

# Do Tourists Dream of Electric Bikes?: Electric Bikes as a Mean to Improve Sustainability of Tourism in Rural Sweden

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Figure 1: An electric bike on a bike path in Skaraborg, Sweden, by the lake Spånnsjön.

## ABSTRACT

The paper investigates the potential of electric bikes as a sustainable alternative for local transportation during vacations in rural areas, replacing mainly transportation by car. Our starting point is that a key to behaviour change in the context of tourism and leisure travels is to make the sustainable travel option the most desirable option for the traveller. We study this by exploring three different electric bike offers in the area of Skaraborg, Sweden, and analysing the experience of the cyclists. 15 participants were invited to rent electric bicycles as mode of transportation for tourism in and around the small towns Lidköping and Skara for one day. Individual semi structured interviews were performed with the participants. Our main result is that there are aspects of electric bikes that make them particularly appropriate as a sustainable mode of transportation for local tourist destinations, and could also lower the threshold for more sustainable behaviours. Travelling by electric bike was experienced as beneficial in several ways; it automatically and effortlessly gives the cyclist access to nature, it constitutes a plausible option for more sustainable transportation at medium distances, and it allows the entire group of travellers, such as a families, to feel as being part of shaping the journey which

contributes to engagement and motivation. Although intended for tourists, it also facilitate local people to access and reflect on their local flora and fauna. We also found that digital tools such as maps, information sources, and booking systems have a key part in the deployment when appropriately integrated. In addition, we found that it was important to lower the threshold of trying electric bikes, and an important key for this was personal service from proficient people who could provide a sense of security by giving instructions, answering questions, and support in adjusting the equipment.

## CCS CONCEPTS

• **Applied computing** → **Transportation**; • **Information systems** → *Information systems applications*.

## KEYWORDS

sustainable tourism, electric bikes, behavioural change, modal shift

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## 1 INTRODUCTION

Tourism on a global scale brings both possibilities and problems, it can bring economic growth to countries and local communities, but at the same time cause stress on climate and quality of life for locals [45]. Sustainable development is thus of great importance for the tourism industry's continuing growth [9, 45]. While technology has the ability to reduce emissions and effects on the climate,

major reductions are likely to happen through behaviour change [24, 34]. Such changes can be facilitated in different ways, and Hall [22] outlines three general approaches to behaviour change within sustainable tourism: (1) education and information, (2) psychological/social approaches, and (3) institutional approaches.

The European Union financed Interreg project Sustainable Mobility for Rural and Urban Transport (SMaRT<sup>1</sup>), which the study reported here is part of, tries to bring together all three aspects by applying a method called *samskabelse*<sup>2</sup>, which emphasises co-design and inclusiveness with both stakeholders (such as politicians, civil servants, and companies) and the end users (in this case the visitors/tourists). As such, the project has initiated a number of activities, such as marketing and information campaigns (first approach), nudges (second approach), and creating new means of transportation, initiating discussions with the regional transportation authorities, and developing infrastructure for easily booking and accessing local produce (third approach). In one part of the project, located in the Swedish region called Skaraborg, we have focused on cycling as a means of local transportation for tourists (mainly between their hotel and the local tourist destinations).

The approach to sustainable tourism that we take here may influence all three approaches as outlined by [22], but we add to this the belief that a key to behaviour change in the context of tourism and leisure travels is to make the sustainable travel option the best option (as in most desirable for the traveller), regardless of attitude towards sustainability and climate change. This includes integrating digital services in the form of route maps and providing a service for renting and returning the bikes. In the context of local travels, we have found cycling to be a strong contender for being the best choice as it provides a social, economic, and environmentally sustainable solution with benefits that are noticeable for the travellers themselves, as well as for other stakeholders.

The purpose of the paper is to investigate the potential of electric bikes for local transportation during vacations in rural areas, from the perspective of the travellers. This is done by exploring three different electric bike offers in the area of Skaraborg, and document and analyse the experience of the cyclists. We rely on qualitative inductive methods to better understand the topic from a user centred perspective focused on the experience of the participants, which might inform other stakeholders in rural mobility and tourism. Some of the results might also be relevant for commuting, such as the aspect of health benefits of meaningful physical activity in natural landscapes [3], but identifying the extent of such overlap is beyond the scope of this paper.

## 2 BACKGROUND

There are several related aspects of relevance for this study, we want to understand *behavioural change* in the context of *mobility of tourists in rural areas using bikes as means of transportation*, and specifically *electric bikes*, to improve *sustainability*, by examining the tourists' experiences. We will start by providing a brief introduction to these aspects before presenting and discussing our investigation.

### 2.1 Behavioural change

The topic of decision making and behavioural change is vast in psychology and cognitive science. Although it has traditionally been studied in terms of economical decisions, there are plenty of insights that can inform the context of sustainable mobility and tourism. For instance, trying new alternatives is associated with uncertainty which often leads to avoiding them (thus keep relying on previously used alternatives) due to the risk of them being significantly worse in respect to some factor, such as economic cost or convenience. This is a well known phenomena for decision making in general, relating to risk and loss aversion [27, 47], but has also been observed specifically for the context of mobility [6].

Another model from psychology used to understand and change mobility behaviour is the Theory of Planned Behaviour (TPB) where human's social behaviours are understood through the attitudes, norms and perceived control of the human [1, 2]. Through such models it is possible to understand the underlying mechanisms and reasons behind behaviours to make targeted efforts to change behaviours more efficient. For example, to make people rely more on public transport it is not enough to create a network that is actually connecting the destinations, it is also necessary make the public transport alternatives be perceived as accessible [38] and attractive [46]. To address such aspects, attitudes and norms have to be taken into account.

To provide structure to the literature in this intersection of fields, Hall [22] outlines three general approaches to behaviour change within sustainable tourism: (1) education and information, (2) psychological/social approaches, and (3) institutional approaches. The first approach sees consumers as rational decision makers, which make optimal decisions based on the information they have access to. From this perspective, the way to change behaviours is thus through education and information campaigns to increase the awareness of the different impacts of, for instance, mode of travel or food consumption. While this does have some effect on behaviour [23] it has not had a large impact with regard to sustainable tourism [22]. A possible explanation for education and information campaigns not being so effective is the so called attitude-behaviour gap in sustainable tourism [26]. The attitude-behaviour gap refers to the finding that despite people caring for the environment and sustainability issues at home, their views and behaviour does not transfer to when they travel as tourists, and this applies even to people with strong attitudes and those that would classify themselves as environmental activists [26]. Illustrative of that is what McKeercher et al. [34] found in their study; that the group of travellers most aware of global warming and climate change to be the least willing to alter their travel behaviour. While this might be hard to understand, we are often able to cope with acting against our convictions in various ways, rationalising our vacation behaviour with explanations such as not affording to travel sustainably, vacation trips being a one-time occurrence, and so on [26].

The realisation that information is not enough has by many been lead to a change to a second approach, which aims to directly change the choices and behaviour of individuals [22, 23]. One popular approach is in the form of nudging, which aims to, by subtle cues in the environment, target the subconscious automatic decision making system and directly alter the choice made in a particular

<sup>1</sup><https://smartprojekt.se>

<sup>2</sup><https://samskabende.com/>

situations [31]. A nudge does not change one's values nor provide more information, does not educate, does not remove choices, and is often implementable at low cost. A concrete example of a nudge that worked to reduce food waste with 22 percent at a hotel buffet was the combination of reducing the size of the plates at the restaurant and adding a humorous sign (*'Welcome back! Again! And again! Visit our buffet many times. That's better than taking a lot once'*) encouraging guests to go several rounds instead. Another type of nudge is to provide the sustainable transportation mode as the pre-selected default choice of online digital route-planning systems [7]. Even though this type of approach in many cases does change the behaviour it also has some limits in addressing the problems on a larger scale and make sure that changes are persistent, as pointed out by [22].

The third approach centres on a broader perspective including systems of consumption, marketing, distribution chains, infrastructure, and political agendas [22], that 'entails a more comprehensive chain of activities between the two extremes of production and consumption, each link of which plays a potentially significant role in the social construction of the commodity both in its material and cultural aspects' (Fine and Leopold, 1993, p. 33 cited in [22]). For tourism to become sustainable it is therefore also necessary to look at the entire industry and include several stakeholders to change the entire system, infrastructure, and business models.

It is, however, important when making these kinds of interventions to remember that prior decisions can influence current choices. If a person makes a decision that is morally more justifiable than the alternatives, the risk increases for the less morally justifiable decisions to be made in subsequent situations, an effect known as the licensing effect [28]. It is primarily studied in relation to consumer behaviour where, for instance, consumers are choosing between what they would consider necessary or luxurious. It has, however, also been highlighted as a risk in terms of pro-environment behaviours, where the fear is that behaviour changes with minor positive impact on the environment might facilitate later behaviours with greater negative impact [18]. Although this seems to be the case, there are ways to reduce or circumvent the licensing effect, for instance by making connections clearer to environmental goals that people are committed to or reminding people of the reasons for their earlier beneficial decisions [18]. Although the prevalence and consequences of the licensing effect needs to be studied further in general, and in the context of mobility and tourism specifically, it is at least important to be aware that efforts towards changing behaviours toward more sustainable alternatives could potentially result in ultimately harmful tokenism. Even the best intended efforts towards changing behaviour therefore need to be done with care, and be appropriately evaluated.

## 2.2 Sustainability

The concept of sustainability has long been acknowledged as both urgent to address, and complex to define and measure [8, 19, 35, 36]. It is common (but not universal) to divide sustainability into three pillars; social, economic, and environmental sustainability, but the origin of this distinction is not clear [41]. The definitions of the specific pillars are also not entirely clear, but there are general themes that are prevalent. Social sustainability can, for instance,

corresponds to perpetuation of social values, identities, and institutions, and emphasise the accommodation of individual need such as well-being, education, and cultural expression in a societal context [20, 36]. Economic sustainability focus more on capital of various kinds, where the idea is that resources should only be exploited at a rate that allow the resource to recover [20, 36]. Environmental sustainability (sometimes called ecological sustainability) will generally have a stronger focus on the physical or biological environment, often with the perspective of Earth as a life-supporting system that needs to be maintained or even improved [20, 36]. There are different opinions regarding what the purpose of the distinction is [41]. On the one hand, some argue that these pillars, albeit linked and overlapping, need to be addressed in isolation to prevent the concepts to become too fuzzy or overloaded, a point for instance made by Goodland and Daly [20] (in their case primarily from a perspective of environmental sustainability). On the other hand, there are those that argue that the concepts by necessity should be addressed together, a point for instance made by Milne [35] (in their case primarily from a perspective of economic sustainability). In addition, it is common to discuss sustainability in terms of trade-offs between goals within these respective pillars, goals that are often considered equally important [41].

Regardless of opinions regarding the relation of the pillars, there are many issues commonly discussed. There are for instance questions regarding what it is that should be sustained, what should be developed and for whom, and if development can be compatible sustainability [19, 41]. For the latter issue, there is for instance a discussion regarding the potential conflation of growth and development, where growth is generally associated with some quantitative increase in something physical or material, but development could be seen as a kind of qualitative improvement [19]. Both are associated with change, but maintaining a material increase is less likely to be reconciled with sustainability.

It has long been acknowledged that issues regarding sustainability, albeit defined and understood differently in different societies and contexts, is a global problem that affects the entire human population [8]. For this reason, the United Nations developed and adopted 'the 2030 Agenda for Sustainable Development' in 2015, which contains 17 goals where all three pillars are integrated to achieve sustainable development [48]. Although progress has been made, the speed and scale is currently not sufficient to meet the deadline of 2030, and global crises such as the COVID-19 pandemic has in some cases eradicated some of the progress that was achieved [25].

## 2.3 Transportation and tourism in rural areas

There are many societal and personal benefits to travelling, but transportation is simultaneously a sector that has a large negative impact on the environment [5, 12, 13]. In conventional analysis of transportation, travelling is largely associated with costs (economic and temporal) that should be reduced, but this assumption is not always appropriate [4]. In particular when the journey is made for leisure. In such cases, the transportation part can in itself be part of the reason to take on the journey. Improving mobility for the traveller would therefore not necessarily be a question of reducing

the amount of transportation, but could instead consist of changing the mode.

Part of a solution to the negative impact of transportation on the environment may, however, still lie in designing urban areas to reduce the need to travel, in parallel with promoting less harmful modes of transportation by considering the spaces of the cities primarily as places for people rather than places for cars [4, 5]. Although cities can be efficient not all can live in urban areas, and ‘[d]espite emerging research on novel mobility solutions in urban areas, there have been few attempts to explore the relevance and sustainability of these solutions in rural contexts.’ [40], a sentiment shared by e.g. McAndrews et al. [33] and Scappini et al. [43]. Much of the published information on this topic, in particular for biking and bike network design, is found in what is sometimes called ‘grey literature’, that is, design standards, reports, handbooks, guides, and similar [32, 43]. There are many reasons for rural areas to be particularly challenging for sustainable transport solutions, such as the low density of population and dependence on urban cores, and private cars are often what people in such areas rely on [37, 40]. This does not only hold for the local population. Tourists also tend to not favour public transport in rural areas, again partly explained by the low supply of alternatives, but reasons such as general attitude toward public transport and ease of bringing luggage and equipment in a private car are also contributing [30]. Another reason for tourists to avoid public transport is the relative difficulty of finding relevant information needed for the trips, in particular when on shorter stays [12, 30]. In addition, the necessary infrastructure to support public transport to remote tourist attractions can harm or detract from the attraction [12, 30].

An important factor to consider in relation to rural tourism is the local population. Tourism can be a benefit to that population, but can also make things more difficult. Tourists can, for instance, provide income to local businesses, make some services more economically viable by increasing volumes, and help motivate projects for modernising and renovating aspects of the communities [21]. However, there are also potential conflicts of interest between the local population and tourists. Tourists might, for instance, contribute to wearing down natural or cultural sites, and development of infrastructure and facilities for tourists might be at the expense of other local interests and sectors [9, 21].

When considering mobility in rural areas it is also important to consider what different modes are plausible, and in what circumstances different modes can replace each other. Again, it is important to acknowledge that permanent residents and tourists tend to have different requirements and preference in this regard [40]. It is also important to remember that transportation for rural tourists tends to both consist of the journey to and from the location as well as the trips done at the location. For instance, even when going on a trip to explore an area by bike, it is not uncommon to go to the location in a private car, potentially to more easily bring a personal bike [49]. As mentioned before, private cars tend to be popular due to the perceived flexibility and control (in that there are no other passengers or time tables to adhere to), and ability to carry luggage and equipment [30].

Cycling is a mode of transportation that has previously been highlighted as a promising alternative to include as a part of more sustainable mobility, both for commuting and everyday transport

[11, 16] as well as for leisure and tourist transportation [17, 49]. Despite the increase in use of motorised vehicles to facilitate cycle tourism, bikes seem to have a positive effect in terms of sustainable transport [49]. Cycle tourism has also shown promise as a desirable way to explore little-known and remote territories, with economical, social, and environmental benefits as a consequence [17]. It has been shown that electric bikes in particular can replace other modes of transportation, such as cars and public transport, for some trips, including commuting, going shopping, and visiting friends [11]. Although electric bikes tend to allow for longer and faster trips, use of electric bikes can stimulate increased use of conventional bikes as well [11].

One particular area that has received some attention in the literature regarding cycling as a mode of transportation is the design of the infrastructure around it, in particular the bicycle road network both in urban [32] and rural [33, 43] areas. It is not only where to locate the paths that has been studied, but also aspects such as how the bike lanes interact with other infrastructure [10, 29] and policies to facilitate cycling [33]. There are, however, still gaps remaining in the understanding of appropriately developing cycling as a mode of transportation, both technical and social aspects. The subject is complex with many stakeholders and dependencies on local particularities. In this paper, we document and analyse the phenomena in the context of rural tourism from a thoroughly user centred perspective. The main focus is on tourists that travel to the location from elsewhere, but we also consider situations where the local population utilise bikes for leisurely trips in their area.

### 3 METHODS

As part of the evaluation of the efforts to explore sustainable mobility of tourists in rural Sweden, 15 participants were invited to rent electric bicycles as mode of transportation for tourism in and around the small towns Lidköping and Skara for one day. The trips took place during July 2021. In some occasions the participants were travelling by themselves but in most cases they were going as a small group often including children of various ages. The study was split into three different cases, more thoroughly discussed below. In all cases, the participants had been recruited through marketing via social media where people were offered to try one of the pre-planned options of tourism in the region for free in exchange for partaking in a semi-structured interview afterwards. The pre-planned offers were either an electrical bike package (as described further below) or an electrical car package (not discussed in this paper). The participants were of course able to retract their consent at any point without any repercussions. As part of the form where potential participants registered their interest in participating they were asked to motivate why they should be selected, allowing us to filter out frivolous applications. No participant left the study before completing the interview.

Based on the methods employed, the result is expected to be somewhat biased for several reasons. The recruitment was done via social media. It was targeted specifically at people in the same county of Sweden as the towns where the study took place, in particular people who had searched for relevant keywords for such a trip. With that said, several participants found the invitation to the study by someone they knew sharing the information with them. One

potential effect of this sampling is that only people with a specific habit of technology use were represented, biasing views on what solutions (technological or otherwise) would be possible, appropriate, or desirable. Another potential source of bias due to this method is that the participants might have a disproportionately positive attitude toward sustainability and environmental protection, since such keywords were used in the description of the project. It is also worth mentioning that, apart from selecting people judged to be motivated based on their applications, most costs during the day were covered by the project for the participants, which re-frames the experience of the trip. Arguably the selection of motivated participants might increase the validity, since they would be the most likely to go on the trip even if it would be associated with costs. However, all participants knew that they were part of an evaluation of this way of travelling, which might make them more conscious about different parts of the journey compared to if the trip was a regular holiday.

There are some further limitations important to highlight. The number of participants is too low to for most statistical analysis to achieve any relevant power, the landscape in which the study was carried out is quite flat and generally open which can have a large impact when travelling by bike, and the bike paths are varied in type with different kinds of interactions with other infrastructure and sometimes shared with other road users. These are examples of aspects that make the domain of cycling in rural areas so complex, but they are also important to acknowledge. For that reason, we have opted for conducting a qualitative study to focus on richness rather than generalisability, to get a deeper understanding of these specific cases and specifically from the perspective of the tourists exploring the area by bike.

In almost all cases, the interviews, which were semi-structured in nature, were conducted within a week of the trip and had one representative from each group of participants. No children were interviewed directly, so the perspectives, opinions, and experience of the youngest participants were conveyed by their guardians. The interviewer was supported by a script, consisting of 30–40 questions (depending on the case), but the order and phrasing of the questions varied based on how each interview developed. The questions that were asked in all cases were, in the script, organised according to the topics ‘views and habits on tourism’ and ‘awareness and opinions on sustainable mobility’, and the case specific questions were organised based on if they referred to aspects before, during, or after the trip, and questions regarding general reflections. The interviews typically took between 30–60 minutes, and were conducted and recorded via Zoom. Each interview was transcribed to facilitate further analysis. The analysis was to a large extent done through inductive content analysis, where systematic readings of the interview transcripts allowed patterns and themes in the participants responses to be identified (see e.g. module 67 in [39]). All interviews were conducted in Swedish, and the quotes included in this paper has been translated when preparing the manuscript.

### 3.1 Case 1, Lidköping

The target group in this case was families, where adults and children (aged in the range 1–13 years) would explore the vicinity of the small town of Lidköping together. Lidköping lies on the coast of a

major lake, so among the potential activities are enjoying the beach as well as visiting museums themed around the biology of the lake. In addition, a local petting zoo lies within bike range and the town itself has value for tourists. Further away from the town are areas famed for the nature as well as an actively managed medieval castle (Läckö castle). These latter areas are within the distance of more experienced bikers, however, beyond the range of typical families. The infrastructure to access the far away places are not yet entirely appropriate for bikes.

For this case, six families (referred to as L1 through L6 in the deidentified data) were accepted to explore Lidköping and its close vicinity using electric bikes. They were all recruited from the same county, but not the same municipality, as Lidköping is located in. The journey to Lidköping, the fee for renting bikes, a lunch, and entrance fees to the planned activities were all paid for by the project. The trip was loosely planned beforehand by selecting specific tourist attractions to attend throughout the day, and the participants received recommendations for routes to take. At the day, however, they were free to choose how to spend the day. No member of the project accompanied them, but they had contact information to project members if they at any point needed assistance.

### 3.2 Case 2, History and Nature

For this case, participants were departing on their bikes from Skara to go the 14 km to Varnhem where they would visit Varnhem Abbey and Kata Farm, two historical landmarks from the late Viking Age or early medieval period. The target group in this case were adults close to retirement or recently retired. They were travelling alone or in pairs along a predetermined route though a landscape defined by nature and agriculture. Along the route the bikers pass by a mix of active farms, forested areas, and Spännsjön — a recently restored lake in the local wetlands. The lake is of particular relevance since it was originally drained to accommodate for the expanding agriculture of the 19th century, but restored in 2015 mainly for ecological reasons but benefits to recreation and tourism were contributing factors [42]. The area is rich in landmarks of historical, cultural, and natural relevance.

In this case, four participants (referred to as H1 through H4 in the deidentified data) were instructed to follow the predetermined route to Varnhem, and then use the same route on their way back. The fee for renting bikes, a lunch, and the fee for a guided tour at Kata Farm were all for paid by the project.

### 3.3 Case 3, the Water Park

The target of this case was families that wanted to visit Skara Sommarland, a water park close to the small town Skara. The participants went as groups of 1–2 adults and 1–3 children (aged in the range 2–16 years), and five such groups participated (referred to as W1 through W5 in the deidentified data). They checked out their bikes in Skara, went via a pre-planned 7 km route to the water park where they spent the day, and finally returned via the same route to return the bikes in Skara. The first 5 km of this route was the same as the beginning of the route from case 2. The fees for renting the bikes, the entrance fee to the water park, and lunch was paid by the project.

## 4 RESULTS

Our analysis of the data shows that there are some aspect that are common to all three cases, but that there are also some aspects that are specific to the type of case and to the purpose of the trip. Translated quotes from participants are attributed to the respective participant using the deidentified index, thus indicating what case they had experienced. However, before describing the main findings from the three cases, we would like to briefly touch upon some general, but relatively minor observations that has been made during the project.

All of the participants were overall satisfied with the trip and enjoyed the electric bike as a mean for transportation. There was a wide variety in previous experience with biking as well as a variety in priority of environmental issues. The latter was spanning from fairly indifferent to fairly high priority of such issues, with a bias towards the side of high priority. During the interviews we asked the participants about their view on the weather with regards to biking as we expected that would have large impact. Albeit several responses were related to the weather, all respondents said that heavy rain and heavy wind would probably have a negative impact on the experience, but it was apart from that mainly seen as a question of dressing appropriately. In particular since the motors of the electric bikes would both make it less difficult to bike in the different conditions as well as make it easier to carry additional luggage, such as spare clothes for shifting conditions. Most participants had previously considered biking on vacations, and some had previous experience of it.

To turn to our main results we describe them in terms of six different categories: integration of digital and physical aspects, integration of different means of transport, bike for transportation vs. bike for exploration, engagement, accessibility of nature, and lowering the threshold.

### 4.1 Integration of digital and physical aspects

Due to technical, organisational, and practical reasons, there are many different types of systems that the traveller needs to interact with to complete its trip: there is one system for booking trains, another one for booking the bikes, another one for the bike routes. This is not unusual when travelling [6], and even when most systems individually have a reasonable degree of usability, the added complexity of identifying and using the different systems reduces the overall usability. Some of the participants in these cases also expressed a need for more, and more integrated, information and L5 mentioned that the uncertainties were increasingly stressful the days before the trip. However, like several of the other participants, they were used to preparing by looking up missing information via various apps and on the internet, and even contacting key people via e-mail and phone calls. Since people were used to this, they did not specifically talk about this as a problem even though they to some extent found it inconvenient. L5 mentioned that *'I know that a number of e-mails were sent back and forth between us [participant and organiser] before we, like, got the hang of how we were going to make it'*.

It was a bit different when it came to information access during the trip. Many participants, mainly in case 2 but also case 1,

proposed a digital map of the area with points of interest, distances, proposed routes, various information, etc. Crucially, participants highlighted that such resources need to be created thoroughly grounded in the needs and perspectives of the users. For instance, H2 mentioned that *'I received a bike map, which I found spectacularly bad, I got to say... with strange suggestions for routes to choose. They are, like... partially marked, and then not as any circular routes, but short snippets, so you wouldn't know how good the road is between to even get to these marked routes'*. This was picked up by other participants as well and having complete networks of bike roads with specific routes highlighted was a reoccurring suggestion. Although such information would mainly be intended to be used during the trip, it would be good to access it beforehand as well to support the planning.

The prevalence of smartphones was highlighted as an opportunity to address some of the experienced issues regarding navigation, lack of information, etc. Such devices are not only facilitating interactive maps or similar apps, but integrating the phone's GPS capabilities would allow for support when reading the map, finding appropriate routes, and provide timely information and suggestions. Having the phones close at hand would also allow for taking photos when encountering particularly beautiful or interesting things, something that was mentioned by the participants. The potential of taking nice pictures might frame the bike trip in a way that encourage the biker to attend and engage with the surrounding landscape and nature, as they are on the lookout for photo opportunities. Having the phone close at hand (including a simple thing as a holder on the handlebar) would have the added benefit of ease of access and was something that many participants requested. Some participants even suggested to integrate solar cells for charging on sunny days.

With that said, several participants expressed appreciation of getting time away from screens in a non-forced way. Partly for that reason, several participants still suggested physical maps and information pamphlets or analogue infrastructure (both in the sense of physical signs with directions or information, and occasional windbreakers where maps could be unfolded and read even on windy days). The conflict between the convenience of smartphones and time away from screens was discussed by several participants, often leaving the issue unresolved. This is another reason why physical and digital solutions need to be developed in parallel, and not attempt to force people to only rely on one kind.

### 4.2 Integration of different means of transport

As noted earlier, transportation for rural tourists tends to both consist of the journey to and from the location as well as the trips done at the location, and it is not uncommon to go to the location in a private car; potentially to more easily bring a personal bike [49]. The challenge is then of how to integrate bikes with other kinds of transportation, such as busses and trains. There can, for instance, be different operators within the different kinds of public transport, which may cause problems for tourists. We have during the project observed two such problems; one relates to when a connection is missed and the ticket is only valid on one train company. For the tourist, it is not necessarily obvious that there are different train companies and different types of tickets, and such minor hassles



may prevent future travels by such means and may also contribute to a negative attitude towards bus and train transportation. L5 mentioned that *'It is more difficult when there are several changes and it becomes a bit complicated. We chose to go a little later, both there and back, and it became a bit later than it might have if we had gone by car. It was also a little trouble when we actually were on the train and had our ticket. It turned out that the last part [...] was [a different train operator], so we had to buy a separate ticket.'* In this particular case the conductors allowed the participants to use the invalid ticket, however, the participant could have received a fine in the ballpark of €100.

The second issue is the different rules for bringing a bike onboard buses or trains. These rules are sometimes due to the limited space committed to holding bikes on such means of transportation, and bringing bikes on such vehicles therefore need to be prioritised as an issue to allow for change, making it a good example of the third kind of approach in Hall's taxonomy [22].

An important reason for considering this is that the different means of transportation have their own properties, making it relevant to combine several kinds on a journey. It might be appropriate to take the train to the starting location, and then go by bike from there. To avoid spending time and effort on less interesting parts of the trip, or to facilitate reaching more distant locations, it might be appropriate to switch to bus or train for parts of the journey. It is in that case necessary to either bring the bike on the other vehicle, or leave the bike in a safe place (potentially returning a rented bike at the new location).

### 4.3 Bike for transportation vs. bike for exploration

Two different views on the bikes emerged from the data in the analysis, and these views were partially introduced implicitly in the design of the cases. We have chosen to call these views 'bike for transportation' and 'bike for exploration' respectively. Bike for transportation refers to situations where there is a clear goal for the trip, that is to be transported from A to B. In the three cases we explore here, the water park case is the one with the clearest association with this type of travel. In this case, there is a clear goal (i.e. the water park), the journey time is less than the time spent at the goal destination, and there is no explicit purpose with the trip other than reaching the destination. Bike for exploration refers to cases in which the goal is the trip in itself and the destination is of less importance. The Lidköping case is the clearest example of this type, where the point is to travel a route but come back to the same starting point, and the point is to experience different types of things during the bike route.

The History and Nature case seems to also be of the type bike for transportation as there was a clear goal, the Abbey and Kata farm, but the participants in this case saw the bike trip as more than transportation. This was probably partly due to the mismatch between the expectations of organisers and participants of the trip. The trip was designed with the intention that bike ride was mainly functional (albeit nice), and the purpose was to experience the historical locations in Varnhem. The participants, on the other hand, saw the ride as a chance to experience the nature, the local producers, and all the things the local countryside could offer. According

to L2 *'[...] the particular choice of route for the bike path does not encourage more biking when you bike so close to road 49 [a heavily trafficked motor road] a long way. With a lot of traffic. You might wish for a possibly more scenic route to get away from the traffic. And that maybe information about interesting destinations were available or, well, you do bike past Axvall Heath, you bike past Brunsbo Episcopium, etcetera. There could be some information about it along the way, if you are there as a tourist.'*

Perceiving the trip as for transportation or for exploration do seem to have an influence on the experience of the trip. Despite using the same bike path a long way, we observed a difference in how the History and Nature and the Water Park bikers experienced the bike path. We observed that in the History and Nature case, the participants experienced the bike path as for commuters and built for efficiency, and saw that as negative for the experience. L1, for instance, mentioned that *'[one of the organisers] mentioned that the bike path had been built for people going to and from their work, with more of a transportation... and for that reason there were no small places to pause or benches or so, or even a place to unfold the map or see where you are heading. So that was also something I missed. [...] I feel like it is unthinkable to simply use the bike for transportation, I also want something from the bike trip itself. And the nature was really beautiful, and it was full of bird life and I stopped several times to watch the birds and such.'* L1 was one of several participants that specifically mentioned how dreary some of the long straight parts were, something previously highlighted in the literature [3].

The participants of the Water park rather emphasised how scenic and 'close to nature' (W1) the trip was. Thus, although there might exist other factors such as what type of nature one is accustomed to, we believe the expectation of the trip being for transportation or for exploration do affect one's experience of the trip, which the organisers should be aware of when constructing offers and bike routes, as well as how they market it. As seen with the History and Nature case, it is important to remember that several factors might shape the expectations of the participants, so simply providing information regarding the intention behind the designed trip might not be enough to manage the expectations of the travellers. This mirrors the findings related to the first approach in Hall's taxonomy [22].

### 4.4 Engagement

In both the Lidköping and Water Park case, families biked together. One aspect that stood out that might be particular to this type of constellation, or at least restricted to when travelling in a group, was a change in group dynamic among the travellers. We observed that all of the families experienced this trip as a new type of travel in which the interaction between and the roles of the members of the family was different than from when travelling by car. When travelling by car, the trip was more divided into driver and passenger and less engaging for the entire family. While travelling by electric bike the participants noticed that the entire family was part of shaping the journey, and that everyone was more engaged in the activity, and also steering the direction and the pace of the journey. This feeling was also associated with excitement and pleasure, giving the families a desire to travel this way again.

There are some possible causes for why this new experience occurs. First, the means of travel, electric bikes, gives each member of the family more autonomy and there is a need to coordinate with everyone. Second, the electric bikes themselves were a novelty for most of the participants and it also put the children on a more even ground in terms of ability to bike. Third, it became more of a project that everyone needed to participate in, and there were less focus on getting to somewhere in time. The combination of these causes are related to the breakdown of the distinction between the (passive) passenger and the (active) driver. In the new dynamic, there are still different roles and hierarchies (for instance, parents would still maintain ultimate responsibility), but the genuine stake and ownership that everyone would hold provided a stronger feeling of community and meaning. This was not only something that was seen during the trip, but also made it easier to engage everyone in the planning of the trip, providing a positive feedback loop. Having a more active part in the planning made it easier to engage during the actual trip.

Several participants mentioned that this trip prompted and facilitated many new thoughts and conversations regarding transportation, tourism, and sustainability. This helped the participants to not only engage with the specific trip, but also with the broader and often abstract issues regarding transportation, tourism, and sustainability in general. Participation in this project prompted, for instance, W3 to many discussions within their family regarding what it would take to change travelling habits in favour of sustainability. They mentioned that *'I love to travel. I have also travelled quite a lot in my youth, but I think of my children. Are they not going to be able to travel and discover the world that I have talked about as such a wonderful place?'* (W3). They also mentioned that the trip prompted conversations with friends, where the initial reactions were laughs, but was followed by more serious discussions about transportation, tourism, and sustainability.

These reflections were observed both among groups of travellers as well as those travelling alone. Part of the reason for of the attention and engagement lays in the novelty, which might wear off in time. However, this might not be a problem since the future disappearance of novelty might be due to the mainstreaming of more sustainable tourism.

#### 4.5 Accessibility of nature

Many participants compared or contrasted travelling by bike with travelling with car. One important and repeatedly reported aspect was how the bike made the landscape and nature more accessible in various ways. It was partly due to the slower pace that gave time to take in the surroundings, and partly due to the experienced freedom of being able to stop at any time. In addition, the participants were able to experience nature through more senses; not only the views, but also the smells, sounds, etc., which is highlighted as an important part for the well being benefits of experiencing nature [3]. Since the bikes are less noisy and requires much smaller paths than cars, it was also possible to get closer to nature without interfering as much.

All of this facilitated a particular peace of mind. One of the participants who had spent the day in the water park had worried that they would be exhausted before the return trip, which they

were, but were surprised that instead of draining them further, the return trip rather provided a kind of recovery. They mentioned that *'it really felt nice to get this... peace and quiet, and it was experiencing nature and it was air. Fresh air. So the way back became a kind of recovery. Maybe more for me then [compared to the accompanying children], instead of getting behind a wheel and drive'* (W2). Having experiencing nature as secondary effect that is not necessarily planned for, in particular when biking for transportation, makes nature more accessible, present, and personally relatable in an implicit way.

For these reasons it is important to not over-focus on individual pragmatic aspects, such as efficiently going from one specific place to another. Understanding that there are several ways and purposes to use bike paths, and also see the value of the more hedonic aspects, are therefore necessary (see also [3]). This can be seen as an opportunity to apply a kind of Universal Design — 'the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design' [44] — for transportation infrastructure. Bikes are in general good alternatives to travel medium distances fairly quickly at a low cost without the need of a drivers licence or adjustment to a schedule, facilitating better mobility for a larger part of the population. Electric bikes are albeit more expensive, but can also provide the benefits of bikes to people who might not have the physical abilities necessary for a regular bike.

For those that were using the bikes more for exploration, many experienced a kind of flexibility with the bike, where it felt feasible to explore more and different routes than if they had been in a car. H4 mentioned, for instance, explicitly how the lake Spännsjön was a beautiful place with rich bird life but inaccessible with other means of transportation, partly due to the sensitivity of the ecosystem. Another strategy that L4 mentioned was they at one point had 20 minutes to spare, at which point they proposed to their fellow travellers that *'we take seven minutes and bike in this [random] direction and see where we end up. That way we get to bike a bit more'* (L4). This was appreciated, in particular due to ease of the electric bikes. However, as mentioned before, many participants mentioned that they would have wanted better and more appropriate maps to be comfortable to explore more and as they wanted.

#### 4.6 Lowering the threshold

One of the clearest results from the interviews is that there are perceived hurdles in the way of choosing more sustainable alternatives for transportation and tourism. Factors often repeated as the most important when considering options were convenience, economic cost, and flexibility. These reasons were highlighted in general by all participants, and returned in different parts of the interviews when different aspects of travelling choices were discussed. A particularly noticeable instance was how most participants in case 2 and 3 used those factors as motivation for going to the start location by car. The irony of travelling by car to participate in a study about sustainable tourism was noticed by all those participants.

In the light of these factors, the uncertainty associated with trying new alternatives would often lead to avoiding them due to the risk of them being significantly worse in respect to at least one of the factors. This is a well known phenomena for decision



making in general, relating to risk and loss aversion [27, 47], but has also been observed specifically for this context [6]. In addition, many respondents were unsure about their own ability to partake in a longer biking trip. The combination of using electric bikes, and using them in a pre-planned format with available support and resources helped to lower the threshold for what is considered feasible, allowing a larger part of the population to try the concept. After the trip, many of the participants reported that they felt more prepared for trying biking on vacations as they now knew more about what to expect and felt more confident in their own abilities. L5, for instance, mentioned that they had considered this kind of trip a long time but the uncertainties had always kept them from trying. With the experience of this trip they felt that it was possible and they *‘[...] dared to take the leap and hopefully do [a trip with] one or two days with overnight stay, with planning or so. Absolutely’* (L5).

The threshold for people to commit to trying this kind of transportation can be lowered in many ways. All participants, emphasised how important and how relieving and nice it was to have a person giving instructions on the type of bike to rent, additional equipment such as attachable carts needed, helmets, how the electric bikes worked, help with adjustments, etc. In the cases studied in this project, the participants collected the bikes personally from an expert on the bikes and received contact information to them in the occasion that something unexpected would happen during the trip. This was universally appreciated despite almost no one actually used them. Simply the knowledge that there was easily accessible help if necessary seemed to provide comfort and confidence to the traveller. This constituted some of the feeling of safety that was associated with this trip. Another source of this feeling of safety was that the routes and destinations were planned, proposed, and thus vouched for, by someone with appropriate knowledge.

Another way of increasing the feeling of safety is infrastructure. Especially the participants that started their journey in Skara (case 2 and 3) expressed that more physical signs showing directions would have increased their sense of security as they experienced some difficulty to navigate the city centre and finding the main bike path. At the water park there were no easily spotted parking spaces for the bikes, which caused minor confusion and insecurity. Participants pointed out that an added benefit of making such infrastructure more visible, apart from benefiting the cyclists, is to make the option of using a bike more present and attractive in the public mind. For instance, W2 mentioned that they found it difficult to get out of Skara and pointed out that *‘if it would have been better signposted in town, people might have been reminded that “oh, that’s right, there is apparently a bike path [from here to the water park]” that we biked to. And with that the thought might be planted among the local population.’* W2 further mentioned that several local people they asked were completely unaware of the possibility of biking to the water park, so the increased awareness might increase the inclination to bike. This can be seen as a kind of nudging, or generally an approach of the second kind in Hall’s taxonomy [22].

## 5 DISCUSSION

In conclusion, our study has found that sustainable tourism in the form of electric bike routes to local tourist destinations is a promising alternative. The key aspects for its success were identified as being (1) integration of digital and physical infrastructure, (2) integration of different means of transport, (3) the purpose of the bike trip, (4) engagement, (5) accessibility of nature, and (6) lowering the thresholds by providing different forms of support (see table 1 for some examples of each aspect).

Although these aspects were identified through an inductive analysis of the interview transcripts, they do mirror some aspects that have been highlighted previously in the literature. For instance, something that has received some attention in the literature, and was also highlighted by many participants in our study, is the challenges with regards to public transport in rural areas in general [37, 40], but particularly problematic in combination with the difficulty for visitors to understand local systems [12, 30]. The latter point was, for example, experienced by several of our participants when they boarded a slightly later train than they first intended, and were there informed that their tickets were not valid. Somewhat related to this is the phenomenon that personal cars often used to at least go to the starting location, due to the flexibility in terms of not having to refer to a schedule and the convenience of being able to bring much luggage without much planning [30, 49]. This phenomenon was clearly present in our study as well. The alternative modes of transportation were not always seen as inferior in general, but it was common to avoid them as they were associated with some risk (in terms of, for example, getting lost or losing time). Such arguments were often, more or less explicitly, used by many participants when talking about biking on vacations. Many were curious about such vacations, but various sources of uncertainty prevented them from trying. Here we saw that the prepared options in this project provided a sense of security, that someone more knowledgeable could vouch for these trips and provide support if necessary, that allowed the participants to obtain the experiences they needed to be comfortable enough to try these kinds of trips on their own in the future.

Another clear pattern we found among the responses, mirroring what exists in the literature, was the importance of appropriately designed bicycle road networks (for example [33, 43]). It is, however, not enough that these networks exist; it is also necessary that the cyclists are aware of them, so maps and other information has to be accessible to make the roads accessible. Such information needs to be thoroughly grounded in the needs of the cyclists, meaning for example that information on the distance, connections, and points of interest along the way for the routes should be provided. What information is appropriate and desirable does, however, depend on several factors, such as the purpose of the trip and how experienced the travellers are. This was evident in our study, but future studies need to explore the details on this further.

One way of structuring the approaches for achieving behavioural change is through the taxonomy of Hall [22], and throughout this paper we have discussed examples we have seen of all three levels in that taxonomy. For example, signs with information in the right context is an example of the first level, road signs for bike paths might indirectly inform people that biking is a possibility and thus

**Table 1: Summary of findings.**

Key aspect	Main take-home message
Integration of digital and physical infrastructure	Physical signs for direction and digital information such as maps should complement each other, not replace each other.
Integration of different means of transport	Different modes of transportation have different roles in the transportation system, and it should be easy to transfer between modes and between service providers.
The purpose of the bike trip	The purpose of trips can vary a lot, and the travellers' expectations on services and infrastructure varies with them. These expectations should be identified and met.
Engagement	The mode of transport may affect social interactions in unexpected ways; in the case of trips by electric bikes we saw improved engagement within groups of travellers.
Accessibility of nature	Electrical bikes provide a unique way to experience nature, partly due to its ease of use and how little it disrupts the local environment.
Lowering the threshold	Having someone knowledgeable available for support if necessary allows people to explore sustainable vacation options, and lowers the threshold for trying biking trips by themselves in the future.

constituting an example of the second level, and improving the integration between different means of transportation is an example of the third level. Importantly, however, the different approaches should be used in parallel in a way that makes sense as a whole. It is not trivial how different solutions interact with each other, or how different stakeholders will be affected, so it is necessary to carefully evaluate the specific conditions of each case — both before, during, and after the deployment of solutions — with a wide variety of representatives of stakeholders and users.

Psychological phenomena such as the attitude-behaviour gap [26] and the licensing effect [28] make it particularly important to study and evaluate the actual consequences of the various arrangements that are tested. With that said, we have seen that the electric bikes can fill an important role in medium range transportation in ways where sustainability benefits would be persistent even with such phenomena. The electric bike might present options that are feasible and help people switch to more sustainable behaviours without feeling that they suffer for their cause. That, in combination with implementation that appropriately ground this means of transport in the context of sustainability, might help to avoid some of the risk of licensing effect.

On a larger scale, this project contributes to several of the United Nations' Sustainable Development Goals [48]. While the results of the project may have some effect on reducing CO<sub>2</sub> emissions and contribute to the Sustainable Development Goal number 13 on climate action, it also contributes strongly to goal 3 good health and well-being by focusing on cycling in a safe way. Cycling as a means of transportation also affect goal 12 responsible consumption and production, and positive connections between increased biking and several of the United Nations' Sustainable Development Goals have been highlighted previously [14]. Given how nature is made more accessible, as a secondary effect of people travelling through natural areas in a slow, comfortable, and non-disruptive way, we also see how it can contribute to goal 15 about life on land; experiencing nature in this way might make that goal more personally relatable for people.

We believe that the concept of deploying electric bikes for tourism may also, at relatively low cost and short time span, be adaptable

to other rural areas that have existing but underexplored roads that can be used for safe cycling as well as allowing the integration with local producers and tourist destinations. This might not only serve the local community by increased turnover in terms of economy and visitors, but might help the local population to find and access their local nature and places of cultural interest. To facilitate such a development, it is important to not only focus on the pragmatics of efficient solutions. It is also important to take hedonic aspect of mobility into account; travelling between destinations can be fun or otherwise rewarding in itself, in particular when using electric bikes. When planning infrastructure it is therefore important to have a wide range of perspectives and solutions, which in turn can have added benefits with regards to UN's sustainability goals.

While some argue that trade-offs between sustainability goals is often necessary [41], no such trade-offs were apparent in our study. Renting electrical bikes is relatively affordable, provides a new and business model for rural areas, promotes new social experiences and well-being (e.g. experiencing something together as a family), it has a very low impact on CO<sub>2</sub> emissions, and little disturbance on the surrounding local environment compared to other modes of transportation. While we agree that issues related to sustainability are too important to be allowed to dissolve into fuzzy and overloaded concepts [20], it is also important to address them in a manner that reflects the complexity of the issues [35]. Although it might be challenging to generalise some of the results from our cases, they can be seen as rich examples to inspire and inform future projects and studies, while providing insights into the experiences of the actual travellers.

As seen in our analysis, our cases are not perfect. For example, there is a need for more integration between booking systems and route maps, better integration in public transport, bike routes can be even more scenic, and also better connected to local producers. It was observed that the digital and physical infrastructure was somewhat lacking, and while efforts where made during the project to develop a new and easy booking system, it is evident that it is difficult to coordinate these types of services as there are many different stakeholders including service providers of different booking and route planning systems, the local industry (including

bike rental shops, cafes, hotels), and the municipality whose role it is to inform and facilitate but not control this system. Part of the difficulty is to convince all stakeholders to prioritise bikes and the corresponding infrastructure, but part of that problem might be alleviated by involving them genuinely and early in the process.

There are plenty of things to study further in terms of how and where this concept of offering electric bikes can be transferred and applied. Notably, there seems to be large potential in using electric bikes in a rural environments, however, this kind of transportation is otherwise often studied in the radically different context of urban environments. The question is how such a switch in context affects the deployment of electric bikes. There might exist similar questions regarding if there are critical particularities with the region, kind of landscape, kind of experiences, kinds of destinations, etc. As a next step, questions remain regarding what the consequences actually are for deploying this concept, in particular more long term. Both in terms of behavioural changes and in terms of CO<sub>2</sub> emissions. An important feature of using bikes to travel between tourist attractions in rural areas is that it requires little modification of the landscape, which is otherwise a large problem for other modes of transportation [12, 30].

For the future, we would like to emphasise the following findings. For particular implementations of similar services it is important to 1) integrate all digital services into one single location (for instance an app), while not forgetting how physical artefacts in the environment interacts with and complements the digital services, and 2) effective and usable booking and planning systems are important, but social interaction with an actual human (such as the service personal at the bike shops) is equally important and should not be neglected. In line with previous studies, we have in the SMaRT-project observed that, despite a slight decrease over the past years, the majority of visitors from urban areas travel to the destinations by car. Therefore, we emphasise the importance of infrastructure development and political decisions, enabling an efficient, flexible, and affordable journey by public transport from urban to rural areas.

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