
T'UMwelt

Project Report **T'UMwelt**

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Preface by the Supervisors

Prof. Dr. Hans-Joachim Bungartz, Prof. Dr. Jan Müller-Wieland and Prof. Dr. Christopher Ungemach

On a great idea, severe roadblocks, and "the way is the destination"

Our team's project started with the name EnterTrainment and ended as TUMwelt – which, maybe, already reflects some of the various problems the team encountered and the several re-orientations these problems entailed throughout the last year. The topic is as timely as such a topic can be, and of high societal relevance – the use of appropriate technology to create incentives that foster ecological behavior at large; or, formulated as the team's research question: "What kind of incentives can be successfully delivered via mobile apps that nudge their users towards eco-friendly behavior?" The primary context: local mobility – public transport, cyclists, pedestrians.

Now for the problems. Building the project on an app needs someone who can rapidly develop and deliver such an app – all the way down from design to implementation. In particular, the latter became an issue. The first plan – find an informatics student who can do this – did not work. If, as a student, you deliver something for a student initiative, you typically want to be part of it. This holds in general, and it holds in particular for an informatics student who sees only a limited attractiveness in being a coding servant to a team of fellow students. Next, the planned incentive were credits. There were vague plans of designing an "Interdisciplinary Project" – without a deeper understanding of what an IDP is (the module in the informatics master curriculum representing the minor, i.e. a project where the topical context is defined out of the minor). Eventually, a student was hired and paid – who actually delivered something,

but not what was intended; money is not the best incentive – see above. Learning outcome: If coding marks a good part of such a project, at least one team member should bring in coding expertise.

A second challenge for such a project is narrowing down the features and potential nudges to be implemented as part of the app. There are various ways to facilitate behavioral change (e.g., decision signposts, information, financial incentives, gamification …), but implementing all of them would keep a whole team of developers busy for months. Furthermore, being able to test the contribution of the various nudges empirically requires a detailed consideration regarding the experimental design and a large number of participants. When the circumstances become more restrictive, some decisions make themselves.

Another issue is communication. We as mentors found ourselves a bit decoupled from the team's activities, without having shown a lack of interest. That feeling is probably also the reason that our preface is less descriptive and more critical than others. But isn't it such a variety that provides "the salt in the soup"?

Concerning the outcome, there are at least two dimenions: outcome in terms of "the product," and outcome in terms of lessons learned. Even if the first is not (yet) fully convincing, the latter is indisputable. Which brings us to "the way is the destination" in the title of this preface – and with respect to that, the lessons have been learned. By the team members, but also by us. Hence, overall, another great TUMJA experience!

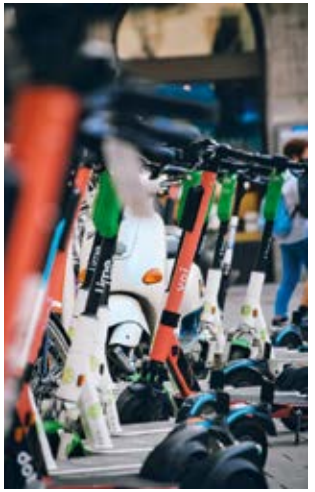
T'UMwelt – let every leaf count.

Have you ever wondered how many CO_2 emissions you could save by walking, biking, or going by public transport instead of the car? As part of our project for the TUM: Junge Akademie, we created the application T'UMwelt which makes your contribution to a more environmentally friendly city visible! After each trip, you will see how many grams of CO_2 you have saved. Thereby, we aim to raise consciousness about mobility habits, awareness about their impact on the environment, and promote eco-friendly behavior.

Knowing that we are not alone in our endeavor for a greener environment, we looked for inspiration from those who are already active and experienced with this challenge. For this, we got in contact with the creators of the platforms GreenApes and MUV. We received important and helpful advice from them about various topics, ranging from how to manage and prioritize the development of features of our final product, what to keep in mind when trying to engage people with our project, and even considerations about making our initiative sustainable in the long term. All these inputs have allowed us to keep moving forward and reach our goal. Are you interested in how we got there? Then join us in a short ride about mobility habits, obstacles for choosing sustainable means of transport, and, finally, experience what it is like to let T'UMwelt accompany your daily trips.

Mobility habits

What impacts people's decisions for or against a means of transport? Regarding cycling, the security aspect has a huge effect on the decision. For a Munich resident, let's call her Marianna, feeling secure due to separated bike lanes, for example, can be an enormous driving force to cycle. In Munich, during the last months, several so-called pop-up bicycle lanes have been created and mirrors have been installed at dangerous crossings to improve visibility for right-turning large vehicles.



How about walking? Apart from being a relatively slow means of transport, why do people walk? First, it is an easy way to get some exercise. Also, in so-called multifunctional neighborhoods which fulfill several functions from shopping to coiffeurs and playgrounds within walking distance, people can be more tempted to walk. For example, when going back from university, Marianna enjoys walking and checking the library and shops that are near the Maxvorstadt. Occasionally she buys groceries before going home. Accessibility and short paths are essential for that. This is also important for the use of public transport. Connections, convenient schedules, as well as comfort and beauty of the stations can affect people's choices.

Experiencing sustainable means of transport

Walking is probably the oldest way to move. Far before the invention of any means of transport, such as bicycles, locomotives, or airplanes, people travelled thousands of kilometres on foot. Over the past centuries, increasing prosperity and the ever-increasing desire of mankind for comfort led to a decrease of distances covered on foot, by bicycle or even public transport. Nowadays, many people want peace and quiet, preferring the comfortable car to other means of transport, so as not to be unnecessarily disturbed by the rest of the population, for example in the subway or bus.

Combined with the ever-increasing frequency of work in the office, modern people are therefore increasingly lacking in exercise, which, in view of ever-improving medical care, is not a cause for concern for them. And although climate change is widely recognized, many people do not like to connect it to their transport behavior if it means foregoing their comforts and being able to get in the car and drive from one's own home to the organic shop in the neighborhood.

Cycling allows for much further traveling distances than walking. Quite easily, you can make about 13 kilometres in an hour. It is also an easy way to do some physical activity, which is – at the same time – an unappealing fact of cycling as you will sweat. That is impractical when cycling to classes, work, or a restaurant. Even worse on hot summer days! Or in the rainy autumn, when damp leaves deceptively cover the little curb between the bicycle path and the footpath. And in the winter months, in freezing cold and on icy roads. But that is not all, we have not even started talking about how to

carry your purchases or travel with children. It can be a challenge to maneuver your way through pedestrians, cars parked on the bicycle path, and on the roads when there is no separate path for bikes. Despite these inconveniences, cycling can be fun. Grab your helmet and pool noodle to indicate the distance cars should respect when passing. Get comfortable clothes and put on a smile. Hop on your bike and enjoy the flow when cruising.

When it comes to larger distances, walking and cycling may no longer be an option. It is in these cases where comfort and flexibility have an even greater importance when choosing between private cars and public transportation; being restricted to specific schedules to initiate a journey, sharing the space with other passengers, and handling luggage from one transport to another represent demotivating factors that drive people away from eco-friendly mobility. Finding ways to overcome these factors or casting a different light on public transport means and their usage, could be an interesting opportunity to convert this behavior. For example, if one has no access to a car (or at least not yet), the cumbersome endeavor of travelling by bus or train ends up forming part of an individual's routine anyway. We must not waste the chance of finding the key to motivate people towards eco-friendly mobility, precisely during this phase, in which custom and inertia can be very helpful.

Now, let us experience T'UMwelt!

Thousands of people go to work every day in Munich, few of them use environmentally friendly means of transport such as ÖPNV or bicycle. Marianna takes the subway to her office every day. She works for a big electronics company and wants to help protect the environment. Through her circle of acquaintances, she became aware of the app T'UMwelt. An app which, finally, makes her contribution to climate protection visible. Marianna is enthusiastic about T'UMwelt! Every morning when getting on the subway, she swipes the blue bottom in the app to the right, her trip is now recorded! When she arrives at work, she immediately sees the distance traveled as well as how many CO_2 equivalents she has saved by going by ÖPNV instead of her private car. What an emotional morning booster! Now, she is ready to tackle any challenge her workday might bring. Marianna is already excited about how many Leaves of Change she will be able to grow in one week. The Leaves of Change are calculated in accordance with the CO_2 savings and are part of Marianna's tree, which she can grow in the app, and which shows her overall contribution to climate protection. After work when Marianna goes shopping by bike, she swipes the yellow button saying 'Bike' and starts cycling. Although the hill she must climb can be challenging, it is worth seeing her Leaves of Change growing and growing. At night, she drops in on her friends who live five streets away for a barbecue ... swipe the green button ... and let's go. At the party, she compares the collected leaves with her friends, and they even make bets on who will grow more Leaves of Change next week. Also at work, Marianna has already motivated her colleagues to use T'UMwelt. It can be so much fun to do something good and contribute to environmental protection when you see the impact you're having. And, of course, when doing it together with others!

Closure

After finally producing our app T'Umwelt, we dream of being able to make a lasting impact on climate protection. It is not only about nature, but also about maintaining people's well-being. In addition, the app offers users the opportunity to compete with their friends and the community, which is designed to lead to an exciting group dynamic. It is our goal to be able to keep the app alive even after the end of our project, possibly also with partners who will continue the app with us or even take it over. At the end all we have to say is: Become part of T'UMwelt, because we are moving Munich!

Evaluating the potential of the app TUMweltfreund to promote eco-friendly transportation habits

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Abstract

Nudging describes the designing of an environment in which decisions are made to lead the chooser in a certain direction. The effect of a nudge can be increased by gamification, which is including game or fun aspects in the design. Nudging strategies can be applied to benefit eco-friendly behavior. Similarly, TUMweltfreund is an app promoting eco-friendly transportation habits. Comparing it with previous projects, as well as examining the theoretical background, led to the conclusion that the TUMweltfreund is a promising development in this direction, with high chances of nudging people successfully.

Introduction

In Bavaria, 30 to 70 % of distances are still traveled by car (VDW, 2017). While emissions per car have decreased, the purchase, as well as usage of cars, has continued to increase, partially explaining the increase in total CO_2 emissions of 3,7 % since 1995 (Umwelt Bundesamt, 2021). In 2017 an investigation by the German Federal Ministry of Transport and Digital Infrastructure indicated the highest increase in car usage in the rural areas from 20 % in 2002 to 67 % in 2017 due to the increase of commuters. In urban traffic, cars represent 36 % of the modal split (VDW, 2017).

Meanwhile, public transport systems, as the eco-friendlier alternative, make up about 20 % of traffic in German urban centers (VDW, 2017). Although usage of public transportation led to an average saving of 10.5 million tons of greenhouse gas emissions (VDV, 2019), people still often decide to travel by car. According to a study by the Münchner Verkehrs- und Tarifverbund (MVV) examining determinants of the decision whether to use public transport, the most important factors are punctuality and frequency. Large decreases in public transport usage were found for frequencies of 10 minutes and longer. Also important are the price-performance ratio, availability of connections, travel time as well as the availability of general information (MVV, 2007).

For an easier description of target goals and backgrounds, travelers are categorized using a set of different criteria. As already mentioned, there is a substantial difference between the rural and

urban population, with different motivations due to a difference in infrastructure (VDW, 2017). Users of the public transport systems can also be divided based on the frequency and their potential to increase usage of public transport (MVV, 2007). Some do not own a car, therefore only travel by eco-friendly means, such as a bicycle or the public transport systems. The other main group consists of car owners and can be further divided by their frequency of taking the public transportations systems. People who tend towards traveling by car can be further divided based on the perceived quality of infrastructure available in their surrounding neighbourhood. Those that do not have good connections but are willing to take the public transportation systems more often represent 23 % of the population of Munich, while those with a good connection and general willingness to use the public transport make up 4 % of the population. This leads to a total of 27 % of the population that could be steered towards public transportation by different means (MVV, 2007).

As shown, people still have different preferences towards various methods of transport, with different reasons and arguments. However, studies have shown many benefits of a modal switch from traveling by car to the usage of public transport in urban areas. Firstly, cars are linked to various health risks from increased mortality rate due to car crashes to increased morbidity due to air pollution (Zhang, 2013). While probably not being obvious at first, noise pollution by increased car traffic can also harm human health, reportedly increasing the risk of myocardial infection, cardiovascular disease, hypertension, reduced sleep quality, and others (Maschke, 2002; Geravandi, 2015). Nonetheless, the most important factor might be the increased temperature rise and climate change due to greenhouse gas emissions, which not only harms biodiversity and health but economics as well, due to high medical costs (Tol, 2009; Haines, 2004; Dantas-Torres, 2015). Furthermore, studies have proven the positive economic, health, and environmental effects of switching to more eco-friendly modes like cycling and walking (Rojas-Rueda, 2012).

Without immediate changes, temperature in Bavaria will rise about 4,8 °C by 2100 (Bayerisches Staatsministerium für Umwelt und Verbraucherschutz, 2021). However, Bavaria still takes the least action of all the German federal states (DVR, 2020), stressing the urgent need for projects increasing eco-friendly travel behavior. One way to do this is by improving the infrastructure, which has various other positive impacts, like improving the economy of the area leading to so-called accumulated effects, which are synergistic effects increasing the impact (Tricker, 2007). An alternative is the method of nudging and gamification, which can be especially relevant for those who have a good infrastructure but use public transport less frequently (MVV, 2007).

One of these nudging programs is the so-called TUMweltfreund, a mobile app developed by the team TUMwelt of the TUM: Junge Akademie. With this, users track their routes traveled either by foot, by bicycle, or by public transport. The distance of the route is used to calculate the savings of CO_2 equivalents, meaning the effect of all greenhouse gas emissions, the time, and the money savings compared to traveling the same route by car. According to their savings, users will be publicly ranked, therefore competing against each other. The program is available as an app for Android users on the Google Playstore.

The objective of this paper is to showcase different nudging approaches and to critically evaluate the design of the app TUMweltfreund. To achieve this goal, a literature search was undertaken to describe the theoretical background as well as case studies in the field of nudging towards eco-friendly behavior. An additional survey provides further insights into the opinions and wishes of potential users.

Methodology

Literature research

In the literature search for this review, we focused on studies that discussed nudging approaches especially in the context of eco-friendly behavior. Starting in May 2021 and finishing in July 2021, the literature review was conducted using three databases, namely “Scopus,” “Web of Science” and “ScienceDirect”. As search strings, “nudg*,” “gamification,” and “intervention” were

used primarily. The search was restricted to English literature more recent than 2000. The results were filtered to fit the specific interest of the field of eco-friendly behavior. The evaluation process of the findings was made independently by three researchers to assure the validity of the results. The screening of the abstracts and full texts resulted in 14 reports that were included in this review. Of those articles, 7 focused on the theoretical background, while 7 focused on field studies. Other articles that were included highlighted the current environmental status of Munich and the health risks that relate to it.

Survey

Design

The survey that provided additional data to the literature review of existing interventions was designed as an online questionnaire. Both closed and open questions were used, where the open questions were used as an addition to the closed questions to add further response possibilities. The wording of the questions was carefully chosen so as not to generate a bias.

The survey was designed and conducted using the platform evasys (evasys GmbH, Lüneburg, Germany).

The questionnaire was divided into four categories, namely "use of public transport," "use of eco-friendly means of transportation," "impact of eco-friendly apps," and "personal data."

Evaluation

For each closed question, the percentage of each possible answer has been calculated, bearing in mind that for multiple-choice questions the percentage is calculated using the number of participants, not the number of answers given. The answers obtained through the open questions were added to the evaluation of the connected closed question.

Theoretical background

Nudging

Theory

There is no set definition of nudging (Vlaev et al., 2016, p. 551), but Thaler & Sunstein define a nudge as "any aspect of the choice architecture that predictably alters people's behaviour without forbidding any options or significantly changing their economic incentives" (Thaler & Sunstein, 2009). The choice architecture is the environment or the surrounding in which the decisions are made. The choice architect aims to create an environment that gently pushes the chooser towards one choice which the architect deems to be in the best interest of the choosing individual (Ferrari et al., 2019, p. 185).

There are believed to be two systems of thinking. On the one hand, system 1 refers to uncontrolled, automatic, fast, and unconscious thinking; and, on the other hand, system 2 refers to reflective, rule-based, slow, and conscious thinking (Dolan et al., 2012). Though nudging is by no means limited to one or the other system, most choice architects focus on system 1 since it is less intrusive, and the choosers do not feel like they are pushed or forced into one direction (Vlaev et al., 2016, p. 551).

One of the best-established frameworks for nudging is the MINDSPACE framework. It combines the nine "most robust effects on behaviour," namely messenger, incentives, norms, defaults, salience, priming, affect, commitment, and ego (Dolan et al., 2012). The following table shows a short definition for each of these effects.

MINDSPACE cue	Behavior
Messenger	We are heavily influenced by who communicates information to us
Incentives	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses
Norms	We are strongly influenced by what others do
Defaults	We go with the flow of pre-set options
Salience	Our attention is drawn to what is novel and seems relevant to us
Priming	Our acts are often influenced by subconscious cues
Affect	Our emotional association can powerfully shape our actions
Commitments	We seek to be consistent with our public promises and reciprocate acts
Ego	We act in ways that make us feel better about ourselves

Table 1: The effects of the MINDSPACE framework (Dolan et al., 2012, p. 266)

By addressing most if not all of these effects, the effectiveness of a nudge is greatly increased and has been confirmed in laboratory and field studies (Vlaev et al., 2016, p. 552).

Having portrayed an effective way of designing choice architecture we want to highlight that nudging itself is controversially discussed. The main questions in the discussion are: is it morally correct to influence the choices of others? What gives one the right to decide what the best choice is for others? In the term 'choice architect,' which is an invention of Thaler & Sunstein, it is implied that the architect has certain expertise in the field in which the decisions are made, which makes him/her capable of judging what the best choice may be (Sugden, 2009, p. 366). Apart from questioning who is evaluating the expertise of the architect beforehand, what is not addressed is whether the choice that is nudged towards is universally the best for all individuals.

In theory "a choice architect uses the choosers' judgements about what makes them better off, rather than imposing her own" (Sugden, 2009, p. 367). This statement is in line with the 'free choice condition,' that Thaler & Sunstein propose as insurance to prevent manipulation. They describe their approach to choice architecture as 'libertarian paternalism' since certain choices are highlighted or guided towards but not forced upon people (Thaler & Sunstein, 2009). However, many reviews of their work point out that even Thaler and Sunstein themselves, though being the inventors of the free choice condition, show some reluctance in applying it (Leonard, 2008; Sugden, 2009; Thaler & Sunstein, 2009). Overall, nudging can be a powerful tool to increase the chance of someone making the choice the architect has intended, but it must always be used carefully and with the free choice condition in mind.

Case studies

Many consumer apps for a sustainable lifestyle have already successfully implemented nudging in their functionality. In the following section, some of them will be presented in the areas of food, general consumption, and transport.

The app "Too Good To Go" for example offers a marketplace for restaurants and shops that have unsold, surplus food and sell it at a discounted price (Too Good To Go ApS, n.d.). The app uses push messages to inform its users concerning new offers at the appropriate time, e.g. sending reminders concerning lunch offers between 11 a.m. and 1 p.m. Messages contain texts like "Support our work against food waste. Save delicious meals from being thrown away." The app has already been downloaded more than 500.000 times.

Consumer apps like "Yuka" or "Code Check" use nudging in their functionality. They can be used to scan the barcodes of consumer goods such as shampoos or processed foods to find out exactly what ingredients are in them and which of them may pose a health risk and to what degree. They also provide information about the carbon footprint of many products. Consumers are encouraged to scan the products themselves as well as to actively contribute to the expansion of the product database.

Apps for sustainable mobility again use push messages to regularly inform the consumer of the carbon emissions he or she has already saved and to compare it with that of other users. This should encourage the user to travel even more sustainably.

As far as consumption is concerned, there are multiple apps available. As far as sustainable travel behavior is concerned, however, there is still a lack of beneficial apps. Although there are already initial offers such as "Carbon Footprint & CO_2 Tracker for Travel and Food," which calculate the CO_2 emissions of travel behavior, the calculation method is usually too general and not comprehensible to the consumer (The Capture Club, 2021). Accordingly, the results are not very meaningful. Furthermore, all these apps differ in their calculation method and weighting of the respective mode of transport.

Gamification

Theory

The term "gamification" is gaining importance today in all areas, be it professional or private. Gamification is the inclusion of playful elements in purposeful actions (Deterding et al, 2011). It can be implemented in (private) education as well as in the generation of ideas by employees. The idea behind this is to promote the motivation and long-term engagement of the respective protagonists through playful elements.

Case studies

Companies such as BMW (Silverman, 2011) have already successfully anchored this in corporate processes, enabling the gathering

of points for kilometers driven in electric mode when using their hybrid cars (BMW, 2021). Gamification is also increasingly used in the field of environmental protection, especially in apps (Rosenau et al, 2013).

“GreenMe Life provides users with hundreds of tidbits and tips on how to live a “greener”, environmental-friendly life. GreenMe Life includes sections” (Incelligence, Inc., n.d. para. 12) such as clothing or food (Incelligence, Inc., n.d.). The app interface is designed like a calendar with green tiles and every time the user reports a green activity in the app, the respective field of the date turns darker green (Mak, 2015).

The app Eco-Dice, on the other hand, aims to motivate its users to do at least one sustainable deed a day. By tapping the screen, a dice is rolled, and instead of a number, an activity is displayed that the user is supposed to perform within 24 hours. In addition to using the bicycle to get to work, this also includes separating waste or even the suggestion to shower with others to save water. The app “Joule” encourages users to consume electricity more consciously. It sets its users small daily tasks regarding electricity consumption, which in turn can have a major impact on electricity consumption (Mak, 2015). “The app even connects to your home utility account and shows you how much you’ve saved! You can earn rewards and badges, for each eco-friendly action you take, and you can even win competitions on the leader-board. Share your experience and results on Facebook and get your friends in on the game too!” (Mak, 2015, para. 8-9).

There is a huge number of gamified sustainable apps; however, most of them are aimed at sustainable waste separation and electricity consumption. Gamified consumer and transport apps like GoEco, which promotes eco-friendly transport habits by tracking the number of kilometers traveled by public transport, are still under-represented and less popular.

Unification of Nudging and Gamification

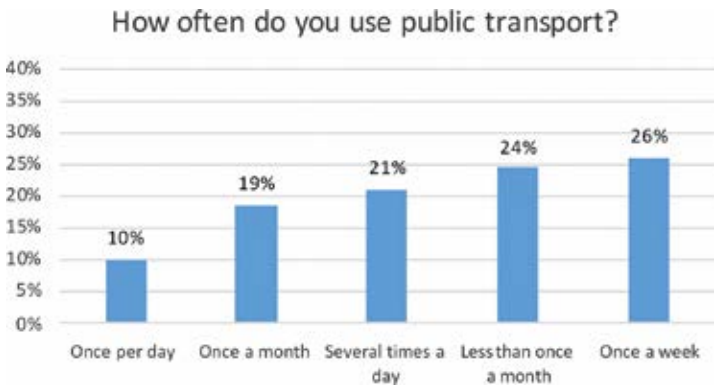
All the apps introduced in the section “gamification” use a combination of nudging and gamification.

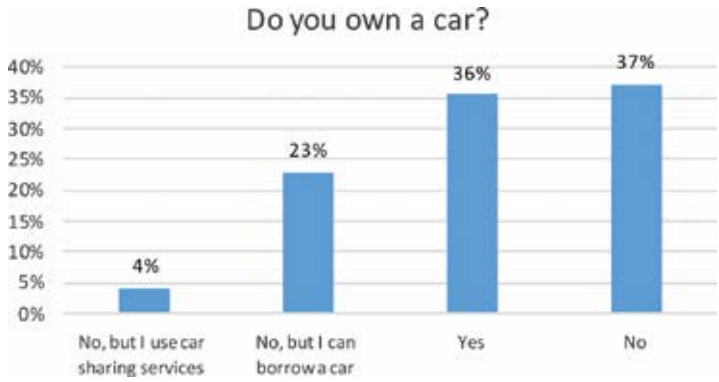
They all have in common the use of push messages that educate users about their behavior and contain general service and background information on the respective subject area, e.g., electricity consumption, food waste, etc. Most apps still rely mainly on nudging and the initiative of their users. As a result, they have a reduced reach, since it is mainly people who already have a clear environmental awareness who access such apps. Users who have little interest in the general topic are less likely to be addressed by them (Dolan et al., 2012).

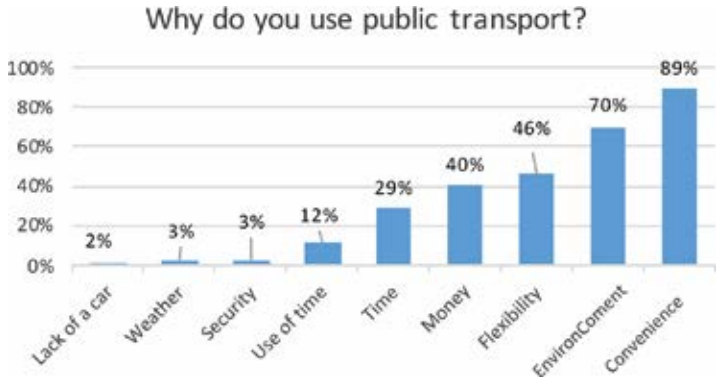
Results of the survey

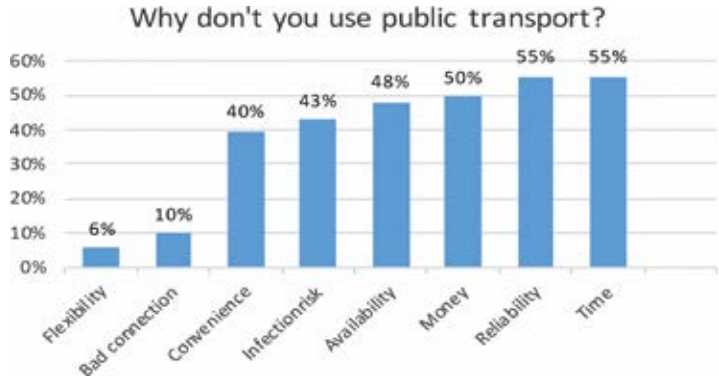
The survey was taken by 119 participants with an average age of 22 years. 47,9 % of participants were female, 51,3 % male and 0,8 % diverse. For better visualization, the results of the first three categories are displayed in the following bar charts.

Use of public transport

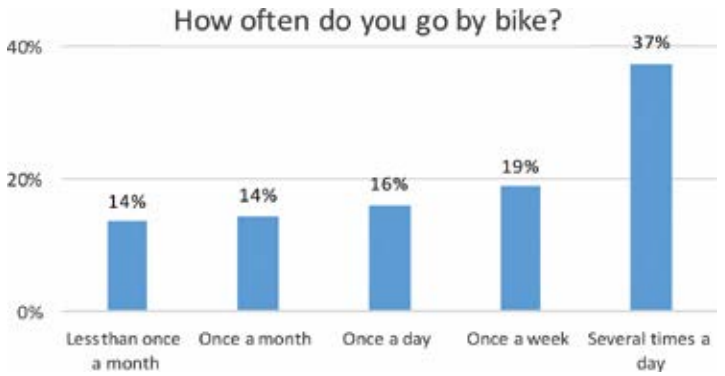


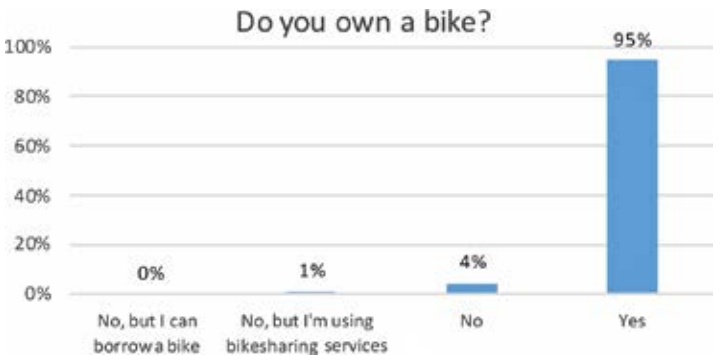


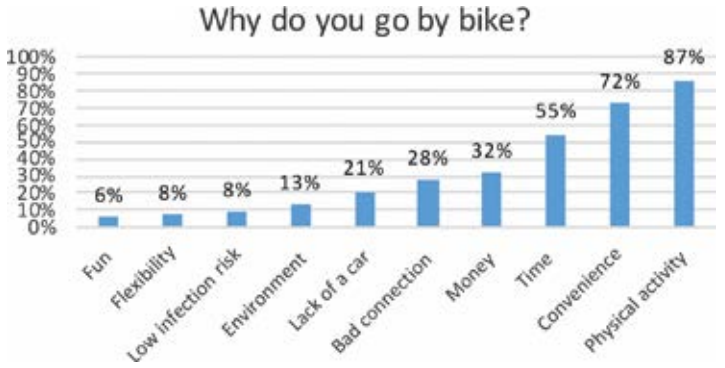


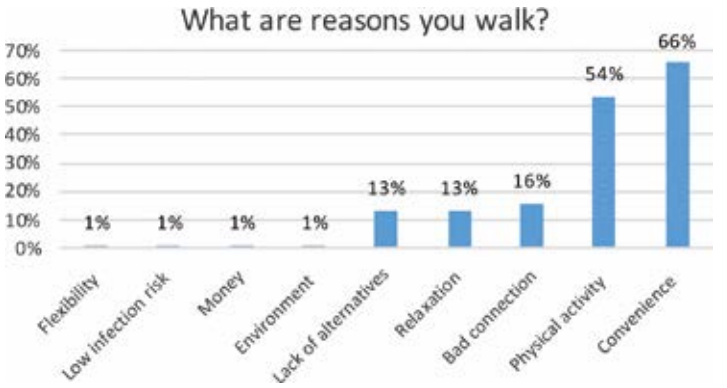


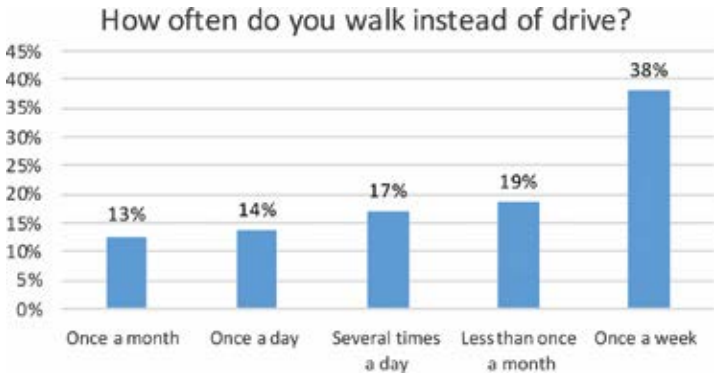
Eco-friendly means of transportation



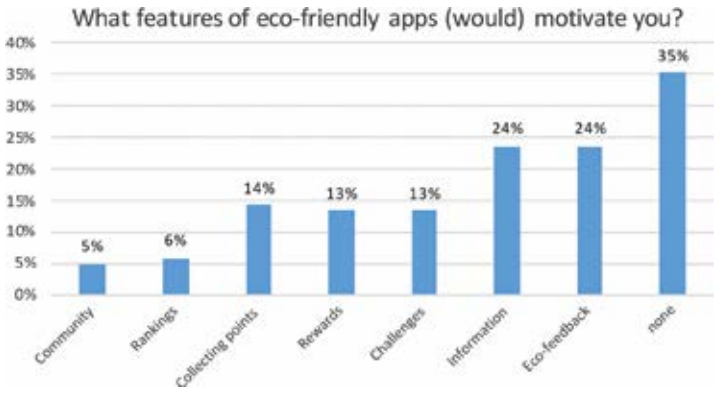


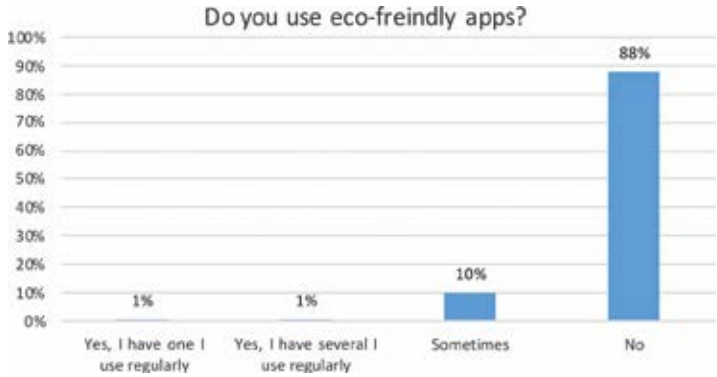


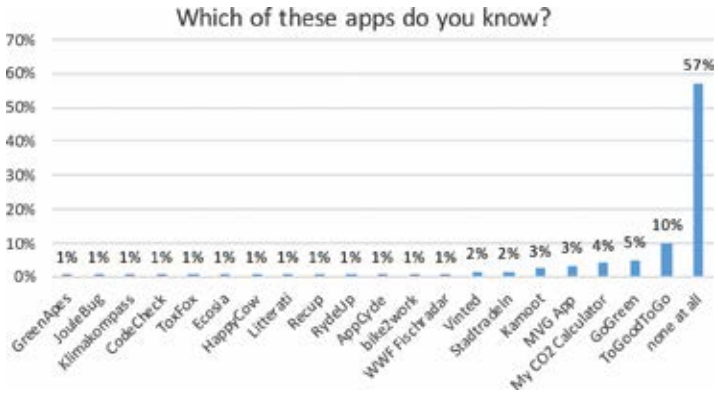




Impact of eco-friendly apps







Regarding the convenience of public transport, it was often stressed that a car is not needed in a big city such as Munich. Furthermore, the term flexibility is not only focused on time and destination but also includes not needing a parking slot and being free to consume alcohol. The inconvenience of public transport, as well as the bad connection, was specified to be worse with greater distance from the city centre.

For eco-friendly apps, several (5) participants expressed concerns about the data security of such apps since most operate by surveying the users' actions. Another critique was the unclear structure of many apps as well as the need for several apps instead of one that covers all aspects of an eco-friendly lifestyle.

Discussion

Critical examination of survey results

As seen in the results, there is a relatively even distribution of medium- and low-frequency users of public transport among the participants with the most (37 %) being high-frequency users. While only 36 % own a car, nearly everyone (95 %) owns a bike. It was pointed out several times that in a big city like Munich, cars are often less practical due to limited space and crowded streets. Summing up the overall motivations to use eco-friendly means of transportation for public transport the environment and convenience were the most pronounced, while the bike was seen as convenient and a good way of getting physical activity. Walking was mostly described as suited for short distances and relaxing. The three possibilities of eco-friendly transportation that were compared in this study, therefore, serve different purposes.

What was most striking concerning the category of eco-friendly apps, was that hardly any were known to our participants and very little (2 %) stated they use such apps regularly. The lack of users could be explained by little or ineffective advertisement, since most participants seemed to be generally interested in an eco-friendly lifestyle, indicating no lack of interest in eco-friendly apps. Several participants pointed out that they would appreciate one app that covers all aspects of eco-friendly behavior.

The survey was primarily distributed among TUM students and alumni, inevitably leading to a bias based on age, education and the general mindset. Additionally, partaking in the survey is more likely if there is a general interest in the subject of the study by the

person asked to participate (Quick & Hall, 2015). This voluntary and involuntary preselection of participants alters the results, which can therefore not be seen as generally valid for the whole population of Munich or Germany. Given that our project mainly focuses on TUM students, the results are still significant for this specific study.

Critical examination of the TUMweltfreund

To assess the effectiveness of the TUMweltfreund using the MINDSPACE framework, the survey needed to be considered (Dolan et al., 2012). Afterwards, the impact of the TUMweltfreund could be evaluated by the number of cues in the MINDSPACE framework being fulfilled. As seen in the results, the most important reasons why cars are being preferred were availability (55 % of respondents), longer travel time (55 % of respondents), followed by ticket costs (50 % of respondents).

On the other hand, 70 % of participants stressed the environmental advantages of public transport. This led to the question of whether stressing the already known positive impacts or using nudging to convince people of time or money savings is more successful. However, with these three factors and availability being the most important aspects, it became clear that the app addresses the right cues. With travel time and ticket costs ranking quite similar, the effects could be assumed to be similar.

When considering the reasons for going by bike, it is either the convenience, probably due to short distances, or to do physical activity, leading to the conclusion that the TUMweltfreund is not ideally designed for nudging towards cycling or walking.

As the program is designed for students in Munich, the name TUMweltfreund references the TU Munich leading to a positive impact according to the MINDSPACE framework (Messenger). However, the app does not give any incentives like small gifts or presents (Incentives). The influence of others is considered, when using a ranking, therefore increasing the likelihood of affecting the travel behavior (Norms). As seen in the survey results as well as in the literature research the popularity of mobility behavior apps is still low, needing thorough marketing (Defaults). With Fridays for Future and other initiatives continuing to draw more attention to climate change, the modal switch to public transportation is beoming relevant for an increasing amount of people (Salience). As seen in the survey, the right cues are addressed by the app fulfilling the priming effect. The same can be said for affect and commitments, with more people speaking out against climate change and therefore being especially committed to saving emissions as well as being affected by such savings. These can in turn make them feel good, especially when showing these savings towards others in a ranking (Ego).

Conclusion and outlook

Nudging can be a powerful tool in changing people's behavior towards an eco-friendlier lifestyle, as was shown in the case studies above. Addressing as many key effects as possible of the MINDSPACE framework can increase the chances of a successful nudge, while including gamification aspects that add to the fun for the nudged person can ensure a long-term motivation to stick with the project.

There is a need for a uniform calculation of the carbon footprint that is comprehensible to the user. At the same time, it must not demand too much information disclosure from the user. On the one hand, this would be too cumbersome, on the other hand, it would be too much of an invasion of privacy. This is a balancing act between too much and too little. Apps should also aim to specifically address users who, so far, have had little knowledge/measurement of environmentally conscious behavior. As already mentioned, this is not yet happening to a sufficient extent. In addition, power consumption should be considered in app development. As in the case of GoEco!, this is often perceived as too high, which is why many users no longer use the apps after a certain time.

The TUMweltfreund includes most of the MINDSPACE effects and joins them with gamification aspects such as ranking and challenges. It, therefore, has a high chance of successfully nudging people to more eco-friendly transportation habits while providing fun and long-term engagement. To prove the effectiveness of the TUMweltfreund further research is needed.

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Self-reflection

As with most project implementations, team TUMwelt had to overcome challenges, starting with the lockdown caused by the global Corona pandemic in 2020. Due to the significant decline in public transport ridership, the members had to ask themselves to what extent their original idea of nudging towards usage of public transport was still possible. Added to this was the difficulty of finding a suitable programmer for the app. There were two possibi lities to involve such a person in the project: via an IDP or a working student position. The team initially wanted to realize an IDP, but then had to hire a student assistant after all. In retrospect, the team has to say that they lost time unnecessarily here in particular because they underestimated the administrative requirements and the associated (time) effort for such an implementation. Believing that all this could be implemented quickly, they accordingly reacted too late and too vaguely to subsequent demands from the faculty administration.

Nevertheless, the team members would not want to have missed this stage of their project because it gave them an insight into how difficult it sometimes is for lecturers to restructure research and teaching projects. Thus, their understanding was further deepened.

With the employment of the programmer, it also became clear to the participants how important it is to keep agreements and communicate regularly. Lack of clear and timely communication led to a delay in the schedule and the results fell far short of the original requirements.

Still, no disadvantage where there is not also an advantage.

It demonstrated to the team the importance to good work progress of contractual conditions such as the agreement of working time documentation.

The TUMwelt team would like to sincerely thank the companies MVV and Pixida for their advisory and supportive role around public transport and app programming.
Special thanks also go to our supervisors Prof. Müller-Wieland, Prof. Dr Ungemach and Prof. Dr Bungartz. Their expertise was an enormous help to the team throughout the whole process.

They would also like to thank their two tutors: Dr Matthias Lehner and Victoria Treßel, who co-supervised the project.

Looking back, it can be said that in the case of team TUMwelt, the journey was the destination. Despite all the hurdles – or precisely because of them – they never discarded their core idea.


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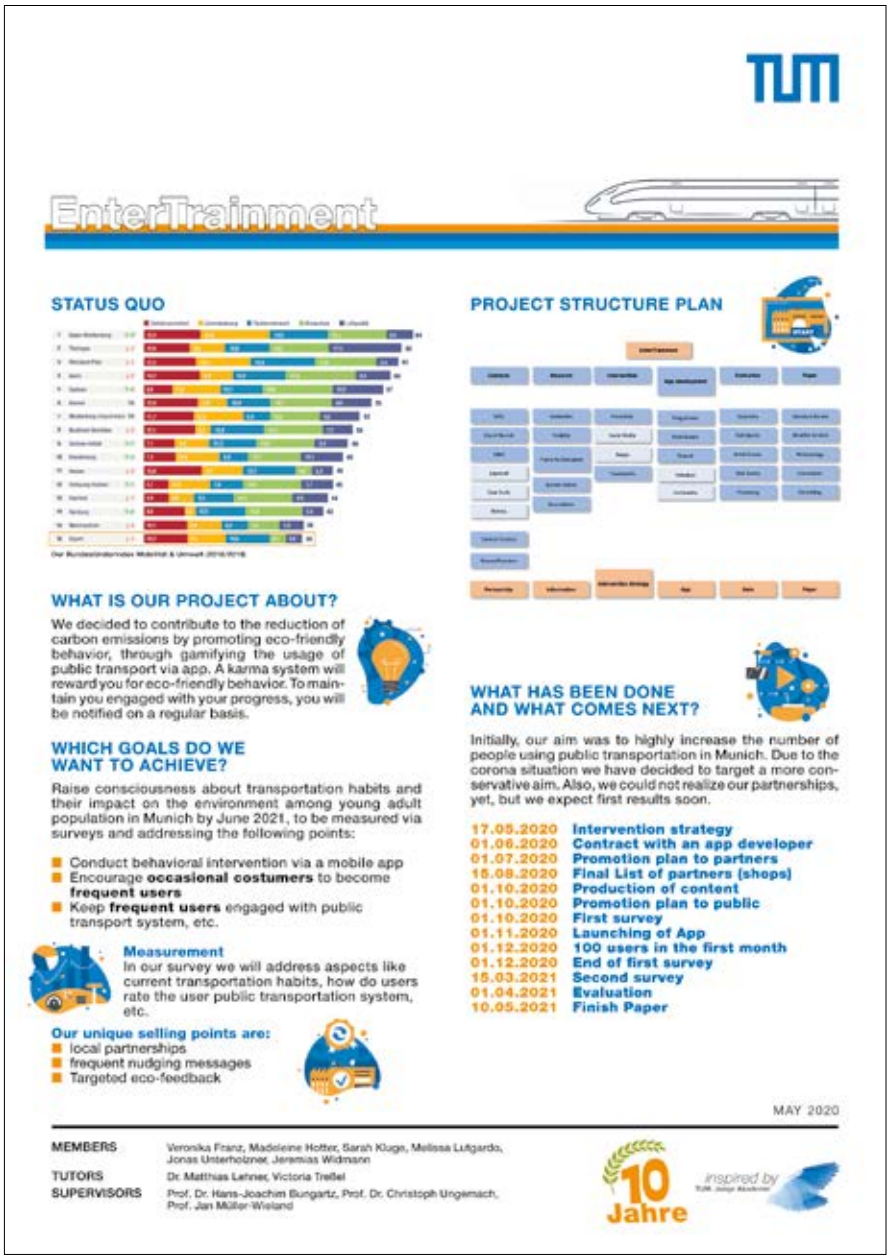


POSTER 1:

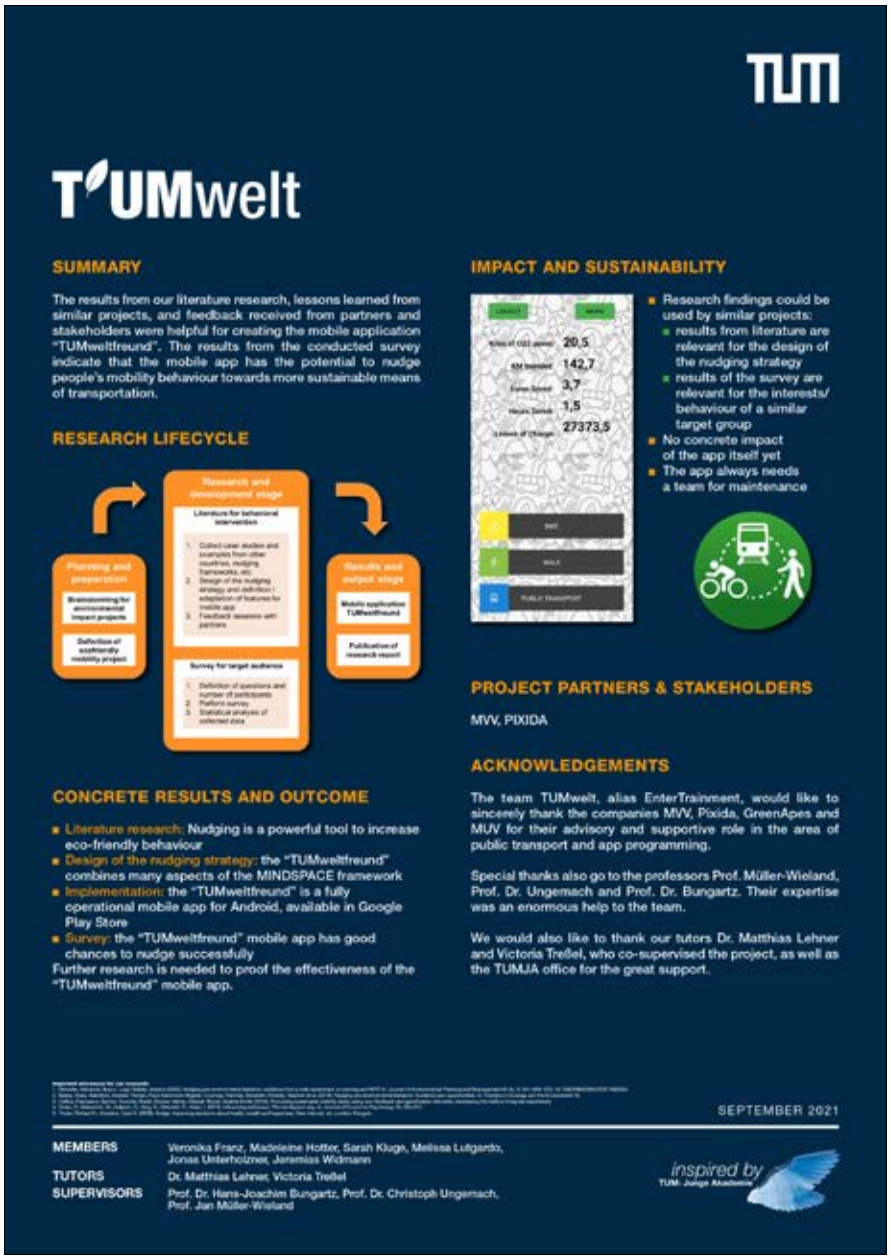
At the beginning of our journey, we started as the team EnterTrainment, a group of six motivated students who wanted to take a step towards a more eco-friendly Munich. In our initial research, we quickly discovered that Bavaria, despite having the worst air quality in Germany, does the least for eco-friendly solutions. We decided to tackle the problem through increased use of public transport. To do that, our idea was to create an app that combines gamification and nudging strategies to promote the use of public transport systems. As unique features, we planned eco-feedback, a karma point system and partnerships with local shops to provide small gifts for the users of our app. As a measurement of our success, we planned two surveys, one before and one a few months after experiencing the app. By that, we wanted to answer the question of how to motivate people to travel in more eco-friendly ways. We had our plan ready to go and went to work.

POSTER 2:

After a few months we had already achieved great results by establishing partnerships with MVG and PIXIDA and getting valuable feedback from like-minded projects. Through the help of our partners, we created a mock-up of our app and had the first idea of our tracking concept, which would be essential for the flawless running of the finished app. To get our project known we created a flyer and social media accounts. Most importantly, by setting up an interdisciplinary project (IDP), we hoped to acquire a motivated informatics student to be the coder who would implement all our ideas. As the first setback, we had to accept that the partnerships with local shops would be solely based on mutual advertisement instead of discounts or gifts for users of our app.

POSTER 3:

Being already over the half-point mark we had to admit that our project, as we had planned it, would not work out. The IDP did not yield a coder, so, instead, we hired a working student. Having lost a lot of time already the app was not taking shape as fast as we hoped. All things considered, we decided on shifting our focus and changing our name to TUMwelt. Now our project and research were about how to best design and implement a nudging strategy to promote a modal switch towards more eco-friendly travel means like the bicycle, public transport or by foot. Seeing the app not yet working out well enough to include it in the research properly we had to content ourselves with literature research and one additional survey.



POSTER 4:

In the end, few things worked out the way we initially planned them, but nonetheless we have some findings to report. Nudging and gamification have proven to be powerful tools to motivate people to behave in more eco-friendly ways. Our app, the TUMweltfreund, although not being completely finished, is designed well and holds great promise to effectively nudge people. Even though the outcome of our project was not what we hoped for, the process was a valuable experience for us, from which we learned a lot.