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Enhancing utilitarian cycling: a case study

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Abstract

An increase in utilitarian cycling could have many benefits for society as well as the individual. Today, cycling is however used for only a small share of everyday trips. Several studies have identified factors that facilitate or hinder an increase in everyday cycling (e.g. built environment; weather; attitudes) but one factor missing from this list is the bicycle per se and its effect on the willingness to cycle. The paper presents the results of an interview study with participants (Ps) of a field trial where they promised to replace three days worth of car journeys with bicycling. Main questions posed were: how did the Ps in the field trial experience trying to shift their transport behaviours? and what role did the bicycle designs play in the attempt to shift travel behaviour? An assumption behind the project was that the present development of bicycles and accessories was an interesting entry point to increase utilitarian bicycling with potential to replace car use to a higher degree for a wider target group than ordinary bicycles. Ps were therefore guided regarding the choice of bicycle, i.e. they had to specify their needs in relation to bicycle design based on which trips they intended to use the bicycle for, and other everyday factors that could influence how and for what they would use a bicycle.

The results show that cycling became the normal mode of transport for the Ps after a short period of acclimatisation and a longer period of regular cycling; they claimed that to have established a new habit. The Ps painted a very positive image of cycling as a mean of transport: as convenient, flexible, energizing, relaxing and fun. With regards to physical health, the Ps reported improvements in terms of loosing weight and lowering blood pressure. The Ps had also discovered new uses for the bicycle, aside from the intended commuting. The personalized choices of bicycle had helped the Ps overcome some initial barriers to increased utilitarian cycling, such as lacking sufficient fitness, uncomfortable, long distances, being tired, too much effort, difficulties with trip chaining, shopping and picking up children with the help of their bicycles, but other barriers remained including bad weather, being too busy, lack of time, lack of daylight, inconvenience, too dangerous and too much traffic.

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The study shows that it is possible to establish new habits, given certain preconditions. A bicycle that fits the individual's needs can increase the adoption of utilitarian cycling, but potential users need to be made aware of their existence and special characteristics. However, bicycle designs cannot remove all perceived obstacles. The design and interplay between different parts of the transport system sets the boundaries for the actions that are available and hence for any behavioural shift.

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Keywords: cycling; field trial; bicycle design

1. Introduction

If people were to perform a larger share of their everyday travel by cycling instead of driving a car or going by other forms of motorised transport, several benefits could be achieved. Society and the environment could benefit from fewer pollutants, less CO_2, less congestion and less noise, while the individual traveller could enjoy the health benefits of a more active lifestyle. However, cycling is the main mode of transport for only 7% of EU-citizens (Gallup Organisation, 2011). Even if Sweden is one of the countries in Europe with a high share of cycling; 9% (Buehler & Pucher, 2012), it has a long way to go to reach the example set by Denmark (18%, ibid.) and the Netherlands (28%, ibid.). Therefore Sweden, along with many other nations, is looking at ways of promoting cycling (Swedish Government, 2008).

Cycling, and cycling promotion, has been increasingly studied by researchers. Several studies have charted the factors that facilitate and hinder everyday cycling, usually in the form of surveys of both current cyclists and non--cyclists (see e.g. Fernández-Heredia et al., 2014; Gatersleben & Appleton, 2007; van Bekkum et al., 2011; Winters et al., 2011). Together, these studies produce an impressive list of factors that explain why people choose, or do not choose, to use a bicycle for their everyday travel. In their review, Heinen et al. (2010) compile a comprehensive list of previously identified determinants of utilitarian cycling and structure them into five categories:

- Built environment factors, e.g. trip distance, infrastructure, urban form, bicycle parking, surface quality, and facilities at work;
- Natural environment factors, e.g. landscape, hilliness, daylight and darkness, weather, climate, and seasonal changes;
- Socio-economic variables, e.g. age, gender, family size, income, employment form, fitness level, and vehicle ownership (car and bicycle);
- Psychological factors, e.g. attitudes, norms, and habits;
- Factors related to cost, travel time, effort, comfort and safety.

However, one factor that is missing from this list is the bicycle per se and its effect on the willingness to cycle. Handy et al. (2014) conclude that even though a few studies discuss general access to bicycles, none mention neither the design of the bicycle and related equipment, nor their affordances or constraints. Lovejoy and Handy (2012) argue that, despite other researchers' claims that bicycle design has a minor role to play in bicycle promotion, the design of the bicycle and bicycle accessories can support the adoption of utilitarian bicycling. The types of transport-oriented bicycles now entering the market can, through their design, help alleviate some of the inhibiting factors established by for instance (Fernández-Heredia et al., 2014; Heinen et al., 2010). For example, the assist given by electric bicycles can overcome the need for a high level of fitness, the extra cargo space provided by freight bicycles can help when picking up children or shopping, and adjustable shock absorbers can give the sought--after comfort (Lovejoy & Handy, 2012). New models are continuously developed, old types updated and relaunched, pulled by an increasing interest in sustainable and active transport.

In the Swedish project Testcyklisterna this development of bicycles and accessories was seen as an interesting entry point to increase utilitarian bicycling with potential to replace car use to a higher degree for a wider target group than ordinary bicycles. Thirty-eight individuals from seven municipalities in western Sweden were lent bicycles and accessories to suit their specific needs. In return they promised to replace three days worth of car

journeys with bicycling during a 6-month period (April–October 2014). Participants were guided regarding the choice of bicycle. During this process the participants were first asked to specify their needs in relation to bicycle design based on which trips they intended to use the bicycle for, and other everyday factors that could influence how and for what they would use a bicycle. Participants also listened to a presentation of different available bicycle options provided by the project's bicycle counsellor, who then helped them to pick out which bicycle and accessories they would use during the trial period. The participants were also offered to purchase the bicycles after the project at 60% of the initial price.

2. Aim

The aim of this paper is to report the findings of an interview study conducted with a sample of the project participants. The goal of the study was to gain a deeper understanding of the factors that affect a shift of travel behaviour towards more cycling. More specifically the questions posed were:

- How did the participants in Testcyklisterna experience trying to shift their transport behaviours, which effects did it have on them, and which adaptations did they make?
- What role did the bicycle designs play in the attempt to shift travel behaviour?

3. Method

Fifteen of the 38 project participants were interviewed in-depth about their experiences during the trial. They were asked how well they had managed to replace car driving with cycling, which factors that had affected them during the test period, if they had experienced any consequences or had to make adaptations to be able to increase cycling. In addition and of specific interest to this paper another question concerned what role the specific bicycle had played.

The sampling intended to include participants that represented each of the bicycle types used in the project. A second recruitment criterion was to get participants from different environmental and infrastructure preconditions as earlier studies have concluded regarding the effect of these factors on people's willingness and possibility to cycle (e.g. Heinen et al., 2010; van Bekkum et al., 2011; Winters et al., 2011). Participants were therefore recruited from four of the municipalities, which represented the different conditions of all participating municipalities. The interviewed participants and their characteristics are listed in Table 1.

Interviews were performed in person at a place chosen by the participant. They lasted approximately one hour and were recorded by notes and on tape. The notes, with support from the sound recordings, were then summarised thematically and analysed.

4. Findings

Overall, the participants paint a positive picture of their experiences during the trial. The majority of the participants intended to use their bicycle for the trips to and from work, or for part of that trip. Most had the goal to replace three days worth of trips by car per week, which was the minimum level in the project, but some aimed higher. They have, to a large extent, reached these goals. All participants report that it was easy to start cycling once they had decided to do so, even if the daily motivation varied. After a short period of acclimatisation and a longer period of regular cycling, cycling has become the normal mode of transport for the participants; they claim that they have established a new habit. Only two of the interviewed participants have had to decrease their intended amount of cycling, as one changed workplace to a location further away and one had an injury that stopped them from cycling.

The participants have a very positive image of cycling as a mean of transport. Cycling is seen as a convenient and flexible way of everyday transport that gets you from door to door but still allows you to change route if you feel like it. The activity of cycling is also perceived as fun, and many of the participants talk about the lovely experiences of nature that they have had 'on the road'. These findings confirm the image of the positive sides of cycling provided by other studies (see Gatersleben & Appleton, 2007; Gatersleben & Uzzell, 2007). However, such enjoyable experiences presuppose that the environment is pleasant enough to cycle in (Heinen et al., 2010). Another

benefit compared to driving is that you avoid much of the hassle associated with cars, like parking problems and congestion.

Table 1. Overview of the participants, their needs and bicycles.

P	M/F	Age	Bicycle history	Transport needs	Bicycle type during test	Km/day
Participants from municipality A: small satellite towns connected to the city with regional train. Thus, possibilities to get quickly into the city, but access to all amenities within cycling distance.						
1	M	25	Used to bicycle, until bicycle stolen a few years back	Commuting (road mix of rough paths/bicycle lanes), between work locations	Sport hybrid, adj. shock absorbers	5-30
2	F	33	Cycled to work twice a week, wanted to increase to everyday	Commuting long distance, picking up children on the way	Electric bicycle, 3-speed, trailer	35
3	F	68	Has always cycled, until knee-problems stopped her.	Errands and social trips, problems getting on regular bicycle	Three-wheeler, 3-speed	5
Participants from municipality B: a smaller town integrated into the larger city, offers inner-city cycling as well as small town infrastructure						
4	M	36	Has tried commuter cycling before, now motivated by partner	Commuting and picking up children, travel with dogs	3-wheel freight bicycle	10
5	F	45	Regular commuter cyclist for 20 years, now less b/c injury	Commuting, assistance because of injury	Electric bicycle, 3-speed, 3 assist modes	20
6	M	52	Cycles for exercise, coaches mountain bike	Commuting, assistance b/c long distance, no facilities	Electric bicycle, 7-speed	35
7	F	64	Has cycled very much, until bought own car 5 years ago,	Commuting, wants to take up cycling again	Dutch-style transport bicycle, 3-speed	15
Participants from municipality C: a small town with reasonable cycling distances and infrastructure in town, but less access to cycle infrastructure at the outskirts of town.						
8	M	36	Cycled everyday as a teenager, later for exercise, but stopped	Commuting, kick-start for exercise, some health issues	Electric bicycle, 3-speed, adj. shock absorbers	20
9	M	42	Cycled for exercise previously, competed in races.	Multimodal commuting across municipalities, bad PT door-to-door	Folding bicycle	25
10	F	44	Longed to cycle after coming back from living abroad	School run with three children, between work locations	3-wheel freight bicycle, space for 4 children	15
11	M	45	Cycled for transport before child was born, 5 years ago	Commuting and trips with child	3-wheel freight bicycle, with electric assist	15
Participants from municipality D: three interlinked islands, connected by ferry to the mainland. Good cycling distances on islands, large share of commuting to the city.						
12	F	29	Cycled for recreation, owns many bicycles	Commuting long distance and picking up children, trips	Electric bicycle, 3-speed, trailer	50
13	F	38	Cycled a little for recreation	Multimodal commuting, between work locations	Folding bicycle	7
14	M	41	Cycled for sport, mountain bike	Commuting long distance	Electric bicycle, 7-speed	50
15	F	48	Always wanted to cycle, but have never managed	Between multiple work locations with equipment	2-wheel freight bicycle	10

4.1. Effects of increased cycling

The participants describe that they have had their minds set to cycle, mainly motivated by the earlier mentioned practical benefits, but also by the positive effects on their mental and physical health. They describe cycling as energising as well as relaxing, aspects of cycling that have been expressed in earlier studies (see Gatersleben & Uzzell, 2007). When you cycle, you get to use your body and increase your pulse rate, at the same time as you get fresh air and can “clear your mind”. The effect of this is that you get to work alert and ready to go in the morning, and on the way home you have time to forget all about the issues at work and come home relaxed and happy. One

participant explained "…when you have children and a dog and a fulltime job and everything, I think it is a very meditational part of everyday life, I do not feel controlled by traffic or anything, I know the time it takes, you can just relax and pedal on, it is nice".

With regards to physical health, the participants report many improvements such as loosing weight and lowering blood pressure. Some state that they have become stronger, faster, and have gained better aerobic capacity. Cycling the same route on a regular basis has given them the opportunity to compete with themselves. Some participants do this actively, using apps to measure and time themselves, others sense improvement by looking at how far up the hill they can get without having to get off: "I had the goal to get to the fifth lamppost at the end of the period, and I got to number four before my injury". Seeing these improvements have been a great driving force to continue cycling as well. In addition, you have done your exercise for the day when you get home and can spend that time on other things.

The participants have also discovered new uses for the bicycle, aside from intended commuting, for instance how convenient it is to use the bicycle for the trips close to home, as they can avoid all hassle connected to driving a car. This was a bonus they had not considered beforehand. The participants have also started making more bicycle trips and excursions with their family, especially those with small children and freight bicycles. One participant commented "the whole family can fit in this bicycle, including the dog, plus you still can fit everything you need for the beach". Therefore they feel they no longer need to use their car for those kinds of trips either.

Additionally, many of the participants have become interested in cycling and bicycles but also in transportation of people in general and have learnt a lot about the subject. They have researched different types of bicycles and accessories, discussed cycling with friends and acquaintances, read blogs and articles on cycling, and they have many thoughts and ideas about making the transport system (more) bicycle friendly. Some of the participants even talk of cycling becoming a way of life; they have "been absorbed by cycling".

In summary, participants have managed to replace their car journeys with cycling to the degree they intended. They have also experienced both expected and unexpected benefits of cycling, confirming many aspect observed in previous studies. These benefits have motivated them to continue cycling and to use their bicycles for more trip types than originally intended, but what role has the bicycle itself played?

4.2. The role of the bicycle and its design

Many of the participants have a history of utilitarian cycling earlier in their lives (cf Table 1) and a few of them currently cycled for exercise. Several had started to think about increasing their utilitarian cycling even before the project began. Hence, the participants were quite motivated to cycle but for many the reason that they had not started to bicycle before the project was that an ordinary bicycle, or the bicycle that they already owned, was not functional enough to fit their needs in everyday travel. They were neither aware of, or did not have access to, the suitable options on the market. Therefore the process of selecting bicycle at the beginning of the project became a kind of revelation for them, where they discovered new possibilities and some reassessed their needs and goals. To cover the different types of needs, several types of bicycles were tested in the project. Below each of the categories of bicycle is discussed in relation to the possibilities they afforded the participants and which positive and negative experiences arose during use.

4.2.1. Ordinary bicycles and accessories

For a few participants, their bicycle needs were not that far from what an ordinary bicycle could offer. For example, one only needed extra comfort and better storage capacity in the form of a basket (P1), and one needed a sportier model that allowed faster cycling and more off-road adaptation from a shock absorber (P7). These participants mostly needed a push in the right direction, and someone to show and help them locate the right accessories. On the whole, these participants are very satisfied and have not had issues due to the bicycle design since the bicycle is so much like an ordinary bicycle. Two participants (P2, P12) tested trailers for children during the project and found them satisfactory. They work for small children when attached to the bicycle, but the participants wished that they could accommodate also slightly older children. To avoid travelling with dead weight, the participants could leave the trailer at the day-care centre after leaving the children, which was a plus. However, it led to that they also wished that the trailers could be used without the bicycle, as a buggy, in case someone else

needed to pick up the children later. Another concern was that the trailer did not afford the cyclist to have supervision over the children during the ride; in this regard freight bicycles fare better.

4.2.2. Three-wheelers

Only one of the participants used a three-wheeler (P3). She was very pleased as it allowed her to get back to cycling, which she had not been able to do for a long while. The three-wheel bicycle offers a safer ride when you have problem keeping your balance or getting on and off an ordinary bicycle. The participant had however observed two problems; that it was difficult to fit in a bicycle shed (she kept hers in a garage) and that the basket was placed behind her so she felt unsafe leaving her handbag there. Before the test, she had not known that anyone could use a three-wheeler, since she thought they might be were reserved for severely disabled people. She had had trouble getting hold of one, but thinks that they could be great for prolonging the years of active mobility for the elderly.

4.2.3. Freight bicycles

Four versions of freight bicycles were used by the participants; one two-wheeler (P15) and three three-wheelers of which one had electric assist (P11) and one had space for four children (P10). The major need of the participants that the bicycles met was to give children a ride to day-care or school (P4; P10; P11), something that has been found to be a common deterrent for bicycling (Dickinson et al., 2003), but also to carry work equipment to/from work and between work locations (P15). All four were happy with their freight bicycles, even if one stopped using it because the children no longer wanted to ride in it; they wanted to use their own bicycles. However, when the bicycles are not needed for freight they are perceived as too heavy, and the participants preferred using an ordinary bike at these occasions. Their weight also makes them hard to ride up hills, even though not an issue for the one with electric assist. The extra space that freight bicycles require can also be a problem, for instance when parking, on bicycle routes with speed traps, and when overtaking someone on a narrow section. They are also a bit tricky to ride and require a period of getting used to. The two and three wheeled versions differ in stability, turning radius, and weight, where the two-wheeler looses in stability but gains in the other two aspects.

4.2.4. Folding bicycles

Two different folding bicycles were used in the study (P9; P13). The reason for the two participants' choice was that they could bring it on board public transportation, making it a flexible and workable part in multimodal travel over longer distances. Both participants felt it was too far to cycle the whole route, but not possible to use public transport from door to door. However, the participants had some problems with the public transport providers and one had been denied to enter the bus with the bicycle, which dampened her motivation to continue trying: "It is embarrassing when you stand there in front of everybody and the driver says you cannot get on". This participant later borrowed an electric bicycle and decided to cycle the whole way, and thus skip the bus. The bicycle also takes up some space whilst folded, which could make you feel guilty on a cramped bus. Where it was acceptable to bring the bicycle was another aspect the participants had wondered about; "Is it ok to put it by the table in a restaurant?". The construction of the bicycle meant that it became very important to keep it clean so that it was pleasant to handle and bring indoors. The constructions also made the participants skeptical towards the bicycles' qualities on winter roads, since they felt it would become very unstable.

4.2.5. Electric bicycles

The electrically assisted bicycles were the types of bicycles that received most comments and considerations from the participants. Several different versions were tested, and the participants' opinions about them varied depending on their configuration and the participants' expectations. The quality of the bicycle appeared to play a bigger part for the electric bicycles than for the other types.

In the project, the participants mostly used electric bicycles to overcome long distances, but also to continue cycling despite fitness or injury concerns. They discovered some benefits along the way, including help overcoming bad weather and less need for shower at arrival, but also some negative aspects, several of which had to do with the battery. Charging and handling the battery is perceived as slightly dangerous, and the battery is deemed to increase the risk of theft, either of the entire bicycle or the battery itself. The result is that participants bring the battery with them when parking their bicycle. The battery is however heavy and unwieldy, and one participant had even bought

a special bag to carry it in. In addition, it is perceived as hard to predict the range available by the state of charge, and the bicycles are also heavy to ride with when out of charge, which meant that the participants were anxious not to run out of charge.

Another group of aspects are related to the actual assistance. The bicycles varied in number of gears and level of assistance; those participants who had fewer gears, and especially those who only had one level of assistance, wished for more options. Using the electric bicycle in the city when the assistance kicked in as soon as you pedalled felt unsafe and choppy as the bicycle accelerated from 0 to 25 km/h very quickly. It is also very hard to cycle with someone who does not have electric assistance, for instance your children. This is coupled to another aspect, accusations of cheating. The participants' children accused them of cheating with the help of electricity when going on trips, but they also heard comments from other people, like colleagues. Some participants internalised the comments and became less motivated to use their electric bicycles, but still felt unjustly accused of cheating, especially by colleagues who drove to work. One participant commented: “How much cheating isn't it to drive a car?”.

For those participants who wanted to get more exercise through utilitarian bicycling, the electric bicycle was not the best option. They concluded that an electric bicycle is a mode of transport and not exercise equipment, since it does all the hard work for you. For those cyclists that want to ride fast it is not a very good option either (these two groups overlap to a great extent) since it is limited to 25 km/h, which was perceived as too slow for some participants. These participants instead started to ride an unassisted bicycle, and considered the electric one as a starter bicycle or a bicycle for someone who really needed the assistance.

All in all, the participants feel they have been supported in their utilitarian cycling by the fact that their bicycles were adapted to their needs. Some bicycles appear to have contributed more than others. Especially the freight bicycles seem to offer the possibility to replace car journeys for those who have been hindered the lack of a safe place to bring stuff and to seat children in bicycles. The experiences of the participants also show that it can be hard to know beforehand which bicycle you need, and which type of cyclist you are. Even if none of the participants have stopped cycling, some have adapted the way they use the bicycle, or which bicycle they use. The electric bicycles do provide an important boost for those needing to overcome fitness issues and the perception of long distances, but may not work for those wishing to go fast and exercise, something you will not know until you have tried.

4.3. What could the bicycle design not overcome?

Out of the lists of reasons not to cycle compiled by (Fernández-Heredia et al., 2014; Heinen et al., 2010), the Testcyklisterna participants have overcome several including lacking sufficient fitness, uncomfortable, long distances, being tired, too much effort, difficulties with trip chaining, shopping and picking up children with the help of their bicycles. These are factors that had stopped them before. Nevertheless, there are aspects left on the lists that the participants agree have a deterring affect on cycling, for instance bad weather, being too busy, lack of time, lack of daylight, inconvenience, too dangerous and too much traffic. These are discussed below.

Built environment factors like availability of cycle lanes and poorly maintained cycle lanes make it harder to keep motivation up to cycle everyday. Here, the special design of the bicycles sometimes worsens this problem, as they require a higher quality of lanes to function well. Cycling in mixed traffic is another issue. On roads it is speeding motorists not expecting cyclists who constitute a safety risk, and in the city it is inattentive pedestrians wandering out into the bicycle lane. However, pedestrians are perceived as less of a problem than other cyclists in the inner city. These cyclists travel with high speeds and the participants regard them as inconsiderate at best, and ruthless at worst.

The natural environment presents further deterrents. For those participants who did not use an electrically assisted bicycle, which can help overcome aspects of bad weather, rain and wind were still problematic and dampened their motivation to cycle. In contrast to some researchers (e.g. Heinen et al., 2010) rain is not the most negatively affecting weather aspect according to the participants; wind has a larger impact as it requires more physical effort to overcome: “Rain is not a problem, you can dress against rain, but headwind gets you every time”. All of the participants see the oncoming winter as a potential problem. Snow and icy roads are one part of the problem, where some bicycles will fare worse than others, i.e. the foldable bicycles and the 2-wheel freight bicycle. Participants believe that snow tyres, if available, can help mitigate the issue for other types. However, the darkness

that comes with winter is considered as a larger problem. Especially those cyclists that cycle outside of city centres feel very hesitant about cycling dark routes in combined traffic as they feel that it is too dangerous, especially if the roads are icy as well.

A further hindering factor that many of the participants talk about (but that is not as frequent a theme in literature) is the concept known as "livspusslet" in Swedish; the puzzle of life. It has a large effect on transport as it includes fitting the places you need to go with the things you need to bring or get, the general lack of time and the different times you need to keep (bus times, day-care closing times, work hours), as well as the coordination with family members, friends and co-workers. Being busy and not having time (cf Heinen et al., 2010) are part of this puzzle but do not describe the full scope of it. Fitting cycling into this puzzle can prove a challenge. Cycling longer distances takes longer time than driving a car, and that time is needed for other things. Additionally, the time it takes to cycle is less predictable due to factors like the weather (headwind again) and how energized you feel the particular day, which can be a problem when you have to be somewhere at a certain time.

Bicycling as a form of everyday transport is also less adapted to sudden changes in plans according to the participants; there may suddenly be a need to give someone a ride, pick something up on the way, or bring something from one place to another. Such trips become harder with a bicycle. For some participants cycling required an increase in day-to-day planning to compensate for the flexibility and freight possibilities offered by a car. For others "…life is just one big planning session anyway", and adding cycling had just involved some minor shifts in that planning. On the other hand, once planned, the participants perceived regular trips like grocery shopping and picking up small children from day-care as easy, which can be contrasted with earlier studies (Dickinson et al., 2003) that have found that specifically those types of errands encourage car use and negatively affect bicycling. The freight bicycles and trailers had an important role to play here.

5. Implications

Even if the special types of bicycles tested in this project have not helped the participants overcome all of the deterrents, they still can be said to have facilitated the shift from car to bicycle. An important reason is that the different type of bicycles helped the participants to tackle the underlying reasons that had caused problems to adopt utilitarian cycling before, like distance and complex trips including errands, instead of tackling the symptoms by for instance providing facilities (cf. Gatersleben & Appleton, 2007). By adding the particular affordances to the bicycles, they are able cover a larger share of everyday trips. They thus provided the participants the opportunity to act on their behavioural intentions and positive attitudes to cycling (cf. the TPB Ajzen, 1991), which had previously not led to change. The choice to go by bicycle instead of car became easy for the participants, as they already perceived car driving as negative. The range of travel actions that they saw fit for bicycle became wider.

For some participants, an ordinary bicycle proved to be a good choice in the end, but the trial of bicycles still helped convince the participants that cycling was possible. For other participants the special design of the bicycle was a deciding factor in whether it was possible for them to cycle or not. These participants were locked into their cars, either due to fitness issues or by the need to bring things and people with them. A wider range of bicycle designs therefore offers the possibility to reach a wider span of people than ordinary bicycles can.

Thus, the study demonstrates that there are bicycles already on the market that can help more people start to cycle for utilitarian purposes. However, it also points to some of the difficulties with getting these bicycles out to the users. The interview participants were to a large extent not aware of the available bicycles and equipment, and it is reasonable that the situation is the same for large parts of the Swedish population. This points to a need to make it easier to get an overview of the market and to promote the wide range of bicycles and equipment. Even if this paper has focused mainly on bicycles, making accessories and equipment available can play an important role, for instance the concerns participants reported regarding winter conditions can be somewhat mediated using winter tires for the icy roads, and stronger lights and high-visibility clothing to combat the effects of darkness.

Even if people are knowledgeable, there are still concerns with regards to investing in such an expensive product, which qualities are untested. Since the participants found it difficult to assess which type of bicycle they actually needed and then to find it for sale, there is a need to guide and facilitate the choice and acquirement of the right type of bicycle, possibly by some form of expert help. Potential users will also need the opportunity to try the bicycle out, before they will be willing to invest in a new bicycle. Different forms of bicycle trial activities could be effective, as

well as having bicycle pool services that include a variety of types. The cost of many of these bicycles is a further hindrance, why supportive policy and financial incentives could be other types of measures to consider.

Additionally, the study shows that many of the benefits as well as limitations of the bicycles are discovered over time. The same goes for the experience of the activity of cycling as well as its effects; the participants reported many discoveries along the way. Thus, a bicycle trial should extend over time, to give users sufficient room to make those discoveries regarding their actual needs and which bicycle suits them. The participants' experiences also indicate that some bicycle types are only relevant for a short period of time, like electric assist to get people started, and freight bicycles and trailers when the children are small. If users perceive the bicycles as only viable in the short term they may be hesitant to purchase one; possibility for long term renting is therefore an option to consider.

To facilitate the diffusion of the tested types of bicycles, some other adaptations may be necessary as well. Some aspects discovered regarding the bicycles point to that for example infrastructure is built in a way that complicates the use of other bicycles than the standard bicycle. Bicycle lanes need to be even better maintained as many of the bicycles can have stability issues. The speed traps also proved problematic. The regulation that electric bicycles cannot go faster than 25 km/h can be considered a hindering factor even though it responds to safety concerns regarding electric bicycles in mixed traffic. Since special types of bicycles are still rare, it is difficult to find spare parts or someone to do repairs. This is a further barrier to their diffusion. Nevertheless, it is an issue that may solve itself if these bicycles become more common.

However, if these special types of bicycles become more common, other forms of adaptation in infrastructure may be necessary. Many of the participants fared well during the test period since they had the only special bicycle around. But, if more freight cycles are used, there is a need for secure parking for them, and parking facilities where they fit. The electric bicycles are not so much in need of extra large parking space to fit, but could benefit from possibilities to charge. Security is another issue. The bicycles are highly visible because of their special designs as well as expensive, which put demands on better locking possibilities or other anti-theft measures. Making bicycles a more prominent part of the transport chain requires yet other solutions, like secure bicycle parking at bus and train stations, or alternatively, better opportunity to take the bicycle on board. Finally, maybe a change in attitude is necessary were electric assist is not considered cheating.

6. Conclusions

The study shows that it is possible to establish new habits, given certain preconditions. To be able to try out a new behaviour increases the perception of the possible range of actions, and triggers changes that were perceived as difficult before. The participants' experiences also show that there are bicycles on the market that can alleviate many of the factors hindering utilitarian cycling on a "normal bicycle", even if bicycle design cannot remove all perceived obstacles. The design of the whole transport system sets the boundaries for the actions that are available; the identified interaction between the participants, the bicycles, the infrastructure, and the other contextual factors provide an excellent example of how the interplay between the different parts of the system sets the scene for any behavioural shift.

Nevertheless, the study shows that there is potential to reduce car use, and increase active mode use, by promoting different types of bicycles. With that comes the possibility for more people to discover the additional benefits of bicycling; the health benefits, the joy of cycling, the relaxation, and the increased connection to the outdoors.

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