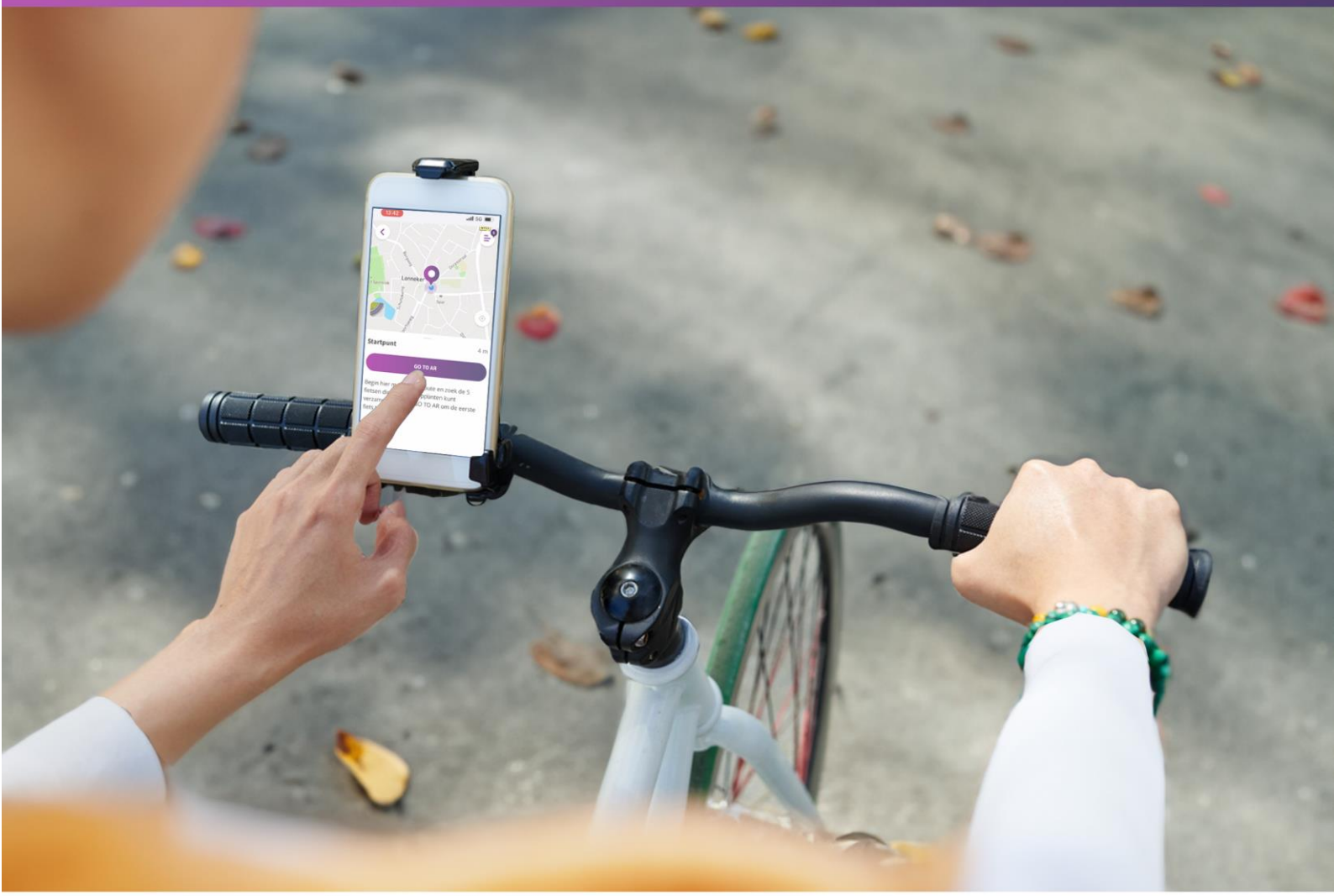

The effects of a gamified AR cycling intervention on recreational cyclists' attitude, subjective norm, perceived behavioural control and intention.

July 2023

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Abstract

Objective – The global obesity epidemic is a serious health problem and new initiatives are needed to tackle this. Stimulating recreational cycling with a gamified cycling intervention could help to positively influence health behaviours. According to the Self Determination Theory, individuals who are intrinsically motivated can achieve sustained health behavioural changes. Therefore, it is expected that a gamified cycling intervention focussing on stimulating intrinsic motivations can positively influence people's attitude, subjective norm, perceived behavioural control and intention. It is expected that intrinsic motivation mediates this relationship.

Method – A between-subjects experiment was conducted. The control group (n = 21) performed a traditional cycling route with Google Maps and the experimental group (n = 19) cycled an intrinsic motivational-focused gamified AR cycling route. From both groups, participants' attitude, subjective norm, perceived behavioural control, and intention were measured after they performed the cycling route. The obtained data was analysed using mediation analysis. In addition, people's experience with the performed cycling activity was evaluated and additional qualitative data was obtained through feedback received from the participants. The additional qualitative data was analysed using content analysis.

Results – The results of this study showed no significant effects of the experimental group compared to the control group, in terms of their intrinsic motivation and their attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling. The additional qualitative data revealed that technical issues of the cycling routes and the weather conditions contributed to the lack of anticipated outcomes of the experiment.

Conclusion – The rejection of all hypotheses suggests that the gamified cycling intervention did not yield the intended effects. This finding was likely to be attributed to the small sample size and therefore it was difficult to conclude if the gamified cycling

intervention was ineffective or if there was not enough power to find an effect. Nevertheless, the need for new initiatives and research and development of effective methods to promote health behaviours like (recreational) cycling remains crucial.

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1. Introduction

Recently, experts have warned for another health crisis besides the COVID-19 pandemic: an obesity epidemic. Globally, over three hundred million adults are classified as obese (WHO, 2022). In the Netherlands, approximately 50% of the population is overweight (CBS, 2022). According to the World Health Organization (2021), the main issue is that there is an imbalance between the number of calories consumed and the number of calories expended. A proper balance between nutrition and exercise is desired and therefore new initiatives are needed to tackle this problem.

In the Netherlands, cycling serves as an important transportation mode, leading to the integration of daily physical activity of many individuals. Besides commute cycling, 76% of the people in the Netherlands cycle as a leisure activity, also called recreational cycling (Fietsplatform, 2022; Stichting Landelijk Fietsplatform, 2021). Due to the health benefits of recreational cycling, stimulating this behaviour could help tackle the global health issue. Physical activity performed by cycling can reduce the risk of all-cause mortality and increase life expectancy by half a year (Andersen et al., 2000; Fishman et al., 2015). Besides the health benefits of cycling, it is a more sustainable option to travel compared to cars or public transport since there is no emission of toxic fuels, which consequently increase global warming (Davis et al., 2010; Helmers & Marx, 2012). Thus, for environmental reasons, decreasing the amount of fuel emission is desired and cycling can offer a sustainable transportation alternative. Lastly, stimulating cycling behaviour is beneficial for municipalities. A shift in the ratio between cars and cyclists in a city can help decrease the amount of traffic and help improve a city's accessibility, which makes it economically more appealing (Gemeente Enschede, n.d.).

Due to the diverse benefits of cycling, several municipalities in the Netherlands try to stimulate cycling among residents with varied approaches. For example, the municipality of

Enschede implemented the cycling project ‘Enschede Fietsstad’, which strives to stimulate cycling in Enschede. Enschede Fietsstad does this through different campaigns, advertisements, and interventions. An example of such an intervention is the Enschede Fietst-app, where people can earn points as an incentive for completing cycling challenges. These points can be exchanged for discounts or free extras at several partner companies or organizations in Enschede like local restaurants or bike shops (Enschede Fietsstad, 2022).

With this intervention, the Enschede Fietst-app tries to stimulate cycling behaviour through a form of gamification. Gamification uses game design elements in non-game contexts and can be effective to make, for instance, physical activity more entertaining and motivating, which can have a positive impact on health behaviours (Deterding et al., 2011; Fanning et al., 2012; Johnson et al., 2016). The Enschede Fietst-app attempts to do this by providing an extrinsic motivational incentive, which does not stimulate sustained health behaviour change (Mekler et al., 2017). Intrinsic motivation on the contrary can positively influence behavioural outcomes like one’s attitude, subjective norm, perceived behavioural control and intention to perform a certain behaviour, and can help achieve sustained health behaviour (Johnson et al., 2016; Ntoumanis, 2001; Vansteenkiste et al., 2005). Gamified elements that enhance intrinsic motivation could help achieve desired behaviour change (Krath et al., 2021; Rongkavilit et al., 2010; Ryan & Deci, 2000). In this study, the effects of an intrinsic motivational gamified cycling intervention will be tested on individuals’ attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling, compared to a non-gamified route like Google Maps. Thus, the following research question is composed:

“What are the effects of an intrinsic motivational focused gamified cycling intervention on recreational cyclists’ attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling compared to a Google Maps cycling route?”

2. Theoretical framework

2.1. Benefits of cycling

Cycling is commonly used for short-distance transportation to school, work, or grocery shopping. In addition, 76% of the Dutch population reported that they have cycled for personal pleasure or relaxation (Fietsplatform, 2022). Where normal or commute cycling has the goal of transporting from one place to another, recreational cycling can be defined as cycling with no other purpose than entertainment and/or relaxation (Stichting Landelijk Fietsplatform, 2021). Stimulating recreational cycling behaviour is desired as it is accompanied by several benefits.

To start, cycling makes a more sustainable alternative than travelling by car or public transport. For example, 72% of the total transport CO_2 emission in Europe in 2019 came from road transportation (European Parliament, 2019). These emissions form an environmental risk, as they potentially threaten to change the global climate system disruptively (Davis et al., 2010). Stimulating cycling behaviour could help shift the ratio between cyclists and cars and thus help decrease car use. Decreased vehicle use will result in fewer toxic substances that are emitted into the environment, which makes cycling a more sustainable alternative. Additionally, as bicycles do not need any fuel, it is a cheaper alternative as well. Furthermore, decreasing vehicle use can also result in benefits for cities and municipalities. Numerous cities are confronted with the challenges of increased car use and the corresponding road crowdedness, like the municipality of Enschede (Gemeente Enschede, n.d.). This results in more traffic, affecting the city's accessibility. Cities and municipalities strive for a reduction in urban traffic near the city centre, as this has the potential to enhance overall accessibility and improve economic attractiveness (Gemeente Enschede, n.d.).

Lastly, cycling or any other form of physical activity can be specifically beneficial for individuals' health, as it can help prevent obesity (Oja et al., 2011). Overweight and obesity

are the fifth leading death risks globally, with at least 2.8 million people that die every year from the consequences of being overweight or obese (EASO, 2020). In addition, obesity and overweight can increase the risk of diseases such as diabetes, cardiovascular disease, and cancer. Decreasing the overweight and obesity rate is crucial and stimulating health behaviours can help with this (Oja et al., 2011).

The study by King et al. (2001) found that adults who engage in physical activity regularly, have a reduced risk of obesity by 50% compared to those who do not engage in regular physical activity. Walking and cycling present potential solutions to the obesity epidemic, as they offer tangible and achievable alternatives to sports (Cavill et al., 2008). Moreover, Fishman et al. (2015) calculated the health and economic effects of cycling with the help of the Health Economic Assessment Tool (HEAT) for cycling and walking. The study concluded that one's life expectancy can be increased by half a year because of the health benefits of cycling. Additionally, the study of Andersen and colleagues (2000) showed that there is a statistically significant risk reduction of all-cause mortality for cyclers compared to non-cyclers. However, cycling regularly can encounter disadvantages as well. De Hartog et al. (2010) identified the hazards cyclists encounter like an increased exposition to air pollution and the possibility of getting into a traffic accident. Nevertheless, the extensive study concluded that the risks of cycling do not outweigh the estimated health benefits compared to car driving or public transport. To sum up, this evidence gives reason to expect general health benefits from (recreational) cycling.

2.2. Health behaviour

Considering the general health of the world population and the so-called obesity epidemic, it is desirable to stimulate any form of health behaviour such as recreational cycling (WHO, 2021). However, influencing any kind of behaviour can be challenging because behaviour is an intangible and complex construct. Several theories and models try to conceptualize behaviour, like the popular social science Theory of Planned Behaviour (TPB; Ajzen, 1991). This theory illustrates how behaviour is derived from its three main components: attitude, subjective norm, and perceived behavioural control. Attitude refers to an individual's positive or negative attitude towards the behaviour. Subjective norm is the perceived social pressure of an individual to perform the behaviour, and perceived behavioural control refers to an individual's perception of their ability and control to perform the behaviour. In addition to these three main components, one's intention to perform certain behaviour is a significant predictor of behaviour as well (Ajzen, 1991; Gomes et al., 2017).

Several meta-analyses support the ability of the TPB constructs to predict and explain behaviour or exercise behaviour (Armitage & Conner, 2001; Hausenblas et al., 1997; Steinmetz et al., 2016). Moreover, the study of Darker et al. (2010) tested the effects of an intervention on the TPB components to promote walking among adults. The walking intervention increased people's attitude, perceived behavioural control, and intention. In addition, the study showed a significant increase of 60% for the intervention group compared to the control group in the time spent walking per day and the number of steps made in a week. This gives reason to believe that the components of the TPB have the ability to explain and predict the effects of a physical activity-stimulating intervention.

2.3. Behaviour change and motivation

Changing behaviour can be challenging, specifically in the context of health. The theories and models focused on health behaviour change are captured by the Health Behaviour Change Theories (HBCT's). HBCT's help understand, predict, and influence health behaviours and provide guidance on how to change them. The Information, Motivation and Behavioural skills model (IMB) is categorized as such a HBCT (Chang et al., 2014; Rongkavilit et al., 2010). In the IMB model, information refers to the knowledge and understanding of an individual about the health behaviour, including the corresponding benefits and risks. Motivation is the individual's attitude towards the behaviour and derives from both personal and social motivation. Personal motivations are the individual's beliefs in the outcome of performing the behaviour and social motivation is the perceived social norm for performing the behaviour. Behavioural skills refer to the skills and the perceived ability to perform the health behaviour (Chang et al., 2014). This model thus indicates that one requires sufficient knowledge, motivation, and skills to be able to successfully change behaviour.

Motivation plays a significant role in the explanation and prediction of health behaviours since it is impossible to create sustained (health) behaviour change without motivation to perform the activity (Fisher et al., 2009; Johnson et al., 2016). According to the Self Determination Theory (SDT), motivation can be distinguished into two types of motivation: extrinsic and intrinsic motivation (Ryan & Deci, 2000). Extrinsic motivation derives from external stimuli and does not fulfil the feeling of inherent satisfaction. Intrinsic motivation on the contrary derives from an individual's belief in their ability to perform certain behaviour, also referred to as self-efficacy (Bandura, 1997; Ryan & Deci, 2000). Furthermore, intrinsic motivation can be determined by factors such as personal interest or the perceived enjoyment of the activity, the perceived value or usefulness of engaging in the

behaviour, and the perception of autonomy in whether to perform the behaviour or activity (Markland & Hardy, 1997; Mekler et al., 2017).

The IMB model demonstrates how motivation is one of the predictors of behaviour change and as the SDT suggests, only intrinsically motivated behaviour can help achieve sustained health behaviours (Chang et al., 2014; Johnson et al., 2016; Mekler et al., 2017). The effects of intrinsic motivation towards an activity or behaviour have been studied extensively for physical activity in the education field (Erbas & Demirer, 2019; Johnson et al., 2016; Kuramoto et al., 2013; Ng et al., 2019; Taskiran, 2018). For instance, the research conducted by Vansteenkiste et al. (2005) demonstrated that shifting the focus from the extrinsic goal of attractiveness to the intrinsic goal of health to motivate obese children to lose weight, resulted in a greater initial weight loss and enhanced weight maintenance over time (Vansteenkiste et al., 2005). Moreover, the research conducted by Ntoumanis (2001) tested the mediating effects of different types of motivation on students' intention to be physically active after leaving school. The study showed that the mediating role of intrinsic motivation positively predicted students' intention to be physically active after school years. In addition, the study of Teixeira et al. (2015) reviewed six studies about weight loss interventions through physical activity. The authors concluded that, among other constructs, high intrinsic motivation was an important mediator for medium- to long-term weight control for obesity interventions. Thus, the presented studies, the SDT, and the IMB model provide reasoning to believe that intrinsic motivation can mediate health behavioural outcomes and that health behavioural interventions, like a recreational cycling intervention, can have positive effects on an individual's attitude, subjective norm, perceived behavioural control, and intention directly, as well as through the presence of intrinsic motivation.

2.4. Gamification

Exploring the strategies for the development of a recreational cycling intervention, literature shows that gamification can act as a strategic tool to positively enhance health behaviours (Erbas & Demirer, 2019; Fanning et al., 2012; Johnson et al., 2016; Ng et al., 2019; Noreikis et al., 2019; Taskiran, 2018). Gamification can be defined as the use of "game design elements in non-game contexts" (Deterding et al., 2011, p. 3). As the definition suggests, gamification can be applied across a wide range of contexts and purposes. The systematic literature review of Johnson et al. (2016) studied the effects of gamification on health and wellbeing. The research identified eight studies with positive outcomes of gamification use for physical activity. Moreover, the literature review of Johnson et al. (2016) concluded that the effectiveness of incorporating gamification on behavioural outcomes shows to have the strongest evidence for physical activity specifically. For example, the study of Hamari and Koivisto (2015) measured the effects of social influence in gamified exercise on people's attitude and behavioural intention to exercise. The results indicated that this social influence had a positive effect on people's attitude, intention to exercise and their intention to use gamified applications.

Several technologies can be used for gamification purposes, like Augmented Reality (AR). AR "incorporates digital information such as images, video, and audio into real-world spaces" (Taskiran, 2018, p. 122). A popular gamification example that incorporated AR is Pokémon Go. This mobile game that peaked in 2016 showed that AR technology can be an effective tool to enhance health behaviour, as it encouraged people to move around in real-world surroundings and resulted in an increase in physical activity (Zsila et al., 2018). Moreover, the study by Lee and colleagues (2017) examined the effect of AR on a muscle-strengthening yoga program for elderly women to prevent falling. This experimental study also showed that gamification implementation, like an AR yoga program, can improve factors

such as muscle strength and increased physical activity levels. Additionally, the study of Mo et al. (2019) tested the effects of a physical activity intervention on WeChat, the social network service in China. The intervention integrated gamification and social incentives in the social network service and measured the effects on the TPB constructs. The study showed increased subjective norms, perceived behavioural control and intentions regarding physical activity for the intervention group, compared to the control group.

Thus, evidence from the literature about the effects of gamification on physical activity suggests that there is reason to believe that a gamified intervention with the use of AR technology can enhance people's attitude, subjective norm, perceived behavioural control, and intention. There is limited research available devoted to the effects of gamification, in the form of an AR gamified intervention, on cycling behaviour specifically (Ng et al., 2019). Nevertheless, according to the given evidence of the studies performed on physical activity, it is expected that such a gamified cycling intervention will have a positive effect on recreational cyclists' attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling.

H_1 Recreational cyclists that cycled a gamified cycling intervention will have a more positive attitude towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

H_2 Recreational cyclists that cycled a gamified cycling intervention will have a higher subjective norm towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

H_3 Recreational cyclists that cycled a gamified cycling intervention will have more perceived behavioural control towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

H_4 Recreational cyclists that cycled a gamified cycling intervention will have a higher intention to cycle recreationally compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

2.5. Gamified intervention effect on intrinsic motivation

Incorporating gamification into a health behavioural intervention has the potential to not only enhance physical activity levels but motivation as well. As previously demonstrated by the SDT and the IMB model, motivation is a crucial element to attain behaviour change (Chang et al., 2014; Johnson et al., 2016; Mekler et al., 2017). Studies performed on the effects of gamification in the educational sector concluded that the use of gamification resulted in increased motivation and enjoyment (Erbas & Demirer, 2019; Noreikis et al., 2019; Taskiran, 2018). For instance, the study of Fernández-Río et al. (2022) investigated the effects of a gamified programme for physical education on intention and motivation. The experiment compared the effects of a gamified intervention to a traditional learning approach for a physical education class. The authors concluded that gamification use in physical education was associated with increased intention to be physically active and intrinsic motivation levels. This gives reason to expect that a gamified cycling intervention will positively influence intrinsic motivation levels.

H_5 Recreational cyclists that cycled a gamified cycling intervention will have a higher intrinsic motivation to cycle recreationally compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

2.6. Intrinsic motivational focused gamified elements

As multiple studies previously have demonstrated, gamified interventions can positively influence intrinsic motivations and behavioural outcomes, if appropriate design elements are incorporated into the intervention. Popular gamified elements that are often used for gamified interventions are points, levels, and leaderboards (Mekler et al., 2017). However, these elements enhance extrinsically motivated behaviour, which is not aligned with the objective to achieve sustained health behaviour change (Mekler et al., 2017). It is expected that gamified elements that focus on stimulating intrinsic motivation are more likely to achieve sustained behaviour change over time (Vansteenkiste et al., 2005).

The systematic review of Krath et al. (2021) listed the theoretical principles used in gamification research and analysed the theoretical backgrounds of these principles to help explain the positive effects of gamification from theory. It can be expected that gamification principles that are based on SDT, are capable of enhancing intrinsic motivation levels. Krath et al. (2021) mentioned the following principles that are based on the SDT: Individual goals, clear and relevant goals, immediate feedback, and positive reinforcement. Affording individuals the opportunity to establish individual goals, allows users to enhance their perceived relevance of the specific intervention. This gamified element is based on the SDT, as it fosters users' need for autonomy (Ryan & Deci, 2000). Moreover, clear and relevant goals support the emergence of flow experiences, which are linked directly to intrinsic motivation as expressed in the SDT. Furthermore, providing gaming users immediate feedback is linked with an individual's need for competence, which is one of the three basic psychological needs mentioned in the SDT. Lastly, positive reinforcement, as characterized by its informational nature regarding users' progress and relevance, can serve as an effective technique of reinforcement and positively stimulate motivation (Krath et al., 2021; Ryan & Deci, 2000). Additionally, increased motivations can consequently influence behavioural

outcomes according to the SDT and the IMB model (Chang et al., 2014; Johnson et al., 2016; Mekler et al., 2017). Thus, it can be expected that these elements will enhance the level of intrinsic motivation and therefore, individuals' attitude, subjective norm, perceived behavioural control, and intention.

2.6.1. Gamified AR elements

Interaction with users or the environment is one of the universal characteristics of gamification (Deterding et al., 2011). Furthermore, interaction is intertwined with AR technology, as demonstrated in the example of the popular gamified app Pokémon Go (Zsila et al., 2018). Wetzel et al. (2011) developed a guide that highlighted essential design elements that should be considered when developing mobile AR games.

To start, the general guidelines express the importance to justify the use of AR and engage players physically. Numerous AR games are just another version of already existing games, resulting in unmeaningful AR games (Wetzel et al., 2011). AR technology should enhance the purpose of the game or intervention, creating interaction between the user and their environment, and stimulating the engagement physically, as the user should be gaining something by using the AR game (Wetzel et al., 2011). Since AR is a mix of virtual and reality, real-world elements should be considered as well according to the AR game guide. For instance, the chosen location for the game should correlate to the purpose of the game. In addition, the journey should be interesting to the users, and providing a narrative structure can support this. According to Wetzel et al. (2011), this could include certain audible, odour or other visible features that can complement and enhance the game. Lastly, safety measures and the usability of the technology or game should be considered as well. It is important to guarantee users' safety when developing games mixed into real-world surroundings and to keep the interaction simple, otherwise, it can be too difficult for people to use it.

2.7. Intrinsic motivational focused gamified AR cycling intervention

From the studies, theories and information given above, the following design elements are considered applicable for developing a gamified cycling intervention for recreational cyclists. First, the elements of immediate feedback and positive reinforcement are expected to enhance self-efficacy positively and, therefore, influence recreational cyclists' intrinsic motivations and behavioural outcomes (Krath et al., 2021). Next, interaction with the environment and the level of difficulty of such an intervention are important and applicable gamified elements for a gamified cycling intervention according to the guide of Wetzel et al. (2011). AR technology already incorporates interaction with real-world surroundings to some extent, yet providing information about the environment, can enhance the interaction and make the user's journey interesting. Moreover, not only providing information about the environment but about the performed health activity as well, can positively influence motivations and behaviour according to the IMB model (Chang et al., 2014; Rongkavilit et al., 2010). Lastly, a gamified intervention for recreational cyclists should be applicable and usable for everyone, especially since the age of recreational cyclists can range from 16 to above 60 years (Fietsplatform, 2022). To sum up, by implementing the design elements of immediate feedback, positive reinforcement, interaction with the environment, and information about the health behaviour into a gamified AR cycling route for recreational cyclists, while considering the level of difficulty, it can be expected that this gamified cycling intervention will positively influence individual's attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling, with the mediating role of intrinsic motivation.

H_6 The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' attitude towards cycling will be mediated by the level of intrinsic motivation towards recreational cycling.

H_7 The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' subjective norm towards cycling will be mediated by the level of intrinsic motivation towards recreational cycling.

H_8 The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' perceived behavioural control to cycle recreationally will be mediated by the level of intrinsic motivation towards recreational cycling.

H_9 The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' intention to cycle recreationally will be mediated by the level of intrinsic motivation towards recreational cycling.

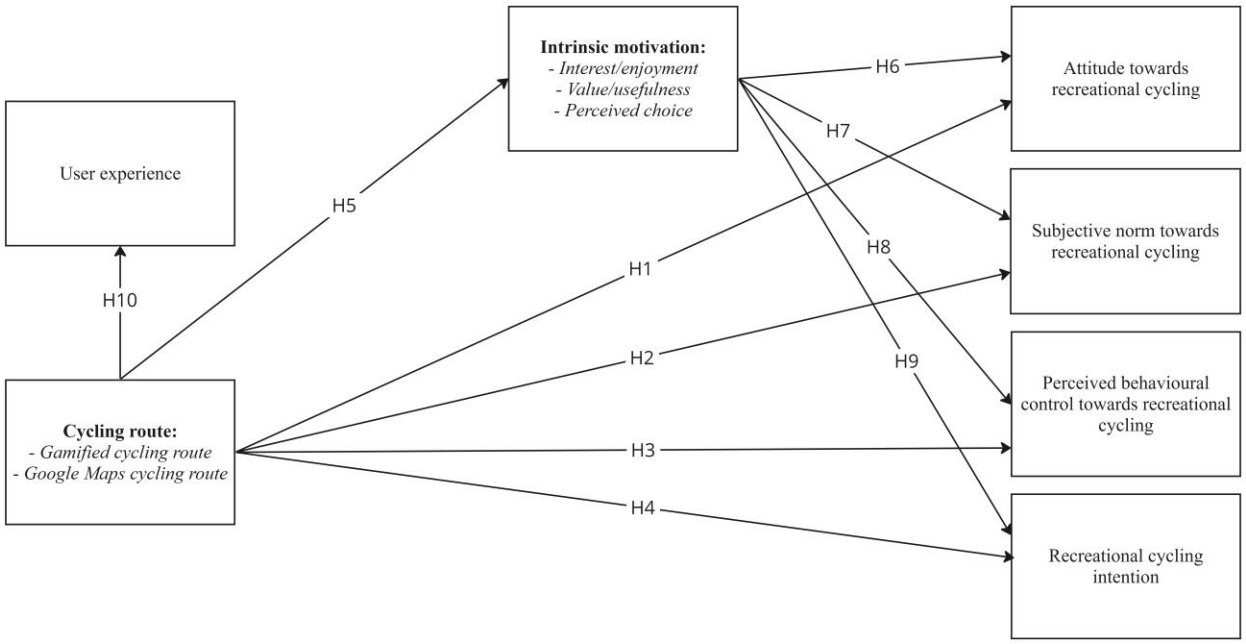
2.8. User experience

Lastly, as the effects of this intervention have not been assessed yet, it is important to evaluate the user's experience of such new interventions. The systematic review of Nor et al. (2020) analysed the main findings from studies on gamification in sports, including the findings for user experience. The paper concluded that gamification components can enhance the user's pleasure through physical activity, resulting in a positively evaluated user experience. Therefore, it can be expected that the user experience of a gamified AR cycling intervention will be evaluated as more positive compared to a traditional cycling route with the use of Google Maps. Figure 1 illustrates the conceptual model of this study.

H_{10} Recreational cyclists that cycled a gamified cycling intervention will have a more positive user experience compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.

Figure 1

Conceptual model



3. Methods

3.1. Research design

The study investigated the effects of a gamified cycling intervention, focussing on intrinsic motivation, compared to a non-gamified cycling route on recreational cyclists' attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling by conducting a between-subjects experiment. Participants were randomly assigned to either the experimental group or the control group. The experimental group was asked to make a recreational cycling trip in Enschede with the use of an AR-based and intrinsic motivational-focused gamified cycling route. The control group was asked to bike the same route with the use of the traditional navigation program Google Maps. Both groups were eligible to receive an incentive, that could be earned by performing the cycling activity. This incentive served as an extrinsic motivational element. Additionally, to the gamified cycling route intrinsic motivational elements were added on top of the extrinsic motivational element.

3.2. Procedure

Recruitment of participants for this study occurred through a process of several steps. Brief information about the experiment was shared via social media (Facebook and Instagram), push notifications in the Enschede Fietst-app and a newsletter (see Appendix A). Additionally, information cards about the experiment were placed in a local bike shop. All the communication about the study referred to a website with more detailed information about the experiment and the study's purpose. This landing page (https://mailchi.mp/34c29e3d623f/onderzoek-fietsroutes) was created in Mailchimp and contained information about the experiment, the informed consent form and a text entry box for people to enter their email address to participate in this study. Applicants' email addresses were collected in the database of Mailchimp.

In Excel, a participant list of in total 200 places was created for both groups. The RAND option was used to randomly shuffle this list, resulting in random but equal spots for 100 participants in the control group and 100 participants in the experimental group. The email addresses from Mailchimp were manually added to the list in Excel and participants were randomly assigned to either the control group or the experimental group. After being assigned to a group, applicants received the participation email. This email contained information about the activity they needed to perform, a link to the gamified or the Google Maps cycling route, and a link to the survey to fill out after cycling. Additionally, both groups received an image of the route mapped out in Google Maps, to help them visualize the route before cycling it. Appendix B shows the participation emails of the control and experimental group. Lastly, participants who signed up via the landing page to participate in the study, but did not cycle the route, received email reminders with the question to still participate in the study, which were sent to the participants weekly.

After performing the cycling activity, participants were asked to fill out the survey. Since the participants were people living in and around Enschede in the Netherlands, the survey was created in Dutch. Either a pre-existing translated questionnaire and scale were used, or the questionnaire and scale were manually translated from English to Dutch by two independent individuals to ensure a reliable translation. The survey was developed in Qualtrics and consisted of demographic questions, questions about their general cycling behaviour (e.g., “how frequently do you cycle recreationally?”), and statements that measured participants’ attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling. Participants’ level of intrinsic motivation was assessed by showing statements to measure their perceived interest or enjoyment, usefulness, and sense of choice regarding recreational cycling. Lastly, participants were asked to evaluate their overall experience of the cycling route. Moreover, the survey offered participants the option to enter

their username at the end to receive the incentive for the Enschede Fietst-app. If a username was given, participants were rewarded with one hundred bonus points in the Enschede Fietst-app. The points were manually added to the participant's app account.

The survey was pre-tested (n = 3) to evaluate if participants understood the questions and the information that was given. According to the results, participants understood the survey. Therefore, no adjustments were made to the survey questions. However, due to the length of the survey, participants of the pre-test suggested adding a progress bar. It was expected for participants to have a better time indication of the length of the survey. In addition, it was suggested to add contact details, in case participants would have questions about the study. These suggestions were implemented into the final survey.

Finally, to ensure participants' privacy, their email addresses and other data were destroyed in both Mailchimp and the Excel file after the study was conducted. This study was evaluated and approved by the Ethical Committee of the BMS-faculty of the University of Twente (Request number: 221337). A visual of the previously described process can be found in Appendix C.

3.2.1. Additional qualitative data

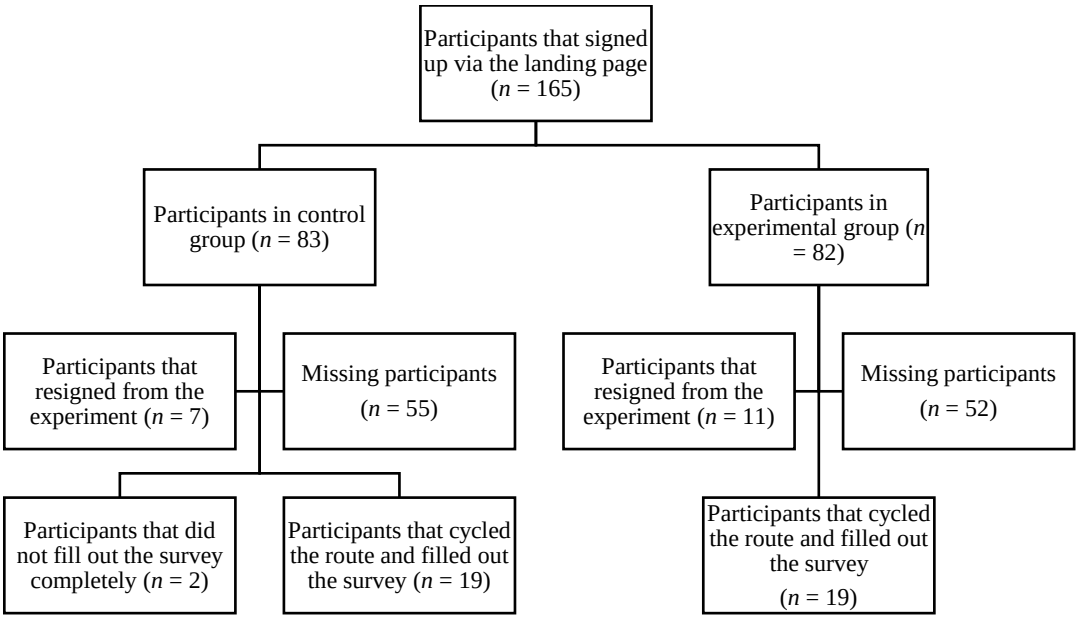
During the data collection period, additional qualitative data was received from participants. The survey enabled participants that did not cycle the route or partially cycled the route to give their reason for why they did not (fully) cycle the route. The survey presented some common reasons like "*Ik vond de route te lang*" or "*Ik begreep niet hoe het werkte*". In addition to these common reasons, it was possible to explain in their own words why they did not cycle the route or partly cycled the route. Furthermore, during the data collection period, participants emailed the researcher as well about several topics, like not being able to sign up for the experiment via the landing page or proving feedback about the cycling route. The additional data retrieved from the survey and received emails were analysed, as it helped to give a deeper understanding of participants' thoughts, feelings, and opinions of the cycling routes and the experiment in general.

3.3. Participants

In total, 165 individuals applied to the website to receive the participation email for this study. Participants who signed up via the landing page were assigned to either the control group or the experimental group. The control group consisted of 83 participants and the experimental group of 82 participants. After signing up for the experiment through the landing page, participants were asked to perform the cycling activity and fill in the survey after they cycled the route. In total, 40 participants cycled the route or a part of the route and filled out the survey. However, two participants did not fill out the survey completely, which were both in the control group. These participants were included in the analysis up to the point to where they filled out the survey. Figure 2 shows a visual representation of the flow of the participants in this study.

Figure 2

Participant flow



The control group consisted of participants with an average age of 52 years. Among them, the majority identified as female (57.1%), followed by male (38.1%) and non-binary (4.8%). The experimental group had a similar mean age as the control group (52), but a more balanced gender distribution with 47% of the participants identifying as female and 53% as male. The cycling frequency of the control group, both for regular commuting and recreational purposes, was relatively high. The biggest part of them engaged in daily cycling and participated in recreational cycling activities at least once per week. For the experimental group, the normal and recreational cycling frequencies were more evenly distributed across the answering options presented in Table 1. Lastly, 62% of the control group reported using an electric bicycle and 38% used a regular bicycle. The experimental group reported a more equal distribution between regular bicycle users (47%) and electric bicycle (53%) users.

Table 1

Participant's demographics

	Control group		*Experimental group*	
Age	*M* = 52.24	*SD* = 16.16	*M* = 51.74	*SD* = 19.73
Gender	Male	38.1%	Male	52.6%
	Female	57.1%	Female	47.4%
	Non-binary	4.8%	Non-binary	0.0%
Cycling frequency	<1 time per week	0.0%	<1 time per week	5.3%
	1-2 times per week	9.5%	1-2 times per week	15.8%
	3-4 times per week	19.0%	3-4 times per week	21.1%
	5-6 times per week	28.6%	5-6 times per week	21.1%
	Every day	42.9%	Every day	36.8%
Recreational cycling frequency	<1 time per month	4.8%	<1 time per month	26.3%
	1 time per month	9.5%	1 time per month	5.3%
	1 time per 2 weeks	19.0%	1 time per 2 weeks	26.3%
	1 time per week	28.6%	1 time per week	10.5%
	>1 time per week	38.1%	>1 time per week	31.6%
Cycling on an electric bicycle	Yes	61.9%	Yes	52.6%
	No	38.1%	No	47.4%

3.4. The development process of the cycling routes

The intrinsic motivational focussed gamified AR cycling intervention and the Google Maps route were developed for this study. The Airport of Twente in Enschede was the chosen location for the cycling route. This popular cycling location offers pleasant cycling roads and interesting surroundings since aeroplanes can be spotted from certain locations and it is possible to see animals like birds and deer during a cycling trip. The cycling route had a length of 9.9 kilometres, which took around 30 minutes to cycle, see Appendix D for the route. Many existing cycling routes are around 20-30 kilometres. However, a route of approximately 10 kilometres was chosen because the starting point of the cycling route was in the northern of Enschede, in Lonneker. Participants would first need to cycle to the starting point before continuing the rest of the route, which would increase the length of most participants' total route length. Thus, it was expected that a cycling route of 9.9 kilometres was an acceptable length for most participants.

To decide on the final cycling route, the route was cycled and assessed by two individuals before the experiment was conducted. The route was pre-tested on the following criteria: 1) the cycling route needed to be attractive to recreational cyclers; 2) the route needed to be properly accessible; 3) for the gamified cycling intervention, participants were required to be able to make a stop during the experience. Therefore, the stopping points needed to be located in places where it was safe to stop. After the received feedback from the two individuals that cycled the first version of the cycling route, the route was adjusted before the experiment was conducted. The location and length of the cycling route were the same for both the control and experimental group.

In collaboration with a software engineer student from Saxion University of Applied Sciences in Enschede, a gamified cycling route was developed with web-based AR technology. Web AR is Augmented Reality technology, experienced through a mobile web

browser like Safari or Google Chrome (González, 2022). Therefore, it was not necessary to download any apps or applications to use the gamified cycling route, which made the cycling route easily accessible. Several (online) programs offer the possibility to develop web-based AR applications. However, the online program Onirix afforded the possibility to create a route in a 2D map and incorporate geolocations. Geolocations provided the opportunity to develop a sort of treasure hunt in the route, where players search for items based on their real-life locations (Gonzàlez, 2022). For the AR experience to work correctly, participants were required to give access to their mobile device's location and give permission to use their camera. Once participants would reach a geolocation within ten metres in real-life, they could interact with the environment through AR by launching the AR scenes with one's mobile camera. Geolocations afforded the possibility to create interaction moments where the intrinsic motivational elements of immediate feedback, positive reinforcement, and information about the environment and performed health activity were integrated.

The final gamified cycling route contained five stopping points on the map and approaching such a point enabled participants to launch the AR scene. The AR scenes contained floating animated bicycles and by clicking on the bicycle, it would disappear and be collected. Collecting the bicycles was the goal of the gamified cycling intervention, which was explained to the participants at the first stopping point in the gamified cycling intervention. After the bicycle was collected, interactive information was shown to the participants in the AR scenes. To illustrate, information about the environment of the route was given at stopping point 1 (e.g., "*Wist je dat vliegveld Twente vroeger een dagelijkse verbinding had met Schiphol? Klik hier voor meer informatie*"), and at point 2 information about the performed activity and immediate feedback was given (e.g., "*Je hebt al 6 km gefietst, je bent op de helft! Wat vind je van deze omgeving?*"). The second-last point contained a positive reinforcing message (e.g., "*Je bent al bij het een na laatste punt, wauw!*

Klik op de fiets en krijg meer te weten over dit stoppunt"). The last point contained a link in the AR scene that would lead to the survey. Appendix E contains visual examples of the intervention and Appendix D shows the coordinates, corresponding elements, and information of all the stopping points.

3.5. Measures

3.5.1. Theory of Planned Behaviour measure

To measure the dependent variables of this study, the Theory of Planned Behaviour questionnaire was used. Ajzen (2006) developed a guide for the TPB questionnaire which measured individuals' attitude towards the behaviour or action, the subjective norm about the behaviour, their perceived behavioural control of the behaviour, and their intention to perform the behaviour. Moreover, it was expected that the variables attitude, subjective norm, perceived behavioural control, and intention would correlate with each other as they are expected to indicate participants' behavioural intentions according to the TPB (Knabe, 2012).

Attitude

To measure participants' attitude towards recreational cycling, the TPB questionnaire from the study of Knabe (2012) was used, which measured individuals' intention to teach or develop an online public relations course. Knabe (2012) used seven items to measure attitude, however, the item that measured the degree of foolishness (i.e., "foolish/wise") was eliminated as it was evaluated as not applicable to measure a participant's attitude towards recreational cycling. Therefore, the survey of the present study presented the statement "recreation cycling for me is…", followed by six items (e.g., "useless/useful", and "unimportant/important"). The full survey of the present study can be found in Appendix F. The items were measured on a 7-point bipolar adjective scale and high scores meant a positive attitude towards recreational cycling. The reliability of the used scale was tested with

Cronbach's Alpha. The study of Knabe (2012) found a relatively high Cronbach's Alpha of 0.96. This is similar to the Cronbach's Alpha found in the current study (0.97), which indicates high internal consistency.

Subjective norm

Participants' subjective norm to cycle recreationally was measured using statements from the TPB questionnaire of the study by Knabe (2012). The questionnaire of Knabe (2012) measured subjective norm with four items. In the present study, one item was eliminated (e.g., "most people who are important to me think that I should not /should cycle recreationally") as it was expected that this item was not applicable for measuring the subjective norm for recreational cycling. This left the study with three items (e.g., "important people in my environment approve of me cycling recreationally" and "important people in my environment also cycle recreationally"). The statements were assessed on a 7-point Likert scale ranging from "disagree" to "agree". Higher scores on this scale were associated with a higher subjective norm to cycle recreationally. Although the study of Knabe (2012) presented a Cronbach's Alpha of 0.78, the present study found a relatively low Cronbach's Alpha of 0.30 for the variable subjective norm, which indicated a low internal consistency. Removing the item "important people in my environment approve of me cycling recreationally" increased Cronbach's Alpha to 0.38, which remains below 0.5 and is, therefore, considered unreliable (Nawi et al., 2020). Additionally, removing this item would interfere with the desired minimum of three items to maintain internal consistency (Armitage & Conner, 2001; Knabe, 2012). Thus, this item was not removed. Nevertheless, the results gained from this measure need to be interpreted with caution.

Perceived behavioural control

Although perceived behavioural control was measured in the TPB questionnaire of Knabe (2012), another questionnaire was used for the current study. Perceived control refers

to people's perception of their ability and control to perform a certain activity, which can be measured by assessing individuals' self-efficacy (Ajzen, 2006; Knabe, 2012). Since the performed activity of this study was cycling a cycling route, which is similar to exercise, the standardised questionnaire of Self-Efficacy for Exercise (SEE) was employed to measure participants' perceived behavioural control. Participants' self-efficacy was assessed by providing nine statements on how confident they were to cycle recreationally if, for instance, the weather was bothering them, or they did not enjoy it (Resnick & Jenkins, 2000). The level of confidence was measured on a 7-point Likert scale ranging from "not confident" to "confident". High scores indicated high self-efficacy for cycling recreationally. The study of Resnick and Jenkins (2000) showed a Cronbach's Alpha of 0.92, which was comparable to the Cronbach's Alpha found in this study (0.89).

Intention

Participants' intention to cycle recreationally was measured with a direct measure derived from the TPB questionnaire guide of Ajzen (2006) and the study of Knabe (2012). One statement about recreational cycling intentions (e.g., "I have the intention to cycle recreationally") was measured on a 7-point Likert scale ranging from "disagree" to "agree". Scoring high on this scale indicated a higher intention to cycle recreationally. Since this direct measure was measured with one statement, Cronbach's Alpha for intention could not be calculated.

3.5.2. Intrinsic motivation measure

To measure the mediating variable of intrinsic motivation, the Activity Perception Questionnaire was used, which is a more specific version of the standardised Intrinsic Motivation Inventory (IMI) questionnaire. This 24-item questionnaire measured intrinsic motivation with the subscales of interest/enjoyment, value/usefulness, and perceived choice

(Markland & Hardy, 1997). Statements measured participants' perceived enjoyment or interest in the activity (e.g., "This activity was fun to do" or "I would describe this activity as very enjoyable"), the usefulness of the activity (e.g., "I believe that doing this activity could be of some value for me" or "I believe that doing this activity is useful for my health"), and their perceived choice in performing the activity (e.g., "I felt like I had to do this activity" and "I believe I had some choice about doing this activity"). Each subscale was measured with eight items. For the subscale measuring participant's interest or enjoyment, one item was negatively framed and from the perceived choice subscale, five items were negatively framed. Therefore, these items were re-coded during data analysis.

The three subscales were all measured on a 7-point Likert agreement scale, asking the participants to what extent they disagreed or agreed with the given statements. Moreover, scoring high on this scale suggests a high level of intrinsic motivation towards recreational cycling. The found Cronbach's Alpha for the subscales interest/enjoyment, value/usefulness, and perceived choice were relatively high: 0.91, 0.84 and 0.72 respectively. This is similar to other studies that used this specific IMI questionnaire like the study of Monteiro et al. (2015), who found a Cronbach's Alpha of 0.86 for the subscale interest/enjoyment, 0.91 for value/usefulness, and 0.86 for perceived choice.

3.5.3. User experience measure

To evaluate how the participants experienced the cycling route, the short version of the standardised User Experience Questionnaire (UEQ) was used. This questionnaire is commonly used to measure various aspects of interactive products and focuses on different features of these (Schrepp et al., 2017). However, for this study the questionnaire was used to measure the overall experience of the cycling route, to provide a general idea about the participant's experience. Participants were asked to assess the user experience of the cycling

route by evaluating fourteen items (e.g., “not efficient/ efficient”, “confusing/clear”, “dull/ creative”, and “obstructive/supportive”). The items were measured on a 7-point bipolar adjective scale. High scores indicated a more overall positive experience of the cycling route. Since the evaluation served to provide a general assessment of the cycling route, the internal consistency of the variable was measured as a whole, without subscales. Moreover, the found Cronbach’s Alpha in this study for the variable user experience was 0.81. This shows that the variable has internal consistency, which is similar to other studies where a Cronbach’s Alpha of 0.85 and 0.81 was found for the subscales of the UEQ (Schrepp et al., 2017).

3.5.4. Validity of the measures

Factor analysis was performed for both the variable measuring intrinsic motivation and the variables measuring participant’s attitude, subjective norm, perceived behavioural control, and intention to analyse the validity of the constructs. The items for attitude and mostly for perceived behavioural control showed construct validity. This indicates that the items used to measure attitude and perceived control, indeed measure participant’s attitude and perceived behavioural control. However, this cannot be stated for the items measuring subjective norm and intention, based on the outcome of the performed factor analysis. The analysis demonstrated that the variables measure more than one construct and therefore do not indicate construct validity.

For the subscales measuring intrinsic motivation, factor analysis did not show construct validity as well. Although the three subscales look clustered, the factor loadings of some items are more scattered across the indicated components, suggesting that the subscales of the variable intrinsic motivation did not show construct validity. Thus, these findings should be interpreted with caution. Appendix G demonstrates the performed factor analysis of the variables intrinsic motivation, attitude, subjective norm, perceived behavioural control,

and intention together, as well as intrinsic motivation and the TPB constructs separately, due to the lack of clarity from the analysis with all the variables together.

Lastly, the user experience measure employed in the present study aimed to measure participants' overall experiences and thus, the used measure of the UEQ was used without subscales, which differs from the original UEQ measure. Therefore, conducting factor analysis for the user experience measure was not applicable in this study. Nevertheless, the UEQ scale is a widely adopted measure, and according to previous studies by Laugwitz et al. (2008) and Schrepp et al. (2017), the scale has established its validity.

3.6. Data analysis strategy

The dataset was downloaded from Qualtrics and analysed in SPSS. Before data analysis, the dataset was checked for missing answers and outliers. The data showed two unfinished answers, which were included in the analysis up to the point to where these participants filled out the survey. The means and standard deviations of the dependent variables and mediating variable were compared between the two study conditions (i.e., the control and experimental group) and the independent samples *t*-test analysed if the two groups were significantly different from each other. In addition, the correlations between the variables of this study were analysed with the help of the bivariate Pearson correlations.

The mediating effect of intrinsic motivation on the relationship between the two cycling routes and the variables of attitude, subjective norm, perceived control, and intention was analysed with the help of the PROCESS macro of Hayes (2017). This resulted in a total of four mediation analyses. A mediation analysis gives the total effect of the relationships between the variables, which can be divided into direct and indirect effects. For this study, the direct effect was the effect of the cycling routes on the individual dependent variables (i.e., attitude, subjective norm, perceived behavioural control, and intention) without the

presence of the mediator (i.e., intrinsic motivation), which represents the relationships of first four hypotheses. The effect of the cycling routes on intrinsic motivation was measured by this mediation analysis as well, which represents hypothesis five. Lastly, the indirect effect is the effect of the cycling route on the dependent variables that work through the mediating variable of intrinsic motivation, representing hypotheses six to nine (Hayes, 2017).

The user experience was analysed by descriptive statistics as well, comparing the means and standard deviations of the experimental group and the control group. Additionally, the relationship between the two conditions of the cycling route and the user experience was analysed by using ANOVA to test if the experimental group evaluated their cycling experience as more positive than the control group.

3.6.1. Analysis of qualitative data

The qualitative data that was obtained during the experiment were analysed using content analysis, to help identify specific characteristics of messages (Stemler, 2001). The data was derived from two different channels. It was either obtained from the survey, where participants were asked to provide reasoning for why they did not cycle the route or partly cycled the route, or from participants who individually sent emails, providing feedback on the cycling route or the experiment. The obtained data was bundled, anonymised, analysed, and coded.

4. Results

4.1. Descriptive results

Table 2 shows the descriptive results of the variables used in this study. Since all questions and statements of the survey were measured on a 7-point scale, mean scores above the median of 4 can be considered high results. Most of the mean scores are above 4 except for the perceived behavioural control for the experimental group and the perceived choice for both groups. Additionally, Table 2 demonstrates that the mean scores of all measured variables were higher for the control group than for the experimental group. However, the performed independent samples *t*-test shows that the differences in the mean scores for all the variables are not significantly different between the two groups.

Table 2

Descriptive results

	Control group		*Experimental group*		*Totals*		*Independent t-test*		
	Mean	*SD*	Mean	*SD*	Mean	*SD*	*df*	*t*	*p*
Attitude	6.30	1.35	5.48	1.97	5.90	1.70	37	1.51	.142
Subjective norm	5.27	0.89	4.67	0.98	4.97	0.97	37	2.00	.053
Perceived behavioural control	4.07	1.14	3.58	1.64	3.83	1.41	36	1.06	.297
Intention	6.53	0.70	5.74	1.70	6.13	1.34	36	1.88	.073
Intrinsic motivation									
Interest/enjoyment	5.08	0.76	4.64	1.02	4.87	0.91	38	1.15	.257
Value/usefulness	5.81	0.79	5.45	0.76	5.63	0.79	37	1.66	.106
Perceived choice	3.45	0.52	3.44	0.67	3.45	0.59	37	0.80	.427
User experience									
	5.00	0.80	4.92	0.88	4.96	0.83	36	0.30	.763

*Significant if $p < .05$

4.2. Correlations

The correlation matrix in Table 3 shows that the variables of attitude, subjective norm, and perceived behavioural control individually correlate positively and significantly with intention. This indicates that if participants have a positive attitude towards recreational cycling, a high subjective norm, or a high perception of their control to cycle recreationally, it can be expected that their intention to cycle recreationally will be high. However, attitude and subjective norm do not correlate with the measure of perceived behavioural control. Only the measures for attitude and subjective norm correlate significantly and positively with each other, meaning that if participants have a positive attitude towards recreational cycling, their perceived social pressure is expected to be high as well. Since these variables do not correlate with the measure of perceived behavioural control, it is suggested that attitude, subjective norm, perceived control, and intention should be analysed as separate variables.

Furthermore, the correlation matrix shows that the subscales of intrinsic motivation correlate significantly and positively with each other. This indicates that if participants are interested in recreational cycling, it is expected that they will view recreational cycling as valuable to them and it is expected that they experience greater perceived choice. Additionally, this gives reason to believe that the subscales together measure the same thing in this study. Lastly, user experience positively correlates with the variables of enjoyment and usefulness. This correlation could be expected, since people who find cycling value to them and enjoy cycling, will evaluate a cycling route also positively.

Table 3

Correlation matrix

		1	2	3	4	5	6	7
Variables								
1	Attitude							
2	Subjective norm	.37*						
3	Perceived behavioural control	.14	-.16					
4	Intention (1 item)	.37*	.38*	.41*				
5	Interest/enjoyment	.29	-.12	.13	.20			
6	Value/usefulness	.02	.17	.25	.14	.48**		
7	Perceived choice	.21	-.25	.51**	.20	.56**	.40*	
8	User experience	.26	.19	-.08	.20	.51**	.35*	.21

* Correlation is significant at the .05 level (2-tailed).

** Correlation is significant at the .01 level (2-tailed).

4.3. Direct and mediation effects

The study investigated the different effects of the two conditions of the cycling routes (i.e., the Google Maps route and the gamified cycling route), the mediator of intrinsic motivation and the dependent variables of attitude, subjective norm, perceived behavioural control, and intention. This resulted in four mediation analyses in total that were performed with the help of the PROCESS macro (Hayes, 2017). The results are summarized in Table 4. To start, the mediation analyses showed no significant direct effects of the study conditions on participants' intrinsic motivation or their attitude, perceived behavioural control, or intention towards recreational cycling. One significant direct effect was found for the variable subjective norm, which showed a negative coefficient (b = -.68, p = .03). Negative coefficients suggest significant effects for the control group. Therefore, this significant effect indicates that participants that cycled the Google Maps route perceived a significantly higher subjective norm, compared to the group that cycled the gamified route. However, due to the unreliability of the subjective norm scale as previously mentioned, this result should be interpreted with caution. Figure 3 shows the conceptual model with the statistics gained from the mediation analysis with the subjective norm measure. In addition, the direct effects for the

variables attitude and intention show to have the same negative coefficient as for subjective norm. Nevertheless, the relationships between the control group, their attitude (b = -.68, p = .23) and their intention (b = -.68, p = .13) were not significant according to the p-value or the confidence interval.

Moreover, no significant indirect effects were found in any of the analysed relationships. This indicates that there was no mediating effect of intrinsic motivation on the relationship between the cycling routes and participants' attitude, subjective norm, perceived behavioural control, or intention towards recreational cycling. Additionally, no significant total effects were found in this study. The mediation analyses with the variables attitude, perceived behavioural control, and intention can be found in Appendix H.

Table 4

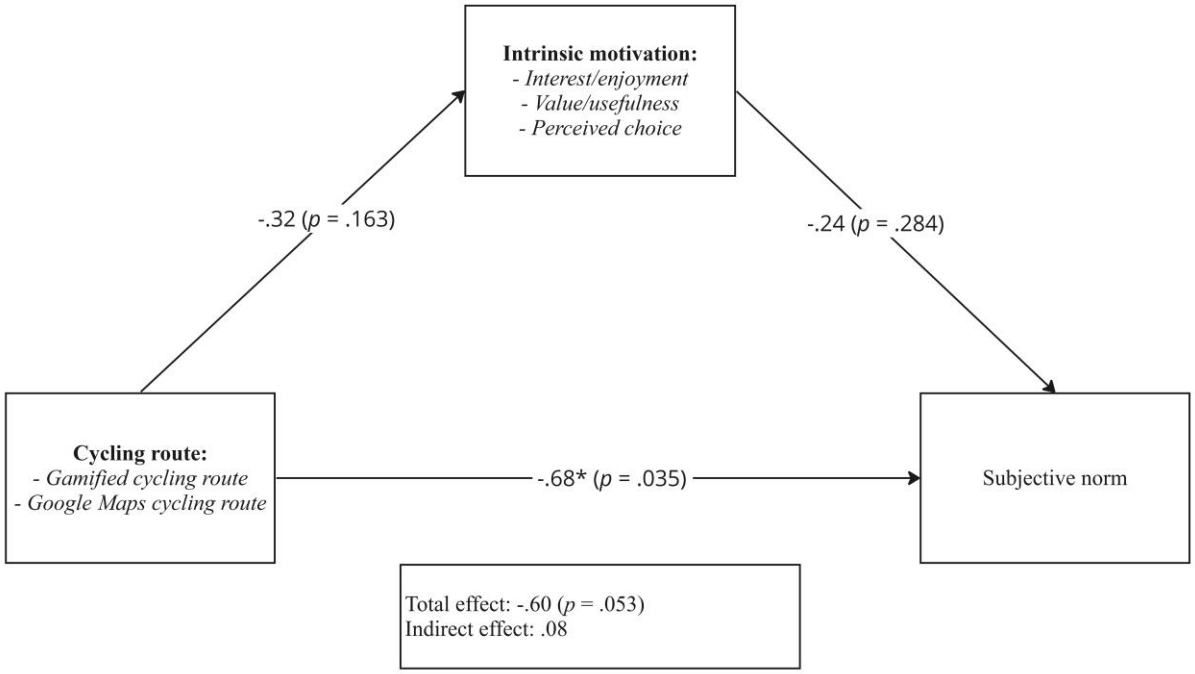
Mediation analysis summary

Relationship	Total effect	Direct effect	Indirect effect	Confidence interval		Conclusion
				Lower bound	Upper bound	
Cycling route > Intrinsic motivation > Attitude	-.82	-.68	-.14	-.49	.06	No significant effects
Cycling route > Intrinsic motivation > Subjective norm	-.60	-.68*	.08	-.06	.31	Only significant direct effect
Cycling route > Intrinsic motivation > Perceived control	-.49	-.25	-.23	-.69	.05	No significant effects
Cycling route > Intrinsic motivation > Intention	-.79	-.68	-.08	-.35	.07	No significant effects

*Significant if $p < .05$

Figure 3

Statistic results of mediation analysis for subjective norm



4.4. User experience effect (ANOVA)

The relationship between the cycling route conditions and the user experience was analysed using a one-way ANOVA. The results in Table 5 show that there was no significant difference in the variance of the user experience score between the two cycling groups ($F(1,36) = 0.09$, $p = .76$).

Table 5

ANOVA cycling route and user experience

	Sum of squares	df	Mean square	*F*-value	*p*-value
Between subjects	0.07	1	0.07	0.09	.763
Within subjects	25.35	36	0.70		
Total	25.43	37			

4.5. Qualitative results

The qualitative data derived from the survey and received emails from participants were coded. The survey asked participants who partly cycled the route or did not cycle the route to explain why they partially cycled the route or did not cycle the route. The emails contained information about participants' experiences during the experiment and examples of the received emails can be found in Appendix I. The coded data from the survey can be found in Appendix J and the coded data from the received emails in Appendix K. Some participants gave extensive information or sent multiple emails and could therefore be coded with more than one code. Table 6 shows the results of the qualitative data derived from both the survey and the emails.

The most frequently given feedback on the cycling route was that the route did not work (n = 15). This was the case for both the control and experimental group. For the control group, feedback was received from participants that experienced technical issues with the Google Maps cycling route. If participants clicked on the link and opened the route in their Google Maps mobile app, the route would change between two points and a different path was shown in the Google Maps route. Unfortunately, the path that Google Maps then showed is not cyclable. This explains why participants only partially cycled the route. The gamified cycling intervention appeared to have technical issues as well. As a result of which some participants from the experimental group were unable to open and cycle the gamified cycling intervention. Another frequently mentioned topic by both groups was the weather (n = 11). Participants expressed their concerns about performing a cycling activity during wintertime. This was mentioned five times by participants that cycled the route and six times by people that did not cycle the route. Moreover, another recurring reason mainly raised by participants that did not cycle the route, was illness (n = 10). Lastly, some topics were only acknowledged by participants via email, like participants mentioning they did not receive the participation

email (n = 8) and not being able to sign up for the experiment to receive the participation email (n = 2). Other topics participants frequently mentioned in the survey and emails were lack of personal time to perform the cycling route (n = 9), not liking the cycling route (n = 5) or viewing the route as obstructive (n = 4). The remaining (feedback) topics can be found in Table 6.

Table 6

Results of the coded data

	Control		*Experimental*		
	(Partly) cycled	Not cycled (or unknown)	(Partly) cycled	Not cycled (or unknown)	Total (mentioned)
Route did not work (properly)	10	1	2	2	15
Weather	5	3		3	11
Illness	1	4		5	10
Lack of time		6		3	9
Not received participation email*	3	3		2	8
Do not like the route		1		4	5
Route was obstructive			3	1	4
Other		1	1	1	3
Sign-up failure*	1	1			2
No reason*		1			1
Received too many emails*				1	1
Do not understand how it works	1				1
Positive*			1		1
Total (participants that filled out the survey)	34		26		

* Only from emails

To sum up the results, all the hypotheses were rejected. The results showed no significant effects between the gamified cycling intervention, the level of intrinsic motivation, participants' user experience, or their attitude, subjective norm, perceived behavioural control, or intention towards recreational cycling. One significant direct effect was found between the group that cycled the Google Maps route and their subjective norm towards recreational cycling. Table 7 shows an overview of the hypotheses of this study.

Table 7

Overview of the hypotheses that are rejected or accepted

Number	***Hypotheses***	***Rejected or not***
H_1	Recreational cyclists that cycled a gamified cycling intervention will have a more positive attitude towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected
H_2	Recreational cyclists that cycled a gamified cycling intervention will have a higher subjective norm towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected
H_3	Recreational cyclists that cycled a gamified cycling intervention will have more perceived behavioural control towards cycling compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected
H_4	Recreational cyclists that cycled a gamified cycling intervention will have a higher intention to cycle recreationally compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected
H_5	Recreational cyclists that cycled a gamified cycling intervention will have a higher intrinsic motivation to cycle recreationally compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected
H_6	The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' attitude towards cycling will be mediated by the level of intrinsic motivation towards recreational cycling.	Rejected
H_7	The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' subjective norm towards cycling will be mediated by the level of intrinsic motivation towards recreational cycling.	Rejected

H_8	The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' perceived behavioural control to cycle recreationally will be mediated by the level of intrinsic motivation towards recreational cycling.	Rejected
H_9	The effect of cycling a gamified cycling intervention compared to cycling a Google Maps route on recreational cyclists' intention to cycle recreationally will be mediated by the level of intrinsic motivation towards recreational cycling.	Rejected
H_{10}	Recreational cyclists that cycled a gamified cycling intervention will have a more positive user experience compared to recreational cyclists that cycled a non-gamified cycling route like Google Maps.	Rejected

5. Discussion

The present study investigated the different effects of an intrinsic motivational focused gamified AR cycling intervention and a Google Maps cycling route for recreational cyclists. It was expected that a gamified cycling intervention that focuses on enhancing intrinsic motivation, would positively influence recreational cyclists' attitude, subjective norm, perceived behavioural control, and intention, with intrinsic motivation mediating these relationships. In contrast to the expectations, no direct effects were found for the experimental group and their intrinsic motivation, attitude, subjective norm, perceived behavioural control, or intention to cycle recreationally. One significant direct effect was found for the control group and their subjective norm. Meaning that the people who cycled the Google Maps route, had a significantly higher perceived social pressure from their environment, compared to the experimental group that performed the gamified cycling route. In addition, no mediating effects of intrinsic motivation were found on the relationships between the cycling routes and participants' attitude, subjective norm, perceived behavioural control, or intention towards recreational cycling.

The findings of the present study are in contrast to the study of Johnson et al. (2016), which demonstrated that gamification has a positive effect on behavioural outcomes. There are a few potential explanations for why the expected effects were not found in this study.

To start, the sample size was too small, which can be of significant influence for the results of the study. Given the sample size of the present study (n = 40), a large effect size would be needed to detect the true impact of the study conditions. However, the literature review studies of Hardeman et al. (2002) and Steinmetz et al. (2016) demonstrate that the effect sizes of behaviour change interventions, in general, are of small to moderate magnitude. This indicates that the likelihood of finding a large effect size for behaviour change intervention studies would be exceptionally rare. Moreover, small effect sizes require

a large sample size to detect the effects of the intervention (Sullivan & Feinn, 2012). Thus, the effects of the intervention from the present study could not be captured with the current sample size and therefore no clear conclusions can be drawn from the results (Hackshaw, 2008). A significantly larger sample size would have been needed in the present study, to help draw more powerful conclusions.

The limited sample size in the present study can be attributed to the challenges encountered in recruiting participants for the experiment, like the weather conditions during the data collection period. Data collection started in November 2022 and ended in January 2023, thus, during the winter season. Although some people enjoy cycling during the wintertime, overall recreational cycling is considered a spring or summer activity, which came forwards from the received feedback as well (n = 11). Additionally, during winter, illnesses occur more often (CBS, 2023), which was also an unforeseen reason for people not being able to participate in the experiment (n = 10).

Thus, it would be recommended to conduct experiments that involve outdoor activities, such as recreational cycling, during a more appropriate time of the year like spring or summer.

5.1. Utilization of the gamified cycling intervention

The utilization of the technology in this study might be another potential factor contributing to the lack of anticipated outcomes from the gamified cycling intervention. The study used web-based AR technology for the gamified cycling route. This specific technology was chosen for its interactive features, the wide accessibility of web browser use, and the possibility to integrate geolocations for the cycling route (Gonzàlez, 2022). The studies of Krath et al. (2021) and Wetzel et al. (2011), which served as the foundation for the gamified cycling intervention of the present study, demonstrated that gamified interventions,

in general, can be effective in influencing and changing health behaviours. Nevertheless, the usability and user experience of such interventions are crucial features that greatly influence the acceptance and adoption by users (Kushendriawan et al., 2021; Siegel et al., 2017). The results of the user experience measure in the present study indicate that the experimental group did not enjoy the cycling route more than the control group, implying that the intervention did not work properly. Additionally, the gamified cycling intervention only would have worked if the intervention was able to trigger intrinsic motivation. However, no significant evidence indicated a higher level of intrinsic motivation to cycle recreationally among participants in the experimental group, despite both groups receiving the same extrinsic motivational incentive. Therefore, it can be recommended to integrate more usability testing and more extensive pre-testing of such newly developed interventions, to assess the effectiveness and functionality of the intervention's features.

Moreover, feedback was received from participants who experienced the gamified cycling intervention as obstructive rather than stimulative. If participants cycled the gamified route, they were asked to stop at the stopping points and use the AR to interact with their environment. In general, recreational cyclists use 'fietsknooppunten' when making a cycling trip. Fietsknooppunten are clear, and physically displayed signs with numbers, placed at intersections of bicycle-friendly roads. A series of numbers can make a cycling route, which allows cyclists to continue cycling without the need to stop and look at their mobile phones during their trip (ANWB, n.d.). Contrary to fietsknooppunten, the gamified cycling intervention requires cyclists to make stops during their trip to interact with the AR. According to the received feedback, this resulted in resistance towards the gamified cycling intervention for some of the participants (n = 4). Therefore, it is recommended to investigate other forms of interactive technology when developing an interactive gamified cycling route as well, like audio technology. Jialiang and Huiying (2020) investigated the effect of an audio

navigation system for cyclists, which can offer a safe navigation option as it is important for cyclists to be able to perform their cycling activity without the need to stop during their trip. Additionally, the study of Rowland et al. (2009) also expresses the importance to be careful when integrating moments of interaction into a cycling activity, as interaction should not interfere with the cyclists' safety. Even though limited research has been done about the implementation of audio technology to help enhance the experience of cyclists, this technology could offer a safe and effective alternative to the gamified cycling route, as it stays close to recreational cyclists' basic needs.

5.2. Effect on subjective norm

The results of this study did show a significant direct effect between participants that cycled the Google Maps cycling route and their subjective norm to cycle recreationally. This indicates that participants that cycled the Google Maps route appear to have a significantly greater perceived social pressure from people that are important to them, compared to the group that cycled the gamified route. This is similar to the results of the study of Williams et al. (2015), who measured the effects of an intervention to promote and stimulate walking behaviour on the TPB constructs (i.e., attitude, subjective norm, perceived behavioural control, and intention). This study found significantly higher subjective norm effects for the control group and no significant effects for the intervention group. According to the authors, the used behaviour change techniques were delivered ineffectively to the study population, leading to the failure of their intervention and the anticipated results. Additionally, it is worth noting that the sample size of the study of Williams et al. (2015) was significantly larger (n = 305) than the sample size of the present study (n = 40) and therefore no clear assumptions can be made from the study. Lastly, the significant direct effect found in the present study should

be interpreted with caution, as the reliability of the gained data was impacted by the used measurement for the variable subjective norm.

5.2.1. Reliability of the measures

According to the study of Knabe (2012), where the measurement instrument was derived from, the measure for subjective norm was a reliable instrument. The Cronbach's Alpha found in their study (0.78) indicated that the instrument showed internal consistency. In addition, the study of S. González et al. (2012) found a sufficient Cronbach's Alpha for the variable subjective norm as well (0.85), indicating a reliable measurement instrument. Considering the findings from these studies, the selection of this measurement instrument was deemed appropriate for implementation in the present study. However, a low Cronbach's Alpha (0.30) was found for the subjective norm measure in the present study, indicating that the findings are inconsistent and unreliable.

The difference between the present study and the studies of S. González et al. (2012) and Knabe (2012), is that the present study measured subjective norm with three items, and S. González et al. (2012) and Knabe (2012) with four items. The study of Smit (2013) measured people's subjective norms with three items as well and found a similarly low Cronbach's Alpha for subjective norm (0.37). This indicates that the number of items used to measure a construct is relevant for the reliability of a measurement instrument. Nevertheless, this is contrary to the studies of Armitage and Conner (2001) and Knabe (2012), who recommended using a minimum of three items to ensure an instrument's reliability. Additionally, it is worth noting that the sample sizes of the previously stated studies were significantly larger compared to the sample size of the present study. This difference could potentially account for the disparities in the observed reliability findings as well.

The study of Knabe (2012) also found stronger correlations between the variables of attitude, subjective norm, and perceived behavioural control, which were not found in the present study. Moreover, the used measures for subjective norm, intention, and intrinsic motivation were not identified as valid measurement instruments according to the performed factor analyses and additionally, some of the items appeared to overlap. For example, one of the subscales of the intrinsic motivation measure assessed if the participants would perform the cycling route again because they believe it is useful to them. The variable attitude was measured on a bivariate scale, including an item asking how useful or useless they find recreational cycling. This overlap among the different constructs raises concerns regarding the reliability of the measures and questions the construct validity of the instruments. Despite the correlations between these items do not suggest an overlap, such measurement instruments should be utilized with caution.

To sum up, the observations previously mentioned indicate that the findings of the present study are inconsistent and unreliable and call to question the used measuring instruments in the present study and to interpret the results with caution. This gives reason to 1) seek other, more reliable scales; 2) recommend the usage of more items to measure a construct; 3) or develop standardized questionnaires. The TPB questionnaire used in the present study was not a standardized questionnaire, but a guide (Ajzen, 2006). Questionnaire guides offer more freedom in terms of interpretation and application, which can result in inconsistent use of the measure across varied disciplines and contexts. Moreover, this facilitates the incorporation of a less reliable measure into the study. The scales used to measure attitude and subjective norm for instance were not as specific as the Intrinsic Motivation Inventory (IMI) questionnaire to measure intrinsic motivation, or the Self-Efficacy for Exercise (SEE) for perceived behavioural control. These IMI and SEE questionnaires were a better fit for this specific study since they were designed to measure

exercise behaviour (Markland & Hardy, 1997; Resnick & Jenkins, 2000). Having a standardized TPB questionnaire focused on exercise behaviour or physical activity could help prevent unreliable and invalid results.

5.3. Limitations and implications

There were a few limitations in the present study. First, the received feedback from the participants of the control group revealed that the Google Maps cycling route experienced technical issues. For some participants, the Google Maps route showed a different route after opening it in the Google Maps mobile app (n = 11). The route changed between two points, resulting in a different route. The changed route passed a road that was not cyclable, which made it impossible for some participants to perform the cycling route as originally planned. In addition, the feedback revealed that the gamified cycling intervention experienced technical issues as well (n = 4). The exact source of the failure of the gamified cycling intervention was unidentified, although it most likely had something to do with individual phone settings since the gamified route requires access to participants' location and camera (Onirix, n.d.). These observations interfere with the reliability of the results from both groups. Although it is not expected that this error had a significant effect on the results, it is a limitation that should be considered. Additionally, since control groups must not be affected by any conditions, it can be recommended for future research to integrate a cycling route for the control group that recreational cyclers traditionally use, like the fietsknooppunten routes.

Second, the current study design collected data at a single moment in time, which was after participants performed the cycling activity. Therefore, participants' intrinsic motivation, attitude, subjective norm, perceived behavioural control, and intention was measured at one moment in time. If the study would be conducted again, it is recommended to implement a different study design and to seek other measures that are more applicable for assessing an

activity. Similar experimental studies used a repeated measures design, which enables the research to provide a more specific impact of the intervention over time due to the baseline measurement. This design not only provides a more precise evaluation of the intervention's impact but has a greater statistical power as well (Bakeman, 2005; Guo et al., 2013). In addition, tracking or observing participants while they perform an activity like cycling recreationally could give more detailed information about the behaviour (Vinten, 1994).

To sum up, no clear practical implications can be given from the results of the present study due to the limitations described in the previous sections. Despite the null findings, cycling and recreational cycling can still be seen as important activities in our society and investing in stimulating this behaviour remains relevant due to the sustainable features, municipal benefits, and individual health improvements (European Parliament, 2019; Gemeente Enschede, n.d.; Oja et al., 2011).

5.4. Conclusion

In this study, it was expected to find a positive mediating effect between people who cycled a gamified cycling route, their intrinsic motivation towards recreational cycling and their attitude, subjective norm, perceived behavioural control, and intention towards recreational cycling. Nevertheless, these expectations were not met as all the hypotheses were rejected after the experiment was conducted. Due to the limited sample size, it is difficult to disentangle whether the gamified cycling intervention did not work or whether there was not enough power to find an effect. The study was also limited due to technical issues of the cycling routes, the measures used in this study, and the chosen study design. Overall, interaction interventions for cyclists should generally be developed with caution as they should enhance and not interfere with the distinctive nature of (recreational) cyclists, as they do not want to stop during their cycling trip. Despite no clear conclusions can be drawn, from a health perspective, promoting (recreational) cycling behaviour is still relevant. Therefore, research and development of new methods, aimed at identifying the most effective approach for stimulating (recreational) cycling behaviour, remains crucial.

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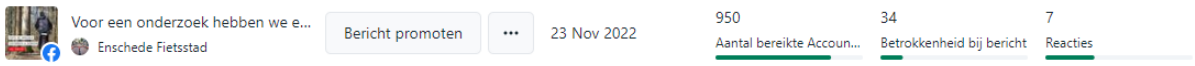
Appendix

Appendix A

Communication about the study

Twitter:

Bereik Facebook post:



Newsletter Enschede Fietsstad and cards in local bike shop:

Meld je aan om de speciale fietsroute te ontvangen!

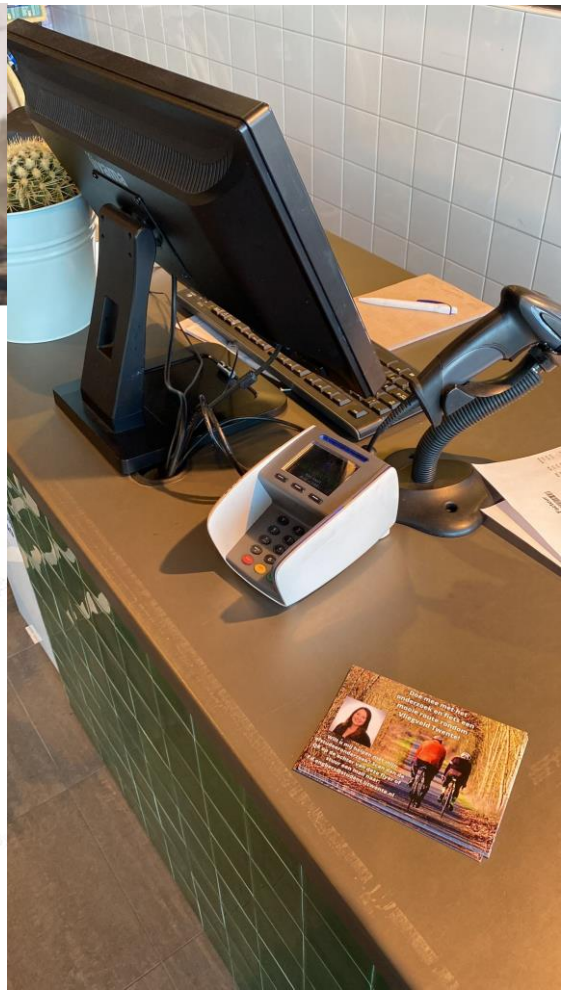
Fiets een speciale fietsroute, verdien 100 punten in de Enschede Fietst-app en help tegelijkertijd met een afstudeeronderzoek!

UT-student Femke Engbers heeft een speciale fietsroute rondom vliegveld Twente uitgezet voor haar afstudeeronderzoek. Door deze route te fietsen verdien je 100 extra punten in de Enschede Fietst-app! Fiets door het prachtige gebied rondom het vliegveld en ontdek wat deze tijd van het jaar met de natuur doet. Na het fietsen vul je de vragenlijst in om mee te doen met het onderzoek. De route ontvang je per mail en kan op elk gewenst moment gefietst worden, hier zitten geen vaste dagen of tijden aan vast.

Koffie, thee en wat lekkers!
Komende dagen wordt het mooi fietsweer: het blijft droog en zondag wordt zelfs beoordeeld met een 7! Fijne omstandigheden om een rondje te fietsen dus en aanstaande zondag 4 december staat er ook nog eens koffie, thee en wat lekkers klaar voor de eerste deelnemers vanaf 10:00 uur bij het beginpunt in Lonneker.

Doe jij mee?
Iedereen kan meedoen met de fietstocht en het onderzoek en je hoeft niet per se de Enschede Fietst-app te hebben (alleen als je de punten wil ontvangen. Meer informatie over de app vind je hier).
Meld je aan voor deze mooie fietstocht via onderstaande knop. Alvast hartelijk bedankt voor je deelname en wie weet tot zondag!

Meld je hier aan!



Appendix B

Participation email

Beste,

Bedankt dat u mij wilt helpen met mijn onderzoek! Hierbij ontvangt u fietsroute A. Bekijk de fietsroute in Google Maps via de link hieronder. Fiets deze route, vul de vragenlijst in en ontvang 100 bonuspunten in de Enschede Fietst-app! https://goo.gl/maps/4HJfa9zyrBYmMzpQ9
Let op: Opent u de route via uw mobiele telefoon? Het kan zijn dat de Google Maps link aangeeft om na het tweede punt rechtsaf te fietsen, over de Oude Deventerweg. Dit is niet nodig, bij het tweede punt kunt u gewoon rechtdoor fietsen, zoals op de afbeelding hieronder staat. Bestudeer deze afbeelding daarom goed.

Uitleg over de fietsroute:

De route start in Lonneker op het plein bij Sprakel eten & drinken (Dorpsstraat). Vervolgens komt de route langs 4 mooie punten en eindigt bij de rotonde aan de Weerseloseweg/Vliegveldstraat. Op deze route zijn in totaal 5 punten waar u kunt stoppen, inclusief het startpunt. Bij deze punten kunt u even afstappen om even te rusten of stil te staan en van de omgeving te genieten.
Heeft u de hele fietsroute afgelegd? Vul dan de vragenlijst in via de link hieronder. Het invullen van de vragenlijst duurt ongeveer 10-15 minuten.

https://utwentebs.eu.qualtrics.com/jfe/form/SV_6JadC7wPxzDTaF8

Belangrijke punten:

- Lees deze mail goed door en bestudeer de route goed
- U kunt de route fietsen tot en met 31 december
- Door de route te fietsen en de vragenlijst in te vullen helpt u mij met mijn onderzoek én ontvangt u 100 bonuspunten in de Enschede Fietst-app.
- Het is wettelijk niet toegestaan om tijdens het fietsen een telefoon in uw hand te houden. Bestudeer de route daarom goed van tevoren en gebruik uw telefoon alleen wanneer u bent gestopt bij bijvoorbeeld een van de stoppunten.

Met vriendelijke groet,
Femke Engbers

Beste,

Bedankt dat u mij wilt helpen met mijn onderzoek! Hierbij ontvangt u fietsroute B. Bekijk de fietsroute door de link hieronder te openen op uw mobiele telefoon. Het betreft een interactieve fietsroute waarmee u door middel van onderstaande link in uw webbrowser een kaart en de punten kunt zien waar de fietsroute langs gaat. Tijdens de fietsroute gaat u op zoek naar de 5 fietsen die u via uw telefoon ziet zodra u bij een stoppunt bent. Verzamel de fietsen om extra informatie te krijgen over de route die u aan het fietsen bent, vul de vragenlijst in en ontvang 100 bonuspunten in de Enschede Fietst-app! https://studio.onirix.com/exp/ew9mwL

Uitleg over de fietsroute:

De route start in Lonneker op het plein bij Sprakel eten & drinken (Dorpsstraat). Vervolgens komt de route langs 4 mooie punten en eindigt bij de rotonde aan de Weerseloseweg/Vliegveldstraat. Op deze route zijn in totaal 5 punten waar u kunt stoppen, inclusief het startpunt. Deze punten kunt u zien in de kaart die verschijnt als u de link hierboven opent. Wanneer u bent aangekomen bij een stoppunt kunt u hierop klikken in de kaart en ontdekken wat de omgeving u te bieden heeft.
Om de interactieve fietsroute juist te kunnen gebruiken, is het van belang dat u uw locatie voorzieningen op uw telefoon aan heeft staan en u toegang geeft tot uw camera wanneer u bij de stoppunten bent.
Wanneer u bij een stoppunt bent aangekomen, volg dan de volgende stappen:

Klik op “Go to AR”

Klik op het + icoontje

Ga bij alle 5 stoppunten op zoek naar de 5 fietsen die u in uw scherm kunt zien.

Zoek de fiets en ontvang extra informatie over de route.

Verzamel alle fietsen door erop te klikken en verdien 100 bonuspunten!

Heeft u de hele fietsroute afgelegd? Vul dan de vragenlijst in via de link hieronder. Het invullen van de vragenlijst duurt ongeveer 10-15 minuten. https://utwentebs.eu.qualtrics.com/jfe/form/SV_6JadC7wPxzDTaF8

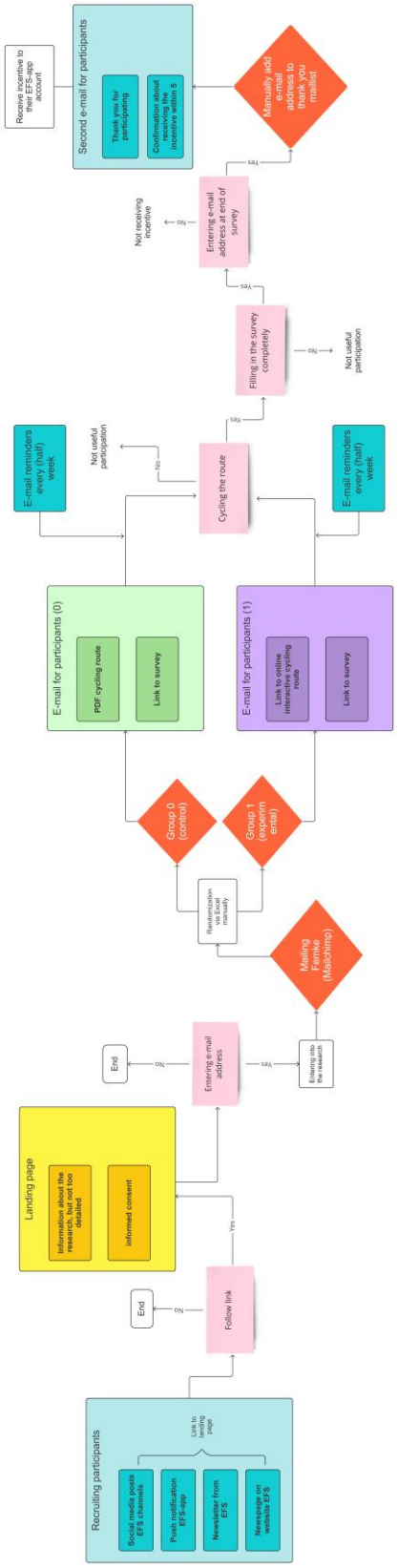
Belangrijke punten:

- Lees deze mail goed door en bestudeer de route goed
- U kunt de route fietsen tot en met 31 december
- Door de route te fietsen en de vragenlijst in te vullen helpt u mij met mijn onderzoek én ontvangt u 100 bonuspunten in de Enschede Fietst-app.
- Het is wettelijk niet toegestaan om tijdens het fietsen een telefoon in uw hand te houden. Bestudeer de route daarom goed van tevoren en gebruik uw telefoon alleen wanneer u bent gestopt bij bijvoorbeeld een van de stoppunten.

Met vriendelijke groet,
Femke Engbers

Appendix C

Research flowchart

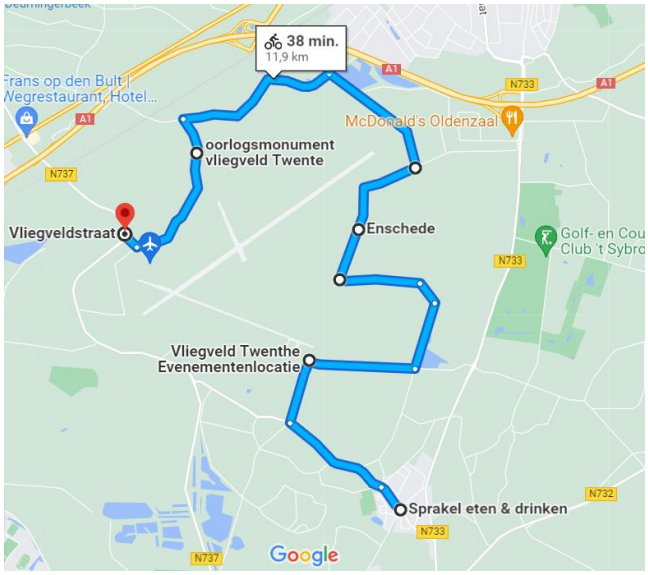


Appendix D

Google Maps route, coordinates and information of the point of the cycling route.

Link naar Google Maps route:

https://goo.gl/maps/4HJfa9zyrBYmMzpQ9



Game 2.0

Startpunt: 52.24977508271493, 6.911315996912214

- Tekst als je in de map zit en bij het start punt bent (zie rood onderstreepte tekst hiernaast:

Begin hier met de fietsroute en zoek de 5 fietsen die je bij de stoppunten kunt verzamelen. Klik op GO TO AR om de eerste fiets te zoeken!

- Spel element: tik op de fiets en tekst verschijnt:

Je hebt de eerste fiets, goed gedaan! Ga door naar stop 1.

Stop 1: 52.26369853923167, 6.897035213494573

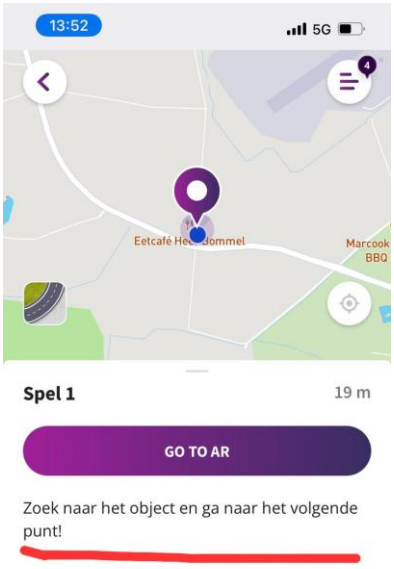
- Tekst als je in de map zit en bij stop 1 bent:

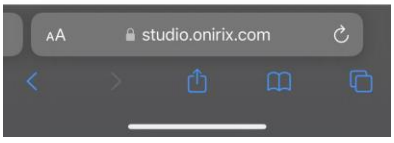
Je bent bij de eerste stop, goed bezig! Zoek de rode fiets, klik erop en fiets naar het volgende stoppunt

- Spel element: tik op de fiets en tekst verschijnt:

Wist je dat vliegveld Twente vroeger een dagelijkse verbinding had met Schiphol? Klik hier voor meer informatie

- Link naar https://vliegveldtwenthe.nl/waarom-vliegveld-twenthe/rijke-historie/





Stop 2: 52.276289, 6.904612

- Tekst als je in de map zit en bij stop 2 bent:

Zoek de rode fiets, klik erop en zie hoever je al hebt gefietst!

- Spel element: tik op de fiets en tekst verschijnt:

Je hebt al 6 km gefietst, op de helft! Wat vind je van deze omgeving?

Stop 3: 52.28348794856855, 6.879661049038699

- Tekst als je in de map zit en bij stop 3 bent:

Je bent al bij het een na laatste punt, wauw! Klik op de fiets er krijg meer te weten of dit stoppunt

- Spel element: tik op de fiets en tekst verschijnt:

Dit is het oorlogsmonument van Vliegveld Twente. Klik hier voor meer informatie

- Link naar https://oorlogsdodendinkelland.nl/

Stop 4 + einde: 52.275925, 6.868958

- Tekst als je in de map zit en bij stop 4 bent:

Je hebt de fietsroute voltooid, wat goed! Na dit punt kun je een vragenlijst invullen en beloond worden met 100 punten!

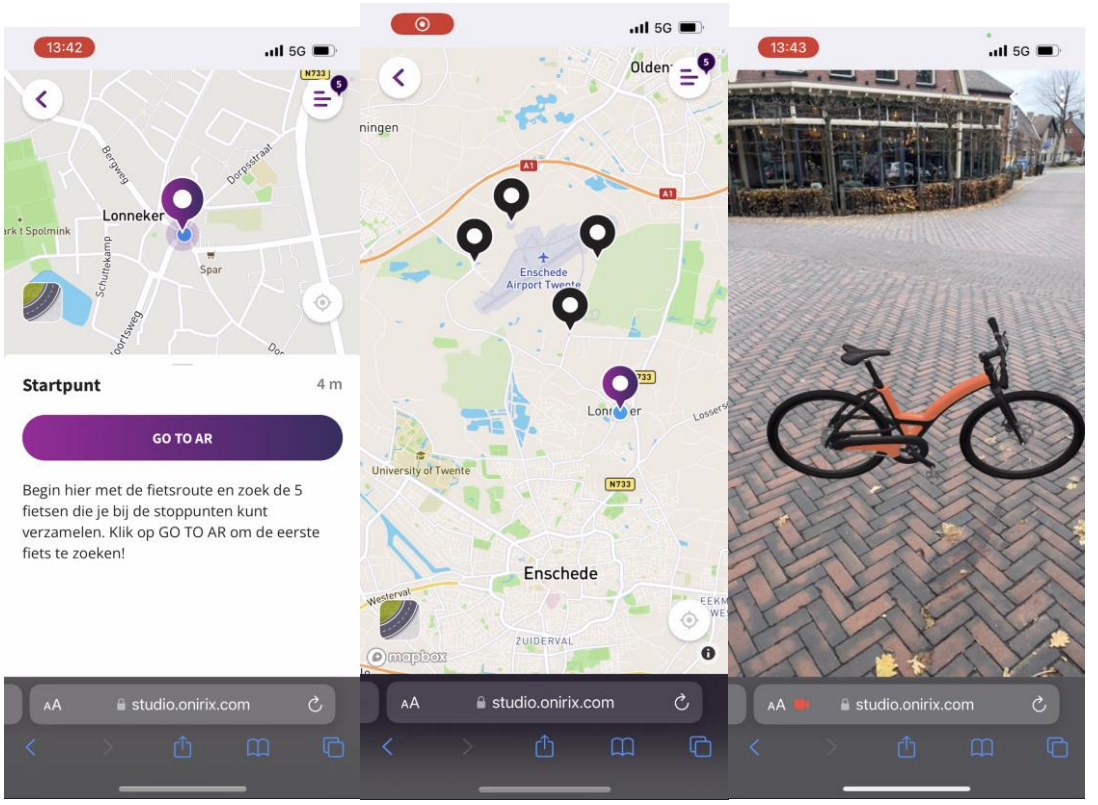
- Spel element: tik op de fiets en tekst verschijnt:

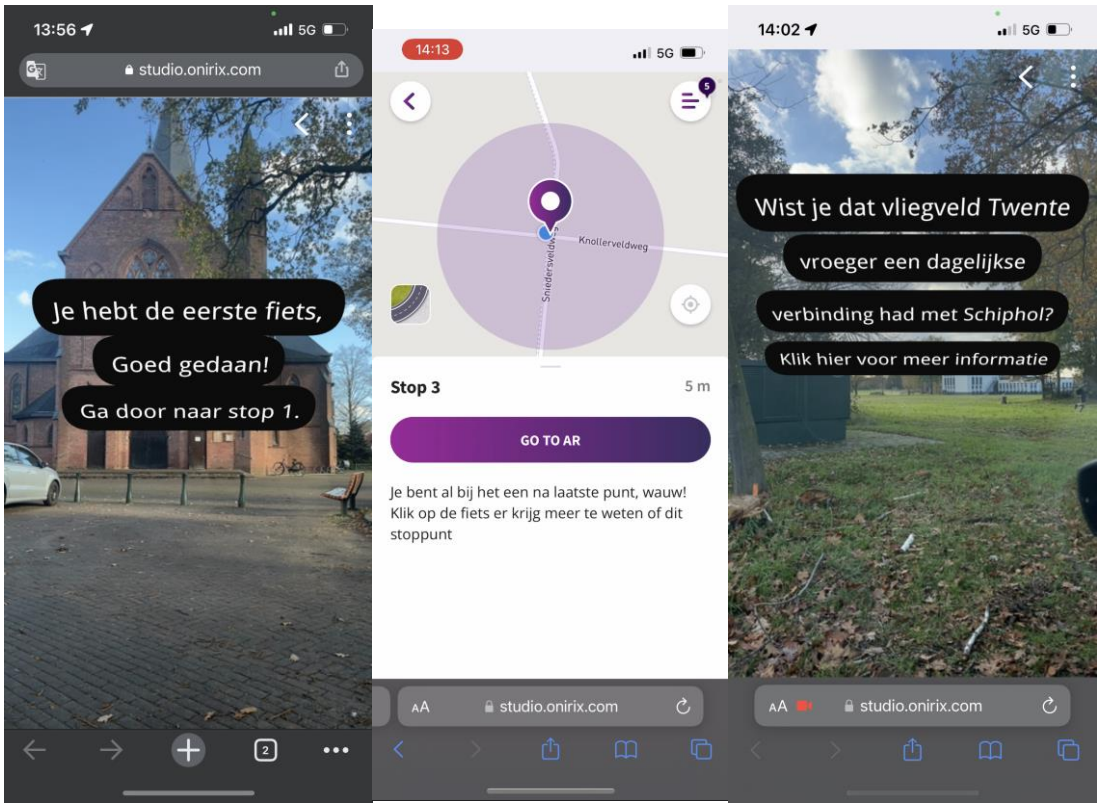
Dit was het laatste punt! Klik hier om de vragenlijst in te vullen

- Link naar survey

Appendix E

Visual examples of the gamified intervention





Appendix F

Full survey

Onderzoek fietsroute & fietsgedrag

Bedankt voor het fietsen van de fietsroute rondom Vliegveld Twente! Ik hoop dat u ervan heeft genoten. Ik ga u wat vragen stellen over uw fietsgedrag en over de fietsroute die u heeft gefietst. Het is belangrijk dat u de vragenlijst volledig en naar waarheid invult, er zijn geen foute antwoorden. Het invullen van de vragenlijst zal ongeveer 10-15 minuten duren.

Indien u de 100 bonuspunten had willen ontvangen, is het belangrijk om aan het einde van de vragenlijst uw gebruikersnaam achter te laten, zodat we de 100 bonuspunten voor de Enschede Fietst-app aan uw account kunnen koppelen. Uw gebruikersnaam kunt u in de app vinden onder 'Instellingen'.

Nogmaals hartelijk dank voor uw deelname!

General

Welke fietsroute heeft u via de mail ontvangen? Dit kunt u terug vinden in de mail die u heeft ontvangen

- ○ Fietsroute A (Google Maps versie)
- ○ Fietsroute B (online versie)

Heeft u de route compleet gefietst? Het is niet erg wanneer u de route niet (helemaal) heeft gefietst en ik vraag u daarom eerlijk te antwoorden.

- ○ Ja, ik heb de gehele route gefietst langs alle aangegeven punten
- ○ Ja, maar ik heb een gedeelte gefietst
- ○ Nee, ik heb de fietsroute niet gefietst

Hoe oud bent u? (alleen cijfers gebruiken)

_____

Wat is uw gender?

- ○ Man
- ○ Vrouw
- ○ Non-binair
- ○ Zeg ik liever niet
- ○ Anders, _____

Condition not met

Waarom heeft u de route niet (helemaal) gefietst?

- ○ Ik vond de route te lang
- ○ Ik vond de route niet leuk
- ○ Ik begreep niet hoe het werkte
- ○ Anders, namelijk... _____

Route points

Geef aan bij welke punten u allemaal bent gestopt. Klik alle punten aan waarbij u bent gestopt.

- ☐ Startpunt (Dorpsstraat in Lonneker)
- ☐ Stop 1
- ☐ Stop 2
- ☐ Stop 3
- ☐ Stop 4 (bij de rotonde)

Cycling behaviour

De volgende vragen gaan over uw fietsgedrag

Hoe vaak fietst u in de week?

- ○ Minder dan 1 keer per week
- ○ 1-2 keer per week
- ○ 3-4 keer per week
- ○ 5-6 keer per week
- ○ Elke dag

Hoe vaak fietst u recreatief? Onder recreatief fietsen bedoelen we fietsen zonder ander doel dan voor het plezier en/of ontspanning.

- ○ Minder dan 1 keer per maand
- ○ 1 keer per maand
- ○ 1 keer per 2 weken
- ○ 1 keer per week
- ○ Vaker dan 1 keer per week

Fietst u elektrisch?

- ○ Ja, ik heb alleen een elektrische fiets
- ○ Ja, maar deze gebruik ik af en toe
- ○ Nee

IMI: interest/enjoyment

De volgende items hebben betrekking op uw ervaring met de door u gefietste fietsroute. Gelieve alle items beantwoorden. Geef aan in hoeverre u het eens bent met de volgende stellingen:

	Helemaal oneens	Oneens	Enigszins oneens	Niet mee eens of oneens	Enigszins mee eens	Mee eens	Helemaal mee eens
Deze activiteit was leuk om te doen	○	○	○	○	○	○	○
Ik vond het erg leuk om deze activiteit te doen	○	○	○	○	○	○	○
Ik had het gevoel dat ik van de activiteit genoot terwijl ik ermee bezig was	○	○	○	○	○	○	○
Ik vond dit een erg saaie activiteit	○	○	○	○	○	○	○
Terwijl ik deze activiteit deed, dacht ik na hoeveel ik ervan genoot	○	○	○	○	○	○	○
Ik vond dit een zeer interessante activiteit	○	○	○	○	○	○	○
Ik zou deze activiteit omschrijven als zeer plezierig	○	○	○	○	○	○	○
Ik zou deze activiteit omschrijven als erg leuk	○	○	○	○	○	○	○

IMI: Value/usefulness

De volgende items hebben betrekking op uw ervaring met de door u gefietste fietsroute. Gelieve alle items beantwoorden. Geef aan in hoeverre u het eens bent met de volgende stellingen:

	Helemaal oneens	Oneens	Enigszins oneens	Niet mee eens of oneens	Enigszins mee eens	Mee eens	Helemaal mee eens
Ik geloof dat het doen van deze activiteit van enige waarde voor mij kan zijn	○	○	○	○	○	○	○
Ik denk dat deze activiteit belangrijk is voor mijn gezondheid	○	○	○	○	○	○	○
Ik ben bereid deze activiteit opnieuw te doen omdat ik denk dat het enigszins nuttig is	○	○	○	○	○	○	○
Ik zou bereid zijn deze activiteit opnieuw te doen omdat het enige waarde voor mij heeft	○	○	○	○	○	○	○
Ik ben bereid dezelfde fietsroute nog een keer te fietsen als ik geen beloning kon verdienen (de 100 bonuspunten)	○	○	○	○	○	○	○
Ik geloof dat het doen van deze activiteit nuttig is voor mijn gezondheid	○	○	○	○	○	○	○
Het is mogelijk dat deze activiteit mijn gezondheid kan verbeteren	○	○	○	○	○	○	○
Ik geloof dat het doen van deze activiteit enigszins gunstig voor mij kan zijn	○	○	○	○	○	○	○

IMI: Perceived choice

De volgende items hebben betrekking op uw ervaring met de door u gefietste fietsroute. Gelieve alle items beantwoorden. Geef aan in hoeverre u het eens bent met de volgende stellingen:

	Helemaal oneens	Oneens	Enigszins oneens	Niet mee eens of oneens	Enigszins mee eens	Mee eens	Helemaal mee eens
Ik had echt geen keus om deze activiteit te doen	○	○	○	○	○	○	○
Ik deed deze activiteit omdat ik dat wilde	○	○	○	○	○	○	○
Ik had het gevoel dat ik deze activiteit moest doen	○	○	○	○	○	○	○
Ik deed deze activiteit omdat het moest	○	○	○	○	○	○	○
Tijdens het doen van deze activiteit had ik het gevoel dat ik een keuze had	○	○	○	○	○	○	○
Ik geloof dat ik enige keuze had bij het doen van deze activiteit	○	○	○	○	○	○	○
Ik had het gevoel dat ik geen andere keuze had dan deze activiteit te doen	○	○	○	○	○	○	○
Ik had het gevoel dat het niet mijn eigen keuze was om deze activiteit te doen	○	○	○	○	○	○	○

Attitude

De volgende vragen hebben betrekking tot uw gevoelens, gedachten en intenties richting recreatief fietsen.

Geef aan in hoeverre de items van toepassing zijn. De rondjes staan voor verschillende gradaties. U kunt uw beoordeling geven door het rondje aan te vinken dat het meest uw indruk weerspiegelt.

Recreatief fietsen is voor mij:

Slecht	○ ○ ○ ○ ○ ○ ○	Goed
Onprettig	○ ○ ○ ○ ○ ○ ○	Prettig
Niet nuttig	○ ○ ○ ○ ○ ○ ○	Nuttig
Onplezierig	○ ○ ○ ○ ○ ○ ○	Plezierig
Onwenselijk	○ ○ ○ ○ ○ ○ ○	Wenselijk
Onbelangrijk	○ ○ ○ ○ ○ ○ ○	Belangrijk

Subjective norm

Geef aan in hoeverre u het eens bent met de volgende stellingen:

Belangrijke mensen in mijn omgeving...

	Helemaal oneens	Oneens	Enigszins oneens	Niet mee eens of oneens	Enigszins mee eens	Mee eens	Helemaal mee eens
keuren het goed dat ik recreatief fiets	○	○	○	○	○	○	○
verwachten dat ik recreatief fiets	○	○	○	○	○	○	○
fietsen ook recreatief	○	○	○	○	○	○	○

Perceived behavioural control

De volgende vragen hebben betrekking tot uw gevoelens, gedachten en intenties richting recreatief fietsen.

Geef aan hoe groot de waarschijnlijkheid is dat u recreatief gaat fietsen in de volgende situaties:

Hoe waarschijnlijk is het dat u recreatief gaat fietsen als...

	Zeer onwaarschijnlijk	Onwaarschijnlijk	Enigszins onwaarschijnlijk	Neutraal	Enigszins waarschijnlijk	Waarschijnlijk	Zeer waarschijnlijk
het weer u dwars zit	○	○	○	○	○	○	○
u zich zou vervelen door de fietsroute	○	○	○	○	○	○	○
u pijn voelde tijdens het fietsen	○	○	○	○	○	○	○
u alleen moest fietsen	○	○	○	○	○	○	○
u het niet leuk vond	○	○	○	○	○	○	○
u het te druk had met andere activiteiten	○	○	○	○	○	○	○
u zich moe voelde	○	○	○	○	○	○	○
u zich gestrest voelde	○	○	○	○	○	○	○
u zich despressief voelde	○	○	○	○	○	○	○

Intention

Geef aan in hoeverre u het eens bent met de volgende stelling:

	Helemaal oneens	Oneens	Enigszins oneens	Niet mee eens of oneens	Enigszins mee eens	Mee eens	Helemaal mee eens
Ik heb de intentie om recreatief te fietsen	○	○	○	○	○	○	○

User experience

Voor de beoordeling van de door u gefietste fietsroute, vragen we u onderstaande items in te vullen. De items bestaan uit twee tegengestelde eigenschappen die van toepassing zijn op de fietsroute. De rondjes staan voor verschillende gradaties. U kunt uw beoordeling geven door het rondje aan te vinken dat het meest uw indruk weerspiegelt.

Wat vond u van de fietsroute die u heeft gefietst?

Belemmerend	○ ○ ○ ○ ○ ○ ○	Ondersteunend
Complex	○ ○ ○ ○ ○ ○ ○	Eenvoudig
Inefficiënt	○ ○ ○ ○ ○ ○ ○	Efficiënt
Verwarrend	○ ○ ○ ○ ○ ○ ○	Overzichtelijk
Vervelend	○ ○ ○ ○ ○ ○ ○	Spannend
Oninteressant	○ ○ ○ ○ ○ ○ ○	Interessant
Conventioneel	○ ○ ○ ○ ○ ○ ○	Origineel
Gebruikelijk	○ ○ ○ ○ ○ ○ ○	Nieuw
Onplezierig	○ ○ ○ ○ ○ ○ ○	Plezierig
Onbegrijpelijk	○ ○ ○ ○ ○ ○ ○	Begrijpelijk
Saai	○ ○ ○ ○ ○ ○ ○	Creatief
Moeilijk te leren	○ ○ ○ ○ ○ ○ ○	Makkelijk te leren
Inferieur	○ ○ ○ ○ ○ ○ ○	Waardevol
Onvoorspelbaar	○ ○ ○ ○ ○ ○ ○	Voorspelbaar

Bonus points

Bedankt voor het invullen van de vragenlijst!

Wilt u de beloning van 100 bonuspunten in de Enschede Fietst-app ontvangen?

○ Ja

○ Nee

Laat uw gebruikersnaam achter om de 100 bonuspunten op uw Enschede Fietst-app te ontvangen. Uw gebruikersnaam kunt u vinden in de Enschede Fietst-app onder 'Instellingen'

_____

Appendix G

Factor analysis of dependent variables and intrinsic motivation

Factor analysis intrinsic motivation (interest, value and perceived choice), attitude, subjective norm, perceived control & intention

Rotated Component Matrixa

	Component										
	1	2	3	4	5	6	7	8	9	10	11
IMI_Inter_1		0,835									
IMI_Inter_2		0,935									
IMI_Inter_3		0,85		0,334							
IMI_Inter_5		0,504									0,728
IMI_Inter_6		0,469		0,505							0,479
IMI_Inter_7		0,877									
IMI_Inter_8		0,878									
Recod_IMI_Inter_4							0,791				
IMI_Val_1				0,819	0,301						
IMI_Val_2				0,319	0,714					0,348	
IMI_Val_3				0,801							
IMI_Val_4				0,821							
IMI_Val_5				0,605	-0,353		0,327				
IMI_Val_6					0,827						
IMI_Val_7					0,788						
IMI_Val_8		0,449		0,563	0,487						
IMI_PerChoi_2		0,552							0,3		
IMI_PerChoi_5				0,537		0,302					
IMI_PerChoi_6						0,619					
Recod_IMI_PercChoi_3							0,878				
Recod_IMI_PerChoi_1								0,81			
Recod_IMI_PerChoi_4		0,536					0,514				-0,371
Recod_IMI_PerChoi_7								0,711			
Recod_IMI_PerChoi_8		0,336	0,328					0,562		-0,338	
Intent_Atti_1	0,911										
Intent_Atti_2	0,943										
Intent_Atti_3	0,933										
Intent_Atti_4	0,921										
Intent_Atti_5	0,933										
Intent_Atti_6	0,903										
Intent_SubjNo_1	0,382				0,406					0,713	
Intent_SubjNo_2	0,373					-0,372	-0,438		0,332		
Intent_SubjNo_3				0,308					0,832		
Intent_PercBeh_1			0,683			0,327					
Intent_PercBeh_2			0,725							0,418	
Intent_PercBeh_3						0,807					
Intent_PercBeh_4			0,848								
Intent_PercBeh_5						0,693					
Intent_PercBeh_6			0,424			0,565		0,325			
Intent_PercBeh_7			0,741	0,318							
Intent_PercBeh_8			0,873								
Intent_PercBeh_9			0,777								
Intent_1	0,318		0,497						0,533		

Factor analysis attitude, subjective norm, perceived control & intention

Rotated Component Matrixa

	Components			
	1	2	3	4
Intent_Atti_3	0,954			
Intent_Atti_2	0,928			
Intent_Atti_6	0,927			
Intent_Atti_4	0,915			
Intent_Atti_1	0,909			
Intent_Atti_5	0,904			
Intent_SubjNo_1	0,485		-0,38	
Intent_SubjNo_2	0,327		-0,302	0,508
Intent_SubjNo_3				0,853
Intent_PercBeh_8		0,882		
Intent_PercBeh_4		0,835		
Intent_PercBeh_9		0,777		
Intent_PercBeh_2		0,758		
Intent_PercBeh_7		0,758		
Intent_PercBeh_1		0,726	0,313	
Intent_PercBeh_5			0,783	
Intent_PercBeh_6		0,433	0,683	
Intent_PercBeh_3		0,326	0,676	
Intent_1	0,301	0,486		0,637

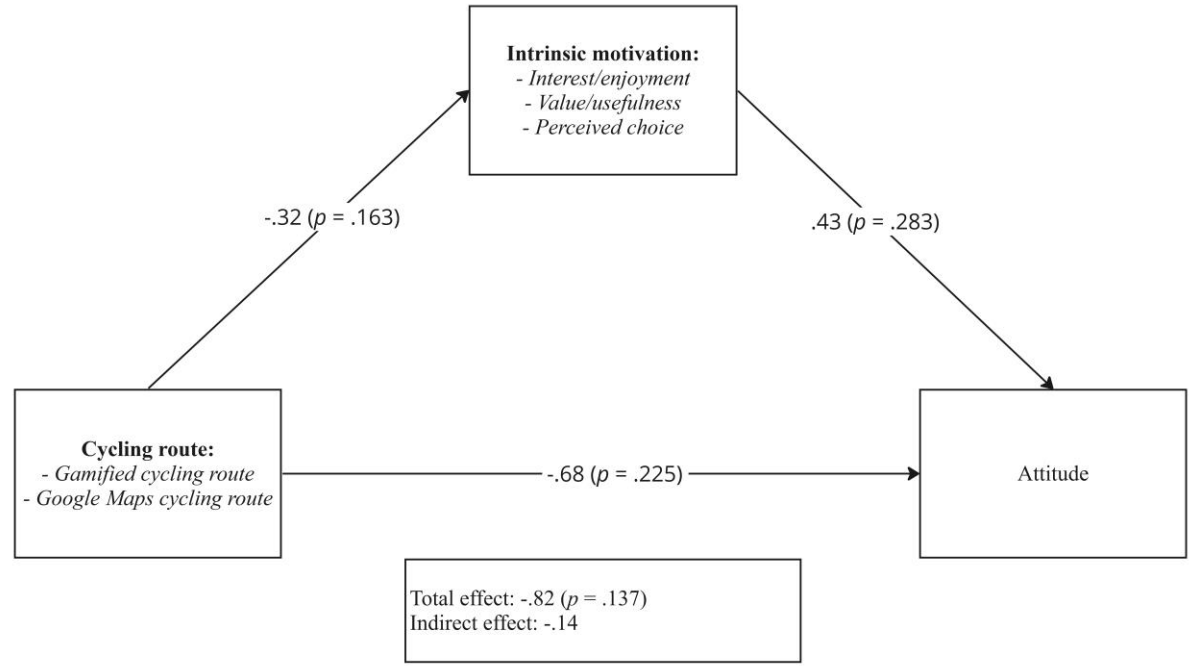
Factor analysis intrinsic motivation

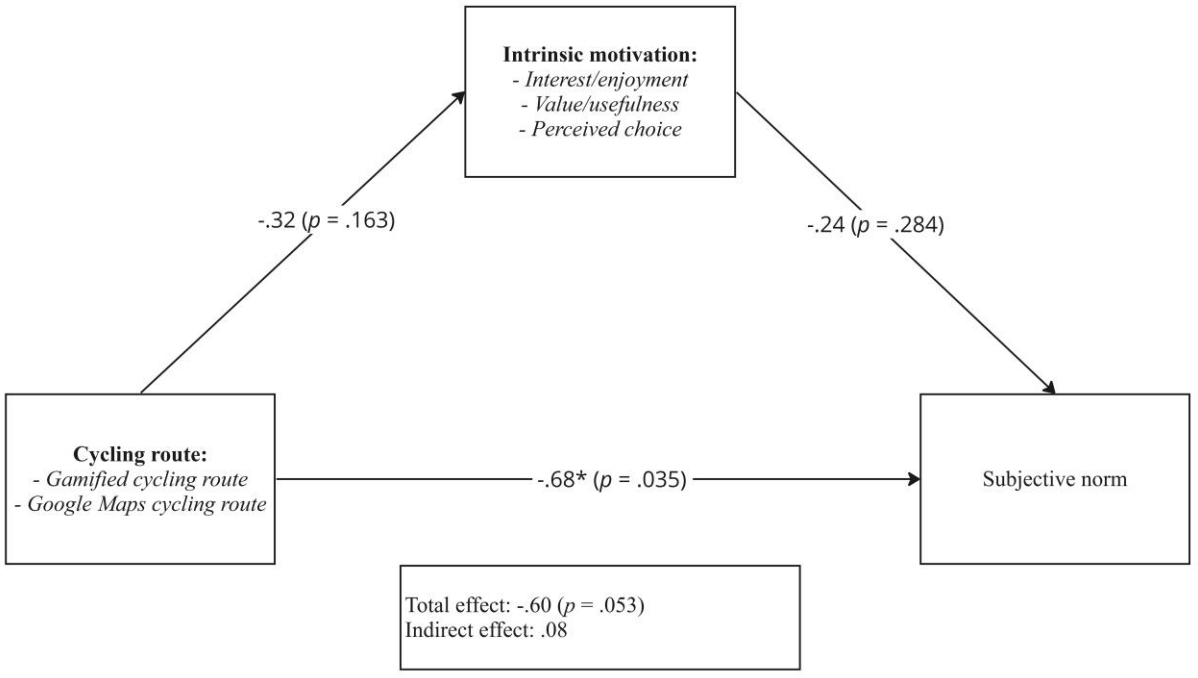
Rotated Component Matrixa

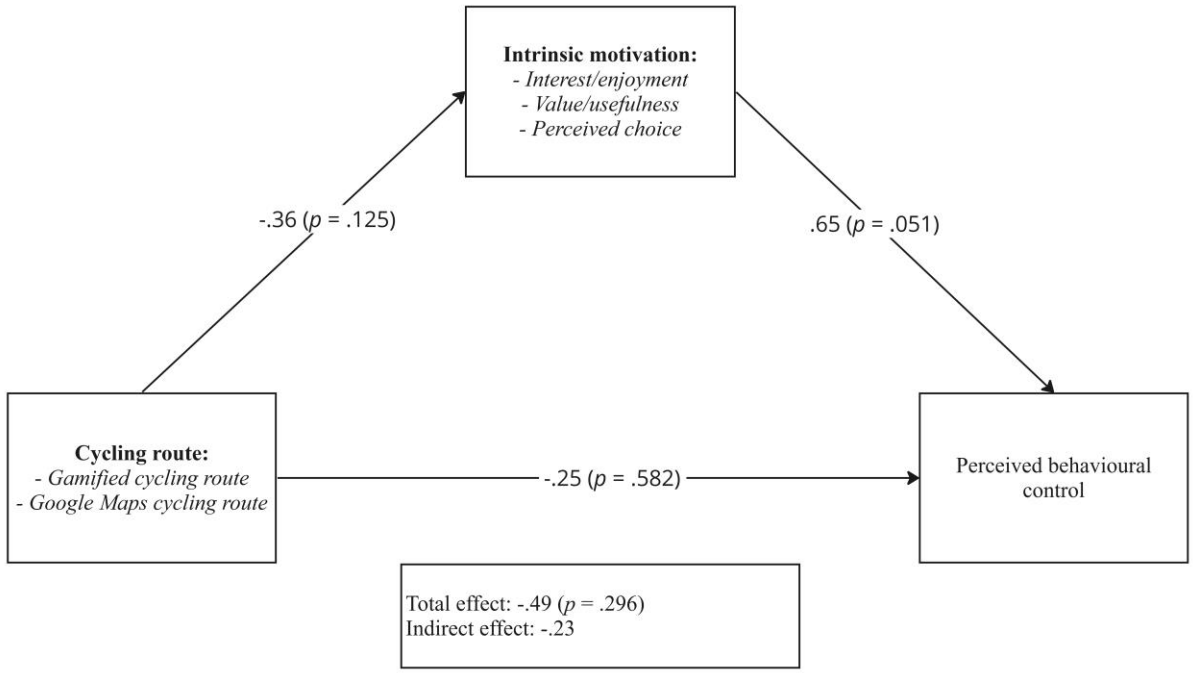
	Component					
	1	2	3	4	5	6
IMI_Inter_2	0,917					
IMI_Inter_8	0,866	0,335				
IMI_Inter_1	0,854					
IMI_Inter_7	0,843					
IMI_Inter_3	0,841					
IMI_Inter_6	0,511	0,504				0,389
IMI_Inter_5	0,521					0,709
IMI_Inter_4		-0,365		0,815		
IMI_Val_4		0,894				
IMI_Val_3		0,864				
IMI_Val_5		0,706	-0,308	-0,412		
IMI_Val_1		0,704	0,398			
IMI_Val_8		0,665	0,323			
IMI_Val_6			0,846			
IMI_Val_2			0,822			
IMI_Val_7			0,811			
IMI_PerChoi_2	0,542				-0,351	
IMI_PerChoi_5		0,559		-0,39		
IMI_PerChoi_6			0,484	-0,429	0,306	
IMI_PerChoi_3				0,822		
IMI_PerChoi_4	-0,514			0,555		0,419
IMI_PerChoi_1					0,872	
IMI_PerChoi_7					0,804	
IMI_PerChoi_8	-0,382				0,604	

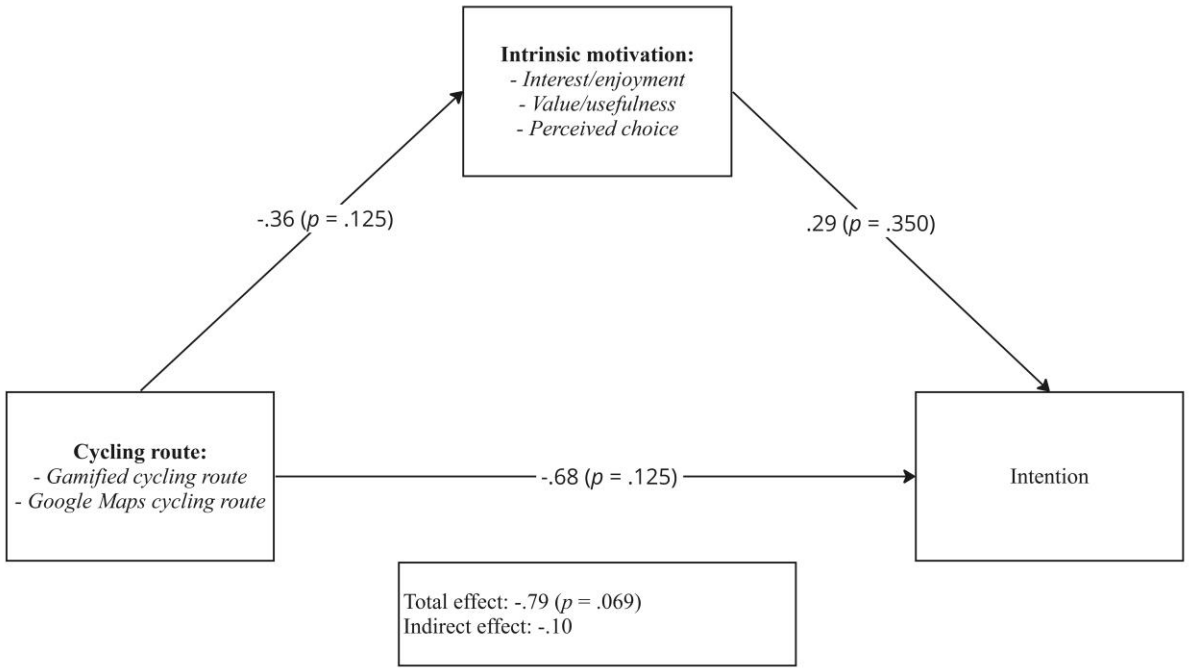
Appendix H

All the mediation analyses






Intrinsic motivation:
- Interest/enjoyment
- Value/usefulness
- Perceived choice
-.36 (p = .125)
.65 (p = .051)
Cycling route:
- Gamified cycling route
- Google Maps cycling route
-.25 (p = .582)
Perceived behavioural control
Total effect: -.49 (p = .296)
Indirect effect: -.23


Intrinsic motivation:
- Interest/enjoyment
- Value/usefulness
- Perceived choice
-.36 (p = .125)
.29 (p = .350)
Cycling route:
- Gamified cycling route
- Google Maps cycling route
-.68 (p = .125)
Intention
Total effect: -.79 (p = .069)
Indirect effect: -.10

Appendix I

Examples of received email (anonymized)

Dag Femke,

Complimenten voor hoe je het hebt opgezet. Leuk om deze techniek een keer uit te proberen. Je kunt mijn vrouw ook uitnodigen.
Zij heeft de fiets app ook.
Haar mailadres is: [redacted]

Succes met je onderzoek en afstuderen. 🍀🍀

Hartelijke groet,

Beste Femke,

Graag zou ik de resultaten van de fietsroute ontvangen.
Ik vond het erg koud, wat weer betreft zou ik het liever in een ander jaargetijde doen.
Groeten [redacted]

Hallo Femke,

Vandaag heb ik de fietsroute afgelegd en de vragenlijst ingevuld. Omdat er in de vragenlijst geen ruimte was voor opmerkingen doe ik dit even via de mail.
Ik vond het een leuke route om te fietsen maar vond het gebruik van de AR eerder belemmerend dan stimulerend werken. Ik vond het storend om steeds te moeten afstappen, handschoenen uit, telefoon ontgrendelen, route controleren, nog niet op de juiste locatie 100 meter verder het hele verhaal opnieuw.... Voor mij voegde de AR niet veel toe eerlijk gezegd.
Wat ik ook lastig vond is dat ik steeds weer vanuit de website terug moest naar de mail om de handleiding te checken. Het lukte me pas bij de 3e locatie om een fiets te vinden terwijl ik wel op de juiste plekken was geweest. Daardoor blijf je de handleiding steeds maar weer lezen en dan moet je steeds wisselen tussen de kaart en de mail. Een handleiding in de app/website zou veel handiger zijn.
Op zich vind ik dit wel een leuke manier om mensen te stimuleren meer te bewegen maar ik vind het nog niet laagdrempelig genoeg.
Veel succes met je onderzoek!

Met vriendelijke groet,

Appendix J

Coded qualitative data from survey

Groep	Mee gedaan?	Gegeven antwoord	Code 1	Code 2
A	Nee	Ik vond de route te lang	Vind route niet leuk/goed	
B	Nee	Ik vond de route niet leuk	Vind route niet leuk/goed	
B	Nee	Omdat ik steeds moest stoppen	Route werkte belemmerend	
A	Ja, maar een gedeelte gefietst	Google Maps had 'problemen' met de route (zie ook toegestuurde mail)	Route werkte niet goed	
A	Ja, maar een gedeelte gefietst	de link naar Google maps deed het niet, dus zelf maar via het plaatje gaan fietsen	Route werkte niet goed	
A	Ja, maar een gedeelte gefietst	Ik begreep niet hoe het werkte	Begreep niet hoe het werkte	
A	Ja, maar een gedeelte gefietst	Het was donker (half 10 s avonds), mijn versnelling was bevroren, en ik wilde zeker weten dat ik bijtijds thuis zou komen.	Weer	
A	Ja, maar een gedeelte gefietst	Hij klopte niet helemaal	Route werkte niet goed	
B	Nee	Te koud	Weer	
B	Nee	Ziek	Ziekte	
A	Ja, maar een gedeelte gefietst	Ik was tot aan het oorlogsmonument, daar heb ik foto gemaakt! Daarna was de route weg en kon ik hem niet herstarten! Uk ben toe rechtsreeks terug gefiets!	Route werkte niet goed	
A	Ja, maar een gedeelte gefietst	Bar slecht weer 🤦‍♀️	Weer	
B	Nee	Geen tijd gehad	Geen tijd	
B	Nee	Geveld door de griep	Ziekte	
A	Nee	Geen tijd en slecht weer	Geen tijd	Weer
A	Nee	Ziekte	Ziekte	
A	Nee	Geen tijd gehad	Geen tijd	
A	Nee	Slecht weer	Weer	
A	Nee	Niet aan toe gekomen en nu te slecht weer.	Geen tijd	Weer
A	Ja, maar een gedeelte gefietst	Ik heb een verkeerde afslag genomen	Verkeerde route gefietst (route werkte niet goed)	
B	Nee	te weinig energie	Ziekte	
B	Ja, maar een gedeelte gefietst	Ik durfde op mijn eentje niet het bos in naast de Bergweg	Durve niet alleen	
A	Nee	eerst niet aan gedacht en later moest ik meer werken i.v.m. ziekte	Geen tijd	
B	Nee	Geen tijd voor gevonden, fiets ook minder in deze donkere maanden	Geen tijd	Weer

Appendix K

Coded qualitative data from emails

Groep	Mee gedaan?	Gegeven antwoord	Code 1	Code 2	Code 3
B	Ja	Complimenten hoe je het hebt opgezet, leuk om te proberen	Positief		
B	Nee	Veel gedoe	Vind route niet leuk/goed		
B	Nee	Route is langer dan aangegeven	Vind route niet leuk/goed		
B	Nee	Kon route niet openen/spel werkte niet	Route werkte niet goed		
B	Nee	Kon route niet openen, route is langer dan aangegeven & te koud	Weer	Route werkte niet goed	Route niet ontvangen
B	Ja, route A gefietst	Kon route niet openen	route werkte niet goed		
A	Nee	Maps gaf verkeerde route aan	route werkte niet goed		
B	Nee	geblesseerd	Ziekte		
A	Nee	Ziek	Ziekte		
A	Ja	Maps gaf verkeerde route aan	Route werkte niet goed	Route niet ontvangen	
B	Nee	Vond de route te ver, dacht dat de route langs Denekamp kwam	Vind route niet leuk/goed		
A	Nee	Heeft corona	Ziekte		
A	Ja	Vond het gebied mooi, beschrijving niet goed gelezen dus verkeerde route gefietst (fout in Google	Route werkte niet goed	Weer	
B	Ja	Spel werkte niet goed wat irriteerde. Vind traditionele manier (met fietsknooppunten) fijner	Route werkte niet goed	Route werkte belemmerend	
B	Nee	Onderzoek loopt te kort, geen tijd	Geen tijd		
A	Nee	Het lukt niet om de route te fietsen	Geen reden gegeven		
A	Ja	Beschrijving niet gelezen & verkeerde route gefietst	Route werkte niet goed		
A	Nee	Heeft geen tijd om te fietsen	Geen tijd		
A	Ja	[illegible] fietsen door kou, gladheid & verkoudheid. Uiteindelijk wel gefietst maar vond het erg koud en	Weer	Ziekte	
A	Ja	Beschrijving niet gelezen & verkeerde route gefietst. Mede door de kou niet verder gefietst dan	Route werkte niet goed	Weer	
B	Nee	Ziekte	Ziekte		
B	Nee	Vond de hoeveelheid herinneringsmails te veel	Te veel mails		
B	Nee	"Dit jaar komt er van fietsen niets meer"	Andere omstandigheden/geen reden		
A	Nee	Lukt niet om de route voor 1-1 te fietsen	Geen tijd		
B	Ja	AR werkte eerder belemmerend dan stimulerend. Vond het idee leuk maar het is niet laagdrempelig genoeg	Route werkte belemmerend		
A	Nee	Gezondheid	Ziekte		
B	Ja, maar survey niet i	Geen rode fietsen kunnen vinden tijdens het fietsen (ook niet goed met computers/telefoon)	Route werkte niet goed		
B	Ja	Vond AR ergelijk en belemmerend werken	Route werkte belemmerend		
A	Ja	Link werkte niet	Kon zich niet aanmelden via landingspagina		
A	Nee	Mail adres werd niet geaccepteerd	Kon zich niet aanmelden via landingspagina		
A	Nee	Route niet ontvangen	Route niet ontvangen		
A	Ja	Route niet ontvangen	Route niet ontvangen		
A	Nee	Vind het moeilijk om te zien waar de route precies begint en hoe te fietsen.	Route niet ontvangen		
A	Nee	Route niet ontvangen	Route niet ontvangen		
B	Nee	Aangemeld, maar niets meer gehoord.	Route niet ontvangen		
A	Ja	Ben de fietsroute kwijt	Route niet ontvangen		