Geoforum 122 (2021) 55–62

Contents lists available at ScienceDirect

Geoforum

journal homepage: www.elsevier.com/locate/geoforum

Information technology and the optimisation of experience – The role of mobile devices and social media in human-nature interactions

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ARTICLE INFO

Keywords:
Mobile media
Human-nature interaction
Outdoor practice
Digitisation
Smartphones

ABSTRACT

Information technologies have seeped their way into every aspect of our lives, mediating interactions between ourselves and our environments. They are becoming an important part of human-nature interactions, with smartphones, their apps and social media offering new ways to plan, navigate and share experiences. This article explores the changes that these mobile media technologies bring to human-nature interactions, focusing on the outdoor practices of experienced outdoor users. Drawing on observational and interview data gathered in the Scottish Highlands, we analysed hillwalkers', mountain bikers' and nature photographers' interactions with mobile media technology. Using social practice theory and the idea of technologies as 'scripts', we found that the increased availability of information reportedly enhanced access to, confidence in and knowledge about outdoor practices. Participants negotiated the use of devices within social norms of good practice, but generally showed enthusiasm for the ever-increasing access to information. The easy access to information and the ability to share one's performance, inscripted in the technology, guided the participants to optimise their experience. Paradoxically, this optimisation seemed to reduce the likelihood of encountering unanticipated situations that would have made their experience memorable, something our participants had previously identified as an important aspect of their outdoor activities. Our findings illustrate the value of an in-depth empirical understanding of lived experiences, revealing how interactions between technological scripts, personal agency and social norms amplify some aspects of human-nature interactions while attenuating others. Although incremental, these changes fundamentally alter the character of our experience of nature.

1. Introduction

Mobile media technologies – such as smartphones, wearables and their associated apps, as well as social media – are omnipresent in our day-to-day activities, both indoors and outdoors. These technologies put an increased emphasis on the exchange of information, building a "network society" which facilitates new interactions between people, society and their environment (Castells, 2010). Research reviewing the use of mobile media technologies for nature conservation and nature activities points to both potential negative and positive influences on people's experience of nature. The use of mobile media, for example, can create a spectacle out of nature (Verma et al., 2015; Adams, 2019). In this light, the integration of nature images with social media can be seen as part of a trend to commodify nature, constructing it as a good to be consumed (Büscher, 2013, see also Stinson, 2017). At the same time, the literature also recognizes opportunities for increased engagement with nature through technology (Sandbrook et al., 2015; Arts et al., 2015). Camera-traps linked to the internet and social media, for example, can get people more intimately involved with animals' lives and motivate some to care about the environment (Kamphof, 2011). Understanding social media use as "prosumption" illustrates that consumers now have the opportunity to creatively shape such media themselves, which could be employed as tool for enhancing engagement with the outdoors (Fletcher, 2017).

Within wilderness and conservation research, several authors have reflected upon the use of mobile media devices and expressed

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https://doi.org/10.1016/j.geoforum.2021.03.009
Received 20 August 2020; Received in revised form 19 February 2021; Accepted 16 March 2021
Available online 13 April 2021

apprehension about the loss of an 'authentic' or 'wilderness' experience, with distance from technology and modern civilization being regarded as an essential element of 'being in the wild' (e.g. Martin and Pope, 2012; Casey, 2012). According to Relph (2008), the last decades have seen a change from interacting deeply with a few places, to many brief encounters with greater numbers of different places. This increases exposure to diverse places and cultural exchanges, but also "*constitutes a loss because deeply focused and meaningful experience has been replaced by the outsideness of relatively fleeting and touristic encounters*" (Relph, 2008 preface). Most of this literature, however, highlights theoretical discussions of the impact of technology, rather than the lived experiences of people visiting the outdoors. An exception is Shultis' (2015) study, which showed that when asked to reflect on their use of GPS and mobile phones, hikers mainly reported positive impacts on their own practices, such as increased comfort and safety, while negative implications tended to be expressed as vicarious. These first empirical insights suggest that the integration of technology in outdoor experiences is more complex than theoretical considerations have expressed so far, often shoehorning the cellphone "*into a pre-existing set of high-theoretical concerns at the expense of an engagement with the empirically complex uses of the cellphone*" (Michael, 2009, p.87). What is thus needed is an increased understanding of people's actual use of and reflections on smartphones and other mobile media technology in nature.

Technology – whether traditional or new, whether maps and trails (Senda-Cook, 2013), walking boots (Michael, 2000) or GPS (Lorimer and Lund, 2003) – has always been crucial in shaping people's movements through their natural environment. In order to better understand the dynamics between people, nature and mobile media technology, this article empirically explores how people negotiate the use of smartphones and social media as part of their outdoor practices. We focus on experienced outdoor recreationists – rather than beginners or occasional outdoor users – as we are particularly interested in how established practices are altered through the inclusion of new technology (see Section 1.1). Our study therefore adds to the conceptualization of human-nature-technology interactions, expanding the current research on new media and nature, and taking not the virtual world but outdoor practices as a point of departure.

1.1. Theoretical perspective: Technology shaping practic

Gaining understanding of how technology shapes our interactions with the world around us has a rich history within the social sciences and philosophy. Heidegger's (1977) "Question Concerning Technology" brought the tensions between modern technology, humans and society into sharp focus and explored the influence of technology on our experience of the world. It raised awareness of technological developments as mediators of existence, as opposed to considering them as neutral phenomena. While questions around the influence of technology are thus not new, digitization and the emergence of a 'network society' have given rise to many additional avenues that call for exploration through empirical research. Zuboff (2019), for example, characterises social media platforms as literally 'herding' people through public spaces; their routes shaped by the instrumental powers of commercial interests.

Recent technologies such as smartphones and social media include features like the co-creation of content and exchange of information (anywhere, anytime) that are described as 'web 2.0' (Fuchs, 2008). The interactions between web 2.0 and nature have been labelled as 'nature 2.0': "*a concept coined to promote investigation into how new online media transform and influence (re)imaginations and understandings of (nonhuman and human) nature*" (Büscher, Koot and Nelson, 2017, p.111). Stinson (2017) uses this as a starting point to conceptualize nature as 'Digiplace', a place where physical and virtual worlds are combined, and where the use of apps and social media can be seen as creating an augmented reality. They therefore argue that research into nature experiences should focus on the interactions between the online and the offline world. Yet, studies have, so far, mainly focused on virtually consumed representations and narratives of nature, through software and platforms such as conservation games (Fletcher, 2017; Büscher, 2014) and social media (Hawkins and Silver, 2017; Büscher, 2013). By contrast, our study draws attention to the interaction between the online and offline, starting from the activities people undertake when they are in nature and how the use of apps and social media intersects with lived outdoor experiences.

To unpack the dynamics of interactions between people, technologies and the outdoors, we draw on social practice theory, recognizing human action is best understood as neither the pursuit of individual interests nor just the outcome of external forces, but as a relation between both agency and structure that shapes people's activities (Shove et al., 2012; Huizing and Cavanagh, 2011). Practices can be conceptualised as incorporating three main components: materials, competences and meanings, linked to each other in the performance of a practice (Shove et al., 2012). A practice is sustained by its regular performance by people who have come to share a routine, combining similar materials, competences and meanings. Changing a practice, e.g. by introducing new elements, involves the reconfiguration of existing links, resulting in new sets of materials, competences and meanings that are drawn upon to perform the practice (Shove et al., 2012). Here, we consider mobile media technologies as new materials, and investigate how these reconfigure outdoor practices. To do so, we focus on experienced outdoor recreationists as they maintain their practices through the repeated performance of these activities.

To describe the material elements of a practice, social practice theory follows insights from actor-network theory (Johnson, 1988), arguing that inanimate objects are active participants and co-produce actions, knowledge and organized settings alongside human and non-human actors (Huizing and Cavanagh, 2011). Mobile technology can thus modify experiences and "*unfolds new ways of organizing and conducting everyday practices in different spheres of life*" (Ek, 2012 p. 40). Based on Latour's conceptualisation of technologies carrying "scripts" (Latour, 1992), Verbeek (2005 p.171) describes how technologies as artefacts "*invite particular actions while discouraging others or even rendering them impossible*". By design, materials are "inscripted" with particular purposes or affordances. This means that mobile media technologies guide action and influence the connections built between the different elements of outdoor practices. Smartphones can mediate actions, for example, by creating the opportunity to move around while communicating, by making information instantly available anywhere and by allowing the sharing of thoughts and adventures unimpeded by physical distance between sender and receiver (Schrock, 2015; Schwartz and Halegoua, 2015).

It is important to keep in mind that the actors' own agency allows for several ways of "translating" a script, and technologies can mediate actions differently in different contexts (Jarzabkowski and Pinch, 2013), allowing for flexibility in use and in the interactions between people and the outdoors. A characteristic of mobile media technology is the possibility for users to (co)create content and make information available to others, albeit within the boundaries that tech-companies create (Hawkins and Silver, 2017; Büscher, 2014). Rose (2016) suggests that researching web 2.0 interactions therefore requires an understanding of both the technology's and the user's agency. Our study aims to understand both the scripts implied in technology and the interaction between technology and user. Technology will not be the only component in a practitioner's negotiated performance, and it is important not to lose sight of the competences, meanings and other materials that make up outdoor practices.

Competences can be understood as the skills, know-how, techniques and knowledge needed to perform a practice (Shove et al., 2012). In outdoor practices these might include navigational skills, practical know-how, and bodily techniques that allow, for example, handling a mountain bike or climbing up a mountain. These skills tend to be intimately linked with the meanings given to outdoor practices, e.g. having certain skills or using certain artefacts that can signify a person's group

membership (Michael, 2000). Mobile media technologies are often considered a threat to certain outdoor competences such as navigational skills, as these technologies have the potential to displace them (Shultis, 2012; Dustin et al., 2017).

The meanings of a practice can include symbolic meanings, ideas, aspirations as well as emotions and motivational knowledge (Shove et al., 2012). In outdoor practices these can entail social norms and ideological stances. Walking, for example, can be linked to the romantic ideal of reflexive practice, but also to values of sociability and exercise (Edensor, 2000). Another notion linked to outdoor practices involves a 'sport-like' framing, focusing on challenges and rewards and looking for strenuous, more rigorous exercise (Kay and Moxham, 1996). All of these meanings can influence how materials and technology are used and what use of gear – from clothes to navigational aids to cameras – is deemed appropriate (Brown, 2015).

In short, technology, through its scripts, can play a role in offering and pre-structuring new choice options for experienced users, thus reshaping the routines that make up a practice. Yet, the mutually shaping character of the different elements of a practice - meaning, materials and competences - renders the influence of a technology situational and fluid, rather than clearly identifiable. While technological scripts need not be deterministic, they will influence the practice by directing action, calling for certain competences to be used or abandoned and meanings to be negotiated. Our study explores the assemblages that are built in outdoor practices and investigates how mobile media technologies shape these configurations and, thereby, people's experience of the outdoors.

2. Methods

2.1. Step 1: Exploratory study

We conducted a qualitative investigation in two steps. In the first step, conducted in April and May 2018, we explored people's technology use in activities undertaken in a green space. Given the dearth of empirical insight into people's interactions with technology in the outdoors, we aimed to get a broad overview of the kind of technologies that are involved in people's outdoor practices and the importance participants attribute to them. Exploratory interviews were conducted with 11 participants of different ages between six and sixty and with different levels of outdoor activity. These activities were diverse but included walking the dog, playing in the forest, hiking along the beach and mountain bike riding in the hills. The greenspaces the activities took place in ranged from city parks to the mountains in Scotland. The participants were selected for diversity, through the researchers' own networks.

2.2. Step 2: Focus on three outdoor practices

The findings of the exploratory study were used to select the practices and material elements to focus on in the next stage of the research, conducted from October 2018 to January 2019. Although some of the participants were using very specific apps, for example to identify birdcalls, overall the generic functionalities of the smartphone – such as the camera, GPS and social media – were the ones used most regularly. For the second step of data collection, we therefore focused on the smartphone and social media use by participants but did not specify any particular (nature related) apps. We narrowed the different activities participants mentioned down to three focal outdoor practices: hillwalking, mountain biking and nature photography.[1] This allowed for a more in-depth exploration of the different elements of each practice, while still maintaining a degree of breadth as the three practices have different needs for and uses of mobile media technology. Nature photography, alongside all forms of photography, has been revolutionized by digital camera advancements. Hillwalking, in stark contrast, still maintains strong links with the use of non-digital gear and skills, such as using compasses and paper maps and practical know-how on reading the landscape to orientate oneself. These traditional practices potentially come under threat from the use of new technologies (Brown, 2014; Martin and Pope, 2012; Michael, 2009). While hillwalking and photography are practices that have developed over many decades, mountain biking has relatively recently entered the scene (Michael, 2009; Brown, 2015). We aimed to explore how the different practices allowed for different ways of integrating new mobile technologies and whether there were common pathways to how technology scripted action. As we show below, there were common themes important to all three practices, although they sometimes played out in slightly different ways. This second step of the data collections focused on the Scottish uplands. While the participants in the exploratory study talked about their experiences in both urban nature and rural places, the three focal outdoor activities chosen here have a strong rural dimension.

Data collection in the second step of the research included qualitative methods to explore: 1) what people do (with mobile media technology) when outdoors; and 2) people's experiences with and reflections on their practice. Participant observation was used for the former and ethnographic, walk-along and in-depth interviews for the latter. As previous research has shown that technology use is often embedded in outdoor practices and cannot always be easily talked about by participants (Shultis, 2015), the in-depth interviews focused on a detailed exploration of a participant's description of a day out walking, mountain biking or photographing.

2.3. Participant selection

While in the exploratory study the level of outdoor engagement had varied between participants, the sampling method in the second step engaged participants who were keen and experienced outdoor recreationists, i.e., people who used the outdoors on a regular basis, although the frequency of use differed (some participants would go out once a month, others multiple times a week). Second phase participants were recruited through snowball-sampling, starting from the researchers' networks as well as clubs and social media pages related to the different practices. Fourteen in-depth interviews were conducted, including 4 with mountain bikers, 5 with hillwalkers and 7 with photographers (two interviews included two participants each). In addition, a researcher accompnied 5 walking groups on one of their respective trips and attended a mountain bike event. Pseudonyms are used throughout this article when quoting participants.

To understand the difference between this group and more casual users of the outdoors, a researcher spent two days at Ben Nevis, the highest mountain of the UK, conducting ethnographic interviews and observations. Ben Nevis attracts a large number of tourists with varying degrees of hillwalking experience, of which around 150.000 each year walk the main track to the summit (John Muir Trust, n.d.). The conversations with these tourists highlighted that those with little hillwalking experience incorporated mobile media technology to a lesser extent in their outdoor activity than the experienced hillwalkers, mountain bikers and photographers that participated in the main part of this study. This observation provided support for our preliminary assessment that a focus on experienced outdoor users would enable in-depth insights into the influence of smartphone and social media use on outdoor practices. However, we acknowledge that the kind of reflections and experiences explored in this study can play out differently in different groups.

[1] Hillwalking refers to the practice of walking in hills or mountainous areas. Mountain biking is the practice of riding a bike over rough terrain, often hills. Nature photography refers to both landscape photography (of natural landscapes) and wildlife photography.

2.4. Data analysis

Data gathering and analysis followed an iterative-inductive process where coding and identification of themes occurred alongside the interviews and observations to inform each other (O'Reilly, 2012). The analysis moved from descriptive themes to conceptual codes that captured the influence of technologies on what participants did, what they learned, how they made decisions, who was involved and how they interacted with their environment. After a first read through the transcripts, practice-related clusters were identified such as 'training', 'meaning making' and 'sharing' which all involved mobile media technology in some way. A second examination of the data followed in which descriptive codes were grouped in conceptual themes that described themes that technology use influenced such as "Access", "Safety", "Setting objectives" and "Planning". In this analysis we initially zoomed in on the material components of a practice, evaluating which mobile media technologies were introduced and for what purpose. We then proceeded to analyse how the use of these technologies affected the links made with the other elements of the practice (competences and meanings), as well as with the participants' outdoor experiences. We identified two important features of outdoor practices that were influenced by mobile media technology: accessibility and ideas on good practice. These are presented in the first two result sections. The third section of the results, "Information addiction: optimizing experiences", examines the link between mobile media technology and participants' overall outdoor experience.

3. Results

3.1. Increased access: gaining confidence, finding new challenges

Smartphones reportedly changed outdoor practices by increasing accessibility of the practice itself and of the places where it might be practiced, as apps and social media allowed participants to gather information on where to go, how to prepare for their activity and find others to share their walks, rides or photography with. For example, our mountain bikers would often use *Trailforks* to plan their trips, an app that shows mountain bike trails uploaded and shared by other mountain bikers. For hillwalkers, the website *walkhighlands.co.uk* proved popular, providing hiking routes and offering a platform to share experiences. Several photographers used the app *The Photographer's Ephemeris*, which shows how sunlight (and moonlight) will fall on any location at a given time. These technologies led some participants to feel better informed about potential places to visit:

> "*And, with the help of these apps and technology, I went to New Zealand and I already knew where the trails are…! (…) Whereas when I first went out to France in 2006, I think, 2007, we got a local guide to show us all the routes. Whereas now when you go across there, you can look everything up and just go.*" (Luke, mountain biker)

For many participants, this information was not only instrumental at a practical level, but also helped to increase their confidence. In a conversation with two mountain bikers, they shared their enthusiasm for *Trailforks* and pointed out that all the information that the app provided gave them the feeling that they were "*a bit less winging it*". This increased confidence was also acknowledged by hillwalkers and photographers, with one hillwalker mentioning that she now felt confident in going out on her own, as she had a navigation app – *ViewRanger* – that helped her find her way.

Part of the appeal of participating in outdoor activities was that it challenged participants to go outside their comfort zone. Participants spoke about confronting their own physical limitations, to aim to go faster or to take their best shot. Hillwalkers and mountain bikers talked, for example, about keeping themselves fit and "earning the mountain", or as one hillwalker put it:

> "*It doesn't matter how rich you are, this part of the natural world you would never be able to buy it. You need to deserve a Munro*[2] *(…) Yeah, it is challenging, like you have been working hard all week and your brain is so tired and then you just go into the wild and you get physically tired. It can be challenging, but then you feel so great afterwards.*" (Zoe, hillwalker and mountain biker)

Mobile media technology offered the opportunity to increase these challenges or to look for new ones. The app *Strava*, for example, lets mountain bikers share the time it takes them to complete a route. A ranking function keeps track of the fastest time (belonging to the 'king/queen of the mountain'), allowing others to aspire to that time as well. Although not all of our participants felt comfortable with this competitive spin, many of them acknowledged that part of the attraction of the activity lay in the competition with themselves or others. Apps and social media were used to look for ways to improve skills and performance. Photographers, for example, used *Flickr* or *Instagram* to look at pictures by other photographers they admired and to learn from their techniques. Participants felt that social media could draw new people into their practice, as well as offering opportunities to build a community and share experiences more easily. It allowed people to find a group they felt comfortable sharing their practice with, even if they were not yet experienced walkers, riders or photographers:

> *"… there is just different [online] forums that we've got. So, if someone is going out for a bike ride they can just post it up and see if they can go with anyone who fancies it, you know. And it doesn't have to be like led rides or anything like that. It is just a case of who fancies going out… And people now feel comfortable enough, if they joined one of the pages, they will come out with you. And that is pretty cool."* (Katie, mountain biker)

Overall, participants expressed their enthusiasm for the ability to access information and learn from each other. However, these increased opportunities also opened up a discussion on when and how (not) to use mobile technologies appropriately. In the next section we explore how mobile media use influenced the meanings that guided outdoor practices, and how meanings in turn influenced the use of these technologies.

3.2. Good practice: stories of (ir)responsible use

While reflecting on whether and when to use mobile technology, mountain safety was an important theme for participants going into the Scottish hills. On the one hand, mobile media technologies offered opportunities for participants to 'double up on safety', such as carrying a transceiver or sharing GPS location with family at home. On the other hand, participants pointed out functional limits to technology, such as phone battery life, accuracy of GPS locations, or the need for training to know how to use an app, that made relying on new mobile technology inadvisable. To balance the opportunities technology could bring against the risks of using the technology, participants entered in a conscious negotiation of smartphone use. Some, for example, took both their phone (with a navigational app) and a paper map and compass as a fail-safe.

These negotiations revealed a deeper layer of tension between mobile media technology and outdoor practices, where social norms and symbolic meaning played an important role. This tension played out slightly differently in each practice. The hillwalking community tended to emphasise the potential loss of skills and the increased risks that unprepared and unexperienced hillwalkers take. When joining hillwalking groups and introducing the topic of the research – the way people use mobile media technology outdoors – at some point along each hike one or several participants would come up to us and explain: 'I have heard of some people going up the hills with only their phone. And then the phone dies and they don't know how to navigate! They get lost

[2] A Munro is a mountain in Scotland with a height over 3000ft.

and eventually have to be rescued by the mountain rescue'. This uneasiness with hikers becoming reliant on mobile technology was widespread and could for example also be found in warnings on the most popular website used by hillwalkers, *walkhighlands.com*[3]. Occasions where (inexperienced) hillwalkers had been rescued were also discussed in online media. However, a conversation with one of the Rescue Teams suggested neither a clear increase in rescue missions nor in the number of inexperienced hikers requiring rescue. Regardless of how regular such an occurrence may be, such stories provide an example of how smartphone use was frowned upon within certain sections of the hillwalking community, with many participants disapproving of sole reliance on mobile phones, especially for navigation. We could also see this pressure in the way some hikers were apologetic when talking about their smartphone use:

> *"Oh and also, in terms of equipment I usually take my… it is quite heavy, well heavy… but my external battery pack as well, for my phone… Well I mean it is probably not the thing you should do, I don't know…(…) I've got one [external battery]… it is not big, just about the size of my phone and I don't know how much it weighs, and yeah I'll stick it in the bag … I feel that is my safety net. I know you shouldn't rely on your phone, but I think that is my safety net."* (Amy, hillwalker)

Mountain bikers seemed less condemning of mobile media technology use, as they emphasised the benefits of these technologies for opening up the practice to newcomers, a development that was greatly valued by our interviewees. However, some mountain bikers expressed similar concerns as the hillwalkers: inexperienced riders could take too high risks and essential skills might be lost.

> *"And I think that's probably one of the biggest challenges, especially now with all this information being shared, and information's so easy to find that lots of people who are just beginning their mountain bike journey then just think 'Oh I can access this track, that terrain' and potentially that leads to slightly more accidents or incidents – potentially (…) Whereas when we were fourteen we would go to Pitfichie pretty much every weekend and know every root, rock, corner and drop-off, and practise it until we got it right… Because we only knew one or two trails at that time."* (Luke, mountain biker)

The ability to read, know and understand a trail was seen as an important feature of the mountain biking practice, one that the participants also derived a certain pride or sense of achievement from. To lose this skill would be to lose something essential to the practice of mountain biking, similar to losing navigation skills for hillwalkers. Photographers valued the opportunity to learn from each other through mobile media, although they echoed concerns about their influence on the overall practice, which included a perceived loss of creativity. Social media, for some photographers, seemed to lead to a saturation of photos of the same landscape, the same kind of pictures, taken from the same viewpoints.

> *"People will start taking photos that for some reason are easily visually satisfying, or like something in your brain says 'oh yeah I like that', and then people will like them on social media or whatever, and then they get stuck into taking the same photo over and over again. And just like… it is not like pushing themselves… it is just they end up taking the same kind of photos all the time."* (Leo, photographer)

Interestingly, most participants reflected on this loss of skill and creativity as something that other, less experienced, people had to look out for. By contrast, their own use of mobile media devices was evaluated in light of managing risk, learning new skills or exploring new (more challenging) terrain, all aspects that were considered important to the outdoor practice. This aligns with Shultis' (2015) observation that hikers in New Zealand would make a (cautiously) positive assessment of their own (proper) use of technology while warning against improper use by others.

3.3. Information addiction: optimizing experiences

While participants reflected on and navigated tensions between building outdoor skills and the opportunities that new technologies offered, the influence of the technology on their overall experience underwent less scrutiny. However, it was precisely here that mobile media technologies seemed to script a particular practice related to the outdoors.

In our conversations with hillwalkers, mountain bikers and photographers, participants talked about why they went out into the outdoors. Regardless of the practice, all participants expressed that one of their motivations was to experience freedom, of just being out in nature and experiencing the landscape:

> *"I think every mountain biker's dream and love really, is just to be able to walk out their house, jump on their bike and go! And not have to worry about anything."* (Luke, mountain biker)

When asked to describe some of their most memorable moments in the past year, a recurring theme was that participants had experienced something unexpected:

> *"So, in August we were doing to the Corrieyairack Pass and we had down jackets with us and stuff and our waterproofs and we've got to the top of there and it was absolutely lashing and we thought we packed everything we needed but I have never been so cold in the middle of summer. If anything would have happened, we would have been in total trouble (…) but at the same time we are never going to forget that (…….) You don't look at your phone at all, you just go 'I think it's that way'. It was desperate, but … very cool, now."* (Jane, mountain biker)

Part of performing the outdoor practice was to encounter something exciting, something new or challenging and this was often associated with not knowing the outcome beforehand:

> *"I do like the excitement. I like the excitement of possibly coming back with something. It's very much like a hunt. It's like you go out and you might be empty-handed or you might get something, and you're never quite sure which it's gonna be*." (Stephen, photographer)

These recollections of participants' walks and rides focused on unexpected, unplanned events, and stood in stark contrast to how mobile media technology was used. Smartphones offered the possibility to gather information on an increasing number of aspects of a route both before and during the hike or ride and overall, participants were very enthusiastic to use this information. They used the opportunities the technology provided when it came to accessing information, monitoring their activities and sharing their experiences: mobile technology created numerous possibilities to look up different routes, people's reviews of them, weather forecasts, the best spots to take photographs, and much more. For example, as one mountain biker explained, time would be spent on *Instagram* to find an exciting place to walk or ride, or *Trailforks* and *Google Earth* would be used to scan and assess trails and landscapes in advance:

> *"I use things like Google Earth to have a look… I can gauge the state of a trail just having a look at the satellite imagery of it. (…) For instance, if I'm going into the Cairngorms, I could have a look on there – I could have a look at photos of the general mountain-scape to give some idea of the sort of trail that I would be in for."* (Thomas, mountain biker)

Multiple weather apps would be checked before and during the activity, and as the weather in the Scottish Highlands is highly variable – as

[3] The website *walkhighlands.com* states a warning when downloading routes in GPX-format: *"you understand the need to also carry a paper map and a compass, and have the skills to use these"*.

in many other mountain ranges – it did not seem surprising that weather apps had become popular in the outdoor community. However, for some the practice of checking the weather seemed to go much further than looking at an app in the morning.

> *"When I'm planning, the first thing I'm planning is weather forecast! You know! Because I want to know if it's gonna be sort of reasonable weather and it's not gonna be raining the whole time. So, I have about five different weather apps that I consult, including a minute-by-minute live radar, which if… For instance, when we were in Aviemore, the weather was very patchy – it was sometimes raining, sometimes sun shining. So, it was important when I was standing where I was, my blue spot on my weather radar telling me where the rain storms were coming from and when the next one was due, so I could actually sort of schedule my shots to sort of take that into consideration."* (Daniel, photographer)

Social media and other online platforms offered the possibility to exchange pictures and videos of places and environmental conditions in real-time, providing a rich body of information and inspiration.

> *"MTB trails, that is [a] really good [website] because it is a Scotland wide thing. And that has loads of stuff on it. People post what they did at the weekend and they post videos and they post the map, GPS. And then [other] people will go 'I was thinking that I should do that, what was it like', and then you get a load down from people [discussing] 'well I did it and I find it like this'. So that sort of thing is very, very useful. (…) Especially if you've got to make a journey, that can help your decision, am I actually going to take the time and travel there or is it worth going elsewhere instead."* (Jane, mountain biker)

The technology seemed to frequently trigger a focus on planning, setting goals and tracking progress, which offered hillwalkers, mountain bikers and photographers an increasing number of options to control their environment and optimise their experience. No one had to be caught off guard by bad weather, or the 'wrong' light for a photo anymore; instead, experiences could be optimised by identifying the perfect time and place to go.

This focus on optimisation could also be seen in the use of apps for monitoring personal progress. Route and navigational apps offered participants the opportunity to track their walk or ride, providing information on personal performance. Joining several hill walks, we observed participants open apps such as *ViewRanger* or *Strava* on their phone or activate their wearables, such as a *Fitbit*, to track their route. In general, during the ride or walk the participants using these apps would only occasionally engage with the information being tracked, for example, to check how many miles they had walked when taking their lunch breaks. It was not always clear for the participants themselves why they gathered this information. One reason, that was mentioned by some participants, was to let others know where you are for safety, but information was also used afterwards for reflection and comparison to previous performances or the performance of others. For some, this information was used just for a nice review at the end of the activity; for others, it was a way to improve themselves. In particular, the app Strava was reported as driving some users to focus on their performance:

> *"I think Strava made me like really competitive about cycling (…) Strava is really addictive you know. And then, when you do several times the same route, it can be frustrating and it can be dangerous as well (…) you end up looking at your Strava and 'oh I don't have any achievement', and then you are disappointed. But when you have done [the route] so many times and the wind is facing you instead of in your back, then of course you are not going to have a good result. So, I guess you need to stand back and take a moment, with the beautiful morning [and enjoy it]."* (Zoe, hillwalker and mountain biker)

Where *Trailforks* or *Viewranger*, or wearables like the *Fitbit*, allow people to track their own route and provide information on the distance covered and the speed reached, *Strava* adds a social component. Like social media, the app allows information on people's performance to be shared and commented upon. Social media were used by several participants to promote and share achievements: photographers spent time selecting and editing their best photo to post on Instagram, while mountain bikers watched go-pro footage of rides online and hillwalkers took pictures of themselves reaching the summit, to share their journey on Instagram or Facebook. On these platforms, participants could share their own story while also accessing the achievements of others, which sparked an interest in setting new challenges, again adding to the body of information participants gathered to optimize their experience.

4. Discussion

We analysed the role of mobile media technology in assembling and performing outdoor practices, and its influence on experienced recreationists' overall engagement with the outdoors. Participants in our study used many apps in their outdoor practices, such as *ViewRanger*, *Strava*, grid-reference applications or dedicated apps for editing photos. Many of these replaced materials used previously to perform similar tasks, which although not immediately reshaping a practice, did constitute small changes in the configuration of the practice (Shove et al., 2012). Yet, the smartphone in which outdoor apps were bundled together proved to add an important new dimension to outdoor practices. While a person's initial intention might be to take the smartphone outdoors because of one function (e.g. to be able to phone for help), the bundle character of the functions made other features immediately accessible too. This key characteristic of mobile communication technology, specifically smartphones, distinguished its use from that of older outdoor gear such as compass, maps and altitude meters. It created a blend of offline and online experiences, constructing the outdoors as an augmented reality where the physical experience is mediated through virtual information and images (Stinson, 2017). Smartphones are mobile devices linked to the internet, offering access to information and social interaction, any place, any time. In these features, translated into different apps and webpages, we could see their transformative impact on outdoor practices.

4.1. Technology's scripts: affording monitoring and control

In our study, the smartphone emerged as a flexible, adaptable device, allowing for a multitude of creative uses that were influenced by the norms and skills of the outdoor community. All study participants used mobile technology to access new places, communicate about their activities and build new skills. Mobile media technology thus afforded accessibility, as these technologies are inscribed with the idea of open communication and a global network of information. However, these features of mobile media technology also encouraged a focus on planning and achievement, inviting specific behaviours or a "programme of action" while potentially inhibiting others (Verbeek, 2005). Apps such as *Strava* are designed as "persuasive technologies" (Fogg, 2003) and based on the idea that tracking your route and providing feedback on your performance can enhance exercise and therefore provide health benefits (Carter et al., 2018). The same can be said of other outdoor apps used by our participants, such as *Trailforks*, *ViewRanger* and the *Photographer's Ephemeris,* as they allow users to measure, set goals, plan and monitor more accurately. These apps promote the activity as performance-driven, often emphasising a competitive attitude to outdoor activities. In a study on cyclists' use of *Strava*, Rivers (2019) showed that these apps can become an integral part of the practice and can be experienced as essential for maintaining motivation. Social media can have a similar effect, as increased visibility of our activities can invite a focus on self-presentation and self-examination as shared stories are exposed to feedback from the online community (Haider, 2016).

This attention to (self-)monitoring, (self-)enhancement and competition has been described as a "metrification" and "gamification" of the outdoors (Carter et al., 2018) and can be seen as connected to the

general features of the "network society", which provides an abundance of data, and focusing on self-expression and self-fulfilment (Viñals Blanco, 2016). These features, promoted by mobile media technologies, have been interpreted as rooted "*in a neoliberal view of society structured around choice and individual responsibility*" (Haider, 2016, p.487). Literature on Nature 2.0 has brought to the forefront how this neoliberal view is integrated in the representation of nature online. Stinson (2017) argues that while new (mobile) media technology can allow the user to actively create and consume content, this content creation takes place within a neoliberal rationale. In their study, Stinson shows that while virtual outdoor campaigns (through websites and social media) aim to promote outdoor recreation and conservation, they are also built and driven by "a neoliberal logic of economic growth" (Stinson, 2017, p.184). This reiterates Büscher's (2013, 2014) analysis of nature 2.0, where idealized images and representations are resources for marketing and branding. This suggests that apps, websites and social media outlets have a "scripted" rationale that goes beyond simply giving the user access to information. Some of our participants' motivations reflected this: they enjoyed being challenged and appreciated the ability the smartphone gave them to set personal goals or to compete with others. However, our participants also enjoyed the outdoors as a space to escape to, having the freedom to "not worry about anything". The latter offers a potential explanation as to why some participants chose not to use tracking or make their activity a competition, and why they reflected on the 'dangers' of *Strava* and the need to remind themselves to enjoy the moment. This suggests that personal agency in use, as well as social norms, also play an important role in determining a technology's impact.

4.2. Negotiated use: linking technology, skills and social norms

Discussions around mobile technology use in the outdoors by both new and experienced recreationists often raise two important aspects: the influence of technology on people's engagement with the outdoors and the influence on people's skills and risk-taking behaviour (Shultis, 2015). Arguments for this second aspect emphasize that mobile technology might increase irresponsible behaviour by allowing people with limited skills to enter the activity (Martin and Pope, 2012). The fear of losing essential skills was emphasised by some of our participants. However, all participants did (want to) use mobile media technology, which resulted in an active negotiation of the "proper" adoption of new technologies. Hillwalking, mountain biking and photography as practices were mediated by a whole set of materials, skills, social norms and ideological stances. Skills, for example, included navigation of terrain, understanding of the environment and the correct use of appropriate gear. These skills tended to be closely linked to materials, such as paper maps and compasses, and to ideas of of taking responsibility in the mountains (Brown, 2014). We found that this "conventional" equipment had gained significant symbolic meaning, guiding social norms on safety, and that performing outdoor activities without it was seen as irresponsible. Outdoor practices were thus embedded in strong ideas around good practice, which were mobilized in the negotiation of the use of mobile media technology.

Pantzer and Shove (2010) point out that for new elements to become integrated into a practice, they have to associate themselves to already existing ingredients. Their study examined the practice of Nordic walking – a form of speed walking with two supporting sticks – which initially had little success, and in order to become an established practice needed an "*effective combination of sticks, ideas, ideals and new techniques*" (Pantzer and Shove, 2010 p.452). Nordic walking found success when it became linked to health benefits, embedding the practice to the already established idea of walking as a way to improve health and well-being (Pantzer and Shove, 2010). In our study on the integration of mobile media technology in outdoor practices, the new gear seemed less successful in claiming an unchallenged place, and its use remained continuously negotiated. The potential of mobile media technology to make routes, trails and mountains accessible to anyone raised questions about the need for the outdoor skills that participants valued so strongly. Thus, while our participants saw the benefits of accessing information and tracking themselves, they deemed such technologies as defensible only where the user also had the ability to handle conventional gear and other 'essential' skills for being in the mountains. The appropriate way to use mobile technologies for our participants was to gather information, to make sure they had as much control over their situation as possible when going outdoors, but for people that did not have the skills to assess environmental conditions and minimize risk, mobile media technology was seen as a dangerous tool.

4.3. The optimisation of experience

Our findings suggest that participants' outdoor experience was shaped by a focus on self-monitoring and self-enhancement, inscripted in the mobile media technologies they used. The mobile media technology we investigated carried an invitation to access and share evermore information. It encouraged the outdoor recreationists in our study to focus on those aspects of their outdoor activity that they could, and as a responsible outdoor citizen felt they should, control. While our participants offered situational explanations of appropriate use, they often did not seem to be aware of the multiple ways in which mobile media technologies impacted the organisation of their experience – a finding that aligns with Butryn and Masucci (2009). Our study showed that mobile media technology embedded a preoccupation with data and information that lead to what we propose to label *the optimisation of experience*. Our participants went to some lengths to *create* their experience, carefully identifying the best moment to go and the best spot to be in. The seemingly simple act of installing outdoor apps on one's phone consequently initiated a cascade of actions that started with an invitation to browse, choosing a route. Easily accessible route information then allowed participants to plan more rigorously, as questions such as 'what is the best time to go?' (e.g. will the terrain be muddy? where is the light at a given time?) and 'what challenge does this route provide?' could all be answered with some level of detail and accuracy. Mobile media technology, while affording access to new challenges, also offers the opportunity to control these experiences (López-Sintas et al., 2017). In more extreme cases, this might lead to the *staging* of experiences, following pre-packaged moments while losing the spontaneity that people enjoy in outdoor exploring (Tribe and Mkono, 2017; Truong and Clayton, 2020). Our participants commented on the way social media seemed to drive people to the same places, an influence of the algorithms in social media that will only show the 'must-see' places (Tribe and Mkono, 2017). Yet, the memorable moments recalled by our hillwalkers, mountain bikers and photographers were very much linked to the experience of unexpected and sometimes 'unpleasant' moments, some even with an element of danger, for example, being caught up in a heavy rainstorm. The outdoors, in western societies, appeal to visitors because they offer both a managed, accessible way into the wilderness and the promise of solitude and unpredictability (Arts et al., 2012). 'Negative' experiences are important contributors to feeling connected to the environment (Van den Born and De Groot 2011), and can provoke imagination (Truong and Clayton, 2020). Mobile media technology seems to limit these provocative experiences valued by our participants, narrowing the opportunities for these uncontrolled events by bringing a data-driven and goal-oriented mind-set to the forefront. If it is the unexpected and unplanned that makes being in the outdoors special, the focus that apps and social media put on planning and optimization calls for critical reflection.

5. Conclusion

This study shows the value of examining lived experiences with a focus on technological scripts, personal agency and social norms to

understand the impact that mobile media technologies can have on people's engagement with nature. Our participants' outdoor activities were embedded in strong ideas around good practice. Yet, while users actively reflected on the proper use of mobile technology, some influences of the technology were not readily recognized. The easy access to information and the ability to share one's performance inscripted in the technology guided our participants' practices, and encouraged measurement, control and the elimination of risks, leading participants to focus on what we call the optimisation of experiences. While these features were important to many of our participants' outdoor enjoyment, they can limit and suppress unexpected encounters in nature, which are precisely those experiences that participants seemed to value the most.

CRediT authorship contribution statement

Irma Arts: Conceptualization, Methodology, Investigation, Formal analysis, Writing - original draft, Visualization. **Anke Fischer:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Dominic Duckett:** Conceptualization, Methodology, Writing - review & editing, Supervision. **René Wal:** Conceptualization, Methodology, Writing - review & editing, Supervision.

Acknowledgement

We would like to thank all the walkers, mountain bikers, and photographers that participated in the study. We are also grateful to Audrey Verma and an anonymous reviewer for comments on earlier versions of this paper. This work was supported by the University of Aberdeen and the James Hutton Institute.

References

Adams, W.M., 2019. Geographies of conservation II: Technology, surveillance and conservation by algorithm. Prog. Hum. Geogr. 43, 337–350.
Arts, K., Fischer, A., Van der Wal, R., 2012. The promise of wilderness between paradise and hell: A cultural-historical exploration of a Dutch National Park. Landscape Res. 37, 239–256.
Arts, K., Van der Wal, R., Adams, W.M., 2015. Digital technology and the conservation of nature. Ambio 44, S661–S673.
Brown, K.M., 2014. Spaces of play, spaces of responsibility: Creating dichotomous geographies of outdoor citizenship. Geoforum, 55, 22–32.
Brown, K.M., 2015. Leave only footprints? How traces of movement shape the appropriation of space. Cultural Geographies, 22, 659–687.
Büscher, B., 2013. Nature 2.0. Geoforum 44, 1–3.
Büscher, B., Koot, S., Nelson, I.L., 2017. Introduction. Nature 2.0: New media, online activism and the cyberpolitics of environmental conservation. Geoforum 79, 111–113.
Butryn, T.M., Masucci, M.A., 2009. Traversing the matrix: Cyborg athletes, technology, and the environment. J. Sport Soc. Issues 33, 285–307.
Carter, S., Green, J., Speed, E., 2018. Digital technologies and the biomedicalisation of everyday activities: the case of walking and cycling. Sociology Compass 12, e12572.
Casey, E.S., 2012. Going wireless: disengaging the ethical life. In: Wilken, R., Goggin, G. (Eds.), Mobile Technology and Place. Routledge, New York.
Castells, M., 2010. The Rise of the Network Society: Economy, Society and Culture. Wiley-Blackwell, Oxford.
Dustin, D., Beck, L., Rose, J., 2017. Landscape to Techscape. Journal of Wilderness 23, 25–30.
Edensor, T., 2000. Walking in the British countryside: reflexivity, embodied practices and ways to escape. Body & Society 6, 81–106.
Ek, R., 2012. Topologies of human-mobile-assemblages. In: Wilken, R., Goggin, G. (Eds.), Mobile Technology and Place. Routledge, New York.
Fletcher, R., 2017. Gaming conservation: Nature 2.0 confronts nature-deficit disorder. Geoforum 79, 153–162.
Fogg, B.J., 2003. Persuasive Technology: Using Computers to Change What We Think and Do. Burlington, MA, Morgan Kaufmann.
Fuchs, C., 2008. Internet and Society: Social Theory in the Information Age. Routledge, New York.
Haider, J., 2016. The shaping of environmental information in social media: affordances and technologies of self-control. Environmental Communication 10, 473–491.
Hawkins, R., Silver, J.J., 2017. From selfie to #sealfie: Nature 2.0 and the digital cultural politics of an internationally contested resource. Geoforum 79, 114–123.
Büscher, B., 2014. Nature 2.0: Exploring and theorizing the links between new media and nature conservation. New Media & Society, 18, 726–743.
Heidegger, M., 1977. The Question Concerning Technology. The Question Concerning Technology and Other Essays. New York: Harper and Row.
Huizing, A., Cavanagh, M., 2011. Planting contemporary practice theory in the garden of information science. Information Research 16, paper 497.
Jarzabkowski, P., Pinch, T., 2013. Sociomateriality is 'the New Black': accomplishing repurposing, reinscripting and repairing in context. M@n@gement 16, 579–592.
John Muir Trust, n.d. Ben Nevis Estate Management Plan [Online]. Available: https://www.johnmuirtrust.org/assets/000/003/325/Ben_Nevis_Estate_Management_Plan_2018-2028_original.pdf?1538746096 [Accessed 18 February 2021].
Johnson, J., 1988. Mixing humans and nonhumans together: the sociology of a door-closer. Soc. Probl. 35, 298–310.
Kamphof, I., 2011. Webcams to save nature: Online space as affective and ethical space. Found. Sci. 16, 259–274.
Kay, G., Moxham, N., 1996. Paths for whom? Countryside access for recreational walking. Leisure Studies 15, 171–183.
Latour, B., 1992. Where are the missing masses? The sociology of a few mundane artifacts. In: Bijker, W.E., Law, J. (Eds.), Shaping Technology/Building Society: Studies in Sociotechnical Change. MIT Press, Cambridge, Mass.
López-Sintas, J., Rojas-Defrancisco, L., Garcia- Álvarez, E., 2017. Home-based digital leisure: doing the same leisure activities, but digital. Cogent Social Sciences 3, 1309741.
Lorimer, H., Lund, K., 2003. Performing facts: finding a way over Scotland's mountains. The Sociological Review 51, 130–144.
Martin, S.R., Pope, K., 2012. The influence of hand-held information and communication technology on visitor perceptions of risk and risk-related behavior. In: Cole, D.N. (Ed.), Wilderness Visitor Experiences: Progress in Research and Management, 2011. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research, Missoula, MT. Collins. COStation, pp. 119–126.
Michael, M., 2000. These boots are made for walking...: mundane technology, the body and human-environment relations. Body & Society 6, 107–126.
Michael, M., 2009. The cellphone-in-the-countryside: on some of the ironic spatialities of technonatures. In: White, D.F., Wilbert, C. (Eds.), Technonatures. Wilfrid Laurier University Press, Waterloo, Ontario.
O'Reilly, K., 2012. Ethnographic Methods. Routledge, Abingdon.
Pantzer, M., Shove, E., 2010. Understanding innovation in practice: a discussion of the production and re-production of Nordic Walking. Technology Analysis & Strategic Management 22, 447–461.
Relph, E., 2008. Place and Placelessness. Sage Publications Ltd.
Rivers, D.J., 2019. Strava as a discursive field of practice: technological affordances and mediated cycling motivations. Discourse, Context & Media 34, 100345.
Rose, G., 2016. Rethinking the geographies of cultural 'objects' through digital technologies: Interface, network and friction. Prog. Hum. Geogr. 40, 334–351.
Sandbrook, C., Adams, W.M., Monteferri, B., 2015. Digital games and biodiversity conservation. Conservation Letters 8, 118–124.
Schrock, A.R., 2015. Communicative affordances of mobile media: portability, availability, locatability, and multimediality. Int. J. Commun. 9, 1229–1246.
Schwartz, R., Halegoua, G.R., 2015. The spatial self: location-based identity performance on social media. New Media Soc. 17, 1643–1660.
Senda-Cook, S., 2013. Materializing tensions: how maps and trails mediate nature. Environ. Commun. 7 (3), 355–371. https://doi.org/10.1080/17524032.2013.792854.
Shove, E., Pantzar, M., Watson, M., 2012. The Dynamics of Social Practice: Everyday Life and How it Changes. Los Angeles, London, New Delhi, Singapore, Sage.
Shultis, J., 2012. The impact of technology on the wilderness experience: a review of common themes and approaches in three bodies of literature. In: Cole, D.N. (Ed.), Wilderness Visitor Experiences: Progress in Research and Management, 2011. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research, Missoula, MT. Collins, COStation, pp. 110–118.
Shultis, J.D., 2015. Completely empowering: A qualitative study of the impact of technology on the wilderness experience in New Zealand. In: Watson, A., Carver, S., Krenova, Z., McBride, B. (Eds.), Science and Stewardship to Protect and Sustain Wilderness Values: Tenth World Wilderness Congress Symposium, 2013. Department of Agriculture, Forest Service, Rocky Mountain Research, Salamanca, Spain. Fort Collins, CO: U.SStation, pp. 195–201.
Stinson, J., 2017. Re-creating Wilderness 2.0: Or getting back to work in a virtual nature. Geoforum 79, 174–187.
Tribe, J., Mkono, M., 2017. Not such smart tourism? The concept of e-lienation. Annals of Tourism Research 66, 105–115.
Truong, M.-X.A., Clayton, S., 2020. Technologically transformed experiences of nature: A challenge for environmental conservation? Biol. Conserv. 244, 108532.
Van Den Born, R.J.G., De Groot, M., 2011. Favoriete plekken en binnendoorpaadjes. In: Van Den Born, R.J.G., Drenthen, M., Lemmens, P., Van Slobbe, T. (Eds.), Plaats. Zeist: KNNV.
Verbeek, P.P., 2005. What Things Do. University Park, Pennsylvania, Pennsylvania State University Press.
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, S648–S660.
Viñals Blanco, A., 2016. The transformation of leisure in the digital age. In: Çoban, B.Ş. (Ed.), Social Media and Social Movements: The Transformation of Communication Patterns. Lexington Books, Lanham, Boulder, New York, London.
Zuboff, S., 2019. The age of surveillance capitalism: the fight for the future at the new frontier of power. Profile Books Ltd, London.