cyclist. Even if the weather was not as bad as expected, it still was a major factor to contend with, as was transporting goods on the bicycle, what to wear to not be too cold or too sweaty, finding the best route in relation to hilliness and scenery, and judging the time the trip would take depending on all these factors. Basically, learning how to deal with the practicalities of cycling in all weathers and for all occasions. One of the participants said that it took her 3–4 months to create the routine to just choose the bicycle each morning, but even now there were plenty of issues to consider every day: "*It's more of a practical matter now, it's not whether or not I should do it, but more about how to do it*" (P2). Thus, the participants discovered a new layer of complexity related to the practicalities of everyday cycling – cycling all year round for all purposes in a Nordic climate is quite a skill

to learn. These issues did not go away on their own but required active work by the participants to adapt their existing routines, to seek information, and as described in 3.2, to seek out new tools and equipment to make cycling compatible with their everyday needs.

The participants also encountered other negative experiences in their process, some related to the interaction with other types of road users. Participants told stories of interaction and conflicts with inattentive pedestrians, aggressive drivers and speeding cyclists. Stressed and aggressive drivers (who demonstrate their perceived right to the road) and inattentive pedestrians, pedestrians who make sudden turns into the cycle lane, and dogs on leashes made the participants feel unsafe. To negotiate these situations, the participants tried to find new routes with less problematic traffic situations, new equipment such as trying to find the perfect bell, as well as learning how to best negotiate with other people in traffic. One participant lamented "*sometimes you ring the bell and then they get mad, and if you don't, they still get mad*" (P3). In regard to other cyclists, the ones who were seen as hardest to coexist with were "the men in lycra" or "the spandex people", cyclists whose attitude was perceived to be "*if I cycle the fastest, I get priority*" (P2). However, some of the more experienced participants also mentioned slow leisure cyclists and wobbly, inexperienced, cyclists as an annoyance. However, in general, the cycling culture, coexistence and communication between different cyclists was seen as unproblematic, and even friendly (when compared to Stockholm where the lycra men were more common). Several participants stated that everything was fine as long as all types of road users showed "consideration and respect".

The participants also could see underlying contextual reasons for some of the unpleasant interactions. In many cases, the conflicts were caused by badly planned or badly maintained infrastructure. Examples of badly planned roads included too narrow cycle lanes where cyclists of different speeds could not coexist, cycle lanes interrupted by frequent crossings for pedestrians and cars, or where the cycle lane switched places or merged/unmerged with the walkway repeatedly over short stretches, as well as roundabouts and other crossings where it was difficult to properly indicate a turn or stop in order to wait for cars to pass. Places where the cycle lane suddenly disappeared or became one-way were also mentioned. Many of the specific spots mentioned are also known by the Gothenburg Urban Transport Administration as badly catered to cyclists. The bad maintenance of the cycling infrastructure took the form of cycle lanes full of potholes and patchy asphalt causing uncomfortable riding and the need to swerve. Other maintenance issues included frequent roadworks carried out without concern for how it impacted cyclists and late snow removal or late sweeping up of grit in the spring. As an example of how this caused conflicts with other road users, inadequate snow removal forced some participants to ride in the streets during winter with annoyed motorists trailing behind them and trying to overtake in dangerous ways. One participant concluded "*a well-developed cycle network, but poorly maintained*" (P5). Overall, the participants felt that cycling was not a prioritised mode of transport, with one stating: "*I almost always feel that the cars are at advantage when you go out, so I cannot think of it as a cycling city*" (P1).

This downgraded priority was not only felt in relation to citywide infrastructure, but also to the facilities provided for cyclists at their destinations. Lack of parking at stores, and secure and inviting storage of bicycles at home were issues mentioned by several participants – some had their bicycles stolen in a locked bicycle room in their apartment building, one of the participants had even converted a wardrobe in his apartment to bicycle storage to avoid getting his bicycle stolen. However, the lack of facilities that seemed to impact them the most and made them feel the least prioritised was the lack of facilities at work. This is a quote from a participant describing the relation between lack of facilities and the felt injustice in comparison to those who drive to work, including its effects on the uptake of cycling:

"When the pandemic started, we were about 6 or 7 at my workplace who started cycling, but I am the only one who's still at it because it becomes a bit tricky with frosty or snowy bicycle lanes. It's not fun to

hang in semi-wet clothes in a small locker and then put them on wet when it's time to go home and since you only can park the bicycle outdoors the lock is sometimes frozen. They're investing quite a lot of money in car drivers right now, which is needed to get people to avoid public transport, but with free parking in the parking garage! But say instead that they had gotten a dryer or a drying room for our clothes and perhaps indoor bicycle storage, we would get many more people to cycle through the winter." (P2).

As the quote indicates, the negative discoveries made in the process of starting to cycle all act as barriers to continue. The negative discoveries reduce the perceived advantages, increase the perceived complexity, and challenge the compatibility of cycling for everyday transport. For the participants we interviewed, they had either come to accept these negative aspects (as the positive discoveries outweighed the negative) or they managed to reinvent the activity in some way to overcome these barriers. This reinvention in many cases took the form of acquisition of new bicycles or new equipment. The need to acquire new bicycles or equipment started its own processes of adoption, described below and illustrated as the lower process in Fig. 4.

3.2. The equipment adoption process and its discoveries

As mentioned, the problems discovered in the adoption of the cycling activity led the participants to reinvent the activity by changing the artefacts involved. These changes range from small adaptations to their clothing, such as buying some gloves, to major upgrades in bicycles.

Different forms of clothing were one of the main items that the participants described as important to adapt in order to manage everyday transport needs with cycling year-round: "*clothes according to weather... because it is super important if you're going to make this work to have really good clothes*" (P8). The participants described the journey of learning to put on the right amount and right type of clothing, and how they now could see that learning process for others, "*you recognize unskilled cyclists on that they always have way too much clothes on*" (P1). There seemed to be a general struggle to find clothes that worked for cycling, while still being considered "normal clothes" as opposed to specialty cycling gear, although the range of what was considered normal varied a lot within the sample. "*I don't have any special cycling clothes with padding in the back and such, just ordinary functional clothes*" (P1). Finding the right clothes to wear for different situation is something that took most of the participants some time and experimentation to get right, and in some cases, they still were looking for a good solution. One participant described her struggle to keep her feet warm: "*Yes [expletive], I have tried. I have experimented with different kind of socks, insoles, newspapers, and I bought those shoe covers but those I lost when I had to walk in 30 cm of snow... When it's minus 15 degrees it's impossible to keep the feet warm*" (P11).

Another adaptation that was slightly problematic when transferring from leisure cycling to everyday cycling was to find a way to transport stuff. To be able to bring clothes, computers, papers and other necessities, many of the participants had invested in watertight panniers. "*...I have invested in a really expensive watertight pannier... one of these roll-to-close ones...it needs to be watertight to work*" (P8). The addition of panniers in many of the participants minds significantly enhanced the utility of the bicycle. "*I used to have a basket attached to the handlebars and then you could buy a bag to fit the basket, which I did to keep my clothes in, but then I noticed it wasn't raintight but instead I found one of those that you roll the lid on, German, really high quality. It's really nice and works great. So now I have nothing in the basket, everything in the pannier, it holds a lot. That's how it goes, from having a neat little basket to damn, this is serious, you need good equipment to make it work.*" (P4).

Others, however, had bought the same type of panniers just to find out that they were not compatible with their needs, as they were difficult to carry when not attached to the bicycle. Many participants instead used a rucksack with a watertight cover: "*I have a neon yellow plastic cover for my rucksack to protect it from rain. It sounds as though I'm some*

kind of gadget person, but I think you should take this seriously. You are worth it...the good stuff*" (P10). One thing that you typically need to bring when you are biking is foul weather gear in the chance of rain. One of the participants had instead solved this issue by buying two of everything; "*I have always had a pair of rain trousers, but now I have two so that I can have one pair at work. I also have two rain jackets and two yellow vests so there is no longer any reason to be afraid of rain or to not having brought rain gear.*" (P10). Similarly, some of the participants kept a change of work clothes at their workplace to avoid having to bring them on the bicycle every day. Having your ordinary clothes stored at work, or having a work uniform, enabled the participants even more freedom in choosing cycling-adapted clothes for the commute, but relied on that they had access to facilities to change and store clothes.

The most important artifact for everyday cycling is of course the bicycle itself, and here the participants had a lot of things to say. Some of the participants bought a bicycle when they decided to start biking, others already had one. What (almost) all of them found out was that the bicycle they initially started cycling with was not at all compatible with the requirements of everyday cycling. The old, traditional, bicycle was found to be just too heavy to bike in snow and rain and the affordable bicycles just broke down constantly when they were subjected to real use. Many of the participants therefor had bought a new bicycle as part of the process when they discovered their own needs. "*Since Björkekärr is on top of a hill it was always hard work to cycle home, that became very obvious when I got a lighter, geared, bicycle how much easier it became. And then when I upgraded to a 100% carbon racer you almost couldn't notice the incline*" (P3). An alternative to the light, sporty bicycle, was the e-bike. Four of the participants had gone this route: "*This was a big investment, SEK27.000. I tried a huge number of bicycles, I wanted a comfortable, robust, good bicycle and thus I needed to step up in price, it didn't feel good otherwise. I was picky. I wanted it to be super easy to go uphill. I wanted to get rid of all obstacles in the way of taking the bicycle, and I think I achieved that*" (P8). Specific features of the bicycle may also be important to counteract some of the negative discoveries, such as the issue with badly maintained bicycle lanes. When asked what people wanting to start cycling in Gothenburg should know about, one participant answered "*I want to recommend good shock absorbers!*" (P1). In the end, it was clear that the participants in the study all really liked the bicycle that they had ended up with, with one participant explaining "*I really like my bicycle, it feels like family*" (P1).

To handle the problematic interaction with pedestrians, and to a certain extent with other cyclists, described above, the participants felt need the need to make themselves noticed. The main tool used was the bicycle bell, even if it appears difficult to find the right bell. As mentioned above, some pedestrians were seen as inattentive, many wearing headphones and hooded jackets reducing their hearing, thus requiring a stronger bell. One participant described her deficient bell "*so I ring the bell and I get so annoyed at the bell on this Ecoride-bicycle because it is so weak, I notice that old people sometimes even can't hear it when they are walking side by side on the bicycle lane... so I'm thinking of getting a stronger bell, but then again, some people get scared when you ring it*" (P8). Another participant had rejected her initial bell just because it scared people, causing them to act even less safe on the cycle lane, "*so I have bought a friendlier sounding bell*" (P5). Apart from being heard, participants also found it important to be seen: "*It a nice thing to be seen. I experience that people get annoyed when you don't have lights and reflexes. When I bought my lights it was actually... I was biking home late at night and there was some who were really drunk who called out 'hey, can you get some lights?' and I thought I need to get some lights, it was even annoying to them when they were really hammered*" (P9).

Different forms of reflective equipment were also an important part in being safe (especially in the dark winter months), as was protective equipment like helmets. All participants wore helmets, and many wore reflective vests, helmet, or rucksack covers, as well as other reflective equipment in order to be seen. They felt an increased urgency to do so since becoming everyday cyclists.

As indicated by some of the quotes, the process of locating and purchasing the right equipment was not easy for the participants. The first hurdle in adopting new equipment and new behaviour, was knowing that it existed. The main source of information for the participants in this study seemed to be friends and colleagues with more cycling experience. They studied what equipment and routes colleagues used, observed how well it work for them and discussed if it could be an option for themselves as well. Some identified that interest groups for cyclists, including forums online and offline, could be an alternative source of knowledge, but few participated in anyway in these types of forums. Instead, an important source of knowledge was observing people in traffic and random meetings with other cyclists. A particular meeting place mentioned was the ferry across the river running through the centre of the city, where there was opportunity to observe a lot of fellow cyclists and to chat with them: *"taking the boat is really good because it's almost like having a smoke break, you know that everyone is there for 8 minutes and it's easy to fall into conversation... I got the inspiration to buy a trailer for my bicycle there because there was someone there with a trailer with a child in and we discussed benefits and drawbacks and..."* (P10). The ferry thus created observability for many of the types of equipment, which the participants relied on to guide their equipment adoption. Many also did other forms of research to identify which equipment they should buy. Some read up online, some went around town testing equipment at different stores and discussing with the sales staff, while others bought and tested, using a trial-and-error approach, especially for less expensive equipment.

Once potential problem-solving equipment was identified, getting hold of it and trying it out to see if it actually worked was the next issue. Some participants mentioned having to purchase equipment online as it was not possible to find in any other way, while some emphasised that they wanted to buy their equipment, as well as get their bicycles serviced, at the local bicycle store. Keeping those small-business owners afloat was an important priority.

When the equipment was acquired, participants implemented it in their cycling practices. If the equipment worked, it helped participants mitigate the problems discovered in the process of adopting everyday cycling and tended to reinforce the participants in their paths towards becoming everyday cyclists. However, the many times that the equipment did not work, participants started over to look for new options or gave up on mitigating the negative discoveries, something that may potentially lead to a discontinuation of everyday cycling in the future once the pandemic as a major driving force is gone.

Thus, the processes of adopting everyday cycling and adopting cycling equipment interact with one another in important ways, where barriers and negative discoveries in the overarching process create felt needs that start up adoption processes for the equipment, and where both positive and negative discoveries in the equipment adoption processes impact the overarching cycling adoption process. To illustrate this relationship between the adoption of cycling and the adoption of cycling equipment, Fig. 4 summarises the participants' experiences of starting to cycle in relation to the innovation-decision process for both cycling and equipment.

4. Discussion

With this study, we wanted to learn from people's forced adoption of everyday cycling in light of the pandemic, to find insights that could be used to attract new cyclists in a post-pandemic future. By studying the adoption process, we were able to capture the dynamic, temporal aspects of becoming an everyday cyclist, as well as highlight the active work this requires from the participants in overcoming the many small and large barriers and negative discoveries they encountered along the way. Throughout the adoption process, these numerous barriers all represent opportunities for rejection and thus these insights are crucial when deciding on measures to increase cycling.

Like Nello-Deakin and Nikolaeva (2021) we can see that the factors

encouraging the participants to continue cycling changed over time, when they discovered the many relative advantages cycling provided over their previous travel behaviour. However, we can also see that incorporating the innovation of cycling into the practices of everyday life also meant actively working with making the innovation compatible. All participants describe a learning process, learning to cycle fast, steadily, and confidently, learning how to deal with weather, topography, practicalities like transport, and learning to navigate in coexistence with other road users in a city where cycling is not prioritised as a mode.

Many of the issues and negative discoveries our participants describe have been seen previously and identified as barriers for people to start or to continue to cycle. In Heinen et al.'s comprehensive review of determinants of utilitarian cycling from 2010, factors in the built environment (including infrastructure and surface quality, as well as bicycle parking and facilities at work) and in the natural environment (including adaptations to hilliness, darkness, weather, and seasonal changes) are included as two out of five categories of determinants. Van Bekkum et al. (2011) also studied the process of becoming an everyday cyclist and concluded that while some barriers, such as safety concerns and the physical effort associated with cycling reduced over time, others such as storage on bicycle, dealing with weather and darkness remained barriers. These insights tell the same story as our findings.

What stands out in our study is the important role reinvention and equipment played in overcoming these barriers and negative discoveries. The importance of bicycle equipment for everyday cycling has previously been rarely discussed. Exceptions include Lovejoy and Handy (2012) who provide an extensive catalogue of bicycle types and associated equipment that could be useful for utilitarian cycling and Strömberg and Karlsson (2016) who describe how different bicycle types, and some equipment, helped presumptive cyclist get over barriers and start cycling, as well as describe which barriers remain and which new occur because of the bicycle. In our study, we can see that by actively engaging and seeking out solutions in the form of adaptations and equipment, the participants were able to overcome many of the aforementioned barriers. By reinventing their cycling practice and adopting new equipment, they could handle many issues otherwise making cycling incompatible with their everyday life: lighter bicycles, more gears or electric assistance could counteract hilliness and the issue of getting to work sweaty, panniers and high-quality rain gear could keep themselves and their stuff dry in the unpredictable weather, adding winter tires and shock absorbers could help deal with less-than-ideal bicycle lanes, and finding that elusive, just loud enough, bicycle bell could help them coexist with other road users.

However, one particular type of equipment perhaps worthy of a separate discussion is safety equipment such as helmets, neon yellow vests, reflective rucksack and helmet covers, as well as other reflectors. All of the participants wore a helmet at all times cycling and over half of them used a yellow vest. In relation to the finding that they felt that cycling was not a prioritised mode, we interpret that they felt it necessary to protect themselves in all ways possible to negotiate a traffic environment where cyclists always were second class to car drivers, and pedestrians. The onus was on them to protect themselves, as car drivers could not be counted on to show consideration and respect.

As described, finding the right equipment was not always easy for the participants. It was a process that relied both on chance meetings and on active research and experimentation. For many, they had to give up on some desired quality in the equipment to find something at all. Digging deeper into the participants' stories, the study demonstrates both a lack of available equipment and ways of getting hold of equipment suited to people who wanted cycling to be a normal part of everyday life, and not be identified as die-hard cyclists. Nevertheless, all participants had come to realise that in order to adopt everyday cycling, they needed a lot of specialty gear including bicycles, panniers, baskets, cycle trolleys, rain gear, reflexes, bells, that made them look like 'cyclists'. Here we see a great opportunity for industry to develop clothing and other equipment

that support cycling equally well as the speciality gear, but with a more varied and inclusive aesthetic.

There was in general a palpable tension surrounding being seen as a 'cyclist' (and the connotations it carried: speeding and ruthless cycling, neon Lycra, carbon fibre frames, being your own bicycle mechanic). Although most of the participants identified themself as cyclists, they did so with some reluctance. Yes, they were cyclists, if you define cyclist as someone who prefers to cycle over other modes of transport, but they definitely did not want to associate themselves to one of those 'cyclists'. While there absolutely are a number of sub-cultures focussed around the bicycle (see e.g. Hoor, 2020), the participants in our study (with one or two exceptions) did not consider themself a part of any of them. However, there was a sense that those types of cyclists were in control of cycling, and that the participants somehow needed to be accepted by the sub-culture(s) to be allowed to call themselves cyclists. Previous research has also found that such cultural images of cycling can be a barrier in encouraging more people to cycle (Gatersleben & Appleton, 2007). For our participants, cycling was considered normal, and something that they, as normal people, were just doing without it being a part of their identity. The equipment and the ways to get hold of it needed to be adapted to that normality.

4.1. Implications for policymakers and other stakeholders

There are a number of implications of this study of interest to policymakers and other stakeholders. In terms of supporting cycling through city planning and infrastructure, the issue of priority must be addressed. We agree with Hull and O'Holleran (2014), who state that you should not implement cycling infrastructure as an add-on, but to consider cycling when designing all transport networks. One way to capitalise on the things that the new cyclists in our study found to be of particular benefit, that is, the pleasure one can get from the activity of cycling, is to create attractive cycle routes that not only are perceived as safe but that induce a feeling of uninterrupted flow and to build environments where people enjoy cycling. Examples of factors that create this pleasurable feeling is greenery, nice views, smooth surfaces, priority over cars in crossings, etcetera (e.g. Hull & O'Holleran, 2014). By creating attractive cycling routes, the relative advantage of cycling over other modes of transport increases, both as it creates a more pleasurable experience in the moment and as it communicates that cycling is prioritised.

However, a further implication of this study is that building designated bicycle paths, while important, is not the only way to increase adoption of everyday cycling. For instance, one thing that the study found was the increased utility and enjoyment one can get out of a bicycle that requires less effort to propel, either by being light and efficient or electrified. *E*-bikes are already outselling conventional bicycles on many markets and a recent study by Fyhri and Sundfør (2020) shows that e-bikes indeed increase the adoption of cycling as an everyday transport mode and that policy makers can expect a positive return of policy measures aimed at increasing the uptake of e-bike. While direct economic subsidiaries, as Fyrhi & Sundfør suggests, is a possibility, this study shows that there are a number of other ways this transformation can be supported, for instance by creating better solutions to prevent theft and increased possibilities to charge batteries at workplaces and other destinations.

On a similar note, there are substantial potential in increasing the compatibility of everyday cycling by reimagining what a parking space could be. Where someone arriving at work by car needs a parking space of 2,5 × 5 m to store said car, someone arriving by bicycle needs considerably less space for their bicycle, but the quality of that space is important, e.g. indoor storage and locking possibilities, and the space also needs to be accompanied by attractive facilities: somewhere to dry wet clothes, and possibilities to shower and change clothes.

The participants in this study had all gone through a process of buying, trying and rejecting a lot of different equipment in order to end up with something that was compatible with their needs. We can only assume that this process is where a lot of all people who try and reject everyday cycling gets stuck as they do not find the right equipment. Increasing trialability of everyday cycling equipment is therefore a great opportunity for the bicycle industry as well as for the public sector. For the industry, it could involve better sales processes spending more time to understand the particular cyclist's needs or creating opportunities to try out different equipment, for instance through a hire and buy scheme. For the public sector, creating libraries where one can borrow and try different equipment could be an alternative, as well as creating forums where advice can be given and experiences shared in a way that encourages people who cycle, without considering themselves 'cyclists', to participate.

4.2. Limitations and suggestions for further research

A limitation with our study is that all participants prior to the pandemic used public transport as their main mode of transport, and thus compare their experience of adopting cycling to their experience of public transport. Some of the positive discoveries that the participants made such as the freedom to go wherever and whenever you want is inherent drawbacks for public transport but not for most other alternatives. Thus, some of the insights included in this paper may not be as relevant to stress if for example aiming to attract car drivers to cycling, since they in some sense already experience those positive aspects in their chosen mode. Nevertheless, the barriers experienced by our participants are likely to translate to car drivers as well. Further studies would be necessary to find which positive aspects of cycling that could be enhanced to attract car drivers. Furthermore, the study was conducted in a city where bicycling infrastructure is quite well developed. The existence of bicycle infrastructure definitely plays an important role in the progress of the adoption process of everyday cycling, and it would be necessary to repeat the study in locations with less developed infrastructure, or even more interestingly in locations where cycling infrastructure was improved during the pandemic, in order to understand the extent of its impact, and how well other measures could overcome limitations in infrastructure.

5. Conclusion

The main conclusion of this paper is that to become an everyday cyclist is a journey where the activity of cycling constantly needs to be reinvented by the individual. This study also shows that equipment plays an important role in the transformation towards a more bicycle-focussed urban mobility system as equipment can compensate for the relative drawbacks of cycling as an unprioritized mode in urban design, of hills, weather, limited cargo capacity, etcetera. These findings, however, should not be taken as a reason for not prioritizing cycling in urban development and policy. If urban developers and policy makers wish to attract more people to use cycling to meet their everyday mobility needs, everyday cycling absolutely needs to be prioritised; in creating an attractive cycle lane network, at interaction points with other types of road users and at the facilities provided at the endpoints of cycle journeys. But we can also see that there is work to do to normalise everyday cycling in the culture and identity of the city – people riding their bicycle to work should be seen (in policy and communication) as just that: people, and not as representatives of a homogenous group of 'cyclists'.

CRediT authorship contribution statement

Helena Stömberg: Conceptualization, Methodology, Data collection, Analyses, Writing, Funding acquisition.
Pontus Wallgren: Conceptualization, Methodology, Data collection, Analyses, Writing, Funding acquisition.

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