

# Nature experience 2.0

Exploring the influence of a digital route app on experiencing nature



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experiencing nature

Thesis report

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## Preface

It is often said that we do not just use digital technologies; we live with it. Ironically, I do not consider myself as someone who 'lives' with digital technologies. A smartphone is something that I only have had for a relatively short amount of time and until I started this thesis, I had no apps on it. Maybe it was because of this personal distance towards digital technologies that my interest was very much sparked in this topic. And as a forest- and nature conservationist student with a particular interest in the relation between nature and people and how to (re)connect the two, I was very curious to discover more about the opportunities of using digital technologies in that regard. Luckily I was able to do so in the form of a thesis for my master program, of which this report is the end product.

I would like to thank a number of people that have guided me throughout the process of writing my MSc thesis and who have played an important part in the realization of it. First of all, I would like to thank my official supervisor, Arjen Buijs, and 'unofficial' supervisor, Bas Breman, for all the useful feedback, advice and interesting ideas. Also a big thanks to all the participants who participated in this research; it is needless to say that without you, this study would not have been possible. And finally, a special thanks to Wim Braakhekke, and to all of the other volunteers and employees of the information center Renkums Beekdal and lunchroom de Beken for welcoming me with open arms and helping me in the process of finding and interviewing the participants.

## Abstract

With the prevalence of digital technologies in our everyday life's, the time people spend in nature is decreasing. However, with this current trend also new types of nature experiences have arose. For this study, the focus has been on hybrid digital nature experiences, which do involve direct contact with nature but this contact is to a greater or lesser extent mediated by the use of a digital technology. In particular, this study has examined the influence of using a route app on experiencing nature. Six sensitizing concepts were identified that provided insights in this, including consciousness, immersion, embodiment, amusement, interest and dedication. As a specific case, the app Crossbill Routes Veluwe was chosen. This app gives notifications with route directions and all kinds of information relating to the surrounding environment. In total, 24 participants were interviewed of which half formed the experimental group (walked with the route app) and the other half the control group (walked without the route app). The results show that the use of the route app had a positive influence on consciousness, embodiment, amusement and interest. From the interviews it became evident that the participants in the experimental group were more aware of their environment due to the information provided by the app and that (certain) sensory perceptions of nature had increased. This positive influence was less strong for immersion, as many participants indicated that the app did not really contribute to feelings of being absorbed in or surrounded by nature and nature connectedness. The use of the app also affected the amusement and interest modes of experience, as it significantly contributed to feelings of ease and educating the participants. The influence of the app was less apparent for the dedication mode of experience, as the participants in the experimental group did not change their ideas of nature. The most significant difference between the experimental and control group was related to the (lack of) information. Because of the information provided by the app, the participants in the experimental group experienced different things compared to the participants in the control group. Also other themes emerged from the interviews, including the intention with which one goes to nature, social interaction, (un)known areas, the variation and balance of information and nature and spoken information from the app. Therefore, it can be argued that the influence of the app on experiencing nature is very much situational and depends on all kinds of factors. The results showed that the participant's experience of nature was significantly shaped by their interactions with the route app. The information provided by the app would be the biggest influence and potentially the greatest enrichment of the app. This information had an effect on many aspects of participant's experience; it made them more aware of the surrounding environment, it stimulated sensory perceptions of nature, and it contributed to an amusing and interesting experience. It can therefore be concluded that the route app is especially interesting for unknown areas, for users that seek a comfortable walk and go to nature with the intention to learn more about the environment, and for those who want to have a more conscious and embodied nature experience.

## Table of contents

Preface.....	ii
Abstract .....	iii
1. Introduction.....	1
1.1 Nature experiences .....	1
1.2 Digital nature experiences.....	1
1.3 Problem statement.....	2
1.4 Research objective .....	3
1.5 Reading guide .....	3
2. Theoretical framework.....	4
2.1 A relational perspective.....	4
2.2 Social-ecological-technological systems.....	5
2.2.1 Social – ecological interactions.....	7
2.2.2 Social – technological interactions.....	7
2.2.3 Ecological – technological interactions .....	8
2.3 The relational nature of experiencing nature .....	8
2.3.1 Consciousness.....	11
2.3.2 Immersion.....	12
2.3.3 Embodiment .....	13
2.4 Five modes of experience.....	14
2.4.1 Amusement .....	15
2.4.2 Change.....	15
2.4.3 Interest .....	16
2.4.4 Rapture .....	16
2.4.5 Dedication .....	16
2.5 Six sensitizing concepts .....	18
2.6 Research question .....	18
3. Methodology .....	19
3.1 Study design .....	19
3.2 Description of the selected route app.....	19
3.3 Data collection.....	21
3.4 Data analysis.....	23
4. Results .....	24
4.1 Overall experience.....	24

4.2 Six sensitizing concepts .....	24
4.2.1 Consciousness.....	25
4.2.2 Immersion.....	30
4.2.3 Embodiment.....	36
4.2.4 Amusement .....	38
4.2.5 Interest .....	43
4.2.6 Dedication .....	48
4.3 Other themes .....	51
4.3.1 Intention.....	51
4.3.2 Social interaction.....	52
4.3.3 (Un)known areas .....	53
4.3.4 Variation and balance.....	54
4.3.5 Spoken information.....	55
4.4 Syntheses of results.....	56
5. Discussion .....	59
5.1 Interpretation of results .....	59
5.1.1 Intention.....	59
5.1.2. Social interaction.....	60
5.1.3 Variation of nature .....	61
5.1.4 Nature connectedness .....	62
5.1.5 The role of environmental education and information .....	62
5.2 Reflection on theoretical framework.....	63
5.3 Reflection on methodology.....	67
6. Conclusions and recommendations .....	70
References.....	72
Appendix I.....	80
Appendix II.....	81
Appendix III.....	86
Appendix IV .....	89

# 1. Introduction

## 1.1 Nature experiences

Nowadays, people are spending less time outdoors due to the rise of urbanization, social media and digital technologies and this affects the relationship between people and nature (Bruni et al., 2017; Soga and Gaston, 2016; Cordell, 2006). Our rapidly increasing connection with the digital world seems to occur simultaneously with a disconnection from the natural world (Schweitzer et al., 2018). The importance of experiencing nature in order to prevent (further) separation of people and nature is often stressed. Experiencing nature can play an important role in fostering feelings of connectedness with nature, and feeling connected to nature is associated with positive values, attitudes and behaviour towards nature (Schweitzer et al., 2018; Soga and Gaston, 2016; Bögeholz, 2006). It appears that experiencing nature can cause a cycle of increased affection towards nature, which enhances the support of and participation in nature conservation (Collado et al., 2015; Kloek, 2013; Wells and Lekies, 2006). Through these processes, nature experiences are often considered to play an important role in combating current environmental and conservation problems resulting from anthropogenic threats (Balmford and Cowling, 2006; Miller, 2005).

People can experience nature in many different ways. Often a distinction is made between direct and indirect nature experiences, depending on the type of interaction with nature. Generally, it is assumed that direct nature experiences involve direct contact with (elements of) physical nature. Indirect nature experiences do not involve this direct contact with physical nature, but relates to contact with what can be called representations of nature. These representations for example include nature-related books, movies and sound clips and can either be realistic or artificial. Therefore, the sensory perception of nature through reading about nature, watching nature and hearing natural sounds without any contact with physical nature are usually also regarded as a form of nature experiences (Duerden and Witt, 2010; Millar and Millar, 1996).

## 1.2 Digital nature experiences

Recently, a new type of nature experience has arose: digital nature experiences (Soga and Gaston, 2016; Ballouard, 2011). In this type of nature experience, digital technologies mediate, augment or simulate the natural world (Kahn et al., 2009). Various digital technologies through which nature can be experienced can be identified (Appendix I). These digital technologies are developed with certain purposes in mind, can be used either indoors or outdoors and seem to open up a whole new range of nature experiences. Based on the type of interaction with nature, two general types of digital nature experiences can be distinguished: indirect digital nature experiences and hybrid digital nature experiences. Indirect digital nature experiences do not involve any contact with physical nature. Examples of this kind of experience include the indoor use of virtual reality and watching (multidimensional) movies. Hybrid forms of digital nature experiences do involve direct contact with physical nature, but this contact is to a greater or lesser extent mediated by the use of digital technologies. Augmented reality and drones are examples of digital technologies that can belong to this type of experience.

Research has shown that not only direct contact with nature, but also exposure to nature imagery and digital nature have a potential to provide several benefits (Hartmann and Apaolaza-Ibáñez, 2008). For example, viewing pictures and images of nature can have cognitive, emotional and

behavioural effects that are positively related to people's connection with nature (Ballew and Omoto, 2018; Levi and Kocher, 1999). Moreover, digital technologies can play an important role in engaging the general public with nature-related issues and contributing to environmental awareness. Experiencing nature through digital technologies could therefore stimulate commitment to nature conservation in the 'real world' (Fletcher, 2017; Sandbrook et al., 2015).

The focus of this study will be on hybrid forms of digital nature experiences. Most nature-related mobile applications (apps) are a type of digital technology that fall under the category of hybrid digital nature experiences, since they often have to be used outdoors. There is a large variety of nature-related apps available at the moment. These apps are often developed with the purpose to let its users enjoy nature, but can furthermore be used to study and support monitoring of nature experiences and contribute to citizen science (Jepson and Ladle, 2015). In particular, the focus of this study will be on route apps. Route apps can be downloaded on smartphones, often for free. In its basic fundamentals, these apps will provide its users with route information, thereby imitating (and replacing) maps of hiking trails. In this way, route apps can also support GPS-tagged site information, route mapping and navigational abilities (Jepson and Ladle, 2015). But nowadays, most route apps offer much more than just route information, as the aim of these apps is often to enhance the nature experience during the hike. This is usually done by providing all kinds of nature-related information in the form of text, pictures, video clips, sound clips etc. at certain points during the hiking route. Some of these apps also include games and quizzes that can be played during the hike (den Ouden, 2014).

### 1.3 Problem statement

For many (young) people, direct nature experiences have been replaced with digital alternatives (Soga and Gaston, 2016; Ballouard, 2011). There has been an increased recognition of the possible influence that digital technologies can have on the relation between people and nature. However, it appears that opinions are divided on whether this influence is positive or negative. Some scholars argue that digital technologies are causing a lack of direct nature experiences, resulting in an *extinction of experience*. They worry that the loss of direct nature experiences will lead to a decreased connection between people and nature (Soga and Gaston, 2016). Moreover, some scholars fear that these often easily accessible digital nature experiences will make people less interested in direct nature experiences, as virtual natural environments are developed with the intention to be enjoyable, impressive and spectacular in order to create 'optimum nature experiences'. This can make direct nature experiences seem boring, disappointing, less exciting and less attractive (Levi and Kocher, 1999).

Others hold a more positive view and argue that there rather appears to be a *transformation of experience*, thereby emphasizing the opportunities of using digital technologies as a means to (re)connect people with nature (Clayton et al., 2017). The potential of digital technologies in attracting (young) people to experience nature is recently being acknowledged, as digital technologies are increasingly becoming ubiquitous and have the ability to make experiencing the natural world possible, even for those who do not have easy access to physical nature (e.g. people living in urban areas). Moreover, the opportunity for people to experience virtual nature can also contribute to some current environmental problems. For example, it allows people to experience (vulnerable) natural areas without actually going there and thereby possibly damaging the natural area. Replacing direct nature experiences by digital alternatives can also reduce CO2 emissions, resource consumption and waste resulting from travelling (Levi and Kocher, 1999).

The debate around whether digital technologies are causing an extinction or transformation of experience reflects a dualistic view between direct nature experiences and (indirect) digital nature experiences. However, due to digital and technological developments, digital technologies are increasingly able to simulate direct nature experiences. Most digital technologies aim to develop highly realistic nature representations and make use of multiple sensory perceptions. This means that the distinction between direct and digital nature experiences becomes more blurred. But even though the distinction between the real and the digital seems to gradually fade away, most scholars in this field of research are still focused on studying the effects of either direct or indirect (digital) nature experiences, often from an environmental psychology based approach (e.g. Duerden and Witt, 2010; Kellert, 2002). These studies are usually based on the assumption that a clear distinction can be made between different nature experiences and that the experiences can be (best) examined from the individual mind. Scientific literature deviating from these assumptions is scarce.

It is also notable that in the existing literature little attention has been given to digital nature experiences that do involve direct contact with physical nature, but in which this contact is mediated by the use of digital technologies. Studying these hybrid forms of digital nature experiences can provide new insights in the influence of using digital technologies during direct nature experiences. In addition, examining the ways in which digital technologies enrich or detract from nature experiences may be useful for explaining human-nature relationships in our current digital era. Understanding how digital technologies influence nature experiences can also be beneficial for developing strategies to keep (young) people attracted to nature in the future. Therefore, it can be considered of importance to get insights in this topic in times where people are spending less time outdoors but at the same time increasingly experience nature by means of digital technologies.

#### **1.4 Research objective**

Since digital nature experiences are a relatively new phenomenon and because digital technologies are constantly changing due to new developments and innovations, scientific literature in this field of research is relatively scarce. How digital technologies are shaping nature experiences and human-nature relationships is still largely unknown. Moreover, most studies regarding nature experiences are focused on the impact of (the loss of) nature experiences on cognitive and emotional aspects of the individual human mind (e.g. Duerden and Witt, 2010; Kellert, 2002). Empirical research that analyses the nature of (digital) nature experiences from a non-individual based approach is lacking. Therefore, the objective of this research is to explore the fundamentals of hybrid forms of digital nature experiences and assess how direct contact with nature is influenced by the use of digital technologies from a relational perspective. The results of this study provide first insights in the ways digital technologies possibly enrich or detract from people's nature experiences.

#### **1.5 Reading guide**

This report consists of six chapters, with the above chapter as the introducing chapter. In chapter 2 the different theoretical approaches and concepts that are used in this study are explained. This chapter ends with the research question of this study. Chapter 3 describes the methods applied in this research. In chapter 4, the results are presented. Chapter 5 discusses the results, theoretical framework and methodology. Finally, chapter 6 provides the main conclusions that can be drawn from this study and recommendations are given.

## 2. Theoretical framework

### 2.1 A relational perspective

The term 'relational' is frequently used in social studies and can be interpreted in various ways, thereby reflecting differing theoretical positions (Blustein et al., 2004). For this study, a relational approach will be explained from social constructionism theory. It can be argued that social constructionists focus on (social) actions that occur between people, thereby creating jointly constructed understandings and realities (McNamee, 2004). This means that social constructionism emphasizes the idea that experiences of reality emerge from people's engagement with others and other contexts (including cultural, historical, socioeconomic, and socio-political contexts), instead of being created within each individual (Blustein et al., 2004). So rather than examining individuals in his or her own context in order to understand the relational, social constructionism proposes that the relational configurations (i.e. different contexts) that construct individuality should be explored. Moreover, according to social constructionism, phenomena such as knowledge, understanding, meaning and experiences do not only exist in someone's mind but arise from the interaction of individuals with others or other things. Therefore, the processes related to these phenomena are considered as inherently relational (McNamee, 2004).

According to social constructionism, people work collectively to construct artifacts, which can be defined as anything created by humans. Social constructionists usually stress these artifacts that are developed through collective interaction, thereby emphasizing the importance of tools, media, (digital) technologies and contexts in individual developmental processes. Acquiring knowledge for instance is according to social constructionism a process that takes place within specific contexts and is influenced by the use of tools, media and (digital) technologies. These mediations can contribute to the learning process and it is considered that external mediation is essential for expanding the capabilities of the human mind (Ackermann, 2001).

For this study, the points of view as put forward by social constructionism theory are adopted. Building on these assumptions, in this study the term relational refers to the idea that all kinds of phenomena and processes, including experiences, come about through interaction with others or other things. Adopting a relational perspective, thereby taking into account different factors and contexts, can provide a more comprehensive understanding and explanation of experiences compared to when experiences are merely studied from the individual mind. This is especially relevant for digital nature experiences, as the mediation of digital technologies plays a significant role in constituting this type of experience. So in order to gain a better understanding of the way digital nature experiences are shaped, social constructionist theory is used as a starting point to show the relational nature of digital nature experiences. Therefore, the aim of this study is to use a relational perspective, explained from social constructionist theory, as a means to explore the complex interactions and interconnections that play a role in constituting hybrid digital nature experiences.

The relational approach will be given more substance in the following sections of the theoretical framework. In the next section, the social-ecological-technological systems approach will be described and explained from a relational perspective. In doing so, it will also be linked to different concepts and views that are in the same line of thought. In section 2.3, the fundamentals of (digital) nature experiences will be explained from a relational perspective.

## 2.2 Social-ecological-technological systems

Over the past decades, many scholars have considered human systems, including their perceptions, values and behaviours, and biophysical elements of ecosystems as being interrelated. This gave rise to the idea of social-ecological systems, which refers to the complex, dynamic and integrated systems of human-nature interaction (Alessa et al., 2009). Recently, the need for incorporating a technological component in the social-ecological systems approach is increasingly being emphasized (McGinnis and Ostrom, 2014; Smith and Stirling, 2008). With the current rise of (digital) technologies and its growing impact on human's everyday life's, it seems that this component can no longer be ignored (Gulstrud et al., 2018). Recognizing the influence of (digital) technologies has resulted in the expansion of the concept to social-ecological-technological systems (SETs) (Figure 1). According to Smith and Stirling (2008), this amplification of the concept is important since *"technologies have profound mediating affects in social-ecological systems"* (p. 4). Other scholars that support this viewpoint are Gulstrud et al. (2018), who argue that technologies mediate the interaction between people and nature *"by opening up new possibilities of perceiving and accessing social-ecological interactions"* (p. 87), and White and Wilbert (2009), who state that *"knowledges of our world are, within such social natures, ever more technologically mediated, produced, enacted, and contested"* (p. 6).

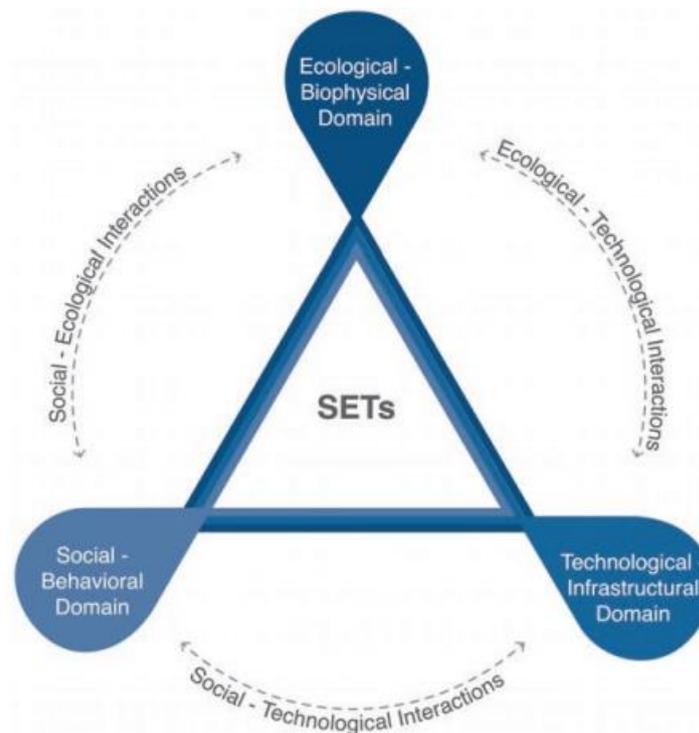


Figure 1: Conceptualization of the social-ecological-technological (SETs) approach (adopted from Depietri and McPhearson, 2017)

By incorporating a technological factor in the social-ecological equation, the SETs approach aims to move beyond the limitations that come with merely focussing on social-ecological systems (Depietri and McPhearson, 2017; McPhearson et al., 2016). One of the benefits of such an integrated approach is that it allows for transdisciplinarity, meaning that exhaustive disciplinary knowledge is exchanged which can for example result in more effective management and policies (Niles and Tachimoto, 2018). Moreover, inclusion of technology in the social-ecological system approach often results in

significantly different outcomes compared to situations in which this component is left out (Alessa et al., 2009).

Even though the SETs framework has been mainly applied in studies relating to urban systems (e.g. Gulsrud et al., 2018; Depietri and McPhearson, 2017; McPhearson et al., 2016), it can also be a useful perspective for assessing digital nature experiences. Most research on nature experiences has been primarily focussed on the interaction or transaction between humans and (physical) nature, i.e. on social-ecological systems (e.g. Dean et al., 2019; Van Marwijk, 2009; Wells and Lekies, 2006; Miller, 2005; Kellert, 2002; Borrie and Birzell, 2001). However, it appears that emerging digital technologies are increasingly influencing human-nature experiences (Bruni et al., 2017; Clayton et al., 2017; Soga and Gaston, 2016; Kahn et al., 2009). Therefore, taking into account a technological component when studying nature experiences can be useful, especially when analysing hybrid forms of nature experiences.

It can be considered that hybrid forms of digital nature experiences consist of a social, ecological and technological component. The social component refers to human individuals, who experience (digital) nature through their mind, body, senses and behaviour, the ecological component comprises the physical elements of nature that are being experienced and the technological component involves the digital technologies that mediate the human-nature experience. Hybrid digital nature experiences are situated at the intersection of these social, ecological and technological components of the SETs approach and thus constructed in and dependent on social, ecological and technological contexts. This means that these contexts or components (partly) determine the experience, and that the mediation of digital technologies influence and change the nature experience. Exploring hybrid forms of digital nature experiences from the SETs approach can be helpful for understanding the interactions between social, ecological and technical components of this type of digital nature experience as this approach allows for equal emphasis on all three interrelated components.

The SETs framework itself can also be considered as a mixed or hybrid approach, as it combines multiple system components and emphasizes their intertwinement (Depietri and McPhearson, 2017). Hybrid digital nature experiences therefore correspond to the SETs approach, as they move between direct and indirect nature experiences, and between the changeable interface of digital technologies, humans and nature. Starting from the notion of mixed or hybrid systems also allows for other concepts in the same line of thought. An interesting term relating to hybridity is cyborgs, which can be described as a human being whose physical abilities are extended beyond normal human capabilities by technological elements that are interwoven with the body (Haraway and Teubner, 1991). A cyborg can thus be defined as a hybrid creature, composed of an organism and a machine (Haraway, 2013). In this study, cyborgs can be related to hybrid forms of digital technologies and humans. Insights in hybridity and cyborgs can therefore be helpful in understanding and expanding the notion of (digital) nature experiences.

The SETs approach is also in line with a relational perspective, as it assumes that social, ecological and technological components interact with each other and are related to each other. Moreover, these three components can be considered as differing but holistic units of analysis that are interdependent and inseparable. White and Wilbert (2006) emphasize the relational character of social, ecological and technological factors by stating that humans are *“ever more entangled with things, with technological, cultural and ecological networks and diverse hybrid materialities”* (p. 100).

Assigning this kind of autonomy and agency to materiality's such as digital technologies also reflects a relational approach (Behagel et al., 2017). According to McPhearson et al. (2016), taking up such a relational approach challenges many fields of study as social, ecological and technological components will have to be more fully integrated into theoretical frameworks and empirical studies. This study aims to do so, and by considering the relational nature of social, ecological and technological components, the SETs approach is thought to be an useful foundation for this study.

In the following sections, the different interactions from the SETs systems approach will be given more substance by linking it to ideas and concepts that are in the same line of thought.

### **2.2.1 Social – ecological interactions**

It used to be generally assumed that the world consists of a nature-culture dichotomy, a view that considers nature and culture as distinct (Smith, 2017; Malone and Ovenden, 2016; Cronon, 1996). However, this view is shifting, and nowadays many scholars that study social-ecological interactions argue that ecological and social systems cannot be considered independent from each other because these systems are highly interconnected and influential. So rather than perceiving nature and culture as separate, the interrelatedness and inseparability of the two is currently often being recognized. This close relation for example appears from the services that both ecological and social components can offer each other. Ecological systems provide all kinds of resources for social systems, and in turn, ecological systems can benefit from social stewardship (Markolf et al., 2018). Some scholars moreover emphasize that nature is not only ecologically or biophysically, but also socially constructed (Fuentes, 2010; Haraway 2003). From this viewpoint, the idea that experiencing nature is merely based upon perceiving physical nature through cognitive processes in the individual mind is dismissed. Instead, this physical nature is socially constructed, making nature experiences socially constructed. This is amongst others supported by Millar and Millar (1996), who argue that even though nature is a physical space, it is perceptually and socially constructed and often produced by human's who attribute meaning to it. Moreover, it can be argued that human's both shape and are shaped by their (natural) environments, reflecting the relational character of these processes. These shaping processes partly happen through the allocation of meanings and values to natural places, which derive from experiencing that place. Hence, it can be argued that each component of human-nature systems defines each other. Consequently, the components constituting nature experiences can be considered as mutually dependent and therefore relational (Hartig, 1993).

### **2.2.2 Social – technological interactions**

Besides socially constructed physical nature, more factors play a role in constituting nature experiences. It appears that digital technologies increasingly influence the ways people experience nature (Arts et al., 2015). A sociocultural and technological context is therefore particularly present in digital nature experiences. Digital technologies are something that stems from human culture and are produced by humans, often with the purpose to serve humans. This means that digital technologies are highly influenced by cultural components. But besides digital technologies being socially constructed, nature experiences mediated by digital technologies are also socially constructed. Corresponding to this idea is the concept of 'the spectacle', which can be defined as *"the mediation of relations between humans and nature through images"* (p.734, Büscher, 2016). This idea refers to the fact that digital technologies are highly influenced by the person(s) who develop them. The developers are enabled to reimagine nature and reflect their own ideas of nature through these digital technologies, thereby highly mediating nature experiences (Büscher, 2016).

This is supported by McPhearson et al. (2016), who argue that the extent to which mediation occurs depends on how and by whom the digital technology is developed. Moreover, a study by Zmihorski et al. (2013) showed that nature conservation organisations are mostly non-objective when using digital technologies to influence and mediate human-nature relationships. Hence, human-developed digital technologies highly mediate it's users relation to the natural world, which highlights the intertwinement of social-technological interactions and substantiates the argument that digital nature experiences are socially constructed.

### **2.2.3 Ecological – technological interactions**

A concept that has recently arose and is in line with the idea of ecological-technological interactions is that of 'digital conservation', which refers to "*the broad range of developments at the interface of digital technology and nature conservation*" (p. 661, Arts et al., 2015). With this concept, the impact and significance of the profound ways through which digital technologies are changing nature conservation is stressed. Digital technologies are increasingly playing a role in shaping nature conservation discourses and practices, thereby showing the intertwinement of ecological and technological components nowadays. Some scholars even argue that the natural and the artificial, including digital technologies, are increasingly merged together (Malone and Ovenden, 2016). Others take this idea a step further and argue that in the future 'real spaces' and 'virtual spaces' will become completely intertwined, which, according to them, makes perceiving the two spaces as distinct categories no longer useful. The idea that meaningful distinctions between lived and mediated reality are fading stems from new media studies, in which it is often argued that because of the profound intertwinement of digital technologies and media in human's everyday life, it makes no sense to maintain a clear distinction between them. However, other scholars argue that it is important that a distinction remains, since otherwise it would mean that lived reality cannot be considered as being separate from mediated reality, which could cause problems for nature conservation as this is about conserving 'real' nature that is detached from this mediation. After all, even though digital technologies are increasingly being used for nature conservation purposes, these conservation practices are aimed at conserving 'real' and 'lived' nature, not virtual species and habitats. So despite nature conservation being increasingly influenced by digital technologies and the intertwinement of ecological and technological components, some scholars stress the importance to remain a meaningful distinction between the two (Büscher, 2016).

### **2.3 The relational nature of experiencing nature**

For this study, nature experiences are explained and analysed from a relational approach. This can be helpful for analysing hybrid forms of digital nature experiences, as many factors seem to play a role in constituting this type of experience. Moreover, this study aims to intervene in the general assumption that experiences are built on processes that happen in the individual mind, and therefore can be best explained from a cognitive or emotional based approach. Even though experiences are located in the brain, many factors besides mental processes seem to influence an experience. Showing the nature of experiencing from a relational perspective, thereby putting forth the idea that experiences are embedded in all kinds of relations, can be helpful to better comprehend the fundamentals of digital nature experiences. Exploring the relational nature of hybrid forms of digital nature experiences will also show a different perspective and therefore complement the existing literature on (digital) nature experiences.

An experience can be defined as *“a continuous and fluid process of interacting with the world through our bodily senses and perceptual concepts”* (p. 70, Zylstra, 2014a). Nature experiences can then be defined as *“human interaction with nonhuman species and natural environments”* (p. 19, Giusti et al., 2014). On the one hand, these definitions reflect a relational view since experiences are considered as being constituted in interaction. On the other hand, it is assumed that this interaction merely takes place between physical nature and perception of the human mind. Indeed, the way people experience nature partly depends on social and ecological factors, which in turn are related to temporality and spatial qualities (Millar and Millar, 1996). However, it should be noticed that human perception is highly mediated by other, socially constructed phenomena. According to Patterson et al. (1998), experiences are *“mutually defined (co-constituted) by the transactional relationships among settings, individuals with unique identities, and situational influences”* (p. 427). From this point of view, the author argues that the fundamentals of experiences lie in relational emerging narratives instead of predictable outcomes resulting from one-way causal interactions, a perspective mostly adopted by an environmental psychology based approach. The relations between nature characteristics, activities in nature and nature experiences have received relatively little attention in scientific literature. Even though nature experiences are personal, they are shaped by ecological or aesthetic, social and cultural factors and a crucial part in understanding people’s relationships with nature (Tyrväinen et al., 2007). Morse (2011) also touches upon this idea as the author mentions that experiences are characterized by mediation, thereby referring to social and cultural phenomena that influence experiences.

Hybrid forms of digital nature experiences are a specific example that show the relational nature of experiencing. Corresponding to the ideas as put forward by social constructionism and the SETs approach, (digital) nature experiences are not merely shaped by mental activities that exist in the brain, but are rather something relational. Hence, nature experiences can be explained as being embedded in all kinds of relationships and evolutionary, sociocultural and motivational contexts (Hartig, 1993). Moreover, in line with the SETs approach, it can be considered that hybrid forms of digital nature experiences are constituted in the interaction of the individual with the digital technology and the physical environment, at which the digital technology mediates the contact between the individual and the physical environment.

Because experiences are subjective, unrepeatable and unique for each individual, it is often considered as an elusive phenomenon of human life. This makes it difficult to analyse and understand other people’s experiences (Zylstra, 2014a). It can be argued that some dimensions of our complex experiences are ineffable, out of our reach and beyond human ability’s to describe them. Hence, the complex nature of experiences remains unknown. However, attempting to examine nature experiences can provide useful insights that may help to understand the ways people engage and connect with nature, which can be useful for nature conservation and policies. There are several aspects that influence how contact with nature is being experienced. Since there are no pre-set theoretical frameworks for digital nature experiences existing at the moment, the aspects used for this study stem from various scientific research and literature on (nature) experiences.

A large variety of qualitative studies has attempted to investigate and explain the working of nature experiences. Research on the aspects that constitute nature experiences can have different angles of approach. For example, experiences can be explained from an environmental psychology based approach, which is concerned with studying relationships between people and the environment from

the perspective of the individual mind (Gifford, 2014). The article by Jacobs (2006) for instance provides a comprehensive description of the working of experiences and several processes and factors that influence this. However, since the aim of this research is to examine the working of experiences from a relational approach, exploring nature experiences from an environmental psychology perspective is not that suitable. Other literature on the various aspects that can shape experiences often originate from studies in social theory, an approach that aims to establish scientific tools and ways of thinking that are used to examine and interpret social phenomena (Harrington, 2005). This is in line with the relational approach adopted for this study. Therefore, in a search for scientific literature that explains the fundamentals of (nature) experiences, the focus has been on studies that do so from a relational and/or social theory based approach.

While reading through various literature on the topic of nature experiences stemming from relational and social theory based approaches, several aspects that influence how nature is experienced came to light. The article by McCarthy and Wright (2007) was considered particularly helpful in this regard and was therefore used as an inspirational source, as this article provides an extensive and comprehensive description of the nature of experiencing in general and experiencing with technology in particular. The ideas behind their arguments are derived from the ways of thinking of the pragmatic philosophers John Dewey and Mikhail Bakhtin. In the article of McCarthy and Wright, a pragmatic approach is aligned with social theory and a relational approach, and experiences are understood as being constituted by the interaction between individuals and others or objects. In addition, it is recognized that experiences always occur in different contexts (e.g. social and material contexts), and also the 'feltness' of experiences is emphasized.

From the article by McCarthy and Wright, that is inspired by the works of Dewey and Bakhtin, three aspects that influence experiencing stood out: *consciousness*, *immersion* and *embodiment*. The article by McCarthy and Wright puts emphasis on the sociality and context-dependency of these three aspects, thereby showing the relational nature of them. While further searching for these aspects, it became evident that they have been frequently referred to in other scientific literature on (nature) experiences, especially in studies relating to leisure, recreation and tourism. Various articles have been consulted to come up with suitable descriptions of the three aspects from a relational approach, which are outlined in the upcoming sections.

Besides discovering the three aspects that seem to play a significant role in the working of (nature) experiences, in the consulted literature on the topic of experiencing several categorisations were come across that typify different types of leisure-related experiences. These studies on leisure, recreation and tourism that are concerned with the topic of experiencing often stem from social theory. The 'modes of experience' by Elands and Lengkeek (2000) will be adopted and adjusted to the purpose of this study. This particular categorisation model has been chosen because it can be related to various recreational-related experiences (including hybrid forms of digital nature experiences), and the characteristics corresponding to the modes of experience can help exploring and explaining different types of hybrid digital nature experiences. The five modes of experience encompass *amusement*, *change*, *interest*, *rapture* and *dedication* and will be described in more detail in section 2.4.

So for this study, the aspects that have been identified as contributing to a valuable nature experience are *consciousness*, *immersion* and *embodiment*. These aspects are chosen as they can

arise from interaction between individuals and the physical environment and shape nature experiences, thereby reflecting a relational nature. Moreover, all three aspects can be related to digital nature experiences, which makes them suitable for this research. In addition, the five modes of experience *amusement, change, interest, rapture* and *dedication* will be used to explore the characteristics of different types of (digital) nature experiences. The three aspects and the modes of experience will be further explained in the following sections. Also specific indicators will be identified that correspond to the descriptions of the aspects and the modes of experience. These specific indicators will be used to guide the data collection and analysis.

### 2.3.1 Consciousness

The aspect of consciousness is deeply intertwined with experiences. According to Jacobs (2006), *“Experiencing something implies being conscious of something. Being in a conscious state implies experiencing something”* (p. 93). Therefore, (digital) nature experiences are highly determined by how consciously a person experiences the environment. One can barely be aware of the natural elements surrounding them or feeling completely absorbed in nature (de Vries, 2016). Consciously experiencing (natural) surroundings is the result of human’s accumulated previous experiences and evolutionary processes. Being conscious of our natural surroundings enhances not only our personal experience of it, but also contributed to human survival in it and allocate it with meaning. A prerequisite for consciousness is perception. A conscious nature experiences thus relates to nature that is being perceived and lived through, thereby organizing and interpreting phenomena from our environment by using our senses (Zylstra et al., 2014b).

In most literature, the aspect of consciousness is explained from the notion of the individual mind (Chalmers, 2003). Lengkeek (1994) is one of the few scholars who approaches the phenomenon of consciousness from more of a relational perspective, thereby not placing most emphasis on mental processes. According to Lengkeek, consciousness can be defined as the degree of awareness of the surrounding environment. Experiencing something takes place when one is highly aware of their surroundings, also referred to as ‘wide-awakeness’ or the ‘tension of consciousness’. The level of consciousness determines which part of one’s surrounding environment is perceived as relevant and thus what is being experienced. Lengkeek argues that the level of consciousness arises from (social) interaction with individuals or other things and is related to social contexts. The author also describes other factors that are related to consciousness, such as temporality, spatiality and the heterogeneity of information. Moreover, according to Elands and Lengkeek (2000), consciousness can take shape in multiple ways: *“of the moment (the experience of here and now), the retrospective (memory and reflection), the prospective (anticipation) and the projective (intention)”* (p. 11).

Li (2000) also applies a relational view and states that consciousness arises from the relation between people and places, and that *“this consciousness is the substance of an individual’s involvement in the world”* (p. 863). Hence, nature experiences resulting from human-nature interaction constitute the phenomenological fundamentals of one’s consciousness of the environment. Some other factors are also related to experiences, such as the socioeconomic, interpersonal and spiritual world, which altogether affect an individual’s consciousness and experience. Here, the emphasis is on the interactional nature of experiences rather than individual brain processes. Understanding the relationship between nature experiences and consciousness can provide insights in people’s meaningful, behavioural and experiential relationships with that particular place. Consciousness is thus related to the spatial and temporal bond of humans and nature (Li, 2000).

Experiencing nature through digital technologies could possibly reduce one's consciousness of the surrounding environment, since the user is perhaps distracted by the digital technology and less aware of the environment. At the same time, digital technologies possibly have a potential to contribute to being more conscious of the natural environment and 'what is going on there', as it can show things that its user would otherwise not have been aware of.

Based on the assumptions regarding consciousness, the following indicators have been identified:

- *Awareness of surrounding nature*: consciousness can be defined as the awareness of surrounding nature.
- *Seeing (new or special) things*: when someone is highly conscious of their environment, the chances of seeing (new or special) things are increased.
- *Memory*: consciousness is also related to what people remember from their experience.

### 2.3.2 Immersion

Multiple studies have discovered that the extent of intrusiveness of contact with nature influences nature experiences. This phenomenon is often referred to with the term immersion. When individuals are immersed in nature, they better recognize and connect with elements of the natural environment. Hence, immersion contributes to a fuller and more profound nature experience and a more robust relationship with nature (Bystrom et al., 1999). De Kort et al. (2006) also state that the aspect of immersion during an experience plays a significant role in the interaction of people and nature and has the potential to provide various (psychological) benefits. For example, immersed nature experiences can foster feelings of oneness with nature and lead to aesthetic appreciation of nature (Carlson, 2005). Moreover, being immersed in natural environments appears to be positively related to feelings of generosity and caring towards others (Weinstein et al., 2009).

The extent to which positive effects of immersed nature experiences are reached depends on the degree of immersion (Weinstein et al., 2009). De Vries (2016) distinguishes two factors that influence the degree of immersion. The extent to which someone is immersed in an environment is especially related to differences in scale, ranging from experiencing a small element in an environment to being completely surrounded by nature. Besides scale, the level of realism also plays an important role in fostering immersion. Several studies have shown that nature representations, such as video footage, that are highly realistic appear to have stronger effects on immersion compared to less realistic representations (Akers et al., 2012). Moreover, the effects of experiencing nature are most apparent when people are completely immersed in their natural environment and experience full presence rather than being distracted by other external, non-natural inputs (Weinstein et al., 2009). This would imply that the use of digital technologies during nature experiences might detract from feelings of immersion. However, research has shown that immersion in virtual worlds is in fact related to a higher enjoyment of the experience (Ryan et al., 2006) and enhances greater memory of the experienced nature (Mania and Chalmers, 2001).

With hybrid forms of digital nature experiences it could be the case that users feel more immersed in the physical natural environment due to the provision of extra information and experience elements, but it could also be that users feel less immersed in nature because of the distraction from the digital technology and consequently feeling less as if they are 'being in the moment'. The extent to which digital technologies make use of scale and the level of realism might play a role in this, as these factors determine the degree of immersion in digital nature experiences.

Based on the assumptions regarding immersion, the following indicators have been identified:

- *Feeling absorbed in/surrounded by nature*: immersion can be defined by feeling absorbed in and/or surrounded by nature.
- *Connectedness with nature*: immersion can lead to an increased connection with nature.
- *Being in the moment*: feelings of presence may enhance and indicate immersion.

### 2.3.3 Embodiment

Another component that plays an important role in how contact with nature is being experienced is embodiment. The fundamental principle of embodiment is that experiences are perceived, registered and interpreted in one's body, brain and mind. Therefore, embodiment relates to the sensory experiences in nature. The more sensory perceptions (including sight, smell, hearing, taste and touch) are fuelled, the more embodied an experience. Moreover, embodiment refers to the idea that experiences not only happen through or take place in the mind, but also through the body (bodily experiences). Embodiment can therefore also relate to sensory perceptions of oneself (i.e. become aware of one's own body) during certain experiences. Even though most studies on nature experiences have focussed on the visual perceptions of nature, it appears that other sensory perceptions also significantly shape nature experiences (Franco et al., 2017). Embodied experiences are related to cognitive processes and can positively contribute to feelings of connectedness with nature (Verma et al., 2015). Moreover, sensory-perceptual stimulation during nature experiences has the potential to stimulate feelings of affection towards nature (Millar and Millar, 1996). The extent to which an experience is embodied also induces thoughts and feelings of 'being-in-the-world' or 'out-there-ness' (Schweitzer et al., 2018).

Even though embodiment is often explained as arising from individual perception, some scholars claim that sensuous or embodied engagement with our environment is not only the result of certain processes in the brain. White and Wilbert (2006) argue that there is no such a thing as a sense of nature or one's body "*that can effectively be thought outside of, or separable from, ever more technologized societies and social relations*" (p. 100). Sensory perceptions of nature and embodiment are thus related to the type of interactions between social, ecological and technological factors. Taking up these claims, embodied nature experiences can also be understood from a relational perspective.

It is often argued that (digital) technologies detract from the embodiment component within an experience (du Toit and Verhoef, 2018), and one of the main concerns regarding digital nature experiences is often that the direct sensory part of a nature experience is lost (Verma et al., 2015). However, corresponding to the idea of cyborgs, it can also be considered that digital technologies have a possibility to expand and change one's sensory perceptions beyond human capabilities. By experiencing nature through digital technologies, people can for instance see and hear things they would otherwise not have seen or heard, thereby possibly contributing to embodiment during nature experiences. Especially hybrid forms of digital nature experiences have the potential to stimulate embodiment in the 'real' natural world.

Based on the assumptions regarding embodiment, the following indicator has been identified:

- *Sensory perceptions of nature*: an embodied nature experience is related to one's sensory perceptions of nature.

## 2.4 Five modes of experience

In order to assess whether the use of a digital technology during nature experiences also influences the type of nature experience, an existing categorisation model is adapted to the purpose of this research. Various theoretical approaches that explain different kinds of experiences and subdivide them into distinct categories have been developed. The categorisation model that will be applied in this study is based on the modes of tourist or recreationist experience, as developed by Elands and Lengkeek (2000). The advantage of applying a categorisation or typology model based on differing modes of experience is that it goes beyond choices that are merely based on motivational or interactional approaches in constructing categorisations or typologies. Moreover, the modes of tourist or recreationist experience can be related to any type of leisure experience and enables a comparative analysis between the different modes of experience (Elands and Lengkeek, 2000), making it a suitable model to explore hybrid digital nature experiences.

The five modes of tourist and recreationist experience from Elands and Lengkeek are based on the phenomenology of tourist experience as developed by Cohen in 1979. From Cohen's viewpoint on tourist experiences, it can be argued that tourist experiences derive from the relationship between an individual and different 'centres' (Li, 2000). The centre of an individual can be explained as the environment and values that constitute everyday life, i.e. 'the known'. This centre is constituted by religious, political, cultural and social values. During recreational experiences people search for centres situated elsewhere from daily life, so beyond the boundaries of the known to what Cohen calls the 'centre-out-there'. Cohen has broken down this search for 'out-there-ness' into five distinct forms of experiences, referring to the modes of experience. His categorisation model includes *recreational*, *diversional*, *experiential*, *experimental* and *existential* modes of tourist experience. Cohen moreover argues that these modes of experience are context-specific, meaning that they depend on for instance one's life stage, socialization and specific leisure surroundings (Elands and Lengkeek, 2000). By recognizing the interrelatedness of different contexts and experiences, it appears that Cohen's modes of experience is in line with a relational approach.

Elands and Lengkeek used Cohen's model as a base for developing a similar but adjusted version of the modes of tourist experience. Elands and Lengkeek use more or less the same starting point regarding experiences as Cohen. According to Elands and Lengkeek, experiencing something does not happen strictly individually, but is rather related to other (social and cultural) context-specific components. Therefore, experiences are influenced by external factors and can be considered as 'intersubjective', which corresponds to the idea that experiences are shared by more than one conscious mind. This means that the five modes of experience as developed by Elands and Lengkeek also reflect a relational perspective. Moreover, tourist and recreational experiences are considered to be variations from daily life, including variations in time and space (Elands and Lengkeek, 2000), but in line with this study it can also relate to variations in the aspects of consciousness, immersion and embodiment.

Elands and Lengkeek (2000) adapted the model of Cohen (1979) by among other things reformulating the five modes of experience in order to better capture the meaning of the modes and avoid different subjective language interpretations. This resulted in the development of five newly formulated and developed modes of experience: *amusement*, *change*, *interest*, *rapture* and *dedication*. Each of these modes have their own characteristics (Table 1), which will be interpreted in such a way that it connects to the purpose of this study. Moreover, the modes of experience are not

necessarily used as pre-set categorisations. Rather, the characteristics of the modes of experience are used to assess which kind of (nature) experiences the use of a digital technology might induce and which factors play a role in this, without the purpose being to classify individuals into a certain category. The five modes will be further explained and related to hybrid forms of digital nature experiences in the following sections.

Table 1: Characteristics of Elands and Lengkeek's (2000) Five Modes of Experience	
Mode	Characteristics
Amusement	<i>Fun; Centre-values:</i> familiar environment, your own language, ease; <i>Temporality:</i> a short break
Change	<i>Escape:</i> away from boredom or stress and drag of everyday life; <i>Relaxation;</i> <i>Recovery:</i> recharge the battery; <i>Context matters less</i>
Interest	<i>Search for interesting vistas and stories;</i> <i>Variation:</i> derived from 'elsewhere' or 'ever'; <i>Stimulation of imagination:</i> not necessarily authentic, like to be informed
Rapture	<i>Self-discovery:</i> new awareness of own identity; <i>Unexpected:</i> open for the unknown or unexpected; <i>Crossing borders:</i> discovery of (physical) boundaries
Dedication	<i>Quest for authenticity:</i> a search for the indisputable authentic otherness; <i>Appropriation and devotion;</i> <i>Merge:</i> being absorbed in a 'back-stage' world; <i>Timelessness:</i> wish for a permanent stay

### 2.4.1 Amusement

The mode of amusement encompasses the types of experience that are not very different from ordinary life. Therefore, it refers to a carefree separation from the well-known and trusted everyday reality. The mode of amusement is characterized by thoughts and feelings relating to fun and comfortableness and to experiences that happen temporarily and in a familiar context. Corresponding to these characteristics is that the experiences might be carefully organised, in order to increase comfort and familiarity during the experience and avoid unexpectedness. Another factor that can play a role during this experience is that of unconcernedness, meaning that people are not that much interested in the 'highlights' during an experience (Elands and Lengkeek, 2000).

Nature-related digital technologies are generally developed and used with the purpose of inducing feelings of enjoyment (Fletcher, 2017). Route apps in particular also provide the opportunity to carefully organise one's nature experience. In addition, they often provide certain information and tools that detract from the unexpectedness component during an experience, thereby contributing to predictableness and feelings of comfort, familiarity and safety. These types of digital technologies usually also point to certain highlights along the experience, which individuals belonging to the amusement mode would not be that interested in. All of these factors might indicate (or dismiss) the amusement mode of experience.

### 2.4.2 Change

In the change experience, people consciously seek to temporarily escape from daily routines and obligations, meaning that the difference with everyday reality is more strongly felt. In doing so, they aim for relaxation and recovery, and to return to their everyday life's with restored energy and feeling rejuvenated. By breaking loose from the ordinary, people can experience a sense of identity (Elands and Lengkeek, 2000).

In certain cases, it could be that hybrid forms of digital nature experiences provide a change from everyday life by partly submerging oneself in a digital world. If people feel relaxed and restored afterwards, this might indicate the change mode of experience.

### **2.4.3 Interest**

During an interest experience, people seek for detailed information relating to their experience. This can for instance be information about the nature and culture of the experienced environment. There are certain elements (or attractions) that can stimulate one's curiosity to seek for information and encourage one's imagination, such as signs and guides. These elements can have significant influence on attracting people to experience certain things, but sometimes they are not fully understood. In that case, feelings of fear and respect towards (certain parts of) an experience can start to play a role (Elands and Lengkeek, 2000). The interest mode moreover encompasses the experiences that are elsewhere in a non-familiar environment, in order to search for, discover and learn about new things. In addition, people take their time for the experience, to ensure that all various and new things are not overlooked (Elands and Lengkeek, 2012).

Most nature-related digital technologies are aimed at providing information and education. If people (consciously) make use of these kind of services from digital technologies, this might indicate an interest mode of experience, as well as whether they actually learned something new. Also an increased interest in the environment where the experience took place implies an interest mode of experience.

### **2.4.4 Rapture**

In the rapture experience, the ordinary and the unordinary reach a confrontational point. This confrontation makes individuals aware of their (physical) boundaries and limitations and encourages to advance further, which leads to self-discovery and creates awareness of one's own identity. Moreover, in this mode of experience the unexpected is appreciated and one has an open-minded attitude towards the unknown. People that experience this rapture mode want to be active and uncomfortable circumstances are not considered as inconvenient (Elands and Lengkeek, 2000).

As described previously, digital technologies have a possibility to expand human abilities. This can lead to awareness of one's (physical) boundaries and limitations, corresponding to the rapture mode of experience. At the same time, using digital technologies during direct nature experiences might diminish the rapture mode of experience, as digital technologies usually detract from factors relating to the unexpected, unknown and uncomfortable.

### **2.4.5 Dedication**

During dedication experiences, the inaccessible, unknown and extraordinary becomes accessible, known and ordinary. Hence, this mode of experience incorporates the previously unreachable out-there-ness and one might go on a quest for authenticity, thereby feeling completely absorbed in their environment and experience. This can give rise to new ideas, e.g. about what nature really is. Context is particularly influential during this experience (Elands and Lengkeek, 2000). The dedication mode moreover encompasses experiences that are far away from home, in order to discover new things and merge into unknown places, thereby not being concerned about time (Elands and Lengkeek, 2012).

Digital technologies might contribute to an increased connection with nature or even feelings of 'becoming one with nature', and give rise to new ideas by showing things you would otherwise not have known or seen. Moreover, if people feel like they have explored the area well (possibly due to the use of a digital technology) and if they want to return, this might indicate a dedication mode of experience.

For this study, three of the five modes are selected which will be particularly focused on: *amusement*, *interest* and *dedication*. These modes are considered to be most suitable for linking them to nature experiences that are mediated by the use of a digital route app. Digital technologies are often developed with the purpose of inducing feelings of enjoyment and creating a pleasant (nature) experience, so the amusement mode of experience is considered to be suitable. Since route apps often have educational elements incorporated, the interest mode is also applicable. Moreover, the use of a route app can stimulate exploration and the information might change people's ideas about nature, so therefore the dedication mode of experience can also be related to hybrid digital nature experiences that involve the use of a route app. The change and rapture modes of experience are not taken into consideration in the continuation of this research, as it is assumed that these modes are less directly relatable to hybrid digital nature experiences. With the change mode of experience, it is for example assumed that context matters less, which contradicts with the approach of this study. It is also not expected that experiencing nature while using a route app will lead to self-discovery (indicating a rapture mode of experience).

Based on the descriptions relating to the amusement, interest and dedication mode of experience, also specific indicators for these three concepts have been identified:

#### Amusement:

- *Fun*: the amusement mode of experience is characterized by fun.
- *Ease and comfort*: easy and comfortable experiences are related to amusement.
- *Organization of the route*: if the experience is highly organized, this indicates an amusement mode of experience.
- *Know what to expect*: a preference for knowing what to expect from the experience points to an amusement mode of experience.

#### Interest:

- *Actively seeking information to learn about nature*: when information to learn about nature is actively sought for, this indicates an interest mode of experience.
- *Learned new things about nature*: the interest mode of experience is related to whether new things about nature are actually learned.
- *Increased interest in the environment*: an interest mode of experience can lead to an increased interest in the environment.

#### Dedication

- *New ideas about nature*: a dedication mode of experience can involve new ideas about nature.
- *Exploring; unknown becomes known*: when an area is unknown and better explored through the experience, this indicates a dedication mode of experience.

- *Wish to return*: a dedication mode of experience is related to a wish to return.

## 2.5 Six sensitizing concepts

The three aspects *consciousness*, *immersion* and *embodiment* and the three modes of experience *amusement*, *interest* and *dedication*, as explained in the above sections, can be considered as ‘sensitizing concepts’. Sensitizing concepts are often used when the course of the (qualitative) study is unclear or unknown and they serve as a starting point to guide the data collection and analysis (Bowen, 2006). In this way, the six sensitizing concepts of this study can be used to explore (the relatively unknown) hybrid forms of digital nature experiences and the possible differences between digitally mediated and unmediated nature experiences. Based on the descriptions corresponding to the six concepts, specific indicators for each concept have been identified (for an overview see Table 2). These indicators are used to develop interview questions and are helpful for guiding the analysis of the interviews.

Six sensitizing concepts	Indicators
Consciousness	<ul style="list-style-type: none"> <li>• Awareness of surrounding nature</li> <li>• Seeing (new or special) things</li> <li>• Memory</li> </ul>
Immersion	<ul style="list-style-type: none"> <li>• Feeling absorbed in/surrounded by nature</li> <li>• Connectedness with nature</li> <li>• Being in the moment</li> </ul>
Embodiment	<ul style="list-style-type: none"> <li>• Sensory perceptions of nature</li> </ul>
Amusement	<ul style="list-style-type: none"> <li>• Fun</li> <li>• Ease and comfort</li> <li>• Organization of the route</li> <li>• Know what to expect</li> </ul>
Interest	<ul style="list-style-type: none"> <li>• Actively seeking information to learn about nature</li> <li>• Learned new things about nature</li> <li>• Increased interest in the environment</li> </ul>
Dedication	<ul style="list-style-type: none"> <li>• New ideas about nature</li> <li>• Exploring; unknown becomes known</li> <li>• Wish to return</li> </ul>

## 2.6 Research question

The objective of this study is to examine the influence of using a route app on experiencing nature. By placing the research question after the theoretical framework, it is assumed that it is clear that the six sensitizing concepts and its specific indicators will provide insights in this. Hence, the choice has been made to develop one comprehensive and overarching research question, instead of incorporating each of the six concepts in sub-questions. So based on the problem statement and theoretical framework of this study, the following research question has been formulated:

*How does the use of a route app influence nature experiences?*

The six sensitizing concepts with its specific indicators from the theoretical framework will thus be used to investigate in what ways the use of a route app influences the nature experience.

## 3. Methodology

### 3.1 Study design

The study design is characterized by three basic fundamentals; it is exploratory, qualitative and comparative. Exploratory research is undertaken when little is known about a certain topic (Kumar, 2014), which is the case for hybrid forms of digital nature experiences. Qualitative research is a suitable method for obtaining in-depth information and acquire a relatively profound understanding of the studied phenomenon (Hammersley and Atkinson, 2007). Moreover, the emphasis in qualitative studies is on the description and narration of certain phenomena (in this case experiences), rather than measuring them. The study is also comparative, as the results of an experimental and a control group will be compared. Participants in the experimental group will walk with a route app, and participants in the control group will walk without a route app. In this way, the control group serves as a baseline which is useful for this study since the theoretical framework is not an established one.

The study design also moves between a deductive and an inductive approach. The research approach is partly deductive, as certain theories and concepts are elaborated before collecting and analysing data, and these altogether comprise the theoretical framework of this study. In addition, cautious predictions are made about what the effects of the use of a digital technology during direct nature experiences on different aspects could be. At the same time, making use of sensitizing concepts reflects an inductive research approach, as these concepts are used as a starting point to guide the data collection and analysis phase, but are not determinative. This (partly) inductive approach is suitable for this study since little research has been done about digital nature experiences.

### 3.2 Description of the selected route app

As a specific case within a substantial variety of route apps in the Netherlands, the app 'Crossbill Routes Veluwe' has been chosen. This app is developed by the Crossbill Guides Foundation, a non-profit organization that is aimed at fostering interest in European nature and its conservation among the general public. One of the ways through which the organization aims to achieve this is by publishing ecotourism travel guides (Crossbill Guides) that include nature trails. Recently, the organization also developed several route apps in the Netherlands, of which the Crossbill Routes Veluwe is chosen as a specific case for this study. The app provides a wide selection of 17 hiking routes (and 8 cycling routes) in and around the nature area of the Veluwe. The hiking routes vary in length, from 2.5 till 23.7 km, and have specific start and end points, which are indicated for each route. The app also provides a general description for each route and tells 'what you are going to see'. When the app is installed, you can select and download a specific route from a list or map that shows all the routes, or you can select a route based on several filters (type, length and location of the route). You can then download a specific route from a list or map that shows matching routes based on the selected filters. The app itself and the specific routes can be downloaded for free. When you have downloaded the app and a specific route, the app also works without internet (if 'location services' are switched on).

The map of a downloaded route shows some practical information: location of public transport/bus stops, parking lots, information centers, overnight and catering facilities. When you want to start the route, the app can direct you to the exact starting point of the route. During the hike, the app will give notifications with route directions and at interesting points along the route. When you open the app at these points, it will provide you with all kinds of information on the nature and landscape

surrounding you, including pictures and sometimes video clips (Figure 3). The approach of the app is therefore very much educative. Beforehand, you can choose all or a selection of theme's that interest you (and of which you want to receive notifications): butterflies, dragonflies, other insects, reptiles and amphibians, birds, mammals, landscapes, (cultural) history and ecology. When certain plant or animal species are mentioned at these points, you can often click on the species name and go through to the field guide option. You will then get to the species page, which provides a more extensive description, pictures and sometimes sound clips of the specific species. At this page you will also get observation tips: how, where and when you can observe the species in the landscape, including an indication of the current chance of success. This information is adjusted to the current season. In this way, the developers of the app claim that the chance of discovering (special) flora and fauna is much higher compared to when you would walk without the app (Crossbill Guides Foundation, 2019).



Figure 2: Screenshot of the app Crossbill Routes Veluwe (adopted from Google Play, 2019)

The specific hiking routes that were selected for this study are: 'Renkums Beekdal – naar de bron' (7,7 km) and 'Renkums Beekdal – naar de monding' (9,1 km). These routes were selected based on several criteria. First of all, both routes start (and end) at information center Renkums Beekdal, which is visited by relatively many recreants. This increases the probability to find participants for this research. In addition, both routes have relatively many notification points (54 and 49 notification points) and a large variety of themes, which can be considered as an appropriate amount of mediation from the digital technology during the hike.

### 3.3 Data collection

Data was collected on the basis of in-depth, face-to face, semi-structured interviews. In this way, the interviews were systemized but certain questions could be adjusted or added during the interviews in order to collect the necessary data (Bernard, 2017). Beforehand, two interview schedules were made with open-ended questions, one for the control and one for the experimental group (Appendix II). Open-ended questions are highly suitable to gather in-depth information on one's experiences (Kumar, 2014). The questions were related to the participant's (digital) nature experience and inspired by the specific indicators of the three aspects of a nature experience (consciousness, immersion and embodiment) and the three modes of experience (amusement, interest and dedication). The difference in the two interview schedules was that for the experimental group questions were added relating to the use and influence of the app. At the end of the interview, some questions relating to the participant's background and demographic data has been asked. The interviews for the experimental group took around 20 minutes, the interviews for the control group lasted approximately 15 minutes. Both were held at the research site (lunchroom de Beken, adjacent to visitor centre Renkums Beekdal). The interviews were anonymously recorded with consent of the interviewees.

In total 24 participants have been interviewed. This sample was divided in two groups: half of the participants walked with the route app (experimental group; 12 participants), and the other half of the participants walked without the route app (control group; 12 participants). For an overview of the participant's characteristics, see table 3 (experimental group) and table 4 (control group). Participants in the experimental group had the possibility to choose between the two routes provided by the app in the nature area of Renkums Beekdal. Participants in the control group could walk these routes too (without the app), but they were allowed to choose other routes as well, as long as it was in the same natural area. Participants were partly recruited at the research site by actively asking visitors to participate in the research. In addition, a table with chairs and a small poster (Appendix III) with an explanation of the research was also in sight to attract participants. It was expected that it would be difficult to find participants, especially for the experimental group, as they had to be willing to walk the specific route with the app and being interviewed afterwards. So in addition to finding participants on site, a message about the research and asking if people want to participate was published in the newsletter and on the website of the information centre Renkums Beekdal, to which a number of participants had responded. Also something to drink during the interview and a small present afterwards had been offered in order to attract and thank the participants.

The participants were selected randomly; every adult who was willing to participate in the research could, but attention was paid to an equal and similar division between the two groups in terms of demographic characteristics and background. If visitors were interested to participate in the research, an explanation about the research and the purpose of the interviews was given. Participants of the experimental group also received instructions on how to install and use the route app (Appendix IV).

**Table 3: Participant characteristics in the experimental group**

<b>Participant</b>	<b>Gender</b>	<b>Age</b>	<b>Education</b>	<b>Knowledge nature</b>	<b>Familiar with area</b>
1	Female	58	WO	Above average	No
2	Female	23	MBO	Above average	No
3	Male	58	WO	Excellent	No
4	Male	26	WO	Below average	No
5	Female	68	WO	Excellent	Yes
6	Female	52	WO	Excellent	Yes
7	Male	22	WO	Above average	No
8	Female	24	WO	Above average	No
9	Female	65	HBO	Above average	Yes
10	Female	52	HBO	Above average	Yes
11	Male	71	WO	Above average	Yes
12	Female	69	WO	Average	Yes

**Table 4: Participant characteristics in the control group**

<b>Participant</b>	<b>Gender</b>	<b>Age</b>	<b>Education</b>	<b>Knowledge nature</b>	<b>Familiar with area</b>
1	Female	52	WO	Above average	A little
2	Female	52	HBO	Above average	A little
3	Female	36	HBO	Average	Yes
4	Female	58	HBO	Below average	A little
5	Female	33	MBO	Average	No
6	Female	64	WO	Average	No
7	Male	23	WO	Excellent	A little
8	Female	52	HBO	Average	No
9	Female	64	HBO	Average	Yes
10	Male	66	WO	Above average	Yes
11	Male	20	MBO	Excellent	No
12	Female	25	WO	Above average	No

### 3.4 Data analysis

After the interviews were held, the voice recordings of the interviews were transcribed. These transcriptions have been analysed by means of coding. Since the interviews contain open-ended questions, the answers given by the participants can be considered as descriptive responses, which are invariably qualitative (Kumar, 2014). Therefore, a qualitative approach was used to code the data. In addition, a combination of an inductive and deductive coding approach was applied. Deductive coding was used to cover the main themes from the interview questions, based on the six sensitizing concepts and its specific indicators. This approach corresponds to directed coding, in which the analysis of data starts with a theoretical framework that guides the initial codes and analysis (Hsieh and Shannon, 2005). With inductive coding also other themes that emerged from the interviews were analyzed. This approach is in line with in-vivo coding, a form of qualitative data analysis that places emphasis on the actual spoken words of the participants (Manning, 2017). The transcriptions of the interviews were coded manually. Manual coding was possible since the interviews were quite structured, as all of the specific indicators had questions relating to them.

The data analysis involved several systematic steps. First of all, the transcriptions of the 24 interviews were quickly scanned to obtain a first impression and get a feel for the data. In this first step, some significant findings were already noticed and notes were made of these. Also noticeable results that could possibly indicate certain themes and patterns were noted. Secondly, the answers to the questions relating to each of the indicators were thoroughly looked at and analyzed one by one, starting with the experimental group and followed by the control group. When a specific indicator was analyzed for the experimental and the control group, a comparison between those results was made. After all the indicators were analyzed, the transcriptions were thoroughly read in its entirety to identify the (suspected) other themes. The responses in the transcriptions that indicated those themes were given differing codes and subsequently analyzed. It was ensured that the emerged themes were shared by multiple participants.

The in-text results include the findings relating to the six sensitizing concepts and other themes that emerged from the data analysis. Also a (qualitative) comparison will be made between the results from the control and the experimental group. The results will be substantiated by the use of actual quotes from the participants. The interviews were held in Dutch, therefore the transcriptions of the interviews are also in Dutch. So for the in-text results and quotes, the statements of the participants are carefully translated to English so that the quotes fully cover the content of what the participants actually said.

## 4. Results

In this chapter, the results of the interviews are presented. First, some main results relating to the overall experience will be outlined. Then, the results of each indicator from the six sensitizing concepts will be reported. Thereafter, other themes that emerged from the interviews will be defined. Finally, a syntheses of the results will be presented in the last section of this chapter.

### 4.1 Overall experience

Before reporting the results of the specific indicators of the six sensitizing concepts, some main results relating to the overall experience of the participants will be outlined here to give a general overview before continuing to the in-depth analysis of the concepts. All of the participants, both in the experimental and control group, had experienced the walk as more or less pleasant, and particularly emphasized the (sometimes surprisingly) variety of nature as something that they highly appreciated during their walks. The participants were very positive about the different types of landscapes occurring in the area and expressed that they enjoyed experiencing this. Aspects that enriched the nature experience of the participants in both groups included the beauty of the different landscapes, peace and quietness and social interaction with others. Aspects that often detracted from the participant's nature experience were cultivated influences and crowds.

In the experimental group, most of the participants had also experienced the use of the app positively for the most part during their walks. However, only one participant (participant 2) was decidedly positive about the app, and one other participant (participant 12) very much pronounced to be unsatisfied with the use of the app. It should be noted that the app of participant 12 had not worked properly, which could be (one of) the reason(s) why this participants was strikingly negative. The rest of the participants had experienced the use of the app positively in most regards, but these participants also criticized the app in certain respects. Therefore, most of the participants in the experimental group can be considered ambivalent regarding the use of the app. This meant that the participants were also able to mention both advantages and disadvantages of the use of the app. Advantages that were often brought up were related to the information that the app provides and its route function. Disadvantages included the information being too brief and that the app could be somewhat distracting in terms of experiencing nature. Moreover, all of the participants indicated that they had experienced the walk with the app differently from previous walks without an app. Most of the participants in the experimental group mentioned that they had experienced nature more active, more attentive and more alert thanks to the app. But the provision of information, thereby appealing to the participant's ratio, also made the experience a different kind of nature experience from previous ones, and this was not always considered positive. For the participants in the experimental group it appeared that the use of the app can therefore be both an enrichment of and a detraction from their nature experience, which will be further explained in the next sections.

### 4.2 Six sensitizing concepts

This section reports the results from the six sensitizing concepts with its corresponding, specific indicators. For each indicator the results from the experimental group will be given first, followed by the results from the control group and subsequently, if certain differences or similarities are noticed, a comparison between the results of the experimental and control group will be made.

### 4.2.1 Consciousness

#### Awareness of surrounding nature

##### Experimental group

Most participants in the experimental group expressed that they were or felt aware of the surrounding nature and that the use of the app contributed positively to their awareness. For example, participant 3 said:

*“During the parts of the walk where I used the app I was more aware of my environment than in the parts where I did not use the app”*

One of the reasons that the app made most participants more aware of their environment, seems to be related to the information it provides. Especially information that was completely new or surprising to the participants, and information that shows the occurrence of nature appeared to make them more conscious of their environment. This was for example referred to by participant 8:

*“The app definitely made me more aware of the surrounding nature. For example, when I walked past the old brick factory, I did not think it looked much like nature, but then the app tells you which animals are in fact occurring in that area”*

Another reason why participants were more aware of their environment due to the app, seems to be because the app can show or point out things the participants feel they might not have seen if they would have walked without the app. This was for example indicated by participant 1:

*“One of the advantages of the app is that you are occasionally alerted to something that you would otherwise not have realized or consciously looked at”*

Also more specific examples that indicate this were expressed. For example, participant 3 mentioned:

*“The advantage of the app is that you sometimes get some information and pay attention to things you would normally have passed by, like a hill, that you think oh, so that is a spring head”*

Even for participants that were already familiar with the area, the app could alert these participants to things they did not know yet. For example, participant 6 who walks in the area every week mentioned:

*“The explanation on the footbridge, about the west side being steeper than the east side, I did not know yet and it makes you think ah, is that right, and you automatically start to look more consciously at your environment. Even though I have been walking here for years, I did not know that, so that was very nice. An extra addition to the experience”*

However, some participants also brought up that the app worked to a greater or lesser extent distracting, making those participants feel less aware of their environment. This was for example referred to by participant 1:

*“One of the disadvantages of the app is that you get distracted. So if you normally walk around and view nature from yourself, you might see more things than you would see by means of the app”*

Main reason why the app worked distracting appears to be looking at a mobile phone screen, instead of looking around. This was indicated by multiple participants. An important factor that also seems to play a role in the extent to which the app works distracting has to do with how the app is being used. Multiple participants said something about how the app should be used, in order for it to contribute to their awareness of the surrounding environment instead of being too much of a distraction. Participant 1 said about this:

*“When I was looking at the app I actually paid too little attention to the things around me. So for the app to have a more positive effect, you should stand still and have a look at the app, but then you have to put it down and just walk further without looking at the app”*

However, putting down the app at times appeared difficult for certain participants as they (felt like they) had to keep it in their hands to check if they were still on the right track. This was the case for participant 8:

*“The disadvantage is that you always have to look at your app to see where you have to go, and that might distract a bit from the environment”*

In addition, multiple participants indicated that at first, the app did distract them from paying attention to their surroundings, but when they got more familiar with using the app this decreased. For example, participant 1 said:

*“In the beginning I was so busy trying out the app that at that time I was not so aware of nature, but at a given moment when I got the hang of it this went better”*

At the same time, this distraction that the app can induce turned out in a positive way for a few participants. For these participants, this ‘distraction’ from the app actually contributed to their awareness of the environment and to a more pleasant experience in general. This was for example mentioned by participant 2:

*“The app did not make me less aware of the environment, because you quickly read it and then you have a look around and you are actually more aware of nature. When I walk without an app, I lose my concentration and then I am more focusing on other things instead of the environment”*

### Control group

All of the participants in the control group expressed that they felt more or less conscious of their environment, or at least seek this. Participant 4 was one of the participants who mentioned always seeking this awareness of nature, but also expressed certain circumstances can detract from this:

*“Being aware of nature is what I want, but that does not always work, for example when I am stressed. But I notice that the longer I am in nature, the more the stress drops”*

The participants often mentioned a lot of specific things they had seen, so it appears that many of the participants in the control group were particularly aware of observing things in nature. This was for example indicated by participant 11:

*“When I walk in nature I do not just walk, when I encounter something I am always concerned with identifying those plant and animal species. Today I have seen many fungi, acorns, chestnuts, mousses and birds”*

For the control group it seemed that social interaction can play a significant role in being aware of your environment. All of these participants walked with others, and it was often mentioned that they were especially aware of their environment because they wanted to show their fellow walkers things in nature, or because fellow walkers alerted them to things in nature. Indicating things in nature to others was for example referred to by participant 3:

*“Yes, I am aware of nature because I want to point out things to my son, such as birds. I am always consciously looking for animals to point out to my son”*

And participant 6 also indicated that walking with others can make you more aware of nature when you talk about it together:

*“We talked about the woodpecker that we both heard and about the grasshopper that we both thought was very large, so in that sense we also talked a lot about nature together”*

This social interaction can also work the other way around; it seems that walking with others can also make the participants more aware of the environment because fellow walkers pointed out things they could observe. And when the fellow walker was familiar with the area and had some knowledge about it, this was highly appreciated. This was for example brought up by participant 1:

*“I was out with a ‘local’, and I was really happy about that because she alerted me to things I would otherwise not have noticed”*

However, walking with others could also have the opposite effect; making participants feel less aware of the environment. It was mentioned by a couple of the participants that because of the social interaction with their fellow walker, they were actually paying less attention to their surrounding and were therefore less aware of nature. Reason for this could for example be that because of the chatting with others, these participants paid more attention to this rather than to their environment. This was for instance indicated by participant 8:

*“I tried to be aware of nature as much as that was possible with a sister whom I had to catch up with”*

### Comparison

It appears that the participants in the control group were more aware of specific things in nature during the walk (e.g. certain plant and animal species), as this was highly emphasized by these participants, whereas the participants in the experimental group did not mention specific things in nature that much. However, the participants in the experimental group were more aware of things related to the information provided by the app, which the participants in the control group were not

aware of. Hence, even though both groups expressed to have been aware of the environment during the walk, there appears to be a difference in what exactly they have been aware of.

In the experimental group, most of the participants expressed that the app made them more aware of their environment, whereas the participants in the control group emphasized the presence of others as something that could contribute to their awareness of the environment. At the same time, where in the experimental group the app provided the greatest distraction, the participants in the control group put more emphasis on others as possibly being a distraction. So even though different things were mentioned as contributing to or distracting from awareness (being the app and social interaction), it appears that both of these aspects can work both ways.

### **Seeing (new or special) things**

#### Experimental group

When the participants in the experimental group were asked if they had seen new or special things, about half of the participants mentioned things that were not related to the app, whereas the other half of the participants mentioned things they had seen because the app pointed them out. Things that were often mentioned were certain plant and animal species and the streams running through the area. The participants were also asked specifically if they had seen things they would not have seen without the app. Again, most participants said they were indeed pointed to things they would otherwise not have seen. This also made them more conscious of their environment. For example, the course of the streams was often mentioned as something that the participants would not have seen without the information from the app. This was for instance mentioned by participant 2:

*“Well for example the course of the streams, that there are actually three instead of one. I would not have noticed this without the app”*

Also some participants that were already familiar with the area said that they had seen new things due to the app. Participant 5 mentioned a specific example of this:

*“That little plant in the roadside, I had never seen that before or been aware of it. Without the app I would never have noticed it”*

#### Control group

It appears that the participants in the control group had seen a lot of specific things in nature, which already came up when these participants were asked about their awareness of the environment. When they were asked specifically whether they had seen special things, most of the participants mentioned specific things again, such as certain plants, animals or mushrooms. Participant 7 for instance could describe quite precisely the specific things he had seen and thought were special:

*“Very beautiful fungi and mushrooms. A crazy looking tree who was almost completely demolished but yet there was a new branch growing, that was nice to see. A couple of pretty views over the stream valley. Some aquatic plants, an ichneumon. Yes, those are cool things to see”*

A few of the participants also mentioned cultivated elements as special things they had seen. For example, participant 1 referred to the works of art, because they fitted nicely into the landscape in her opinion, and participant 2 mentioned the cultural history of the landscape.

### Comparison

A lot of the participants, both in the experimental and in the control group, mentioned certain plant and animal species or other specific things in nature as special things they had seen during the walk. In that sense, the results of both groups are somewhat similar. It is self-evident that the things participants in the experimental group had seen due to the information provided by the app, the participants in the control group had not seen. Also some things the participants in the control group had seen, such as works of art, the participants in the experimental group had not seen. This can be related to the fact that the participants in the control group have walked other routes than the participants in the experimental group.

### **Memory**

#### Experimental group

As a final indicator for consciousness, the participants were asked what they had remembered the most about their walk. It is noticeable that the participants that were not familiar with the area all mentioned the valley with the wooden plank footpath, which is something that is not directly related to the use of the app, whereas the participants that were familiar with the area almost all mentioned things that were related to the use of the app. It appears that the participants familiar with the area remembered things that they did not know or noticed before the most. For example, participant 6 mentioned:

*“That there were eight mills, I did not know that yet. Hm, surprisingly I have learned something from the app. I always wondered how many mills have been here and the app said eight. That was new to me so I think that is why I remember that the most”*

Some other participants that were familiar with the area did not mention new things they had seen or learned from the app, but did mention that they walked a different route than what they would normally walk and remembered this the most. For example, participant 9 said:

*“Tying together two areas that I know, but that I have never walked in this way one after the other. That has also given me more insight into the structure of the environment”*

Participant 12, whose app had not worked properly, expressed things related to the malfunction of the app when asked what she remembered most:

*“Only the criticisms. That sounds so ungrateful but I really missed the cultural-historical aspects. And also because the app worked so distracting, I had to look at the map all the time to see where I had to go”*

Finally, it was also brought up by a few participants that the app has a possibility to stimulate memorizing things. For example, participant 4 said:

*“I think you remember more things than if you would walk without the app, especially certain information that the apps provides”*

### Control group

Most of the participants in the control group mentioned the same things that they had mentioned as special things they had seen during the walk as what they remember most. For example, participant 9 and 10 mentioned seeing the owl again as what they remember the most. Also the variation of the landscape and its nature was mentioned multiple times, among others by participant 11:

*"I think the variety, the forest on both sides and then the valley in the middle. I thought the variation of forests and grasslands was beautiful"*

Some of the participants mentioned things related to their social interaction during the walk as what they remember most. This was for example referred to by participant 6, who said:

*"The sociability. Doing something fun together in a pleasant environment in which you both feel at ease"*

### Comparison

There appear to be some differences between both groups with regard to what the participants had remembered the most. First of all, the participants in the control group did not mention things that they had learned, whereas half of the participants in the experimental group did mention things they had learned. This can be explained by the provision of information by the app in the experimental group and a lack information for the participants in the control group. It is noticeable that most of the participants in the control group, like the participants in experimental group, walked across the wooden plank footpath. However, this was never mentioned by these participants as what they had remembered most, in contrast to half of the participants in the experimental group, who all mentioned the wooden plank footpath. Also things related to social interaction was oftentimes brought up by the participants in the control group as what they had remembered most, but not by the participants in the experimental group.

### **4.2.2 Immersion**

#### **Feeling absorbed in/surrounded by nature**

##### Experimental group

Most participants expressed that they more or less did feel absorbed in and surrounded by nature for the most part during the walk. However, certain aspects were mentioned that detracted from this. Some participants mentioned that when they encountered cultivated influences during the walk, they felt less absorbed in or surrounded by nature. For example, participant 1 said:

*"Yes I did feel absorbed in nature during most of the walk, except in places where there were other things to do, like that sculpture garden and such"*

The participants were also asked whether the app contributed to feelings of being absorbed in or surrounded by nature or not. Almost all of the participants stated that the app did not influence this. For example, participant 3 said:

*"I did feel surrounded by nature, but not more through to the app. But it is not that I found the app disturbing in this respect. I found it disturbing to see that at a certain moment a large building had just been placed as a caravan arrangement. That I find disturbing, not the app"*

Only one participant (8) said that the app had a positive effect on feeling absorbed in and surrounded by nature:

*“Yes, because on the map of the route you could see that everywhere you walked it was a natural area, so the app did influence the feeling of being surrounded by nature”*

#### Control group

All of the participants in the control group did to a greater or lesser extent feel absorbed in or surrounded by nature. Some of the participants expressed that when they encountered a lot of cultural influences, such as works of art, industries or highways, they did not mind this and still felt absorbed in and surrounded by nature. Others however mentioned that the visibility of cultural influences actually detracts from feelings of being absorbed in or surrounded by nature. This was for example referred to by participant 7:

*“It might be personal taste, but I did not like the gnomes that are put in the forest. It might be nice for children but for me that does not belong in nature. And also crossing a main road, I thought was a pity. Then I felt less absorbed in nature”*

#### Comparison

Participants in both groups expressed that they felt absorbed in and surrounded by nature during their walks. In addition, cultural influences were mentioned by many participants in both groups as something that can detract from feelings of being absorbed in or surrounded by nature, so similarities can be found in that regard. Since the use of the app did not really have an effect in this respect for most of the participants in the experimental group, the results between both groups can be considered as relatively similar.

### **Connectedness with nature**

#### Experimental group

Most of the participants expressed that they did feel connected with nature during the walk. The participants that felt this connection often mentioned that they always feel connected with nature when they walk in a natural area, or at least aim for a connection. For example, participant 10 said:

*“I do seek a connection with nature during walks in nature... And yes, I feel that too”*

A couple of the participants that did not feel a connection said that this is the case because they were not aware of or seeking for a connection during the walk. For example, participant 7 mentioned:

*“Personally, I do not really feel connected with nature during walks in general. I do not think about that when I walk around, to be honest”*

A connection with nature was often associated with knowledge about nature, especially by the participants that did not have much knowledge about nature. It was mentioned multiple times that a disconnection with nature stems from a lack of knowledge about nature. Hence, the influence of the app on the participants connectedness with nature could be positive, with one of the reasons being the information the app provides. Participant 4 indicated this:

*"I think that the app does contribute to a certain connectedness, especially if you do not have much knowledge of nature. It was easier to connect with nature due the app because you knew more about it"*

A couple of other participants mentioned that the use of the app had a negative effect on their feelings of connectedness with nature. It appeared that the distraction of the app originating from having to look at your mobile phone screen was an important factor why participants felt that the use of the app had a negative influence on their connection with nature. For example, participant 12 said:

*"Well, you are clearly being occupied with walking with an app, so that always plays a role in the background. You are not 100% concerned with nature"*

The participants were also asked if there were certain parts during the walk where they felt less connected with nature and felt more of a distance towards nature, and, if so, what caused this distance. A few participants mentioned that the use of the app caused a certain distance from nature. For example, when I asked participant 12 if there were moments during the walk where she experienced more distance towards nature, the answer was:

*"Yes, I guess so, when I looked at the app"*

And participant 6 said:

*"You have to be careful not to look at 'that thing' all the time. Otherwise you are too much concerned with the route and not with nature, and then you feel a certain distance towards nature"*

However, a few of the participants particularly stated that the use of the app did not cause a distance to nature, but rather enhanced their connectedness towards nature. For example, participant 8 said:

*"No, the app does not create a distance, it actually fosters connectedness"*

Also other things that caused a perceived distance towards nature were mentioned. Again, the presence of cultivated influences, such as residential or rural areas, was often brought up as detracting from an experienced connection with nature. Also encountering other people, especially when in groups and talkative, was indicated as causing a distance towards nature and decreasing feelings of connectedness with nature. A few other participants expressed that they did not feel a certain distance towards nature at any time during the walk.

### Control group

The participants in the control group brought up many different things regarding connectedness with nature. The majority of the participants in the control group expressed that they did feel connected with nature during their walk. A couple of these participants associated connectedness with nature with being able to relax in nature and being detached from everyday life. This was for example referred to by participant 2, who said:

*"Well, connected... What I like is that when I am in nature I am detached from everything from everyday life, so I can recharge. That is what walking and nature does with me"*

For participant 4, a connection with nature can be hard to achieve as it is somewhat related to an embodied experience:

*“There is a difference between just walking through nature or feeling a profound connectedness with nature. That can be the result of really being present, in the first place in your own body as that is your own nature, and from there I am much more able to connect with nature around me”*

Some of the participants that were very much familiar with the area said that it is important to continue to realize how special the area and its nature is in order to retain feelings of being connected with nature in this particular area. For example, participant 9 mentioned:

*“We are used to walking in this area, because it is so close by. It is important to keep realizing that it is actually very special, to have such beautiful nature nearby”*

Some participants mentioned that they did not really feel connected with nature or did not understand what this entails. Participant 7 was one of the participants who did not feel a connection, and said about this:

*“I actually never feel connected to nature, because I always have the feeling that we are outsiders as human beings. That you have to visit nature because nature is somewhere else and you do not really belong there. You are not a part of it”*

The participants in the control group were also asked whether they felt some sort of distance on certain moments during their walk. About half of the participants answered that they felt a certain distance towards nature when they came across cultivated elements. This was amongst others expressed by participant 12, who said:

*“Yes, when I heard the road and you realize that you are actually walking next to a residential area”*

The rest of the participants said that they never felt a distance towards nature during the walk. These participants were also not disturbed by encountering cultivated influences during their walk. This was for example indicated by participant 1:

*“I did not mind seeing the road and cars, because I thought life goes on over there but here in nature it stands still for a moment. I see it as two worlds that are separated from each other”*

### Comparison

The results from the experimental and control group in terms of nature connectedness are somewhat similar. In both groups most participants expressed that they did feel a connection with nature, and the other participants mentioned that they did not feel this connection or are not really concerned with it. As a matter of course, the participants in the control group missed the provision of information, which, according to the results from the experimental group, could enhance connectedness with nature for people that do not have a lot of knowledge about nature. Also the results related to feeling a certain distance towards nature are quite similar; in both groups multiple participants mentioned that cultivated influences can cause a certain distance towards nature and some others expressed not having felt a distance. A noticeable difference is that participants in the

control group also mentioned certain 'states of mind' as something that can influence connectedness with nature, which was not referred to by the participants in the experimental group.

## **Being in the moment**

### Experimental group

As a final indicator for immersion, the participants were asked if they experienced a feeling of 'being in the moment' during the walk. All of the participants expressed that they indeed felt they were being in the moment, and also aim for this during a walk in nature. For example, when participant 5 was asked whether she felt in the moment during the walk, the answer was:

*"Yes, I try to do that as much as possible when I am in nature. If your head is always in the past or in the future, you do not experience the presence"*

The participants were also asked about the influence of the app on feelings of being in the moment. The majority of the participants expressed that the use of the app had a positive influence on this. For example, participant 3 said:

*"The app reinforced my feelings of being in the moment, because when you do not have the app you would more easily think of completely other things"*

Main reason that the app contributes to feelings of being in the moment seems to be related to keeping the participant's attention with the environment. More specifically, for most of the participants the app contributed to feelings of being in the moment because of the information it provides and because the app indicates things that are related to the present. This was for example mentioned by participant 5:

*"The app did not work distracting because all the information was related to here and now, and to things you could see on sight"*

And by participant 8:

*"I did have a feeling of being in the moment, because you are continuously occupied with where you are at on the route, what is happening and what is going to happen, what am I going to see, so you cannot dream away completely and therefore you stay in the moment"*

However, some participants expressed that they actually felt less in the moment because of the app. Again, this seems to be related to having to look at your mobile phone instead of around you. For example, participant 10 said:

*"I felt less in the moment than when I walk without the app, because you are disconnected from the world around you every time you look on the app"*

It also appeared that the use of the app could be distracting in a more indirect way, thereby making participants feel as if they are less in the moment. This was the case when participants would also use their mobile phone for other purposes besides the route app during the walk. For example, participant 1 said:

*“When you also receive other signals from friends that are messaging et cetera, it worked distracting. I did not like that, I do not want that when I am in nature”*

Participant 4 also referred to this:

*“The disadvantage of the app is that when you look at your phone for the app, you might also check if you received a message or something, and then you forget for a moment that you are actually outside in nature”*

It thus seems that not only the route app itself could make the participants feel less in the moment, but indirectly the use of the app (unintentionally) stimulated some of the participants to also use their mobile phone for other purposes. This external input coming through their mobile phone appeared to make these participants feel less in the moment and disconnected from nature.

### Control group

All of the participants mentioned that they did more or less felt as if they were being in the moment for the most part during their walk. Multiple participants mentioned that nature helps with being in the moment, because these participants are better able to let go of things and certain thoughts when in nature, thereby clearing their mind. However, also certain aspects were mentioned by the participants that did or might detract from this. The main reason mentioned was related to social interaction, as this can be distracting in terms of being in the moment. For example, when I asked participant 8 whether she felt in the moment during the walk, the answer was:

*“Yes, I was not concerned with what I had to do later. But you are sharing things with each other constantly, so I think I would have experienced it differently when I would have walked alone. Then I would be much more focused on what is happening around me and probably felt more in the moment”*

At the same time, social interaction does not always have to detract from being in the moment. It actually could also positively contribute in this respect according to a few of the participants. This appears to be the case when all fellow walkers are also concerned with the environment and the ‘here and now’. For example, participant 11 mentioned:

*“Walking with somebody else was not distracting for me, because you talk a lot about the environment and you point out things to each other. Of course you also talk about other things, but then I was still experiencing nature”*

Besides social interaction, cultivated influences such as the sculpture garden and riding schools were brought up again as something that made some of the participants feel less in the moment.

### Comparison

All participants from both groups expressed that they did feel in the moment during their walk, and also like to ‘use’ nature in this respect. From the control group it appears that social interaction can detract from feelings of being in the moment. Social interaction was not so much directly emphasized by the participants in the experimental group, but it was mentioned that messages from others through your mobile phony could detract from being in the moment. It should also be noted that all of the participants in the control group walked with others, whereas about half of the

participants in the experimental group walked alone, which could be (one of ) the reason(s) why social interaction was less stressed by the participants in the experimental group. Both groups mentioned that the alerting to things that have to do with the environment contributed to being in the moment. For the control group, this could be done by fellow walkers, whereas for the experimental group the app could fulfill this role of alerting the participants to certain things.

### 4.2.3 Embodiment

#### Sensory perceptions of nature

##### Experimental group

All of the participants reacted positively when they were asked about their sensory perceptions of nature during the walk. All participants mentioned that they had seen and heard a lot from nature during the walk, and some of the participants even brought up things they had smelled and felt. The participants could not really identify aspects that contributed to or detracted from sensory perceptions of nature, only that they experienced a lot of sensory perceptions during the walk. The participants were asked again about the influence of the app, this time on their sensory perceptions of nature. Almost all of the participants said that the app had a positive influence on their sensory perceptions of nature, especially on sight and hearing. These participants mentioned that they were more consciously concerned with their sensory perceptions of nature due to the app, and therefore also had more sensory perceptions. Reason for this appeared to be related to the information, pictures and sound clips the app provides, and that it alerts to things you can actually see or hear. This was mentioned multiple times, amongst others by participant 3, who said:

*“Well, I think that you see and hear more due to the app. I noticed for example that when I heard a bird or saw a plant I thought hm, what is that, while I am normally less concerned with that”*

The participants who regularly clicked through to the field guide option highly appreciated the birds sounds that could be played. These sound clips also seemed to have had a positive effect on the sensory perception of hearing of the participants, as all of the participants that listened to the bird sounds mentioned that because of these digital sound clips, they started to hear more sounds in nature. It appeared that not only sensory perceptions of the (bird) species indicated by the app improved, but also sensory perceptions of nature in general. This was for example brought up by participant 2, who said:

*“The bird sounds on the app triggered you to also pay attention to sounds in real nature”*

One of the reasons why the participants were more consciously paying attention to their sensory perceptions, and also appreciated the app for contributing in this regard was that the participants enjoyed recognizing and identifying specific species in nature. This was for example brought up by participant 1, who said:

*“I tried to pay more attention to birds sounds, which I normally do less, because I liked it when I could recognize something. I would also prefer if more plants would be included in the app, because I would enjoy searching for them”*

However, participant 12 felt that the use of the app did not necessarily improve sensory perceptions of nature, with the main reason being:

*“My sight was divided between the route and my screen”*

And participant 3 addressed that even though the app can enhance sensory perceptions, this is different compared to when these sensory perceptions are triggered by the environment itself:

*“The disadvantage of the app is that you are guided a bit more by what the app tells you, and you are less open to what comes in from outside”*

It seems that the use of the app can have a positive effect on the sensory perceptions of sight and hearing, but not so much on other sensory perceptions. So even though the app provides extensive information and descriptions of certain landscapes and species, this did not trigger any other sensory perceptions than sight and hearing. One participant (4) brought up that it would be nice if maybe also a fragrance description for certain plants and flowers would be given, in order to stimulate an even more comprehensive experience.

### Control group

All of the participants in the control group expressed that they had a lot of sensory perceptions of nature during their walk. All participants mentioned certain things they had seen, heard, smelled or felt. Participant 6 said:

*“We saw mushrooms, we heard rustling of crickets in the field, we heard a woodpecker, we felt acorns because they were so big, we felt the rain. So yes, a lot of sensory perceptions”*

A few participants moreover expressed that they also consciously seek sensory perceptions or that it is even the purpose of walking in nature; to see and discover things. This was for example referred to by participant 7:

*“I always pay attention to my sensory perceptions in nature, hoping to see nice species. So when I see or hear something, I directly turn around”*

Participant 4 stressed the importance of sensory perceptions of nature:

*“It is extremely important to for example also grab and feel a leaf every once in a while, reflect on what you feel and realize it is a living thing. That can be almost spiritual”*

Some participants even mentioned sensory perceptions they did not like, such as smelling the Parengo factory, or sensory perceptions they had missed, such as hearing flowing water. Social interaction was mentioned by a couple of the participants as something that detracts from (certain) sensory perceptions, especially from hearing. Chatting seems to decrease this sensory perception, which was for example indicated by participant 2:

*“Seen a lot, heard a little less. We talked too much for that. I hear more when I walk alone”*

It appears that these participants have more sensory perceptions of nature when they walk alone. Participant 3 for instance also mentioned that she has less sensory perceptions of nature when it is busy in an area. However, some participants brought up that walking with others can also enhance sensory perceptions of your environment, especially when it comes to seeing things. This was for example indicated by participant 11, who said:

*“With two you often see more than alone, because the one sees something different than the other, and you can point out these things to each other”*

### Comparison

All participants in both groups mentioned that they generally had high sensory perceptions of nature during their walk. A remarkable difference is that most of the participants in the control group also mentioned things they had felt or smelled, besides things they had seen and heard, whereas most of the participants in the experimental group only mentioned things they had seen or heard. It is also noticeable that the participants in the experimental group could not really express things that contribute to or detract from sensory perceptions of nature, in contrast to many of the participants in the control group, who referred to social interaction again as something that can either enhance or detract from sensory perception of nature. The alerting to things which increases sensory perceptions also seems to be the case for the experimental group, with the difference being that for these participants the app served this role of pointing out things in nature instead of other people. Another difference seems to be related to hearing sounds of nature; many of the participants in the control group said that they did not hear much (because of the chatting with others), whereas most of the participants in the experimental group mentioned that they had heard more sounds than normal, especially birds, as a result of the use of the app.

### **4.2.4 Amusement**

#### **Fun**

#### Experimental group

All of the participants expressed that they experienced the walk as amusing and that they had enjoyed themselves during the walk. Things that were mentioned that contributed to an enjoyable experience were interaction with others, the beauty and variety of the area and nature, and certain feelings that being in nature generates (e.g. feeling calm and at peace). The participants were also asked if the app contributed to an enjoyable experience or not. Most of the participants said that the app did positively contribute to a fun and enjoyable experience. It is noticeable that the participants who walked in groups, at which all participants made use of the route app, mentioned that they particularly enjoyed using the app in group context. For example, when participant 1 was asked whether the app contributed to an enjoyable experience, the answer was:

*“Yes, but that was especially because of the interaction with the family, that you are all being occupied with the app, with the same things at that moment”*

Figuring out the app together, using it together and comparing to each other seemed to have been amusing for participants that walked in groups at which all participants used the app. This was also brought up by participant 6:

*“Yes, constantly checking ‘what is yours doing’, and see who gets a notification first was fun”*

Also the information that the app provides was mentioned by some participants as positively contributing to an enjoyable experience. However, a few participants mentioned that the app was educational, but this does not necessarily contribute to an enjoyable experience. Educational and enjoyable experiences were considered separately from each other by these participants. Other

things that were mentioned that made the experience less enjoyable were crowds and uncomfortable pathways.

### Control group

The participants in the control group also all expressed that they experienced the walk as amusing and that they enjoyed themselves during the walk. One of the things that was mentioned multiple times as contributing to an enjoyable walk was the variation of the environment. And even though from the first three concepts it appears that social interaction could have a negative effect on certain aspects of experiencing nature, this social interaction was mentioned by most of the participants as the main reason that made the walk enjoyable. Participant 9 was one of the many participants who mentioned both the variation of the environment and social interaction:

*“The company, the social contact. But also the variation of the environment during the walk I really enjoyed. You do not only walk through a forest, you also walk along small waterways, puddles, open fields, the wooden plank footpath and the gnome path”*

Besides the variation of the area and social interaction, the peace and calmness of nature experienced during the walk was also brought up by a few participants as contributing to a pleasant walk.

### Comparison

The results from both groups relating to the indicator ‘fun’ appear to be very similar. All participants in both groups enjoyed themselves during their walks and the same things were mentioned as contributing in this respect; social interaction, variation of the environment and certain feelings that nature generates. The only difference is that most of the participants in the experimental group also thought the app contributed to a fun experience, a factor that the participants in the control group self-evidently did not have.

### **Ease and comfort**

#### Experimental group

Most participants found the walk more or less easy and comfortable. It was mentioned multiple times that the pathways were generally well passable and the route was easy to find. The app was often considered to have made the walk more easy and comfortable. Most mentioned reason for this was related to the route function, and the fact that you could not really get lost with the app. In addition, multiple participants brought up that the route descriptions were quite clear and that it was useful that you could also follow your location on a map, which contributed to ease and comfort during the walk. Also the notification points were mentioned by a couple of participants as making the walk more easy and comfortable, because it served as a ‘pastime’ during the walk. For example, when I asked participant 3 if he experienced the route as easy and comfortable, the answer was:

*“Yes, knowing that you cannot get lost, and also that you have something to do at certain moments”*

Some of the participants found the walk quite long. It is noticeable that one of the participants (2) mentioned that the use of the app made the walk more bearable, because it distracted in a positive

way from the (long) walk. Walking from one notification point to the other encouraged this participant to continue. However, another participant (4) mentioned that the use of the app actually made the walk less comfortable and that it took more effort, because you had to stop from time to time to read the information, meaning that you could not constantly walk through. From this it appears that the use of the app can work both ways in terms of ease and comfort during the walk.

#### Control group

All participants experienced the walk as easy and comfortable. It was mentioned by multiple participants that the pathways were well passable, even though muddy at some places. The only thing that had made the walk a little less easy and comfortable for the participants who had walked a picket route was that the signs were sometimes difficult to find, and really had to be searched for. Not knowing which way to go was experienced as uncomfortable by these participants.

#### Comparison

Similarities between both groups appear in terms of the experienced ease and comfort of the pathways. However, some participants in the control group mentioned that it was sometimes difficult to figure out the course of the route and this was considered as somewhat uncomfortable. The app helped the participants in the experimental group in this regard, and the clear route function of the app was often emphasized as contributing to an easy and comfortable walk. So for both groups, knowing the course of the route enhances feelings of ease and comfort during the walk, but for the control group this was sometimes missed whereas for the experimental group the use of the app helped in this regard.

#### **Organization of the route**

##### Experimental group

For the indicator 'organization of the route', questions were asked relating to whether the participants checked the (course of the) route beforehand, if they already opened any notification points before they started the route, etc. All of the participants mentioned that they had checked out the course of the route before they started their walk. Moreover, it appeared that all participants prepared their walk quite precisely in terms of the route, as they all knew exactly which route they wanted to walk before they started and also checked an overview of the route. However, most of the participants did not check the notification points beforehand. This was for example indicated by participant 1:

*"I have roughly looked at how the route went but I did not look at the notification points beforehand, I wanted to be surprised by that"*

One participant (7) also opened some of the notification points beforehand, seemingly driven by curiosity and seeking some certainty, as this participant wanted to know how the app worked and what kind of information the app provides before the start of the walk.

##### Control group

All of the participants in the control group had picked out or thought of a route before they started their walk. The participants that were unfamiliar with the area chose picket routes, and the

participants who were already familiar with the area had devised a route themselves. Hence, all of the participants thought of a route in advance and thus organized their route in terms of choosing a specific route beforehand. None of the participants had deviated from the route during the walk. In addition, all participants more or less knew what to expect in terms of the length and duration of the routes, and the participants who followed a picket route also checked an overview of the route before they started their walk. Some participants had particular motives for this, such as participant 9, who said:

*"I never go walking without a plan. I cannot walk any longer than an hour and a half, so therefore I am definitely not going to wander"*

Most of the participants also mentioned that when they go to an unfamiliar area, they always choose a fixed route, whereas in areas in which they are familiar these participants are more likely to walk without a plan or deviate from the original plan in terms of the route. This was for example referred to by participant 7:

*"In unfamiliar areas where I have never been before I always check a map with marked routes and their duration, and then choose one, whereas when I walk in familiar areas I often go discover parts where I have not been yet and I am more likely to deviate from the route"*

### Comparison

Quite some similarities appear between both groups in terms of organization of the routes. All participants seemed to have chosen a particular route beforehand, and did not deviate from this route. Most participants also preferred to have seen an overview and know the length and duration of the route. For the participants in the experimental group, the app significantly contributed in those respects.

### **Know what to expect**

#### Experimental group

Because of the use of a route app, the participants in the experimental group had to walk a fixed route and therefore knew to a greater or lesser extent what to expect during the walk in terms of the route (depending on how much they 'organized' the route). This can detract from an 'unexpected' element during the route, which might either be desired or undesired by the participants. Hence, the participants were asked how they felt about this fixed route, and that they could see (an overview of) the exact route and therefore more or less knew what to expect from the route. Most participants said that they did not mind knowing the course of the route and as a result knew what to expect in terms of the route before and during the walk. It appeared that these participants prefer certainty over the unknown and expressed things relating to this (e.g. being sure that they do not get lost during a walk). For example, when I asked participant 1 about this, the answer was:

*"Personally I find that pleasant, I am not the type of person who goes roam around without a plan, so it was nice to have the app in that sense"*

And participant 8 said:

*"I very much enjoyed that you could exactly see where you were at during the route and how long you still had to walk. I would like it even better if you could see how many kilometers you still have to walk"*

It was also mentioned a couple of times that even though you kind of know the course of the route due to the app, you still do not know what you are actually going to see and there are still a lot of unexpected things during the route. This was for example clearly indicated by participant 4, who said:

*"Well, you do not really know what to expect right? Yes, you see the route but you still do not know what you will come across during the route. And I prefer to at least know beforehand how the route runs, the length of the route and at which points you could encounter something"*

A few participants stated clearly that they did not like the fixed route and knowing what to expect of the route beforehand. This was for example referred to by participant 7:

*"Personally I did not like that I could see on the app where I was and how long I still had to walk. I would rather just walk without being concerned with that"*

However, participant 9, who also enjoys roaming around and does not mind getting lost, said that it was actually quite nice to have the app during a walk in nature. When asked why, the answer was:

*"Because I knew exactly where I was and how to get back on the right track at the time I wanted to. The app served as a sort of back-up, I really liked that"*

### Control group

The participants in the control group also more or less knew what to expect in terms of which route they were going to walk and the length and duration of the particular route. When they were asked how they felt about more or less knowing what to expect in terms of the route, most participants expressed that they do not mind this and also prefer this, especially when in unfamiliar areas. For example, participant 8 said about this:

*"I do not need to know what to expect in terms of what kind of nature you are going to see, but in terms of the practicalities of the route I prefer to know what to expect"*

Some participants also mentioned that even though you have seen an overview of a route, you still not really know what to expect during the route as in what you are actually going to see and experience. This was for example brought up by participant 6:

*"I like knowing what to expect in terms of the route, seeing an overview of how the paths run globally, but still you never know what you are going to experience during the route beforehand"*

### Comparison

Again, the results of the experimental and control group seem to be quite similar. Most participants in both groups expressed that they did not mind knowing what to expect in terms of the route and also prefer this. For the participants in the experimental group, the app contributed in this respect

and the participants in the control group looked for picket or familiar routes so that they more or less knew what to expect in terms of the route. It is also noticeable that participants in both groups mentioned that even though you know what to expect in terms of the practicalities of the route, you still do not know what you are actually going to experience.

#### 4.2.5 Interest

##### **Actively seeking information to learn about nature**

###### Experimental group

To examine whether the participants in the experimental group had actively used the app to learn about the environment and nature during the walk, several questions were asked of which the answers would give insight in this. For example, questions were asked relating to how many notification points the participants read, how many times the participants clicked through to the field guide, and if the participants had filtered the information. Except for one participant, all of the participants had not filtered the information, because they were interested to learn about each of the nature-related theme's. Participant 12 was the only participant who used the option to filter the information from the app:

*"Yes, I did filter the information, because I am not very interested in amphibians, so I left that one out"*

Most participants opened all of the notification points, read the accompanying text and viewed the pictures. A couple of participants opened most of the notification points but not all, because they thought there were too many and it would take too much time to view them all. It was also mentioned by a few participants who walked with others that they did not open the app at every notification point, because they thought the app would otherwise disturb their social interaction in one way or another. This was for example brought up by participant 8:

*"At some notification points I did not open the app because I was busy talking and I did not want to interrupt the conversation, so for that reason I consciously skipped a few points"*

It appeared that the information at the notification points and from the field guide was more appreciated if it was related to things that the participants could observe. For example, participant 4 mentioned:

*"It is nice if the app points you to something that you can actually see. Otherwise you only record the knowledge, but then do nothing with it"*

But for other participants, the information was also appreciated if one failed to see whatever it was the app pointed out, because they still learned and knew what is occurring in the area even though you might not encounter it. This was for example referred to by participant 3:

*"What I liked about the field guide is that you can hear the sounds of the birds that occur in the area, even when you cannot actually see or hear them in real nature"*

Participant 2 appreciated that the app can work both ways; you might observe things in nature that the app points out, but you can also identify certain species you see in nature by means of the app:

*"I used the field guide option to see if I could observe the species mentioned in the app in real life, but also the other way around; when I heard something in the forest I opened the app to listen to the different birds sounds and check whether the sound I heard corresponds to one of the species indicated on the app"*

The majority of the participants used the option to click through to the field guide, in order to learn more about a specific species that occurs in the area, view more pictures and in some cases hear the sounds they make. But the participants who used the field guide option, did not click through every time there was a possibility to do so. Some participants mentioned that this was because they only clicked on the species they are particularly interested in. Others expressed that they did not click on all the species name because it would take up too much time during the walk. For example, participant 1 said:

*"Because you are also walking with other people, it takes too much time to really delve into it. So when I would walk with the app again, maybe I would look at the field guide beforehand so that when you come across certain birds for instance you already know more about it"*

It also appeared that some of the participants were not aware of the field guide option. When this came up during the interview, the participants were given an explanation of the field guide. All of these participants subsequently mentioned that they thought it was a pity they were not aware of the field guide, and that if they would have been aware of it and/or when they use the app next time, they would definitely be interested in using the field guide option.

It appears that most participants did actively use the app to seek nature-related information about the environment. There seems to be no difference between the people who were already familiar with the area and those who were not, all participants were interested in using the app to learn more about the environment. This was for example clearly indicated by participant 5, who is very familiar with the area and already had a lot of knowledge about it:

*"I have read all the information because I wanted to learn even more about the area and see if there is anything I did not know yet"*

Some participants mentioned that they missed certain information and would have preferred more information. It was brought up multiple times that the participants would prefer more extensive information, as it was thought by multiple participants that some of the information was too brief, and that it would be nice if more species would be included in the field guide, since the focus of the field guide is currently very much on bird species. The participants who mentioned this would like this because then they could also more easily observe these species. This was for example brought up by participant 9:

*"I thought it was a pity that flowers, trees and mushrooms were missing in the field guide. I would like it if these would be included, and if the information could be seasonal. That you can see the species that you can expect in the spring, summer, fall and winter. That would be an enrichment"*

Even though most participants were quite positive towards the information of the app, some of the participants also mentioned that this is detached from one's nature experience, or even detracts

from the experience. This was for example clearly stated by participant 9, who said the following about the information provided by the app in relation to experiencing nature:

*“For increasing my knowledge an enrichment, for my experience an impoverishment. Because for me, nature experiences are really about experiencing and not about knowledge. I find the information nice and interesting, but it is detached from the experience”*

### Control group

The Renkums Beekdal does not really contain information signs. So when the participants were asked about whether they have actively searched for information during their walk, they often mentioned that this was not possible because of this lack of information signs in the area. The participants were also asked whether they had searched for information in other ways (e.g. looking up information on their mobile phone). None of the participants had done this during the walk. However, participant 1 and 2 mentioned that they wanted to visit the information center after the interview, because they had some questions about that area that came up during their walk and were curious to learn more about the environment. Despite the fact that the participants did not actively search for information themselves during the walk, most of the participants mentioned that they would have preferred the presence of information signs in the area, because they would have liked to learn something about the area and the occurring nature during their walk. This was for example indicated by participant 11:

*“Well, at some point we saw a little hill and I thought this might be a burial mound, but I was speculating, so if it would be a burial mound it would be nice if there had been an information sign about it”*

The participants that were already highly familiar with the area mentioned that they do not mind the absence of information signs in this area because they already have a lot of knowledge about it, but when in unfamiliar areas they would prefer the presence of some information signs along the route to learn new things about the environment. This was also referred to by the participants that were unfamiliar with the area, that it is nice to have information signs in areas where you have not been before. For example, participant 8 said:

*“I think it is a shame that there were no information signs in this area, I always like to read those when I am somewhere for the first time. Just some information relating to the environment, which bird species occur or about the origin of the area for instance. Usually you come across information signs on the way, but not here”*

### Comparison

Significant differences appear to be the case between the experimental and control group in terms of actively seeking information during the walks. This difference is mainly due to the fact that the experimental group had the app at their disposal, with all the information it provides, whereas the control group did not encounter any information (signs) during the route and also did not actively search for information through other means. At first sight, it seems that the participants in the experimental group were much more willing to seek information compared to the participants in the control group, and used the app optimally in this regard. However, it should be noted that these participants had used the app ‘on request’ to participate in this research and not necessarily on their own initiative, whereas the participants in the control group were not ‘influenced’ in this respect.

This makes it somewhat difficult to compare the results from both groups for this indicator. But similarities appear regarding the attitude towards information when in nature; most participants in both groups expressed that they usually prefer some information about the environment they are walking through (depending on whether they are familiar with the area or not). Also participants in both groups mentioned certain information they had missed, so participants in both groups were concerned with this.

### **Learned new things about nature**

#### Experimental group

The participants were also asked if they actually learned new things about the environment and the associated nature, and if this was because of the app. Most of the participants mentioned that they did not learn new things about nature in general, but that they did learn new things about nature in the specific area of Renkums Beekdal. Things that the participants had learned were related to certain plant and animal species, vegetation, landscape formation and structure and cultural history of the Renkums Beekdal. Everything the participants had learned during the walk was due to the information provided by the app. Also participants with above average or excellent knowledge of nature learned new things, for example about the cultural history of the area. It was mentioned a couple of times that those are things you cannot directly see (in contrast to for example plant and animal species), so therefore the app was considered very useful to learn about things in that regard. The participants who were already familiar with the area also learned new things about the area due to the app. For example, participant 5 was surprised to find a certain plant species indicated by the app, as the participant was not aware of its occurrence in the area before. Participant 6 had always wondered how many mills used to occur in the area, and got an answer to this thanks to the app. It also appeared that the app was useful for reminding some of the participants of certain things that they used to know, but forgot.

#### Control group

As a result of the absence of information signs in the area and a lack of actively seeking information themselves, the participants in the control group did not really learn new things about nature or the environment during their walk. A couple of the participants who had walked with someone else that was already familiar with the area and knew something about it mentioned that they had learned a few things from their fellow walker.

#### Comparison

Again, significant differences between the experimental and control group turn out to be the case for this indicator. The participants in the experimental group did learn new things about nature in the Renkums Beekdal, but this was all due to the information from the app. Self-evidently, the participants in the control group had not learned those things, and because there were also no information signs in the area, most of the participants in the control group had not learned new things at all. Interestingly, the participants in the control group that were familiar with the area mentioned previously that they do not mind the absence of information in this area or search for information because they already have quite some knowledge about it, but from the experimental group it appears that even the participants familiar with the area can learn new things or memorize things they used to know but forgot (due to the information provided app).

## **Increased interest in the environment**

### Experimental group

Here, the participants were asked what the influence of the walk and the app had been on their interest in the Renkums Beekdal. It must be noted that, as a matter of course, there was a big difference between people that were familiar and unfamiliar with the area. The participants who were familiar with the area and walk there quite often were already highly interested in the area, and it appeared that this particular walk with the app did not really have an effect on their interest as it had remained the same. The participants who were unfamiliar with the area mostly expressed that the walk and the use of the app did have a positive influence on their interest for the Renkums Beekdal. These participants enjoyed getting to know the area, and this was often mentioned as a reason why the walk and the app had a positive effect on the participant's interest in the environment. This was for example brought up by participant 8:

*"It is increased, because I started to think that this area is pretty close to home, and also very nice, so I was thinking which other routes I can also walk. So my interest is actually very much enlarged"*

And this could even be the case for participants that were sceptic about the app and its information, as participant 6 said:

*"Now that we are talking about it I think, yes, the knowledge does affect me. At first I thought it would be all ballast and it will distract me from the experience, but it actually increases your interest"*

### Control group

The participants that were (relatively) unfamiliar with the area all mentioned that the walk had increased their interest in the environment and the Renkums Beekdal nature reserve. Main reason that was brought up as having sparked these participant's interest was because of the (unexpected) beauty and variation of the landscape. Also some participants were pleasantly surprised that the area is quite close to where they live and they did not expect this type of landscape nearby. For example, participant 8 said:

*"My interest is positively stimulated. I only knew Renkum as a village but I was never aware of this beautiful nature area, even though it is quite close to home. Beforehand I even thought it would be boring, that we would only walk through meadows, so this variation along the walk was very unexpected. I was therefore pleasantly surprised"*

The participants who were familiar with the area expressed that their interest was already high and had remained the same.

### Comparison

The results of the experimental and control group are similar in the sense that in both groups the participants that were unfamiliar with the area all said that the walk had increased their interest, and the participants familiar with the area expressed that their interest is already high and therefore it did not change because of this particular walk. For the participants in the experimental group the app

had mostly sparked their interest, whereas the participants in the control group mentioned the beauty and variation of the landscape as the main reason for enhancing their interest in the environment. Some participants in both groups also mentioned to be pleasantly surprised by the fact that the area is close to home and that this 'discovery' or realization had also contributed to their interest.

#### 4.2.6 Dedication

##### **New ideas about nature**

###### Experimental group

As an indicator for the dedication mode of experience, the participants were asked if the walk had changed their views on and ideas about nature in general or in relation to the area of Renkums Beekdal. All of the participants expressed that their ideas about nature in general had not changed. The participants that were already familiar with the area also stated that their ideas about nature in the Renkums Beekdal had not changed either. However, the participants that were unfamiliar with the area mentioned that the walk did influence their views on nature in relation to this particular area. Before the walk, these participants did not really know what to expect in terms of nature in this area, and by getting to know the area better during the walk these participants apparently changed their views towards nature in the Renkums Beekdal. This was for example indicated by participant 7:

*"No, I do not think of nature any differently, but I do think differently about nature in this area, because I did not expect this much nature in the Renkums Beekdal. The app has also contributed to that"*

###### Control group

The participants familiar with the area mentioned that their ideas about the area and its nature had not changed because of this particular walk. Most of the participants that were unfamiliar with the area said that their ideas and views of this particular area did change. Main reason mentioned for this was that those participants did not know what to expect in terms of nature in this area, and discovering that it has such varied types of landscape had made them change their minds of nature in this particular area. Some participants also indicated that the walk had an impact on their ideas of nature in general. These participants all referred to the transformation of the area from an industrial area to a nature reserve as what had changed their ideas towards nature conservation. For example, participant 1 said about this:

*"Yes, because I find the realization of nature in this area very special. There are not many projects in the Netherlands where an industrial area is bought up to develop nature, so that is quite unique. And it is also good to see that this is actually possible in the Netherlands"*

###### Comparison

In both groups, participants unfamiliar with the area mentioned that their ideas of nature in this particular area did change. Reason for this was similar between both groups; the fact that these participants did not know what the area entails in terms of nature, and discovering this during the walk had affected their ideas about nature in this particular area. Also the participants unfamiliar with the area show some similarities between both groups; these participants mentioned that their ideas of nature in general or this particular area had not changed. The app also did not influence this.

Some participants in the control group also mentioned that their ideas about nature in general had changed, which was related to the nature realization projects of the area. This was not the case for any of the participants in the experimental group. However, it should be noted that the participants in the experimental group had walked routes whereby they did not pass the old industrial area, whereas some of the participants in the control group did (deliberately) walked passed this part of the area.

### **Exploring; unknown becomes known**

#### Experimental group

The participants were also asked whether they felt they had explored the area well or better. All of the participants that were unfamiliar with the area expressed that they felt that they had explored the area quite well, especially because most of them did not know anything about the area and what it looked like. Most of them also mentioned that the app played a role in the exploration of the area. For example, participant 2 said:

*“Yes, I think I have explored quite a big part of the area and I also explored the different landscape types of the area. And I think because the app mapped out specific routes, you can explore the area better”*

Some of the participants that were unfamiliar with the area, particularly addressed the information from the app as contributing to exploring the area. This was for example brought up by participant 7:

*“I think I have explored the area quite well, I think that I have seen a little bit of everything, the walk was also quite varied so I think I saw most of what kind of nature occurs here. And especially the information from the app contributed to my exploration of the area”*

Also the participants that were already familiar with the area expressed that they felt they had explored the area better, and that the specific routes from the app contributed to this. This was the case because these participants walked a different route due to the app, one that they would normally not walk in that order. Participant 5 for instance mentioned:

*“Because of the app I was led through parts where I would normally not walk, so I have discovered new pathways and routes which are also quite handy to for example get from one point to another. So all of the sudden I started to see new connections”*

Participant 9 also mentioned the walking of a different route than normally as having contributed to a better exploration of the area, as well as the information the app provided. When this participant was asked whether she explored the area better, the answer was:

*“Yes, because I have never walked those two areas one after the other. And also the information about the existence history of the area, I already knew that information but I have never read it like this, one after the other. I really enjoyed that, also that I could see the wider context”*

However, one participant (7) mentioned that the use of a route app could also have a negative impact on exploring an area, because you are walking a fixed route rather than roaming around in the area:

*“If you are for example walking somewhere and you want to deviate from the route, you would not really do that when you walk with the app, so in that sense you might explore the area less compared to when you would walk without the app”*

But again, it seems that the app could also work the other way around; participant 4 and 11 both mentioned that in fact it would be easier to deviate from a specific route with the use of an app, because you can see on the map where you are at and how to get back on the ‘right’ track, so you do not have to worry that you will get lost. They thought that this certainty might invite people to actually roam around more and subsequently explore the area better.

### Control group

The participants that were (relatively) unfamiliar with the area all expressed that they thought they had explored the area well or better. For these participants the area was new so therefore it was obvious they had explored the area better. This was for example referred to by participant 8:

*“Yes I think I have explored the area quite well, not that I know everything about it now but with this walk I at least got a good and nice first impression”*

Also discovering the variety of the landscape was mentioned as something which made the participants feel like they had explored the area quite well. The participants that were already familiar with the area walked routes that they had walked before and therefore did not explore the area any better.

### Comparison

Both the participants in the experimental and control group that were unfamiliar with the area mentioned that they had explored the area well or better, and also exploring the variety of the area was often brought up as having contributed to their exploration. A noticeable difference between the two groups is related to the participants that were already familiar with the area; in the control group these participants expressed that they had not explored the area better, whereas the participants in the experimental group did say that they had explored the area better or in a different way because of the specific routes provided by the app. Therefore, it seems that the app can significantly contribute in the sense of exploring the area better, even for people that are already familiar with the area because the app invites these people to walk different routes than they would normally do.

### **Wish to return**

#### Experimental group

Finally, the participants were asked whether they intend to come back to the Renkums Beekdal in the future. For the participants that were already familiar with the area and visit it frequently, the wish to return appeared needless to say. The participants that were unfamiliar with the area all expressed that they are also interested in visiting the area again. Most of them also mentioned that when they visit the area again, they also want to walk with the app again. For example, participant 8 said:

*“Yes, I want to return to this area again, I like it here. I also liked the app, so I would probably walk with the app again. I want to walk the other route from the app”*

And some of the participants that are highly familiar with the area also mentioned wanting to walk the other of the two routes provided by the app in the Renkums Beekdal.

### Control group

All of the participants in the control group expressed that they would like to come back to the Renkums Beekdal sometime, because they enjoyed their walks and especially the variety of nature was well received. The participants that were unfamiliar with the area also want to return because they felt that there is still much more to explore. For the participants that were already familiar with the area and visit it frequently, the wish to return was again needless to say.

### Comparison

Most participants in both groups had overall experienced an enjoyable walk and therefore expressed a wish to return to the area in the future. The participants in the experimental group moreover indicated that they are interested in walking with the app again when they would visit the Renkums Beekdal again. When the participants in the control group were more extensively informed about the research and told about the route app after the interview, they were also very much interested to use the app during future visits.

## **4.3 Other themes**

In this section, other noteworthy themes that emerged from the data analysis are presented.

### **4.3.1 Intention**

From the interviews with the participants in the experimental group it appeared that how the app is experienced is very much related to the intention with which you go to nature. These participants mentioned that this intention is highly determinative when it comes to them wanting to use the app and experiencing it as either positive or negative. It appeared that the participants had different intentions (which in itself are related to other circumstances) when walking in nature, and the use of the app did not always comply with this. One of the intentions mentioned by these participants with which they go into nature was not to be on your mobile phone, which the use of an app self-evidently detracts from. This was for example indicated by participant 1:

*“What I found negative was that I also walk in nature to be completely relaxed and to actually not being occupied with my phone”*

Also not wanting any external disturbance through the mobile phone was brought up, for example by participant 5:

*“On the one hand I found using the app a bit annoying, just because normally when I walk in nature I leave that thing home on purpose so that I do not get ringed and I can just walk without those distractions”*

Relaxation, finding peace and clearing your mind was also often mentioned as one of the intentions with which participants go to nature. The use of the app was often experienced negative in this regard, which was clearly stated by participant 6:

*“A disadvantage of the app is that when I walk in nature I like to dream away a bit, I find that relaxing, but that does not really work with such an app. It is thus associated with what I am looking for in nature; peace. So for the purpose of clearing my head when in nature the app did not help”*

Participant 3 mentioned that it he was fine with using it in the area in the Renkums Beekdal, but that he would not use it in every area:

*“I would for example not use it abroad. Then I am in a different mode and I want to get away from it all, I actually want to get lost, come across unexpected things, and receive no notifications whatsoever”*

Also receiving information was mentioned as something that the participants do not always intend when they go to nature. This was for example referred to by participant 9:

*“I usually go to nature to be concerned with nothing, which means that I normally do not like to receive information and appeal to my ratio when in nature”*

However, sometimes the intention can also actually be to obtain information (e.g. when in unfamiliar areas), and then the app is experienced more positive. Participant 10 said about this:

*“What I liked about the app is to get the additional information on sight, that was an enrichment. Sometimes I walk in nature to clear my head, but another time I also like to learn about what I see, which was also the case today”*

The significance of the intention with which you go to nature especially emerged from the experimental group, but was also referred to by some participants in the control group. This particularly came up when the participants were asked about how they felt towards the lack of information signs in the area. Some of the participants in the control group mentioned that they did not mind this because they do not always seek information when in nature, whereas others expressed that they actually do intend to learn some things about the areas in which they walk.

#### **4.3.2 Social interaction**

The semi-structured interviews did not contain questions directly related to social interaction. However, at many questions relating to the different indicators, social interaction was brought up by the participants during the interviews. Therefore, social interaction has also been identified as a separate, noteworthy theme. It appeared that social interaction was an important factor that defined the participant's overall experience, both in the experimental and the control group. Walking with others generally fostered a positive experience for participants in both groups, even though it can also be distracting. In the control group, social interaction was also often referred to as what had made the participants more or less aware of the environment, more or less in the moment and more or less sensory perceptions, and as one of the things that had made the experience fun. Especially from the control group it became evident that social interaction can often work both ways; for example, it could make the participants more aware of the environment by alerting things to each other, but talking with others could also be distracting and made that those participants paid less attention to their environment. Social interaction can thus be significantly determinative for the experience. For the experimental group, using the app simultaneously with others contributed positively to their experience. So even though each participant used the app individually on their own

mobile phone, using it in group context was considered to have enriched the overall experience. This is a noticeable result of this research, and was also unexpected for some of the participants themselves. For example, participant 3 said:

*"I discovered that you can also have fun together in nature with an app. Especially in the beginning, when everyone was figuring out the app, we had some hilarious and unifying moments"*

#### 4.3.3 (Un)known areas

Another significant factor which influenced how the participants felt towards the app and whether the participants experienced the app as positive or negative appeared to be related to whether the area is known or unknown. Participants that were not familiar with the area were generally more positive about the use of the app compared to the participants who were familiar with the area. The participants that were already (highly) familiar with the area needed the app less for the route descriptions and the information. Therefore, these participants generally considered the app as more disturbing and negative compared with the participants unfamiliar with the area, who in fact highly appreciated the clear route directions and the information provided by the app. The participants familiar with the area also often indicated that they would be more interested in using the app in unknown areas, and that if they had used the app in an unknown area that would probably have experienced the app differently. This was for example mentioned by participant 6, who said:

*"I think the advantages of the app would be more pronounced in an area that is unknown to you. I am pretty familiar in this area but if you visit an area of which you have no idea what kind of nature is occurring there the information of the app will help in that regard"*

Participant 12 also clearly indicated that the app is particularly interesting to use in unknown areas, because you have less need for its functions in familiar areas:

*"The app is nice if you are in a new area that you want to know more about. I do not think that you would use the app in areas that you know or use it multiple times in the same area, because then you will have less need for information and route directions. I think it is mainly interesting when you come somewhere for the first time. Then you are also more open to it"*

And when participant 5 was asked whether she is interested in using the app again, the answer was:

*"I would use the app in an area that is unknown to me and of which I want to obtain more background information, because here, well at some point I knew more about certain things than the app told me. So the app would be most interesting for unfamiliar areas"*

For the participants in the control group, the difference between known and unknown areas also came up during the interviews. For example, some participants mentioned that certain aspects of their nature experience, such as awareness and sensory perceptions of the environment, are more pronounced in areas that are unknown to them. This was for example indicated by participant 2, who said:

*"I liked walking in a different environment, in unknown areas my attention is more with the environment and with what I see compared to areas that I am familiar with"*

It was also mentioned by a couple of participants from the control group that they prefer to have some information provided relating to the area when they have little knowledge about it. For example, participant 9 said:

*"I did not miss the information here because I already know a lot about the area, but when I walk somewhere new I always look for information about the area"*

#### 4.3.4 Variation and balance

Two things that were mentioned or indicated a lot during the interviews from both the experimental and the control group, was the importance of variation and balance, both relating to the information about nature and nature itself. It appeared that this variation and balance of (information about) nature is an important factor that seems to highly influence the experience. First of all, the participants in the experimental group emphasized the importance of variation and balance of information provided by the app. Participant 4 was one of the many participants who mentioned that he would have preferred more variation in the information provided by the app:

*"There was a lot of the same kind of ecological information about birds for example. I would like to have had more varied information, so also more information about plants and other animals or insects that occur in the area, or historical and geographical information"*

The importance of balance in providing information, meaning that the notification points are evenly distributed along the route, was for example brought up by participant 1:

*"I found that there were a lot of notifications from the app in the beginning of the route, while at that moment I was like I just want to stretch my legs and walk through, whereas later on the route there were only few notification points, and I thought now some information may be provided so that you can also stand still for a while"*

Also the balance between using the app and putting it down at times to also have more of a direct nature experience was emphasized by multiple participants, i.e. the balance between a mediated and unmediated experience. For example, participant 6 mentioned:

*"You have to consciously put your mobile phone in your pocket every now and then, and just walk in nature without being concerned with the app. So you really have to use it as a route description and for the information, but in between you have to consciously put it away just to stay in nature"*

And participant 3 said about this:

*"It is nice that after a part with lots of information you also have a part with less information, it is nice that it varies a bit, because otherwise you will only be concerned with your app"*

In addition, all participants in both the experimental and control group very much emphasized the variation of nature as something that contributes to their overall nature experience. Variation of different landscape types, such as forests, open fields, and water, was brought up frequently as what had contributed to their (nature) experience. From the interviews, the variety of nature seemed one of the key factor for defining the experience as this was brought up by all participants in both groups, even though they were not directly asked about this.

#### 4.3.5 Spoken information

Multiple participants in the experimental group mentioned that they would have preferred the information on the app to be spoken information which you receive through earphones, instead of having to read the information on a mobile phone screen yourself. These participants felt that in this way, the advantages of using the app would be much higher because you do not have to look at your mobile phone screen during the walk and you would be able to look around more. Therefore, the benefits of the app on for example seeing things and feeling in the moment would be increased according to these participants (as looking at the screen was often considered to detract from these aspects of one's nature experience). Participant 8 for example would appreciate the route directions to be spoken:

*"Maybe it would be nice if the app speaks itself, like google maps, so that you just hear the route directions and do not have to grab your phone every time to look at the directions"*

And participant 12 clearly referred to the benefits of spoken information:

*"If you let the app speak the text, you would not be interrupted as much during the walk. If it would be more of an audio tour, you can look around more. I would prefer that"*

## 4.4 Syntheses of results

The results show that the app has had a significant effect on most of the sensitizing concepts and its indicators, but for some concepts this influence was less apparent or lacking. In addition, the extent to which these effects are apparent depend on several situational and contextual factors. From the results of the specific indicators for each of the six sensitizing concepts, it appears that the use of the app had a positive influence on consciousness, embodiment, amusement and interest. Based on the interviews it became clear that the participants in the experimental group were more aware of their environment because of the app and that (certain) sensory perceptions of nature increased. This positive influence seems to be less strong for immersion, as many participants indicated that the app did not really contribute to feelings of being absorbed in or surrounded by nature and also not so much to nature connectedness. The app also affected the modes of experience of the participants, as it significantly contributed to feelings of ease and educating the participants, i.e. to the amusement and interest mode of experience. The influence of the app seems less apparent for the dedication mode of experience, as the participants in the experimental group did not really change their ideas of nature for instance. Table 5 shows an overview of the main effects of the app on each of the six sensitizing concepts.

Table 5: Main effects of the app on the six sensitizing concepts	
Six sensitizing concepts	Main effects
Consciousness	<ul style="list-style-type: none"> <li>• Increased awareness of surrounding nature</li> <li>• Ensured encountering (new or special) things</li> <li>• Remembrance often related to things indicated by the app</li> </ul>
Immersion	<ul style="list-style-type: none"> <li>• No contribution to feeling absorbed in/surrounded by nature</li> <li>• No increased connection with nature</li> <li>• Mixed influence on feelings of being in the moment</li> </ul>
Embodiment	<ul style="list-style-type: none"> <li>• Increased sensory perceptions of nature (especially sight and hearing)</li> </ul>
Amusement	<ul style="list-style-type: none"> <li>• Using the app together was fun</li> <li>• Route function made the walk easy and comfortable</li> <li>• Organization of the route with the app was preferred</li> <li>• Knowing what to expect due to the app was appreciated</li> </ul>
Interest	<ul style="list-style-type: none"> <li>• App encouraged actively seeking information</li> <li>• New things were learned about nature because of the app</li> <li>• Information from the app increased interest in the environment</li> </ul>
Dedication	<ul style="list-style-type: none"> <li>• No new ideas about nature in general</li> <li>• Route function of the app can contribute to exploring the area</li> <li>• Wish to return, but not clearly related to the use of the app</li> </ul>

From the results it also became evident that whether the use of the app and the experience itself is considered positive or negative, is very much situational. For example, it depends on how the app is being used, with which intention one goes into nature and whether the area is known or unknown. This meant that the app was experienced more positive when the participants knew exactly how the app worked, when they went to nature with the intention to learn more about it and when the area was unknown to them. How the use of the app is being experienced is thus very much determined by certain circumstances and the situation in which the use of the app takes place, and can differ for

different aspects of one's experience. Therefore, it cannot be clearly stated that the app has either a positive or negative effect on one's nature experience.

It is also noticeable that the same effect of the app can often work both ways. For example, most participants mentioned that the app works distracting, but by some participants this distraction was experienced positive because it gave the participants something to do during the (long) walk, whereas others considered this distraction as something negative because it made these participants feel as if they were experiencing nature less when reading the information on their mobile screen. This was also the case for the control group; these participants also mentioned that certain aspects, such as social interaction, can be both an added value to the experience as well as detracting from it. On the one hand, the participants could alert each other to things in nature, but on the other hand it appeared that paying attention to each other often meant that less attention was paid to the surrounding. Moreover, certain indirect effects from the app came forward. For example, the birds sounds of the app did not only enhance the participants sensory perceptions of the specific bird, but also stimulated sensory perceptions of nature in general. The use of the app could also have indirect negative effects. Reading the information from the app for instance also resulted in some of the participants looking at other things on their mobile phones (e.g. received messages), which was usually considered disturbing by the participants.

Given that the experience of nature with the app is very much situational, and that the effects of the app on one's experience can often work both ways, it cannot simply be stated that the use of the app is either an enrichment of one's nature experience or actually detracts from it. It appears that the app can enrich the nature experience in certain respects, but at the same time can detract from the experience in other respects. From the results it became evident that the information provided by the app would be the biggest influence and potentially the greatest enrichment of the app. This information had an effect on many aspects of participant's experience; generally, it made them more aware of the surrounding environment, it stimulated sensory perceptions of nature, and it contributed to an amusing and interesting experience. It is noticeable that the impact of the information was not only apparent for participants that were unfamiliar with the area or with (below) average knowledge of nature, but also for the participants that were already familiar with the area and had above average or excellent knowledge of nature. At the same time, having to grab your phone and looking at a screen to read the information of the app can be distracting for one's nature experience, and was oftentimes considered as detracting from the experience. In addition, it should be noted that the participants clearly indicated that an educational experience is not always desired or sought for when in nature.

For almost all indicators, differences as well as similarities could be identified between the experimental and the control group. The most significant difference between the two groups would be related to the (lack of) information. Because of the information provided by the app and the significant influence of this information on the experience, the participants in the experimental group had a different kind of experience compared to the participants in the control group, who missed this information. This difference is mainly apparent in what the participants had experienced. For example, participants in both groups expressed to be aware of their environment and had a lot of sensory perceptions of nature, but what exactly the participants were aware of and the things the participants had sensory perceptions of differed. For the participants in the experimental group, these things were very much related to what kind of information they received from the app. For

example, the participants in the experimental group mentioned being aware of things they would not have been aware of without the app, such as the course of the streams. The participants in the control group did not refer to those things. The participants in the experimental group also had higher sensory perceptions of birds because of the birds sounds provided by the app compared to the participants in the control group. Hence, from the comparison between the experimental and control group it became evident that the experience was different in certain respects, with the use of the app playing a prominent role in this.

## 5. Discussion

The discussion consists of three sections. In the first section, some of the main results of this study will be interpreted and linked to scientific literature, thereby placing these findings into perspective. In particular, attention will be paid to some of the themes that emerged from the analysis and which are not covered by the theoretical framework of this study, as it is considered useful that these findings are compared with existing scientific literature. The six sensitizing concepts will be mainly discussed in the second section, in which the theoretical framework will be reflected upon. The third section will discuss the methodology adopted for this study and its limitations.

### 5.1 Interpretation of results

The aim of this study was to explore how the use of a route app influences nature experiences. One of the main findings of this study is that the way in which nature is experienced with the use of a route app is highly situational. Assuming that digital nature experiences (partly) depend on certain circumstances and contexts is in line with the relational approach adopted for this study, and substantiates the idea that experiences are not merely shaped by mental processes. Rather, experiences are also highly influenced by external factors that exist outside one's individual mind. The variation of nature, being in (un)known areas, social interaction and of course the route app itself are examples of external factors that had a significance influence on the participant's experience. This corresponds to the ideas put forward by Cohen (1979), who also emphasizes that different experiences are context bound and depend on someone's life stage, the specific surroundings and the company of others. This finding is also similar to the views of Hartig (1993), who argues that experiences depend on all kinds of human and environmental aspects, which can for example refer to social interaction and the variation of nature in the case of this study.

However, from the results it also appeared that individual mental processes do also play an important role in constituting the experience. For example, someone's intention to go to nature is something that is not an external factor, but rather stems from one's individual mind. The specific intention at a certain moment in time can of course be affected by external circumstances, but intentions itself involve individual thoughts or feelings with which someone enters nature. Aspects such as consciousness, immersion and embodiment are also closely related to mental processes that take place in someone's brain, but can be significantly influenced by external factors, for example by the use of a route app, the presence of others and nature itself. Therefore, from the results of this study it became evident that both individual and situational aspects and the interaction between those play important roles in shaping people's (digital) nature experience.

#### 5.1.1 Intention

From the analysis of the interviews it appeared that whether the use of an educative route app during a walk in nature is experienced positive or negative is partly related to the intention with which someone enters nature. The intention or motivation of people to go to nature is frequently studied. Hartig (1993) states that outdoor recreation is often motivated by a desire to break free from (the obligations of) daily life and to escape from the crowd. This was also referred to by many participants as one of the intentions with which they go to nature; to let loose of all kinds of thoughts and feelings related to their everyday settings and to experience peace and tranquility. In addition, Hartig (1993) also refers to motivations related to an aesthetic experience. With this intention, the recreant is 'pulled' by expectations about the aesthetic qualities of the area rather than 'pushed' by the circumstances of everyday life. The participants in this research did not directly mention this as

one of the intentions. Instead, most of the participants unfamiliar with the area had hardly any expectations about the area and the occurring nature at all. Rather, it appeared to be an effect of the experience; the nature experience made the participants highly appreciate the aesthetic values of the area. So the participants did have an aesthetic experience, even though this was not mentioned as one of the intentions. Kloek (2013) also touches upon several motivations for outdoor recreation, including enjoying nature and socializing. These were not directly mentioned by the participants as one of the intentions with which they might go to nature, but from the results it appeared that when in nature many participants did appreciate the enjoyment of and social interaction in nature and these factors influenced the experience.

From the results it also became evident that when someone goes to nature with one of the above-mentioned intentions, the use of an educative app is not always desired. However, it was also mentioned by some of the participants that learning more about nature (in relation to a specific area) can be an intention, especially when these areas are unknown. The research of Manfredo and Driver (1996) also showed that learning can be a motivation for people to be involved in outdoor recreation. Developing knowledge of the concerning area, learning about nature in general, experiencing new things and exploring the area are motivations that were frequently found in the study of Manfredo and Driver, and also emerged from the results of this study. It can thus be considered that when people visit a natural area with the intention to learn, the app can be an added value to the experience, but with other intentions the app might actually detract from the experience.

Considering the intention with which people want to experience nature is also important to understand what people expect from their experience and which benefits they want to gain from it (Manfredo and Driver, 1996). Therefore, taking into account people's intentions can also be helpful to (partly) explain why (certain aspects of) the route app are preferred or, conversely, undesired. The use of the app in group-context for instance was experienced positive by the participants, which is in line with the intention of sociality. And the route function of the app can contribute to an easy and comfortable experience, which is also often an intention with which people go to nature. However, for some participants, escaping from everyday reality was more difficult with the use of the app, because they were for example distracted by other notifications or messages. Some participants also found using the app quite difficult and/or distracting, making the experience less comfortable, even though an easy experience was sought for. It might be interesting and helpful to take the different intentions with which people might go to nature into account during the development of a route app, in order to respond to the wishes of its users and optimize the nature experience through the app. This can be combined with intentions for using digital technologies, as our interaction with digital technologies also involves certain intentions (McCarthy et al., 2007). Interestingly, these intentions appear to be quite similar to those with which people often go to nature, as the intentions for digital consumption are also often related to enjoyment and social interaction (Orru et al., 2019).

### **5.1.2. Social interaction**

From the results, social interaction appeared to be one of the key factors shaping the participant's nature experience. Social interaction during the experience was generally viewed positive; it was considered enjoyable and could also contribute to the nature experience by alerting each other to things in nature. This importance of social interaction in nature is supported by multiple other studies, that show the interrelatedness of social interaction and nature. First of all, socializing can be

one of the main motivations for people to engage with nature (Kloek, 2013). Several studies also show that green spaces, especially public or urban green spaces, stimulate social interaction, and that these social interactions can foster a sense of social cohesion (Biedenweg et al., 2017). In addition, besides contributing to people's nature or overall experience, social interaction during exposure to nature can also generate shared nature conservation support (Dean et al., 2019).

Besides social interaction playing an important role during direct nature experiences, it is noticeable that the participants in the experimental group who walked with others also brought up social interaction as something that had positively contributed to their experience. In particular, the participants enjoyed figuring out and using the app together. This is an interesting outcome, because it is often thought that digital technologies have an individualizing effect and actually diminish socialization (McCarthy and Wright, 2007). However, from this research it seems that this does not have to be the case for hybrid forms of digital nature experiences, as the participants also interacted with each other while using the app on their individual smartphones. Again, this is in line with relational theory, at which emphasis is placed on the interaction with others as a main factor that constitutes all kinds of phenomena and experiences. And when linking this finding to the SETs approach, it can be argued that not only one's interaction with the environment (social-ecological interactions) and with the app (social-technological interactions), but also social-social interactions play an important role in shaping people's digital nature experiences. These social-social interactions should be taken into consideration when examining hybrid digital nature experiences, and could also be taken (more) into account when developing route apps.

### 5.1.3 Variation of nature

From the results it became evident that the way nature is experienced is also significantly determined by the kind of nature, and especially the variation of different landscapes types in the Renkum's Beekdal had a positive effect on the participant's nature experience. That variation of nature can play an significant role in constituting one's nature experience is supported by Voigt and Wurster (2015), whose study showed that perceived diversity in (urban) nature enhances the quality of people's nature experience. This diversity of nature can increase the aesthetic appreciation of the area (Lindemann-Matthies et al., 2010), which also appeared from the results of this study. In addition, a study by Fuller et al. (2007) showed that diversity of nature is positively correlated with psychological wellbeing of urban green recreants, something that most of the participants from this study also sought for. For example, many participants mentioned that they wanted to 'recharge' during their walk in nature. Lerstrup and Konijnendijk van den Bosch (2017) examined different environmental features and its effects on children's nature experiences. From their study it appeared that nature experiences highly depend on the naturalness of an area and the presence of certain qualitative environmental features, including the variety and changeability of those. It became evident that direct nature experiences in areas with high quality environmental features (including variety) are more intense compared to areas in which a lot of cultivated influences are visible, and that variation in nature made the area more attractive. These outcomes also substantiate the finding of this study that variation of nature has a significant effect on people's nature experience, and is in line with the SETs approach, in which ecological components are emphasized.

This preference for varied landscapes and natural features can be explained by evolutionary and cultural influences. According to the psycho-evolutionary theory of Ulrich (1983), whether people feel pleasant in a certain area is amongst other things related to the variation and complexity of the

landscape, characteristics that make it possible to gain insight into the structure of an area and the presence of water. All of these features were mentioned by the participants and some participants also brought up that the app could contribute to this in certain regards. The information of the app about the different species and landscapes occurring in the area for instance made that the participants were even more aware of the variation in nature of the area, and the map of the route and the route itself made that the participants gained more insight in the structure of the area. This also gave an (often desired) sense of security for the participants, as they felt they that they had a good overview of the area and could not really get lost. Therefore, it can be considered that to a certain extent, the app can have an influence on someone's perceived landscape characteristics, thereby also (indirectly) influencing the experience in this regard.

#### 5.1.4 Nature connectedness

As an indicator for immersion, the participants were asked about their connection to nature during the walk. The results showed that the use of the app had the least positive effect on immersion and nature connectedness when compared to the other two aspects, consciousness and embodiment. For some participants it seemed to be a challenging act of juggling to experience nature and use the app at the same time, and this was in conflict at times. As a consequence, it was difficult for some participants to really feel surrounded by and connected with nature. For a sense of immersion and connection, direct and unmediated contact with nature seemed to be crucial, which would also be supported by various studies conducted on this topic (e.g. Cleary et al., 2018; Ives et al., 2017; Restall and Conrad, 2015).

Besides, according to Neuteleers and Deliège (2019), a clear, causal relationship between experiencing nature and connecting with it cannot simply be made, since mediating factors play a fundamental role in (culturally or morally) framing how people interpret their nature experiences. Neuteleers and Deliège argue that nature experiences are mainly shaped by our interpretation and say that *"the deeper impact of the experience crucially depends on the broader interpretative frame within which the experience takes place"* (p.49). This assumption can also be applied to digital nature experiences, with the route app being a framing mediator in the case of this study. The arguments of Neuteleers and Deliège are somewhat in line with the viewpoint of Büscher (2016) about 'the spectacle', as referred to in the theoretical framework of this study. Büscher also argues that human-nature relationships are highly mediated, for example by digital technologies and the persons who develop them. Therefore, it is not only difficult to examine the influence of using digital technologies during nature experiences on nature connectedness, it is also tricky to draw causal conclusions on this since many factors seem to play a role in this.

#### 5.1.5 The role of environmental education and information

Many research has been conducted to study the various benefits of environmental education and information. Environmental education and information is associated with fostering nature connectedness, enhancing positive values and attitudes towards nature and stimulating pro-environmental behavior. Again, the importance of direct contact with nature is apparent, as several studies have shown that the benefits of environmental education are higher when these programs contain outdoor nature settings (Andersson and Öhman, 2015; Ernst and Theimer, 2011). And vice-versa, direct nature experiences can contribute to obtaining environmental knowledge, as directly discovering, exploring, observing and interpreting the natural surroundings is considered to positively influence learning (Dieser and Bogner, 2016; Bögeholz, 2006). Therefore, outdoor environmental

education is assumed to be most effective, not only for increasing environmental knowledge, but also for supporting conservation awareness and environmental sensitive behavior in turn.

What is interesting about the use of an educative route app during direct nature experiences, such as the one examined for this study, is that the provision of education and information of the app takes place in an outdoor natural setting. Based on scientific literature regarding this topic, one would be inclined to think that the benefits from the app on nature connectedness can be significant. However, as discussed in the previous section, from the results of this study it appeared that the use of the app had a relatively small effect on nature connectedness. Perhaps this is the case because even though the participants were out in nature, the information was provided on a digital screen and did not necessarily involve intensive, direct contact with nature. In addition, only reading the information on the screen is required, whereas studies have shown that interactive learning is more effective compared to passive learning (Lapoix, 1997). The duration and intensity of the experience can also partly determine the extent to which environmental education is effective, and studies have shown that the longer and more intense the experience, the stronger nature connectedness (Braun and Dierkes, 2017). Because the walk with the app took about 1.5 – 2 hours, this might also be one of the reasons why most of the participants did not feel a strong connection to nature. Also, if the intention with which one goes to nature is not to learn about it (which was the case for some participants), the effect of information might be less strong (Bögeholz, 2006).

However, the information of the app did (positively) influence the participant's nature experiences in many other ways. First of all, most of the participants highly appreciated the information of the app; they enjoyed reading it and liked to obtain knowledge about the area and the occurring nature. It also had a positive effect on consciousness and embodiment; due to the information provided by the app, the participants expressed to be highly aware of their environment and had a lot of sensory perceptions of it. The information also significantly increased their interest in the area and the occurring nature of the Renkums Beekdal. Even though many research has been conducted on the effects of environmental education, especially on the relation between environmental education and nature connectedness, pro-environmental attitudes and behavior, little research is done about the influence of this information on other experience-related aspects, such as awareness and sensory perceptions. It can be useful to conduct more scientific research on this to better explain the complex and profound impacts that environmental education and information can have.

## **5.2 Reflection on theoretical framework**

Because of the lack of scientific research on hybrid forms of digital nature experiences, a tentative theoretical framework was developed, which was inspired by and based around multiple theories and concepts. A relational approach was used as the starting point from which experiences and relating theories and concepts were explained, the SETs approach was used as a base to explore social, ecological and technological components, and the six sensitizing concepts relating to different aspects and types of experiences formed the foundation and gave insight into the participant's (digital) nature experiences. All of these approaches, theories and concepts appeared to be more or less useful for the purpose of this research. A relational approach appeared to be suitable, since the outcomes of this study showed that one's (digital) nature experience highly depends on various interactions and situational circumstances, which can be best explained from a relational approach as adopted for this study. The SETs approach was useful for conducting a first exploration into the topic of human-nature-technology interactions, which could also be related to (hybrid forms of)

digital nature experiences. And, as in line with the SETs approach, from the results it became evident that all components indeed played an important role in shaping the participant's experiences. Building on the assumptions from relational theory and the SETs approach, the fundamentals of experiencing could be explained and related to the purpose of this research. From there, the six sensitizing concepts with corresponding indicators were outlined, and it appeared that all six sensitizing concepts and its specific indicators were helpful for developing relevant interview questions relating to the participant's experiences. The answers have given useful insights in the influence of a digital route app on experiencing nature.

This study has shown that the SETs approach cannot only be applied in urban and infrastructural studies, but can also be related to a topic such as digital nature experiences. For this topic, it is very important that a technological component is taken into account when examining people's nature experiences. Yet, many SEs studies still consider the technological component as a subcategory of social systems (Markolf et al., 2018). However, from this study it became evident that a technological component (in this case being a route app) can significantly influence several aspects of one's nature experience, i.e. affect social and ecological systems, and should therefore be considered as a distinct category rather than a subset. The six sensitizing concepts appeared to be useful for showing this significant influence of the technological component on people's nature experience. The route app had influenced how the participants engaged with and perceived their environment, by providing information about it and alerting to things in it. The participants also mentioned that they would not have known or seen certain things without the use of the app. And in comparison with the control group, who only 'dealt' with social-ecological interactions, it appeared that the participants in the experimental group had experienced different things, showing the significant mediating impact of the technological component on experiencing nature. When used in group-context, it also shaped the participant's engagement with each other, and the participants enjoyed using the app together with others. This is in line with the arguments of Stokols (2018), who also emphasizes that cyber-based technologies are increasingly shaping social and ecological systems and relations. In addition to showing the influence of the technological component, some situational factors that emerged from this study also underline the significance of social and ecological systems, such as social interaction and the variation of nature that played an important role in shaping the participant's nature experience.

The theoretical framework of this study was particularly developed for the purpose of this research and is not an established one, and some of its elements should be discussed. Even though the sensitizing concepts of the theoretical framework were a useful starting point for structuring the interviews, and also provided interesting insights, some comments can be placed. One of the things that came up during the interviews and the analysis was that the three aspects consciousness, immersion and embodiment are highly interrelated and therefore the results relating to these three concepts could sometimes overlap a bit. For example, being more aware of your environment can result in more sensory perceptions of it, and the other way around; more sensory perceptions of your environment can result in more awareness of it. This made it difficult at times to clearly distinguish between the three aspects. But at the same time, this interaction between the three concepts and the way they affect each other is also an interesting result in itself and somewhat in line with the relational approach of this study.

In addition, even though the results of this study provide first insights in several aspects that influence one's (digital) nature experience, it is likely that much more factors play a role in this which have not directly come forward from this research. Some other factors that were not incorporated in the theoretical framework in advance emerged from the data analysis and are presented in the results, but presumably not all factors that influence one's (digital) nature experience have been covered. This means that the theoretical framework is certainly not 'complete'. However, the results have shown that useful and interesting insights can be derived from the interviews that were based around the six sensitizing concepts of the theoretical framework.

The three modes of experiences (amusement, interest and dedication) were adopted from and inspired by the research by Elands and Lengkeek (2000). Despite being adapted, it appeared difficult at times to relate the three modes of experiences to a 2 hour walk, especially the dedication mode of experience. These modes have proven to be very useful for categorizing different types of tourist experiences, whose experience usually lasts over days, weeks or even months. As a matter of course, these kind of tourist experiences differ highly from a 2 hour walk in (nearby) nature type of experience. Nevertheless, it was a helpful starting point for obtaining inspiration about different types of experiences, and the questions relating to the different modes of experience significantly contributed to the results of this study. In addition, from the results it became evident that many participants walk in nature to escape from everyday life, to relax and to recover. This corresponds to the change mode of experience, which was left out from the sensitizing concepts used for this study in advance. But based on the results, the change mode of experience should be included as one of the main concepts since many participants indicated aspects of their experience that relate to this.

Besides these general findings, a reflection on each of the six sensitizing concepts will be given below:

### **Consciousness**

The results showed that consciousness plays an important role in experiencing nature and that the app positively contributed to this aspect, which made it a useful concept for exploring the influence of using a route app on experiencing nature. As addressed in the theoretical framework, the level of one's consciousness determines which part of the environment is perceived as relevant and apparently, the app provided information about the environment that the participant's experienced relevant and therefore consciously. In addition, the app extended the participant's consciousness by pointing out things they would otherwise not have been aware of. A lot of participants also mentioned things related to the information from the app as what they had remembered most from their experience, which also indicates the significant influence of the app on consciousness. Explaining consciousness from a relational perspective appeared to be highly suitable, as the results show that not only internal factors (i.e. the individual mind) but also external factors, such as the use of a route app determine one's consciousness. Lengkeek (1994) is one of the scholars that explained consciousness from more of a relational perspective and therefore, Lengkeek's points of view were very helpful for understanding the relational nature of conscious experiences.

The indicators *awareness of surrounding nature* and *memory*, and the interview questions relating to those helped to give useful insights in the aspect of consciousness. The indicator *seeing (new or special) things* was also interesting for exploring the influence of the app on experiencing nature, but

this indicator had some overlap with the indicator sensory perceptions of nature and would therefore probably be more suitable as an indicator for embodiment.

### **Immersion**

Even though the app did not really contribute to the aspect of immersion, the use of the concept was helpful for exploring hybrid forms of digital nature experiences. The various literature on immersion in relation to experiencing nature that was consulted for the theoretical framework showed that direct contact with nature fosters feelings of immersion, while the results of this study show that the use of a route app while experiencing nature did not really affect immersion. Therefore, the concept of immersion shows a difference between unmediated and mediated nature experiences, with unmediated nature experiences having a greater effect on feelings of immersion compared to mediated experiences. Even though multiple studies have shown that realistic digital representations of nature can enhance an immersed nature experience (e.g. Akers et al., 2012; Kratky, 2011), for hybrid digital nature experiences it seems that unmediated contact with nature has the upper hand on mediated contact regarding immersion. Taking this into account, the concept of immersion may be particularly applicable for indirect digital nature experiences, in which people are completely surrounded by a different reality. This outcome is moreover in line with the arguments put forward by Weinstein et al. (2009) on experiences, which were used in the theoretical framework of this study. According to Weinstein et al., people can only feel completely immersed in nature if they experience full presence, thereby not getting distracted by other external, non-natural inputs. The results showed that indeed the influence of an external factor (being the app) did not have a significant positive effect on immersion.

The three different indicators for immersion, *feeling absorbed in/surrounded by nature*, *connectedness with nature* and *being in the moment* all provided relevant insights in the aspect of immersion in relation to experiencing nature. However, from the interviews it appeared that questions relating to these indicators were considered incomprehensible by many of the participants and some found it difficult to answer these questions. Therefore, the concept of immersion and its corresponding indicators should be elaborated and brought in such a way that it can be well understood.

### **Embodiment**

The results showed that the use of an app during direct contact with nature can enhance an embodied experience. Moreover, it showed that embodiment is highly relational when it comes to hybrid forms of digital nature experiences, as not only human-nature interactions induced an embodied experience but also the use of the app significantly contributed to this. This is in line with the relational perspective on embodiment as put forward by White and Wilbert (2006), which was used to explain embodiment in the theoretical framework of this study. The positive influence of the app on embodiment is an interesting outcome, since it is usually assumed that digital technologies diminish an embodied experience (e.g. du Toit and Verhoef, 2018; Verma et al., 2015). But for hybrid digital nature experiences it appears to be the case that because of the use of an informative app people see and hear things they would otherwise not have seen or known, and that it actually stimulates sensory perceptions in the 'real' natural world.

The indicator *sensory perceptions of nature* was very helpful for gaining insights in the extent to which the participant's nature experiences had been embodied and how the app contributed to this. However, an embodied experience can encompass much more than only sensory perceptions of nature, and might for example also include certain (sensory) perceptions of oneself and feelings of 'out-there-ness', which were also referred to in the theoretical framework. But because of the relatively short duration of the participant's experiences it was considered irrelevant to ask about these profound aspects of an embodied experience. However, with sensory perceptions being the only indicator for embodiment, it did not fully cover the concept of embodiment.

### **Amusement**

The amusement mode of experience was more or less apparent amongst all participants and the concept was useful for obtaining insights in this. From the results it became evident that many participants 'used' the route app for purposes relating to this type of experience. The (route-function of the) app contributed to a *fun, easy and comfortable* experience (which were indicators for the amusement mode of experience) and it gave the participants the opportunity to carefully organize their route which made sure they knew what to expect. The indicators *organization of the route* and *know what to expect* were treated as separate indicators, but during the analysis of the interviews it became clear that these can be merged into one indicator as they are highly intertwined. If a participant had highly organized the route they also more or less knew what to expect from the route and prefer this, so viewing them as separate indicators turned out to be unnecessary.

### **Interest**

This mode of experience appeared to be highly applicable for the participant's experience, as the app has an informative approach. The ideas behind the interest mode of experience and the identified indicators were very useful for gaining insight in the influence of the information from the app on the participant's nature experience, and all three indicators (*actively seeking information to learn about nature, learned new things about nature and increased interest in the environment*) were helpful for this. With the information from the app having such a significant influence on several aspects of the participant's experience, more attention could have been paid to the role of environmental education in the theoretical framework in advance.

### **Dedication**

The results relating to dedication showed that this mode of experience was the least applicable to the participants, especially regarding the indicator *new ideas about nature* as this was not the case for the participants. This was already expected beforehand because of the relatively short duration the participant's nature experiences. Therefore, this specific indicator was perhaps not very relevant for exploring the participant's nature experiences. However, the other indicators did provide some interesting insights, such as that the use of the app can contribute to *exploration of the area* (even for people familiar with it) and all participant's expressed that they *wish to return* to the area in the future, which also indicates the dedication mode of experience. Therefore, the concept of dedication can also be considered useful.

## **5.3 Reflection on methodology**

The aim of this study was to explore the influence of using a route app on experiencing nature, and the methodologies applied appeared to be generally suitable for the purpose of this research.

Qualitative research appeared to be highly suitable for this, as it was possible to obtain in-depth information from the participants regarding their experiences. The use of an experimental and control group is unusual for a qualitative approach, since this is mainly applied in experiments and quantitative research. This meant that the noticed similarities and differences between both groups could not be statistically measured and quantitatively demonstrated. However, comparing between an experimental and control group did contribute to the exploration of different experiences and the influence of the use of the app. Combining an inductive and deductive approach is also considered to have been a helpful approach. A deductive approach was necessary to guide the interviews and ensure that sufficient information would be detected from this. At the same time, partly maintaining an inductive approach ensured that it was possible to also include other themes that emerged from the interviews, i.e. for a bottom-up approach. Since the topic is little studied and the theoretical framework is not an established one, this 'open-minded' methodology can be considered valuable.

One of the obstacles that were faced during the research was finding participants, especially for the experimental group. Even though the opportunities for finding participants were 'optimized' (e.g. by placing messages on several forums and offering participants something to drink and a present), it turned out to be a challenge to find people that were willing to participate. In the end, 24 people participated in the research, of which half formed the experimental group and the other half the control group. This might seem like a low sample size, which would detract from the validity and reliability of the results and making it difficult to draw general conclusions. However, for qualitative research and in-depth interviews, this can be considered as a sufficient sample and from the analysis it became evident that even some patterns and repetitive results could be identified. It should be noted that the participants had actively responded to the call to participate in the research themselves, indicating that these participants are likely to already have had an above average interest in walking in the area of Renkums Beekdal, in using a route app and/or participating in a scientific study. So even though the participants were 'selected' randomly (no conditions for participating were set), the representativeness of the participants can be questioned.

Another thing that should be taken in consideration is that for some participants in the experimental group, the app had not worked properly and/or they were not aware of the field guide function. This will undoubtedly have influenced the results of these individual participants, and has possibly also seeped through to the overall results. In any case, it can be stated that the participants whose app had not worked properly were more negative towards the app compared to the participants whose app did work properly, and the participants who did not use the field guide option because they were not aware of it missed a significant element that could have influenced their experience.

The control group appeared to be of interest, as significant differences between the experimental and control group came to light. This was especially the case for showing the difference between an informative and non-informative experience, and it substantiated the potential of the app being an added value in terms of the information it provides. However, also some criticisms can be made regarding the use of an experimental and control group. First of all, even though attention was paid to an equal division between both groups in terms of demographics of the participants (e.g. age, gender, knowledge about nature, familiarity with the area), there still appeared to be some differing circumstances which influenced the results. For example, all participants in the control group had walked with others, whereas half of the participants in the experimental group had walked alone. This could be one of the reasons why social interaction was much more emphasized by the control

group compared to the experimental group. Also the fact that the participants in the control group had walked other routes than the participants in the experimental group might have caused differences in the experience. For the comparison between the experimental and control group, the results would have been more reliable if the participants in both groups had walked the same routes. In addition, an experimental and control group are usually used for experiments and thus for quantitative research. Because this research has a qualitative approach, the differences between the experimental and control group are not measured and therefore the objectivity of those results can be questioned. However, because the theoretical framework of this study is not an established one, using a control group makes the results of the experimental group a bit more plausible and gives it more substance.

The semi-structured interviews were helpful for obtaining profound insights in the participants experiences. With an interview schedule made beforehand, it was ensured that all of the indicators of the six sensitizing concepts would be covered during the interviews, and also additional questions were occasionally asked depending on the course of the interview. However, because of the pre-made interview schedules and the aim to cover all indicators during the interviews, the interviews did lack a certain degree of flexibility. For instance, after the first couple of interviews several other themes came up, and it would have been useful to adjust the interview schedule a bit more and also incorporate other questions (relating to these emerged themes) to obtain a profound understanding of the other factors play an important role in shaping this (besides the six sensitizing concepts). The interviews could thus have been less structured, thereby responding more to what was actually being said by the participants. In addition, the topic of 'experiences' is a difficult one to grasp and the participants sometimes struggled with answering some of the interview questions relating to the specific indicators. Certain questions were oftentimes not fully comprehended, such as questions relating to nature connectedness, or participants found it difficult to answer certain questions because they never consciously thought about those particular aspects relating to their experience before. Because of this ineffability, it was challenging at times to obtain a profound and comprehensive description of each of the participant's experience.

The analysis of the interviews, which was done by means of manual coding, appeared to be a suitable method for this study. Coding manually was possible because the interviews were quite structured (with most of the questions relating to each of the specific indicators), and therefore, using a coding program was not necessary in this case.

## 6. Conclusions and recommendations

This study was aimed at exploring how the use of a route app influences nature experiences. From the results it can be concluded that the participant's experience of nature was significantly shaped by their interactions with the route app. The effects of the route app were most apparent for the aspects of consciousness and embodiment, as the participants in the experimental group were highly aware of their environment and had a lot of sensory perceptions of nature during their walk, and on the amusement and interest modes of experience, since the app contributed to an easy, comfortable and amusing walk and taught the participants (new) things about the surrounding environment which sparked their interest in the Renkums Beekdal nature reserve. The use of the app seemed to have had the least impact on the aspect of immersion and the dedication mode of experience. The influence of the app on feelings of being absorbed in or surrounded by nature and on nature connectedness were less clearly present compared to the aspects consciousness and embodiment. Also the dedication mode was less detected compared to the amusement and interest modes of experience, since the participants did not change their ideas of nature.

Besides the six sensitizing concepts that were incorporated in the theoretical framework of this study in advance, also other factors emerged from the data analysis that had influenced the participant's (digital) nature experience. These factors included the intention with which one goes to nature, social interaction, the variation and balance of the information from the app and nature itself, whether the area is (un)known and spoken information of the app. By comparing these findings with other scientific literature it became evident that most of these factors have been recognized as playing important roles in shaping direct nature experiences, and this study has shown that they also influence hybrid forms of digital nature experiences. Taking all these different aspects and factors that constitute (digital) nature experiences into account, it can be argued that the way nature is experienced with the use of an educative route app is highly situational and depends on various external and internal circumstances and contexts.

Based on these conclusions, it can be considered that the using the app is especially interesting for unknown areas, for users that seek a comfortable walk and go to nature with the intention to learn more about the environment, and for those who want to have a more conscious and embodied nature experience. For those who can relate to this, the use of a route app might be an added value to their nature experience. However, whether the app is truly an enrichment for or actually detracts from one's experience is difficult to grasp and there seems to be no unambiguous answer to this, because of the complexity of the many factors and processes that play a role in shaping the experience. The same effect of the app can be experienced either positive or negative by different people, and indirect effects can also affect the experience. One of the things that was most apparent detracting from the participant's nature experience was the direct or indirect distraction the app might give from experiencing nature. And from the results it became evident that the information provided by the app has the potential to be the greatest enrichment of the app for the nature experience of its users, which confirms the saying that *facts feed wonder*.

### Recommendations

Since the topic of digital nature experiences in general and hybrid forms of digital nature experiences specifically is relatively new and therefore not much studied, it can be considered that conducting more research on this topic is desirable, especially given the current, simultaneous trends of

diminishing nature experiences on the one hand, and an increased engagement with digital technologies on the other hand. Because of the gap of scientific literature, there are many possibilities for future research to investigate the topic. This study was aimed at providing a comprehensive description of various aspects of the participant's nature experiences with the use of a route app. More similar types of research can be conducted to substantiate the new insights of this study, but future research could also focus on other sides of the 'digital nature experience spectrum', such as the motivations of people for using digital technologies while in nature, or (quantitatively) examining certain effects of using digital technologies during direct contact with nature. Insights in this can be helpful for explaining human-nature-technology relations and possibly applied in an attempt to attract people to nature and reverse the 'extinction of experience'.

Besides studying various sides of the digital nature experience spectrum, it would also be interesting to examine other forms of digital technologies. The digital technology chosen for this study was a route app with an educational approach, but many other nature-related digital technologies and apps exist, and it would be useful to gain insight in how these different types of apps with differing approaches are experienced. Studying the influence of different types of digital technologies can be helpful for understanding and assessing what characteristics work best in order to 'optimize' the digital nature experience. This study provides first insights in the possible advantages and disadvantages of using a route app for one's nature experience, but more research should be conducted to reveal potential opportunities and threats of digital technologies in general. In this way, it might be possible to create digital technologies that aim to include 'the best of both worlds', thereby providing the benefits of both digital and direct nature experiences, and of both mediated and unmediated experiences.

The results of this study provide some interesting insights in how the participants experienced the use of the Crossbill Routes app. Based on the responses of the participants, some recommendations for the development of (educative) route apps can be made. First of all, many participants expressed that they would prefer the information from the app to be spoken, and indicated that this would decrease some of the negative effects of the app. These participants would like it better if they could leave their mobile phone in their pocket during the walk, as looking at their mobile phone screen at every notification point to read the information made the participants feel as if they were experiencing nature less. In addition, the app might include a function to demise other notifications while using the app, so that users are for instance not distracted by other messages during their walk. It might also be interesting to incorporate more interactive learning elements into the route app. Now, users only have to read the information which can be considered a passive learning approach, whereas the impact of interactive education is generally higher compared to passive education. In addition, it can be interesting for route app developers to make use of certain gamification techniques. One might think of options to 'collect' the notification points and the species from the field guide, allocating an (imaginary) reward if a user collected all of the notification points and/or species, and providing an option to share these accomplishments with other users of the app or on social media. But also including a quiz for instance can be interesting for attracting (younger) users. These techniques cannot only be applied to attract users and stimulate their activity, but it can also be used to encourage environmental learning. By optimizing the usability of the app, the advantages for experiencing nature can be increased and the disadvantages decreased. In this way, the use of a route app can definitely be an added value to people's nature experiences.

## References

- Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference. *Future of learning group publication*, 5(3), 438.
- Akers, A., Barton, J., Cossey, R., Gainsford, P., Griffin, M., & Micklewright, D. (2012). Visual color perception in green exercise: Positive effects on mood and perceived exertion. *Environmental science & technology*, 46(16), 8661-8666. DOI: [10.1021/es301685g](https://doi.org/10.1021/es301685g)
- Alessa, L., Kliskey, A., & Altaweel, M. (2009). Toward a typology for social-ecological systems. *Sustainability: Science, Practice and Policy*, 5(1), 31-41. <https://doi-org.ezproxy.library.wur.nl/10.1080/15487733.2009.11908026>
- Andersson, K., & Öhman, J. (2015). Moral relations in encounters with nature. *Journal of Adventure Education and Outdoor Learning*, 15(4), 310-329. <https://doi-org.ezproxy.library.wur.nl/10.1080/14729679.2015.1035292>
- Arts, K., van der Wal, R., & Adams, W. M. (2015). Digital technology and the conservation of nature. *Ambio*, 44(4), 661-673. <https://doi-org.ezproxy.library.wur.nl/10.1007/s13280-015-0705-1>
- Ballew, M. T., & Omoto, A. M. (2018). Absorption: How Nature Experiences Promote Awe and Other Positive Emotions. *Ecopsychology*, 10(1), 26-35. <https://doi-org.ezproxy.library.wur.nl/10.1089/eco.2017.0044>
- Ballouard, J. M., Brischoux, F., & Bonnet, X. (2011). Children prioritize virtual exotic biodiversity over local biodiversity. *PLoS one*, 6(8), e23152. <https://doi.org/10.1371/journal.pone.0023152>
- Balmford, A., & Cowling, R. M. (2006). Fusion or failure? The future of conservation biology. *Conservation Biology*, 20(3), 692-695. <https://doi-org.ezproxy.library.wur.nl/10.1111/j.1523-1739.2006.00434.x>
- Behagel, J. H., Arts, B., & Turnhout, E. (2017). Beyond argumentation: a practice-based approach to environmental policy. *Journal of Environmental Policy & Planning*, 1-13. <https://doi-org.ezproxy.library.wur.nl/10.1080/1523908X.2017.1295841>
- Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*. Rowman & Littlefield.
- Biedenweg, K., Scott, R. P., & Scott, T. A. (2017). How does engaging with nature relate to life satisfaction? Demonstrating the link between environment-specific social experiences and life satisfaction. *Journal of Environmental Psychology*, 50, 112-124. <https://doi.org/10.1016/j.jenvp.2017.02.002>
- Blustein, D. L., Schultheiss, D. E. P., & Flum, H. (2004). Toward a relational perspective of the psychology of careers and working: A social constructionist analysis. *Journal of Vocational Behavior*, 64(3), 423-440 <https://doi.org/10.1016/j.jvb.2003.12.008>
- Borrie, W. T., & Birzell, R. M. (2001). Approaches to measuring quality of the wilderness experience. *Visitor use density and wilderness experience: proceedings; 2000 June 13; Missoula, MT. Proceedings RMRS-P-20*, 29.

- Bowen, G. A. (2006). Grounded theory and sensitizing concepts. *International journal of qualitative methods*, 5(3), 12-23. <https://doi-org.ezproxy.library.wur.nl/10.1177/160940690600500304>
- Bögeholz, S. (2006). Nature experience and its importance for environmental knowledge, values and action: Recent German empirical contributions. *Environmental education research*, 12(1), 65-84. <https://doi-org.ezproxy.library.wur.nl/10.1080/13504620500526529>
- Braun, T., & Dierkes, P. (2017). Connecting students to nature—how intensity of nature experience and student age influence the success of outdoor education programs. *Environmental Education Research*, 23(7), 937-949. <https://doi-org.ezproxy.library.wur.nl/10.1080/13504622.2016.1214866>
- Bruni, C. M., Winter, P. L., Schultz, P. W., Omoto, A. M., & Tabanico, J. J. (2017). Getting to know nature: evaluating the effects of the Get to Know Program on children's connectedness with nature. *Environmental Education Research*, 23(1), 43-62. <https://doi-org.ezproxy.library.wur.nl/10.1080/13504622.2015.1074659>
- Büscher, B. (2016). Nature 2.0: Exploring and theorizing the links between new media and nature conservation. *new media & society*, 18(5), 726-743. <https://doi-org.ezproxy.library.wur.nl/10.1177/1461444814545841>
- Bystrom, K. E., Barfield, W., & Hendrix, C. (1999). A conceptual model of the sense of presence in virtual environments. *Presence: Teleoperators & Virtual Environments*, 8(2), 241-244. <https://doi-org.ezproxy.library.wur.nl/10.1162/105474699566107>
- Carlson, A. (2005). *Aesthetics and the environment: The appreciation of nature, art and architecture*. Routledge.
- Chalmers, D. (2003). Consciousness and its place in nature. *Blackwell guide to the philosophy of mind*, 102-142.
- Clayton, S., Colléony, A., Conversy, P., Maclouf, E., Martin, L., Torres, A. C., ... & Prévot, A. C. (2017). Transformation of experience: Toward a new relationship with nature. *Conservation Letters*, 10(5), 645-651. <https://doi-org.ezproxy.library.wur.nl/10.1111/conl.12337>
- Cleary, A., Fielding, K. S., Murray, Z., & Roiko, A. (2018). Predictors of nature connection among urban residents: assessing the role of childhood and adult nature experiences. *Environment and Behavior*, 0013916518811431. <https://doi-org.ezproxy.library.wur.nl/10.1177/0013916518811431>
- Cohen, E. (1979). A phenomenology of tourist experiences. *Sociology*, 13(2), 179-201. <https://doi-org.ezproxy.library.wur.nl/10.1177/003803857901300203>
- Collado, S., Corraliza, J. A., Staats, H., & Ruíz, M. (2015). Effect of frequency and mode of contact with nature on children's self-reported ecological behaviors. *Journal of Environmental Psychology*, 41, 65-73. <https://doi.org/10.1016/j.jenvp.2014.11.001>
- Cordell, H. K. (2008). The latest trends in nature-based outdoor recreation. *Forest History Today*, Spring 2008.
- Cronon, W. (1996) The trouble with wilderness: Or, getting back to the wrong nature. *Environmental History*, 1(1), 7-28

- Crossbill Guides Foundation (w.d.). *Crossbill Routes App*. Consulted at 1 May, from <https://crossbillguides.nl/app>
- Dean, A. J., Barnett, A. G., Wilson, K. A., & Turrell, G. (2019). Beyond the 'extinction of experience'—Novel pathways between nature experience and support for nature conservation. *Global Environmental Change*, 55, 48-57. <https://doi.org/10.1016/j.gloenvcha.2019.02.002>
- Depietri, Y., & McPhearson, T. (2017). Integrating the grey, green, and blue in cities: nature-based solutions for climate change adaptation and risk reduction. In *Nature-based solutions to climate change Adaptation in urban areas* (pp. 91-109). Springer, Cham.
- Dieser, O., & Bogner, F. X. (2016). Young people's cognitive achievement as fostered by hands-on-centred environmental education. *Environmental Education Research*, 22(7), 943-957. <https://doi.org.ezproxy.library.wur.nl/10.1080/13504622.2015.1054265>
- Duerden, M. D., & Witt, P. A. (2010). The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. *Journal of Environmental Psychology*, 30(4), 379–392. <https://doi.org/10.1016/j.jenvp.2010.03.007>
- De Kort, Y. A., Meijnders, A. L., Sponselee, A. A., & IJsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of environmental psychology*, 26(4), 309-320. <https://doi.org/10.1016/j.jenvp.2006.09.001>
- De Vries, S. (2016). *Van Groen Naar Gezond: mechanismen achter de relatie groen-welbevinden* (No. 2714). Alterra, Wageningen-UR.
- Den Ouden, I. (2014, 6 October). *Top 10 natuur wandelapps in Nederland*. Consulted at 1 May 2019, from <https://www.dewandeldate.nl/tips/top-10-natuur-wandelapps-nederland>
- Du Toit, J., & Verhoef, A. H. (2018). Embodied digital technology and transformation in higher education. *Transformation in Higher Education*, 3(1), 1-8. <https://doi.org/10.4102/the.v3i0.52>
- Elands, B. H., & Lengkeek, J. (2012). The tourist experience of out-there-ness: theory and empirical research. *Forest Policy and Economics*, 19, 31-38. <https://doi.org/10.1016/j.forpol.2011.11.004>
- Elands, B., & Lengkeek, J. (2000). *Typical Tourists: Research into the theoretical and methodological foundations of a typology of tourism and recreation experiences*. Mansholt Graduate School.
- Ernst, J., & Theimer, S. (2011). Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research*, 17(5), 577-598. <https://doi.org.ezproxy.library.wur.nl/10.1080/13504622.2011.565119>
- Fletcher, R. (2017). Gaming conservation: Nature 2.0 confronts nature-deficit disorder. *Geoforum*, 79, 153-162. <https://doi.org/10.1016/j.geoforum.2016.02.009>
- Franco, L. S., Shanahan, D. F., & Fuller, R. A. (2017). A review of the benefits of nature experiences: More than meets the eye. *International journal of environmental research and public health*, 14(8), 864. <https://doi.org/10.3390/ijerph14080864>

- Fuentes, A. (2010). Naturalcultural encounters in Bali: Monkeys, temples, tourists, and ethnoprimateology. *Cultural anthropology*, 25(4), 600-624.
- Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of greenspace increase with biodiversity. *Biology letters*, 3(4), 390-394.
- Gifford, R. (2014). Environmental psychology matters. *Annual review of psychology*, 65, 541-579. <https://doi-org.ezproxy.library.wur.nl/10.1146/annurev-psych-010213-115048>
- Giusti, M., Barthel, S., & Marcus, L. (2014). Nature Routines and Affinity with the Biosphere : A Case Study of Preschool Children in Stockholm. *Children, Youth and Environments*, 24(3), 16–42.
- Google Play, (2019). *Crossbill Routes Veluwe*. Retrieved at 28 August 2019, from <https://play.google.com/store/apps/details?id=nl.knowlogy.jimbo.crossbill.veluwe&hl=nl>
- Gulsrud, N. M., Raymond, C. M., Rutt, R. L., Olafsson, A. S., Plieninger, T., Sandberg, M., ... & Jönsson, K. I. (2018). 'Rage against the machine'? The opportunities and risks concerning the automation of urban green infrastructure. *Landscape and Urban Planning*, 180, 85-92. <https://doi.org/10.1016/j.landurbplan.2018.08.012>
- Hammersley, P. & Atkinson, M. (2007). *Ethnography. Principles in practice* (3rd ed.). New York: Routledge
- Haraway, D. (2013). *Simians, cyborgs, and women: The reinvention of nature*. Routledge.
- Haraway, D. J. (2003). *The companion species manifesto: Dogs, people, and significant otherness* (Vol. 1, pp. 3-17). Chicago: Prickly Paradigm Press.
- Haraway, D., & Teubner, U. (1991). *Simians, cyborgs, and women* (p. 203225). na.
- Harrington, A. (2005). *Modern social theory*. Oxford: Oxford University Press.
- Hartig, T. (1993). Nature experience in transactional perspective. *Landscape and Urban Planning*, 25(1-2), 17-36. [https://doi.org/10.1016/0169-2046\(93\)90120-3](https://doi.org/10.1016/0169-2046(93)90120-3)
- Hartmann, P., & Apaolaza-Ibáñez, V. (2008). Virtual nature experiences as emotional benefits in green product consumption: The moderating role of environmental attitudes. *Environment and behaviour*, 40(6), 818-842. <https://doi-org.ezproxy.library.wur.nl/10.1177/0013916507309870>
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15(9), 1277-1288. <https://doi-org.ezproxy.library.wur.nl/10.1177/1049732305276687>
- Ives, C. D., Giusti, M., Fischer, J., Abson, D. J., Klaniécki, K., Dorninger, C., ... & Raymond, C. M. (2017). Human–nature connection: a multidisciplinary review. *Current Opinion in Environmental Sustainability*, 26, 106-113. <https://doi.org/10.1016/j.cosust.2017.05.005>
- Jacobs, M. H. (2006). *The Production of Mindscapes: A Comprehensive Theory of Landscape Experience*. Wageningen: Wageningen University

- Jepson, P., & Ladle, R. J. (2015). Nature apps: Waiting for the revolution. *Ambio*, 44(8), 827-832. <http://dx.doi.org.ezproxy.library.wur.nl/10.1007/s13280-015-0739-4>.
- Jordan, D. J., Cox, A., Thompson, T., Jeon, J., Palacios, I., Patterson, A., ... & Henderson, K. A. (2009). An Exploration of the Meanings of Parks in Oklahoma. *Journal of Park & Recreation Administration*, 27(2).
- Kahn Jr, P. H., Severson, R. L., & Ruckert, J. H. (2009). The human relation with nature and technological nature. *Current Directions in Psychological Science*, 18(1), 37-42. <https://doi-org.ezproxy.library.wur.nl/10.1111/j.1467-8721.2009.01602.x>
- Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. *Children and nature: Psychological, sociocultural, and evolutionary investigations*, 117151.
- Kitchin, R., & Dodge, M. (2011). *Code/space: Software and everyday life*. Mit Press.
- Kloek, Eva Marjolein (2013) Colourful Green: Immigrants' and non-immigrants' recreational use of greenspace and their perceptions of nature. Degree of Doctor at Wageningen University, 1-196.
- Kratky, A. (2011, September). Playing nature—a short history of our mediated relationship to Nature. In *International Workshop on Human-Computer Interaction, Tourism and Cultural Heritage* (pp. 89-98). Springer, Berlin, Heidelberg.
- Kumar, R. (2014). *Research methodology: A step-by-step guide for beginners* (4th ed.). Sage.
- Lapoix, F. (1997). *Pour une sensibilisation a l'environnement*. Paris: Class. Oxford 907.19.
- Lengkeek, J. (1994). *Een meervoudige werkelijkheid: een sociologisch-filosofisch essay over het collectieve belang van recreatie en toerisme*. Lengkeek.
- Lerstrup, I., & Konijnendijk van den Bosch, C. (2017). Affordances of outdoor settings for children in preschool: revisiting heft's functional taxonomy. *Landscape research*, 42(1), 47-62. <https://doi-org.ezproxy.library.wur.nl/10.1080/01426397.2016.1252039>
- Levi, D., and S. Kocher (1999). Virtual nature; The future effects of information technology on our relationship to nature. *Environment and Behaviour* 31(2):203-226. <https://doi-org.ezproxy.library.wur.nl/10.1177/00139169921972065>
- Li, Y. (2000). Geographical consciousness and tourism experience. *Annals of tourism research*, 27(4), 863-883. [https://doi.org/10.1016/S0160-7383\(99\)00112-7](https://doi.org/10.1016/S0160-7383(99)00112-7)
- Lindemann-Matthies, P., Junge, X., & Matthies, D. (2010). The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation. *Biological Conservation*, 143(1), 195-202. <https://doi.org/10.1016/j.biocon.2009.10.003>
- Malone, N., & Oviden, K. (2016). Natureculture. *The International Encyclopedia of Primatology*, 1-2. DOI: [10.1002/9781119179313.wbprim0135](https://doi.org/10.1002/9781119179313.wbprim0135)

- Mania, K., & Chalmers, A. (2001). The effects of levels of immersion on memory and presence in virtual environments: A reality centered approach. *CyberPsychology & Behavior*, 4(2), 247-264. <https://doi-org.ezproxy.library.wur.nl/10.1089/109493101300117938>
- Manfredo, M. J., Driver, B. L., & Tarrant, M. A. (1996). Measuring leisure motivation: A meta-analysis of the recreation experience preference scales. *Journal of Leisure Research*, 28(3), 188-213. DOI: [10.1080/00222216.1996.11949770](https://doi.org/10.1080/00222216.1996.11949770)
- Manning, J. (2017). In vivo coding. In Matthes, J. (Ed.), *The international encyclopedia of communication research methods*. New York, NY: Wiley-Blackwell. Retrieved from <https://doi.org/10.1002/9781118901731.iecrm0270>
- Markolf, S. A., Chester, M. V., Eisenberg, D. A., Iwaniec, D. M., Davidson, C. I., Zimmerman, R., ... & Chang, H. (2018). Interdependent Infrastructure as Linked Social, Ecological, and Technological Systems (SETSs) to Address Lock-in and Enhance Resilience. *Earth's Future*, 6(12), 1638-1659. <https://doi-org.ezproxy.library.wur.nl/10.1029/2018EF000926>
- McCarthy, J., & Wright, P. (2007). *Technology as experience*. MIT press. DOI: [10.1145/1015530.1015549](https://doi.org/10.1145/1015530.1015549)
- McGinnis, M., & Ostrom, E. (2014). Social-ecological system framework: initial changes and continuing challenges. *Ecology and Society*, 19(2). <http://dx.doi.org/10.5751/ES-06387-190230>
- McNamee, S. (2004). Relational bridges between constructionism and constructivism. *Studies in meaning*, 2, 37-50.
- McPhearson, T., Haase, D., Kabisch, N., & Gren, Å. (2016). Advancing understanding of the complex nature of urban systems. *Ecological Indicators* 70, 566–573. <https://doi.org/10.1016/j.ecolind.2016.03.054>
- Millar, M. G., & Millar, K. U. (1996). The Effects of Direct and Indirect Experience on Affective and Cognitive Responses and the Attitude–Behavior Relation. *Journal of Experimental Social Psychology*, 32(6), 561–579. <https://doi.org/10.1006/jesp.1996.0025>
- Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. *Trends in ecology & evolution*, 20(8), 430-434. <https://doi.org/10.1016/j.tree.2005.05.013>
- Morse, M. (2011). *River experience: A phenomenological description of meaningful experiences on a wilderness river journey* (Doctoral dissertation, University of Tasmania).
- Natuurmonumenten, (w.d.). *Op pad met de route app*. Consulted at 1 May 2016, from <https://www.natuurmonumenten.nl/routes/route-app>
- Neuteleers, S., & Delière, G. (2019). 'Does nature experience matter? Why not to care too much about the link between nature experience and valuing nature' in *Biological Conservation*, 231 (March): 49-50. DOI: [10.1016/j.biocon.2018.12.028](https://doi.org/10.1016/j.biocon.2018.12.028)
- Niles, D., & Tachimoto, N. (2018). Science and the experience of nature. *Nature Sustainability*, 1. <https://doi-org.ezproxy.library.wur.nl/10.1038/s41893-018-0124-y>

- Orru, K., Kask, S., & Nordlund, A. (2019). Satisfaction with virtual nature tour: the roles of the need for emotional arousal and pro-ecological motivations. *Journal of Ecotourism*, 18(3), 221-242. <https://doi-org.ezproxy.library.wur.nl/10.1080/14724049.2018.1526290>
- Patterson, M. E., Watson, A. E., Williams, D. R., & Roggenbuck, J. R. (1998). An hermeneutic approach to studying the nature of wilderness experiences. *Journal of leisure research*, 30(4), 423-452. <https://doi-org.ezproxy.library.wur.nl/10.1080/00222216.1998.11949842>
- Restall, B., & Conrad, E. (2015). A literature review of connectedness to nature and its potential for environmental management. *Journal of Environmental Management*, 159, 264-278. <https://doi.org/10.1016/j.jenvman.2015.05.022>
- Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, 30(4), 344-360. [DOI 10.1007/s11031-006-9051-8](https://doi.org/10.1007/s11031-006-9051-8)
- Sandbrook, C., Adams, W. M., & Monteferri, B. (2015). Digital games and biodiversity conservation. *Conservation Letters*, 8(2), 118-124. <https://doi-org.ezproxy.library.wur.nl/10.1111/conl.12113>
- Schweitzer, R. D., Glab, H. L., & Brymer, E. (2018). The Human-Nature Experience: A Phenomenological-Psychoanalytic Perspective. *Frontiers in psychology*, 9, 969. <https://doi.org/10.3389/fpsyg.2018.00969>
- Smith, N., Bardzell, S., & Bardzell, J. (2017, May). Designing for cohabitation: Naturecultures, hybrids, and decentering the human in design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 1714-1725). ACM.
- Smith, A., & Stirling, A. (2008). Social-ecological resilience and socio-technical transitions: critical issues for sustainability governance.
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: the loss of human–nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94-101. <https://doi-org.ezproxy.library.wur.nl/10.1002/fee.1225>
- Stedman, R. C. (2003). Is it really just a social construction?: The contribution of the physical environment to sense of place. *Society & Natural Resources*, 16(8), 671-685. <https://doi-org.ezproxy.library.wur.nl/10.1080/08941920309189>
- Stokols, D. (2018). *Social ecology in the digital age—Solving complex problems in a globalizing world*. London, UK: Elsevier. <https://doi.org/10.1016/C2014-0-04300-6>
- Tyrväinen, L., Mäkinen, K., & Schipperijn, J. (2007). Tools for mapping social values of urban woodlands and other green areas. *Landscape and urban planning*, 79(1), 5-19. <https://doi.org/10.1016/j.landurbplan.2006.03.003>
- Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In *Behavior and the natural environment* (pp. 85-125). Springer, Boston, MA.

van Marwijk, R. B. M. (2009). *These routes are made for walking: understanding the transactions between nature, recreational behaviour and environmental meanings in Dwingelderveld National Park, the Netherlands.*

Verma, A., van der Wal, R., & Fischer, A. (2015). Microscope and spectacle: On the complexities of using new visual technologies to communicate about wildlife conservation. *Ambio*, 44(4), 648-660. [DOI 10.1007/s13280-015-0715-z](https://doi.org/10.1007/s13280-015-0715-z)

Voigt, A., & Wurster, D. (2015). Does diversity matter? The experience of urban nature's diversity: case study and cultural concept. *Ecosystem Services*, 12, 200-208. <https://doi.org/10.1016/j.ecoser.2014.12.005>

Wells, N. M., & Lekies, K. S. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children Youth and Environments*, 16(1), 1-24.

Weinstein, N., Przybylski, A. K., & Ryan, R. M. (2009). Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin*, 35(10), 1315-1329. <https://doi-org.ezproxy.library.wur.nl/10.1177/0146167209341649>

White, D., and C. Wilbert. 2009. Introduction: Inhabiting technonatural time/spaces. In *Technonatures: Environments, technologies, spaces, and places in the twenty-first century*, ed. D.F. White, and C. Wilbert, 1–32. Waterloo: Wilfried Laurier University Press.

White, D., & Wilbert, C. (2006). Introduction: Technonatural time–spaces. *Science as Culture*, 15(2), 95-104. <https://doi-org.ezproxy.library.wur.nl/10.1080/09505430600707921>

Żmihorski, M., Dziarska-Pałac, J., Sparks, T. H., & Tryjanowski, P. (2013). Ecological correlates of the popularity of birds and butterflies in Internet information resources. *Oikos*, 122(2), 183-190. <https://doi-org.ezproxy.library.wur.nl/10.1111/j.1600-0706.2012.20486.x>

Zylstra, M. J. (2014a). *Exploring meaningful nature experience, connectedness with nature and the revitalization of transformative education for sustainability* (Doctoral dissertation, Stellenbosch: Stellenbosch University).

Zylstra, M. J., Knight, A. T., Esler, K. J., & Le Grange, L. L. (2014b). Connectedness as a core conservation concern: An interdisciplinary review of theory and a call for practice. *Springer Science Reviews*, 2(1-2), 119-143. [DOI 10.1007/s40362-014-0021-3](https://doi.org/10.1007/s40362-014-0021-3)

## Appendix I

Overview of digital technologies through which nature can be experienced							
	Purpose					Indoors vs outdoors	
	Enjoyment & excitement	Information & education	Awareness raising	Socialization	Health & well-being	Indoors	Outdoors
<b>Apps</b>	✓	✓		✓		✓	✓
<b>Games</b>	✓	✓	✓			✓	✓
<b>Interactive screens</b>	✓	✓	✓			✓	
<b>Films, documentaries and TV shows</b>	✓	✓	✓			✓	
<b>Multidimensional movies</b>	✓		✓			✓	
<b>Virtual reality glasses</b>	✓				✓	✓	
<b>Augmented reality</b>	✓	✓			✓		✓
<b>Soundscapes</b>	✓				✓	✓	
<b>Webcams</b>	✓					✓	
<b>Drones</b>	✓						✓
<b>Social media</b>	✓		✓	✓		✓	

## Appendix II

### Interview schedule experimental group

#### Korte uitleg interview

- Mezelf voorstellen, korte uitleg onderzoek en doel van het interview
- Interviews zijn anoniem
- Toestemming vragen voor opnemen
- Open vragen: algemene vragen, specifiekere vragen en achtergrond vragen
- Geen goede/foute antwoorden
- 20 minuten

#### Interview vragen experimentele groep (met app)

##### Algemene vragen:

- Welke van de twee routes heeft u gelopen? (Naar de bron of naar de monding)
- Alleen of met anderen gelopen?
- Hoe heeft u de wandeling ervaren?
- Wat vond u van het gebruik van de app tijdens de wandeling?
  - Wat waren voor- en nadelen van het gebruik van de app tijdens de wandeling?
  - Wat vond u fijner: de gedeeltes van de wandeling met of zonder app? Waarom?
  - Miste u bepaalde dingen van de app tijdens het gedeelte van de wandeling zonder app? Wat miste u precies?
  - Heeft u de wandeling anders ervaren vergeleken met eerdere wandelingen zonder app? In welk opzicht was het anders?
- Kunt u omschrijven hoe u de natuur beleefd heeft tijdens de wandeling?
  - Had het gebruik van de app voor uw gevoel invloed op uw beleving van de natuur? In welk opzicht?
  - Was het gebruik van de app een verrijking/verarming van uw natuurbeleving? In welke opzichten?

##### Specifieke vragen gerelateerd aan zes concepten:

###### *Consciousness*

- Was u of voelde u zich bewust van de natuur om uw heen tijdens de wandeling?
  - Verschil met/zonder app?
- Heeft u tijdens de wandeling bijzondere dingen gezien?
- Heeft u dingen gezien die u zonder app waarschijnlijk niet had gezien?
- Wat is u het meest bijgebleven van de wandeling?

###### *Immersion*

- Hoe heeft u uw verbondenheid met de omgeving en de natuur ervaren tijdens de wandeling?
  - Had u het gevoel zich als het ware opgenomen in/omringd door de natuur te zijn?
  - Had het gebruik van de app hier invloed op?

- Voelde u op sommige momenten ook meer afstand tot de natuur? Op welke momenten en waar werd dat door beïnvloedt? Zorgde de app voor een bepaalde afstand tot de natuur, of voelde u juist meer afstand tot de natuur in de gedeeltes zonder app?
- Had u tijdens de wandeling het gevoel in het moment te zijn?
  - Zorgde de app ervoor dat u meer of minder in het moment was?
  - Werkte de app afleidend?

### *Embodiment*

- Hoe waren uw zintuiglijke waarnemingen van de natuur tijdens de wandeling? Heeft u veel van de natuur gezien, gehoord, gevoeld, geroken etc.?  
 ○ Wat was de invloed van de app op uw zintuiglijke waarnemingen van de natuur? Droeg het bij of had u voor uw gevoel juist minder zintuiglijke waarnemingen van de omgeving tijdens het gebruik van de app?

### *Amusement*

- Heeft u de wandeling als vermakelijk en leuk ervaren?  
 ○ Wat maakte de wandeling vermakelijk/leuk?  
 ○ Had het gebruik van de app hier invloed op (droeg het bij aan een leuke ervaring of niet)?
- Heeft u de wandeling als gemakkelijk en comfortabel ervaren?  
 ○ Had het gebruik van de app hier invloed op (maakte het de wandeling in bepaalde opzichten makkelijker en comfortabeler)?
- Wat vond u ervan dat u dankzij de app precies kon zien hoe de route liep en wist wat u kon verwachten tijdens de wandeling?
- Heeft u van te voren gekeken hoe de wandeling liep en naar de notificatie-punten onderweg?

### *Interest*

- Welke functies van de app heeft u gebruikt tijdens de wandeling (route-functie, notificaties)?  
 ○ Welke filters heeft u gebruikt voor de notificatiepunten?  
 ○ Hoe vaak heeft u de app erbij gepakt (bij iedere melding, vaker of alleen op bepaalde punten)?  
 ○ Heeft u telkens de tekst bij de notificatiepunten gelezen?  
 ○ Wat vond u van de route-functie en notificatiepunten?
- Heeft u weleens doorgelikt naar de veldgids? Hoe vaak ongeveer?  
 ○ Heeft u telkens de tekst gelezen, foto's bekeken, vogelgeluiden beluisterd?  
 ○ Wat vond u van de veldgids?
- Heeft u nieuwe dingen geleerd over de natuur tijdens de wandeling (dankzij de app)?
- Wat voor invloed had het gebruik van de app op uw interesse voor de natuur in het Renkums Beekdal?  
 ○ Heeft het gebruik van de app interesse voor de natuur in het Renkums Beekdal aangewakkerd, is het hetzelfde gebleven, etc.?

## *Dedication*

- Bent u anders tegen de natuur aan gaan kijken of anders over de natuur in dit gebied gaan denken?
- Heeft u het gebied voor uw gevoel goed of beter kunnen verkennen?
  - Heeft u het gebied beter of juist minder goed kunnen verkennen dankzij de app?
- Bent u van plan om nog eens terug te komen naar dit gebied?

## **Demografische gegevens en achtergrondvragen:**

- Man/vrouw
- Wat is uw leeftijd?
- Wat is uw woonplaats?
- Wat is uw opleidingsniveau?
- Wat doet (of deed) u voor werk?
- Hoe vaak wandelt u gemiddeld in de natuur?
- Bent u al vaker in dit gebied wezen wandelen?
- Hoe staat het met uw kennis van de natuur?
- Heeft u wel eens eerder gebruik gemaakt van digitale technologieën als u in de natuur bent?
  - Welke? Hoe heeft u destijds het gebruik ervan ervaren?
- Zou u een route-app vaker willen gebruiken tijdens een wandeling in de natuur?
  - Waarom wel/niet?

Dat was mijn laatste vraag. Heeft u zelf nog dingen die u had willen zeggen of wil toevoegen die nog niet aan bod zijn gekomen in het interview?

## **Interview schedule control group**

### **Korte uitleg interview**

- Mezelf voorstellen, korte uitleg onderzoek en doel van het interview
- Interviews zijn anoniem
- Toestemming vragen voor opnemen
- Open vragen: algemene vragen, specifiekere vragen en achtergrond vragen
- Geen goede/foute antwoorden
- 10-15 minuten

### **Interview vragen controle groep (zonder app)**

#### **Algemene vragen:**

- Welke route heeft u gelopen? (paaltjes route, met kaart, helemaal zonder route aanwijzingen, ?)
- Alleen of met anderen gelopen?
- Hoe heeft u de wandeling ervaren?
- Kunt u omschrijven hoe u de natuur beleefd heeft tijdens de wandeling?
  - Welke aspecten hadden voor uw gevoel invloed op uw beleving van de natuur?

- Welke aspecten waren een verrijking/verarming van uw natuurbeleving?

### **Specifieke vragen gerelateerd aan zes concepten:**

#### *Consciousness*

- Was u of voelde u zich bewust van de natuur om uw heen tijdens de wandeling?
- Heeft u tijdens de wandeling bijzondere dingen gezien?
- Wat is u het meest bijgebleven van de wandeling?

#### *Immersion*

- Hoe heeft u uw verbondenheid met de omgeving en de natuur ervaren tijdens de wandeling?
  - Had u het gevoel zich als het ware opgenomen in/omringd door de natuur te zijn?
  - Voelde u op sommige momenten ook meer afstand tot de natuur? Op welke momenten en waar werd dat door beïnvloedt?
- Had u tijdens de wandeling het gevoel in het moment te zijn?
  - Wat maakte dat u meer of minder in het moment was?
  - Waren er ook dingen die afleidend werkten?

#### *Embodiment*

- Hoe waren uw zintuigelijke waarnemingen van de natuur tijdens de wandeling? Heeft u veel van de natuur gezien, gehoord, gevoeld, geroken etc.?
  - Wat zorgde ervoor dat u veel (of weinig) zintuigelijke waarnemingen had van de natuur?

#### *Amusement*

- Heeft u de wandeling als vermakelijk en leuk ervaren?
  - Wat maakte de wandeling vermakelijk/leuk?
- Heeft u de wandeling als gemakkelijk en comfortabel ervaren?
  - Waren er bepaalde dingen die bijdroegen aan een gemakkelijke/comfortabele wandeling?
- Heeft u van te voren een wandeling uitgezocht en al gekeken hoe deze liep?
  - Wat vond u ervan dat u wist hoe de route liep en wist wat u kon verwachten tijdens de wandeling?

#### *Interest*

- Heeft u informatieve borden gelezen onderweg of op een andere manier informatie over het gebied en de natuur opgezocht?
  - Welke? Wat vond u van de informatie?
- Heeft u nieuwe dingen geleerd over de natuur tijdens de wandeling?
- Wat voor invloed had de wandeling op uw interesse voor de natuur in het Renkums Beekdal?
  - Is dankzij de wandeling uw interesse voor de natuur in het Renkums Beekdal aangewakkerd, is het hetzelfde gebleven, etc.?

#### *Dedication*

- Bent u anders tegen de natuur aan gaan kijken of anders over de natuur in dit gebied gaan denken?
- Heeft u het gebied voor uw gevoel goed of beter kunnen verkennen?
  - Welke aspecten zorgden ervoor dat u het gebied goed (of niet goed) heeft verkend?
- Bent u van plan om nog eens terug te komen naar dit gebied?

**Demografische gegevens en achtergrondvragen:**

- Man/vrouw
- Wat is uw leeftijd?
- Wat is uw woonplaats?
- Wat is uw opleidingsniveau?
- Wat doet (of deed) u voor werk?
- Hoe vaak wandelt u gemiddeld in de natuur?
- Bent u al vaker in dit gebied wezen wandelen?
- Hoe staat het met uw kennis van de natuur?

Dat was mijn laatste vraag. Heeft u zelf nog dingen die u had willen zeggen of wil toevoegen die nog niet aan bod zijn gekomen in het interview?

## Appendix III

Posters experimental group



Voor mijn afstudeerscriptie doe ik **onderzoek** naar **digitale natuurbelevingen**. Hiervoor ben ik op zoek naar participanten die **met route-app** een wandeling willen maken door het Renkums Beekdal, gevolgd door een **interview** van ongeveer 20 minuten. Als dank voor uw deelname ontvangt u naderhand desgewenst koffie of thee en een klein presentje.





**WAGENINGEN**  
UNIVERSITY & RESEARCH

Voor mijn afstudeerscriptie doe ik **onderzoek** naar **digitale natuurbelevingen**. Hiervoor ben ik op zoek naar participanten die **met route-app** een wandeling willen maken door het **Renkums Beekdal** in de maanden **augustus - september**, gevolgd door een **interview** van ongeveer 20 minuten. Als dank voor uw deelname ontvangt u naderhand desgewenst koffie of thee en een klein presentje.

Geïnteresseerd om mee te doen? Stuur dan een e-mail naar **[dagmar.bade@wur.nl](mailto:dagmar.bade@wur.nl)** voor meer informatie

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Voor mijn afstudeerscriptie doe ik **onderzoek** naar **natuurbelevingen**. Hiervoor ben ik op zoek naar participanten die een **wandeling** hebben gemaakt door het Renkums Beekdal. Ik zou graag een **interview** houden van ongeveer **15 minuten**. Als dank voor uw deelname ontvangt u desgewenst wat te drinken en een klein presentje.



## Appendix IV

### Instructions app Crossbill Routes Veluwe

#### Stappenplan downloaden app

1. **Download** de app Crossbill Routes Veluwe: dit kan gratis via Wifi bij het bezoekerscentrum.  
Wifi netwerk: RenkumsBeekdal Gast  
Wifi wachtwoord: gast2017
2. De app zal vragen om **toestemming** tot uw locatievoorzieningen en om meldingen te geven. Voor optimaal gebruik van de app moet u beide functies toestaan.
3. Open de app en zoek in de lijst met alle routes de **specifieke route**: Renkums Beekdal – naar de bron (7,7 km) of Renkums Beekdal – naar de monding (9,1 km).
4. Klik op de route die u wilt lopen en klik op **Download**.
5. Zodra de route is gedownload, ga naar **Mijn routes** en klik op de route. Rechts bovenin ziet u 4 streepjes; klik hier om te filteren van welke informatie u tijdens de route een notificatie wilt krijgen (dit mag uiteraard ook alle informatie zijn).
6. Klik vervolgens op **Kaart**. Hier ziet u nu een overzicht van de route (de blauwe lijn) en alle notificatiepunten.
7. Klik rechts onderin op **Start Route** als u met de route wilt beginnen. Zodra u de route heeft gestart, heeft u geen internet meer nodig om de app te gebruiken.

#### Tips

- Zorg dat u in het begin even in de gaten houdt of de app goed werkt. Het kan bijvoorbeeld zijn dat u de notificaties niet (tijdig) hoort/voelt trillen. In dat geval kunt u het beste de mobiel er regelmatig bij pakken om te checken voor notificatiepunten. Zorg in ieder geval dat locatievoorzieningen en geluid aanstaan in de instellingen van uw mobiel en van de app. Tip voor iPhone gebruikers: zorg dat de schakelaar voor beldsignaal (aan de zijkant) aanstaat.
- Mochten de route aanwijzingen soms niet helemaal duidelijk zijn, kunt u ook het bolletje of pijltje volgen dat uw locatie aangeeft. Deze moet ongeveer op de blauwe route lijn zitten.
- Bij sommige notificatiepunten ziet u bepaalde flora- en faunasoorten onderstreept staan. U kunt hierop klikken om door te gaan naar de **veldgids**; hier vindt u extra informatie over de soort.
- Mochten zich problemen voordoen, kunt u zich altijd weer bij mij melden. Ook ben ik bereikbaar op het nummer: 06-28582692

*Als alles gelukt is, wens ik u een hele fijne wandeling door het Renkums Beekdal!  
Ik zie u graag terug na de wandeling voor het interview bij de lunchroom de Beken.*