“Off the beaten map”: navigating with digital maps on moorland

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ABSTRACT

Resources made available through the digital map app change, but do not replace, the skills of ‘ordinary wayfinding’. Looking at the challenges of wayfinding with new mobile devices helps inform the development of digital mapping tools for navigating through difficult terrain. With this background in mind, in this article we consider how the contemporary navigational resources of mobile devices with GPS, and the resources of countryside landscape features, are brought together in visiting a tourist site. We analyse video data from groups walking across unfamiliar moorland terrain, following a guide and map app which takes them on a tour of a remote Roman marching camp in the Brecon Beacons National Park, Wales. Following an ethnomethodological and conversation analytic approach, we examine three instances of navigational work for paired walkers as they traverse the moorland. The three fragments are of: an orientational struggle to establish where to go next; a routine check to select a path and the discovery of a feature mentioned in the guide. Across the three episodes we explicate how our walkers make sense of the guide and map in relation to investigating the moorland surface. We examine how their ambulatory and undulatory practices on the moorland are tied to their wayfinding practices. While we analyse wayfinding talk, we also attend to the mobile practices of stopping and pausing as part of practical navigational reasoning.

KEY WORDS

Navigation; Wayfinding; Digital Map; Mobile Technology; Moorland; Surfaces

1 INTRODUCTION

The idea of walkers circling endlessly in the desert, forest or on mountains, features prominently within our imagination of how we get lost. The arrival of Global Positioning System (GPS) enabled devices and digital mapping apps appear to have rid the well-equipped walker of those dangers. Yet, the use of GPS in the countryside does not mean that the work of wayfinding has disappeared nor, in fact, that it has necessarily been made easier.

We are only beginning to understand how mobile digital technologies shape walking, navigation and social interaction. Most of the research on the digital turn has focused upon digital technology's reconfiguration of the city (Ash et al. 2016), whilst critical cartography has been preoccupied with map production, rather than map use (Kitchin et al., 2009). In this paper, we examine the intersections between the practices of leisure walking and the use of new navigational media in the countryside. Our video data is of groups walking across an unfamiliar moorland terrain as they follow an app, which takes them on a tour of a remote Roman marching camp in the Brecon Beacons National Park. We present three navigational episodes, describing, as we go, the practical reasoning of our walkers, as they encounter moorland features, tracks and paths, in relation to the resources provided by the app as guide. Geographers have recently become interested in the nature of surfaces and human interactions with them (Forsyth et al. 2013) and here it is moorland surfaces that provide wayfinders with resources and problems in grounding the digital guide.

2 NAVIGATION AND WAYFINDING

Although we noted that navigation in the countryside has been largely neglected, many of the issues raised about wayfinding are relevant to the country and city. To begin with the nature of wayfinding itself, Ingold (2000) and others (Laurier and Brown 2008; Laurier et al. 2012) critique the notion of a cognitive spatial representation held inside the brain by humans who then check that representation against an external landscape. Instead, *wayfinding* is conceptualised and studied as a socially organised, intersubjective practice, which is itself culturally variable and locally accomplished. Drawing on examples of indigenous groups who successfully navigate their worlds without maps, Ingold (2000) suggests that we come to *know as we go*, where perception of the environment is continuously formed in moving through it, rather than presupposed. A number of studies in urban environments have gone on to show how navigation as a collective accomplishment is achieved through mobile investigations alongside the inspection of maps, in relation to architectural features and textually inscribed environments (Bell et al., 2009; Laurier and Brown, 2008). It is, however, the relative absence of architecture and textual inscription that is one of the defining features of the countryside, and particularly of moorland environments. There is a second important distinction, between wayfinding of familiar and unfamiliar places. A number of existing studies, building on Ingold's work, have concerned how individuals or groups navigate familiar terrain, through habitual practices and working out *on-the-way* (Laurier et al., 2012). Our concern in this article is with finding a way through an unfamiliar place. Building on these two distinctions, we ask how it is that recreational walkers navigate a countryside that is unfamiliar to them, in the absence of architectural landmarks and familiar pathways. It is, of course, in these circumstances that walkers, runners, and others who make use of 'wild' places, turn to maps, and, increasingly, technologies that display *interactive* forms of mapping.

Maps are one resource among many in wayfinding, which may be accessed and assessed differently by group members when traversing terrain. In their study of urban navigation by tourists, Laurier and Brown (2008) describe how the process of orientation involves members drawing on multiple perspectives on the environment, as well as shifts back-and-forth between the map and urban landscape to determine 'where they are'. Wayfinders draw on the resources of their local media (maps, guidebooks, street signs, etc.), but also on linguistic and bodily resources between individuals relating to their environment (Laurier et al., 2012; Laurier et al., 2016). Different mobilities produce resources, which then have a bearing on navigation itself. In this article we are considering just this—the resources brought *to* walking by the distinctive variety of walking that constitutes walking together in the countryside.

How environmental features, such as paths, rivers, ridges and slopes are made sense of in the countryside plays a central part in navigation, yet the significance of such features has only been tentatively explored in existing studies. Amongst these, the path is central because it is itself a pre-given way, set out by earlier walkers (be they human or non-human animals) and/or demarcated by those who manage rural landscapes. Studies outside urban environments have examined clear pathways, such as well-marked trails followed by runners (Hockey and Allen-Collinson 2013). Yet the path is a less homogeneous and regulated feature than the urban road, cutting between buildings and blocks. What constitutes a 'proper' path is often open to interpretation (Brown, 2015), and often routinely interwoven with and disrupted by other lines created by humans and non-humans (Lorimer and Lund 2008). While in urban landscapes, built landmarks play an important role in navigation (Bell et al., 2009), in rural areas, landmarks are often less well defined and distinguishable (Sarjakoski et al., 2012). When straying off the path into moorland, which is where this study takes us, landscape features range from subtle to invisible and sheep paths proliferate.

2.1 Achieving navigation whilst walking together

Ed Hutchins' (1995) iconoclastic study — *Cognition in the Wild* — broke spatial cognition away from the individual to examine its social organisation and distribution on board a ship. As a result, he opened up navigation for place-based studies of how it is intersubjectively organised. Walking, in its particular practices has varied forms of navigation reflexively tied to it, from orienteering through a forest, to a fetching a pint of milk from your local shop (McGookin and Magnusson, 2012). Walking in its varied forms has received considerable recent attention not only as a form of purposeful mobility, but as an embodied, social act, as a skilled practice, an act of 'getting along' (Lorimer, 2011), one which almost always has a purpose and meaning made 'on the move' (Horton et al., 2014).

There are two aspects to the accomplishment of walking: the social organisation of walking together and walking's interweaving with other social practices. As a collectively organised practice, walking together is continually produced and recognised by members, using a range of methods to render its qualities intelligible to others (Laurier et al., 2016; McIlvenny, 2013; Ryave and Schenkein, 1974). These methods include the use of gestures, pace and gait (Mondada, 2009), the arrangement and re-arrangement of spatial formations of groups (especially when traversing obstacles, e.g. Tolmie et al. 2014; Weilenmann et al. 2014). Deceptively 'simple' actions, such as stopping together to focus on an object of interest, are the result of moment-by-moment adjustments of walkers (Mondada, 2009; 2014). Walking is tightly interwoven with, and draws upon, the organisation and achievement of

'linguistic' actions, such as closing a conversation (Broth and Mondada, 2013), or role-taking and making responsibilities accountable (Stefani and Mondada, 2013). Walking, talking and other embodied practices in the environment are interdependent, and therefore navigating whilst in the countryside is in turn interdependent on various other outdoor practices.

Practices of walking are often equally entangled with other embodied actions, such as gestures of care and responsibility (Horton et al., 2014). Where many studies have concentrated on movement, 'stillness' and stopping should also be explored for their productive elements, including how they are incorporated into walking (Cresswell, 2012). Although it has been demonstrated that particular environments demand a halt — for summits as point to see and appreciate the wider landscape (Lorimer and Lund, 2008; Wylie, 2002), or for performing acts of locating (Lorimer and Ingold, 2005) — how, when and why walkers routinely stop and go, and how their pauses relate to more minor features of the landscape, is missed. Wayfinding while walking is a practice generated in and by particular places, such that wayfinding develops in skillscapes (Hunt, 2016), i.e., that bring together long-standing materials (e.g., Roman ridges) with the most recent (e.g., mobile devices with GPS-based navigational apps). In this paper, we explore how, whilst finding the way, environmental features present obstacles and reveal perspectives, making relevant the reorganisation of walking and talking together.

Walking in the countryside is reflexively productive of the paths being walked on, through the impressions of footfall on the ground, turning grass to mud and thereby maintaining, creating, shifting and sometimes destroying paths. The lines of paths, in turn, are partly dictated by the geomorphology that affords more or less conducive ways to walk. Paths, which may be curated directly by humans or created through animal and human movements, equally construct the environment for walking (Lorimer, 2011), and in turn walking constructs the environment through creating visible traces or lines (Ingold, 2007). Paths are surface features and geographers have turned their attention to surfaces, asking how material surfaces function in interactions with human movement, but also how surfaces are sensed and apprehended, through human senses and technologies (Forsyth et al. 2013; Lorimer 2012)**.** Thinking of space as a 'flat surface' has been dismissed because of the association between surfaces and mapped representations of space 'from above' (e.g. Massey, 2005). Yet, how surfaces are encountered seems critical for understanding human wayfinding. Similarly, writing in critical cartography and digital geography has rarely featured the ground in analysis of digital mapping, instead concentrating on the intersections between space, technology and society (Leszczynski, 2019). In this paper we examine how the particular surfaces of moorland are encountered and navigated through, and how features of the moorland surface are productive of and in the social accomplishment of wayfinding.

2.2 Technologies, walking and navigating

Technology and walking in the countryside are typically counterposed in Western societies, with computer technologies associated with increasingly sedentary cultures of work and recreation (Jarkievich et al., 2008; Lorimer, 2011), or more broadly associated with modernity and the distancing of people from the natural environment (Smith and Dunkley, 2018) and one another (Turkle, 2011). Indeed, the absence of contemporary technologies and signs of them (such as phone signal) engenders 'rural skill' (Flemsæter et al., 2015; Hunt, 2016). The characterisation of places as wild, natural and untouched presupposes the absence or intrusiveness of screens and digital

networked technologies (Brown, 2015; Lorimer and Ingold, 2005). Yet walking is mediated through a host of technologies, some old (e.g. shoes, paths, milestones), some more recent (mobile devices, Goretex). Moreover, Human Computer Interaction (HCI) research has explored how devices are brought into interaction as co-present, and/or used as shared artefacts, rather than treated as separate entities, making their users absent from local activities (Brown et al., 2013; Jarkievich et al., 2008).

GPS devices with interactive screen maps increasingly assist people in accessing the countryside, including those who might not have learnt the skills to navigate with a map and compass. Critical cartography, that sought to expose the discursive power and authority of maps to define territories, has chiefly focused on the production and producers of maps (Harley, 2001). Interest in map use and function was confined to states, empires, and practical actions in the broadest sense, such as boundary making and warfare (Leszczynski, 2019). The 'close reading' of maps as singular, stable cultural artefact or text, has been characteristic of the work of cultural geographers (Rose, 2016) who, when attending to mapping practices, have tended to focus on map creation (see, for example, Kitchin et al., 2009; Wilson, 2019). Now that the form of the map is often digitised, manipulable, and closely read for divergent purposes by both their creators and users, there are calls to better understand map use in everyday practices and journeys (Crampton, 2009). Writing on digital geographies recognises that digital maps engender different forms of mobility and navigational practice (Ash et al., 2019), and the resulting practices are the focus of this paper.

Map and guide apps now commonly used for navigating 'everyday space' (Farman, 2012) differ from traditional maps and guides in several ways. Map apps use GPS, cellular-tower triangulation and Wi-Fi signal to display the user's location as an icon on the map. They change scale and orientation, vary the features displayed, recommend routes and more (Bell et al., 2009). Moreover, social media maps, such as Strava, allow for sharing and comparing of routes across terrain otherwise poorly mapped by standard map apps, such as Google maps (Schwanen, 2019). Guide apps overlap, and are usually interwoven with, map apps, while also moving beyond the paper guidebook or leaflet in bringing audio and video as additional resources. While mapping apps on mobile devices bring considerable new resources, they remain incomplete, like all maps, requiring sensemaking (Brown et al., 2013).

Making sense of the map is itself reflexively tied to the environment it represents. When map and guide apps are used in urban environments points of alignment are plentiful, particularly street names, intersections and landmark buildings. These features are largely absent in rural, wild landscapes, although even in urban environments considerable work has to be done by pedestrians to locate themselves (Laurier et al., 2016). How mobile devices are used in 'wild' settings ('wild' here not meaning a form of landscape but to mark, as Ed Hutchins did, a contrast with lab-based and/or experimental methods) has been the focus of much recent HCI research. A principle concern has been that technologies are often developed without designing for how users then appropriate technologies to existing practices in those settings (Crabtree et al., 2013). For example, turn-by-turn navigational instructions developed for driving and walking in urban environments do not translate well into unstructured rural environments (McGookin and Magnusson, 2012); GPS-navigation is useful for macro-navigation, but poor at supporting micro-navigation (D'Orazio and Lueg, 2012).

Users of map apps perform acts of orientation in a similar way to those using traditional maps, but they also make use of dynamic features, such as 'walking the blue dot' to check a new position relative to a previous one (Brown et al., 2013). Map apps also present users with sense-making problems which manifest as navigational troubles, such as time lag for GPS (D'Orazio and Lueg, 2012). Guides and maps' uses are shaped by the activities they serve, equally the guide or map is shaped towards its uses (e.g. the difference between a game map and a guided tour map (Bell et al., 2009)). The function of the map and guide is not determined but instead constructed in and through how it is brought into practice in the 'here and now' (Ferreira and Höök, 2011; Laurier and Brown, 2008). While the use of new media, therefore, shapes walking, mobile activities are just as significant in configuring the media (Laurier et al., 2016). The availability of new technologies for walkers shifts how technologies show up, where they are required, and the skills that go with them (Ingold, 2000; Hunt, 2016). Indeed, mobile devices engender new forms of skill that emerge out of their presence in the environment (Ferreira and Höök, 2011). Within the remainder of this article, we will explore how mobile devices feature in the organisation of walking together in the countryside.

3 NAVIGATING OUTDOORS: THE WALKING WITH ROMANS MOBILE APP

Working in collaboration with, and reporting back to, the Brecon Beacons National Park Authority (as part of a larger research project), we investigated participants' use of a smartphone app visitor guide called *Walking with Romans* (WWR). The guide app was developed to facilitate physical and historical access to a little-visited site. It features a tour of a remote Roman Marching Camp (Y Pigwn) and Fortlet (Waun Ddu), built circa 78 AD. Employing digital mapping services from the Google Maps Platform, it renders the map on-screen and draws various features including a custom overlay that provides more detail of the local area than the standard Google Maps representation. The overlay adds marked paths, annotated waypoints, and a GPS 'you are here' blue dot. The GPS dot in particular provides a central resource for visitors in using this mapping service (Figure 1A). The dot provides visitors with an icon that moves when they do, thus displaying the direction of their movement. Walkers also leave a trail behind them on the map, produced in real-time so that they can see their previous movements in relation to other features of the map. In this location, mobile phone signal is poor, a common occurrence in some rural and mountainous regions of the UK, and therefore visitors must download the app prior to arrival. However, GPS signal is typically good, given the open nature of the terrain. Using the WWR app, visitors are instructed to follow a trail with distinct waypoints (Figure 1B; 1C) where they listen to a series of audio clips describing archaeological and historical aspects. The app also incorporates a range of content, including animated depictions of the camp as it might have looked during Roman occupation. The walking loop (Figure 1B) is six kilometres, partly on a vehicle track and partly over open moorland that has neither signage nor established footpaths. The moorland creates a significant navigational challenge for visitors and indeed, it forms a core part of the experience of the activity. The remaining earthworks of the camp, which include the camp's entrance, palisade fences and ramparts, are both easily confused with other geomorphological features and overgrown with moorland vegetation.

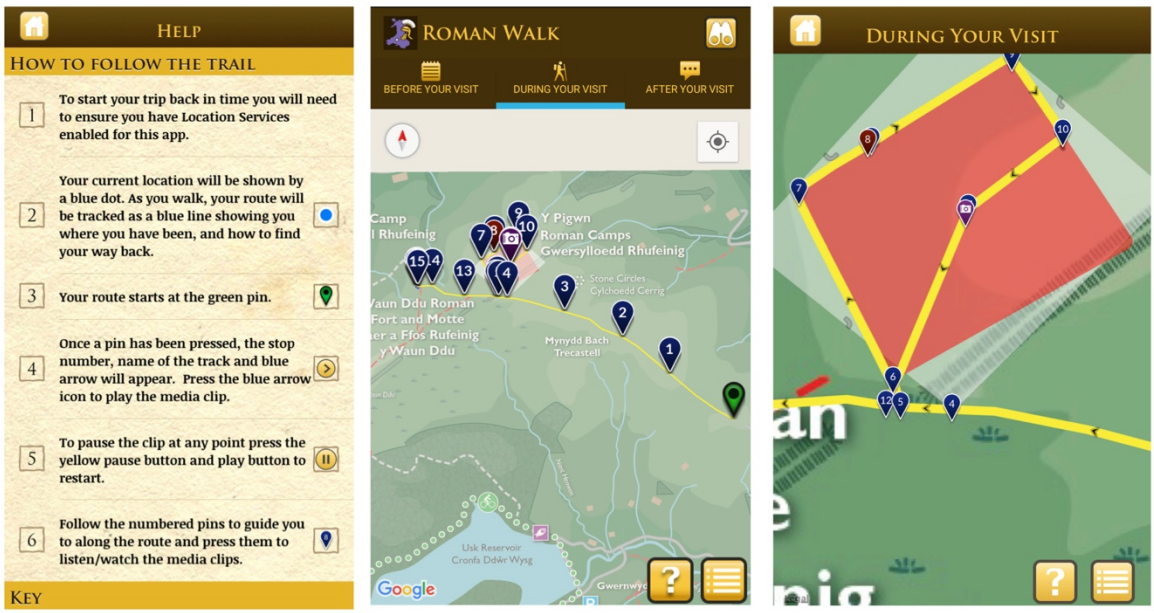


Figure 1: [A] App instructions with 'you-are-here' blue dot; [B] Overview of the tour; [C] detail of the tour around Y Pigwn Camp.

In moorland, there are very few features to reference and, like many upland environments in the UK, the moorland here is grazed by sheep, who produce numerous minor tracks, which crisscross the minor paths produced by human walkers. As a result, establishing exactly the right track for the walkers — who are in this environment for the first time — is not straightforward. What is distinctive to walking this landscape, as we argued earlier, is that walkers have minimal textual and built environment resources relating to the map (e.g., no street signs, landmark buildings, etc.). These aspects of moorland offer us a perspicuous setting in which to explore the distinctiveness of outdoor navigation and better understand the "organizational *thing*" that we are attempting to explicate (Garfinkel, 2002, p. 181-182).

We recruited eight groups of between two and four participants to trial the WWR app in the field. These groups included adult friends, a family with two children and one group of retirees. Each group was equipped with two on-body video cameras, worn on chest-harnesses, which provided an insight into their experience, without the need for the presence of researchers. Each group took between 2 to 4 hours to complete their visit, generating, in total, 24 hours of video-footage. Filming outdoors on exposed sites has challenges, including wind and other inclement weather that affect audio and video quality. The multi-camera footage was synchronised, and selective sequences transcribed (on the format, see Heath et al., 2010). Our approach to examining participant recordings was based in ethnomethodology and conversation analysis (EMCA). EMCA has a focus on the sequential organisation of 'embodied' actions as context sensitive and context renewing. It explores how practices are jointly accomplished and pursues the description of practices of participants in a non-ironic attitude (Laurier, 2010). The researchers watched through the footage to identify distinctive exhibits of key navigational practices, choosing fragments between 10 minutes and 30 seconds for further inspection. Initial selection of material focused on points where navigation became a common trouble for participants (aided by GPS traces), ranging between fifteen and forty navigational 'incidents' per group. The three fragments in this paper are common

problems for participants, while also exhibiting the participants ordinary geographical reasoning in responding to the problems.

Video recording has been used for a range of EMCA research studies of walking (Broth and Mondada, 2013; Stefani and Mondada, 2013), mobile technologies 'in the wild' (Brown et al., 2013), and mobility (Brown and Spinney, 2010). Mobile video documents details of actions which might be missed by other observational or ethnographic methods (Brown et al., 2008). Recording allows researchers to re-watch encounters to support 'noticing' of how interactional practices are organised by participants (and recognised as such by them). Video also allows study of social situations where the researcher is not present and distracting in the peculiar ways that researchers are (Laurier, 2014). All of the co-authors have extensive experience of outdoor navigation, which was also brought to bear on the accounts offered in this paper.

Whilst on-body cameras allow for filming without holding the camera, the direction of shooting is dependent on the participant's facing direction and typically does not capture faces and bodies of all participants (as will become evident in the transcript images later). In our study, synced footage from multiple camera angles helped mitigate the problem of limited and torso-directed perspectives. The limits of the torso-camera recording, however, also shaped the focus of our analysis. The terrain has become more central to our analysis because it was itself always fully in view for us as post-hoc observers (though with strong participatory knowledge of the challenges of walking on moorland) and, as such, we have selected fragments of video where physical features of the environment come to be more or less explicitly topicalised by participants. One of the contrastive features of walking on informal paths is the close monitoring by walkers of the ground (Ingold 2000), and the ways in which walkers respond to the surface they walk upon (Lorimer 2013). This dual significance led us to focus on the surface of the moorland terrain and its relationship to navigation, walking, and the use of technologies through which the landscape is interpreted.

4 WAYFINDING WITH A TOUR-GUIDE APP

In this section, we present and analyse three events from the WWR app trial in which each group was more or less conspicuously involved in the work of navigation. Fragment 1 shows our first group, Aled and Bryn, who are discussing where to depart the vehicle track, roughly between waypoints points 4 and 5 in Figure 1C. Examining Aled and Bryn's decision-making gives us a first look at the complexities of making sense of 'where we are now' and 'where to go next' with the mapping app. Fragment 2 then joins a second group, Tina and Delyth, who are making their way over the undulating moorland. In contrast with Aled and Bryn, Tina and Delyth's navigational work is more subtle and woven into a humorous conversation. Finally, Fragment 3 joins Rhys and Ceri, who are finding one of the archaeological features. By unpacking Rhys and Ceri's work in finding features, we show the intersection of the terrain and the guide's description, which is realised through walking as a way of exploring the slopes and textures of the surface.

4.1 Finding where to leave the vehicle track (Fragment 1)

Locating a candidate departure point from the vehicle track presents a first navigational trouble for participants using the WWR app. It is on leaving the vehicle track and stepping into the open moorland that our groups first realise that the map correlates poorly with their "immediate

perceptual experience" (Ingold, 2000, p. 224). In Fragment 1, we join Aled and Bryn encountering this first navigational trouble. They have just finished listening to the audio clip for waypoint 4 (Figure 1C), which discusses the marching camp visitors will encounter. Aled (A) is holding his mobile device and is standing ahead of Bryn (B). Aled has the WWR app's map on-screen, and thus acts as the 'map-reader'. This role makes relevant particular entitlements and responsibilities, such as manipulating and aligning the map, making it available to others, being more accountable for route choices, and suggesting 'where next' (Laurier et al., 2016) as we shall witness in what follows. We will divide this fragment of wayfinding into shorter sections so that you as reader can more easily keep track of disorientation and re-orientations of Aled and Bryn.

Fragment 1a: Proposing a way off the track

In panel 1, having just listened to Waypoint 4's audio clip, Aled tuts, and his "ah, there you go" closes the listening activity. On the basis of consulting the device, Aled's movement forwards serves as a non-verbal proposal to continue along the track, yet Bryn stays stationary (throughout panels 1-3): an equally non-verbal response. This non-uptake by Bryn also acts as a possible analysis of

their wayfinding: that they are actually *not* yet finished deciding where to walk, or that Bryn's *current* position is already a candidate departure point from the track. In panel 3, we then see Aled stopping in response and offering an extended account of why he is continuing: "I didn't see anything else that looked" (although incomplete: Aled does not provide an explicit formulation of what navigational feature they are looking for). Bryn then produces a question with two alternative next courses of action, ("carry on down here" "or we going round this" (panels 4 to 6)) which also accounts for his refusal to proceed, but still does not offer an explicit candidate departure point from the track, only to either continue on, or leave the track.

During Bryn's questions, Aled glances at the screen of his mobile device maintaining the relevance of the WWR app as the basis for restating his proposal, "I think we (.) carry on" (panel 7). However Aled's "I think"-preface, softens his proposal and creates an environment where Bryn can contribute to making sense of the map. Moreover, when Aled pauses ("we (.) carry"), he raises a pointing finger to the device's screen and, at the same time, rotates it towards Bryn and steps slightly backwards as Bryn closes in. His adjustment of the device angle enables both of them to see their current location on the app and the suggested routes to the Roman camp. This deft set of movements supports co-viewing of the smartphone's screen, while simultaneously making it relevant to the current navigational trouble. Moreover, he is inviting a shift from a spatial formation for walking onward to an inclusive 'huddle' around an object of interest (Goodwin, 2007). While Bryn is walking toward him, Aled downgrades his app-based claim still further with "well, I dunno" (panel 8). However, Bryn ultimately walks beyond Aled, only taking a 'drive-by glance' at the map and offering an acceptance to "carry on" by continuing forward himself. Meanwhile, Aled's second enquiry into the WWR app's map provides the basis for a proposal building on Bryn's question: "well, maybe we do go up" (panel 9). Aled couples this second proposal with stopping and turning rightwards towards the moorland. This stop-start series of moves between Aled and Bryn is something we repeatedly see in other fragments.

At this point, we can make a number of initial observations about what it means to walk and navigate together in the countryside. In this first part of the transcript, we described how Aled and Bryn made their wayfinding problem intersubjectively available. Finding the way emerged in movements and talk, including: how Aled's first proposal was implicit in his forward walking, how that was resisted by Bryn, then accepted, yet as a consequence of that resistance, Aled returned to the app and produced a revised proposal. This, then, is our first glimpse at the intersubjective accomplishment of wayfinding in this environment. Three points surface. Firstly, the WWR app and its map configure the distribution and responsibility of wayfinding work. Secondly, app use occurs in the midst of talking and walking practices that amount to, as well as make apparent, the resistance to and acceptance of various navigational proposals. Thirdly, the initial lack of visible resources for 'moving on' in the moorland terrain up to this point is made evident in the non-specific suggestions made by our walkers thus far. Leaving the track is referred to generally as "going up" or "going round this" (Bryn), with no clear candidate departure point, such as an alternative path, being identified.

In fragment 1b, below, we follow on from Aled's new proposal of "maybe we do go up" (panel 9), which re-opens the possibility that Aled and Bryn actually should leave the vehicle track 'here'. As they huddle around the mobile device, Aled and Bryn re-inspect the map and scrutinise local

features, beside the track, as candidate paths constituted by their possible relation the WWR map's yellow line (Figure 2).

Fragment 1b: Re-inspecting the map

Aled turns toward the moorland beside and behind, tentatively configuring a zone of slope for Bryn to scrutinise ("suppose there's a bit of a track there" (panel 11 – more visible later in panel 17)). Having raised this slope as a candidate, Aled then builds on his spotting of this path by turning back to the mobile device's map (pointing at it as Bryn closes in again, panel 14). Finding the path on the screen ("it looks as though […] there's a yellow line to go up"), he traces his finger diagonally across it (panel 13). In doing this, Aled sequentially contrasts the yellow line of their intended path as displayed in the WWR app's map with the "bit of track" they have been visually inspecting on the slope.

By Aled turning back and tilting the device towards Bryn, he not only shares access to the device (panel 12), but brings Bryn into the task of making sense of the app. Bryn inspects the map and then provides an additional suggestion, based on his inspection, by also pointing in the region where Aled had suggested, further back down the road from where they have come (panels 15 & 16). Yet Aled

then moves to reject the region behind them, on the basis of their GPS location-dot on the map ("but we're not quite there yet, according to the map", panel 15 & 16). He then reinforces this disjuncture between the WWR map and local environment by turning back towards the faint path again (panel 17 & 18) to cast major doubt on the earlier candidate path: "there's nothing there, is there?".

In fragment 1b, Aled and Bryn have, then, jointly re-investigated the map and the local physical organisation of track, moorland and candidate paths. In doing this, they oriented towards the various environmental resources that offer possibilities to 'move on', including the hill, paths 'up' the moorland, and the track they are on, in an attempt to solve the navigational problem, and in doing so, resolve the inevitable disjunctures between lines on a map, GPS data, the moorland environment as inspectable from their perspective, and even their individually differing visual aptitudes. Their sense of what a route marked on the map will look like on the ground will have to be recalibrated in the light of the absence of well-trodden or otherwise clearly marked tracks.

Aled's dismissal of the path used the app as the source of his authority: "according to the map". Yet by attributing the information to it as a third party, Aled opens up the possibility of further inquiry and, indeed, Bryn brings the device up later as the source of their wayfinding troubles (panel 20). In doing this, Bryn leverages uncertainties familiar to many location-based device users: map inaccuracies and GPS error.

Fragment 1c: Heading up the hill

In panel 19, we see Bryn re-initiating progress on their tour by moving down the vehicle track once again, following the dismissal of the candidate departure point by Aled. However, to maintain their togetherness (e.g., not 'walk off' from Aled), Bryn steps to one side of the track and waits while Aled catches up. Although Aled has caught up and Bryn sets off, yet again (panel 22) seemingly re-initiating walking along the vehicle track, Aled returns to the ongoing query with the app by stopping and raising the mobile device alongside Bryn (panel 22). Aled's halt then projects them re-reading the device's map in relation to their current location: "maybe this is it" (panel 23). Confirmation of Aled's conclusion is delivered from the WWR app itself: when readying himself to press audio clip 5, it would appear the location-dot has moved and they are "right on five" (panel 25). The audio guide then begins by describing their next move as "head up the hill" (see figure 2), a phrase which finds immediate sense (humorously so). Aled and Bryn then turn towards the hill and continue up, completing their brief, if fraught, wayfinding.

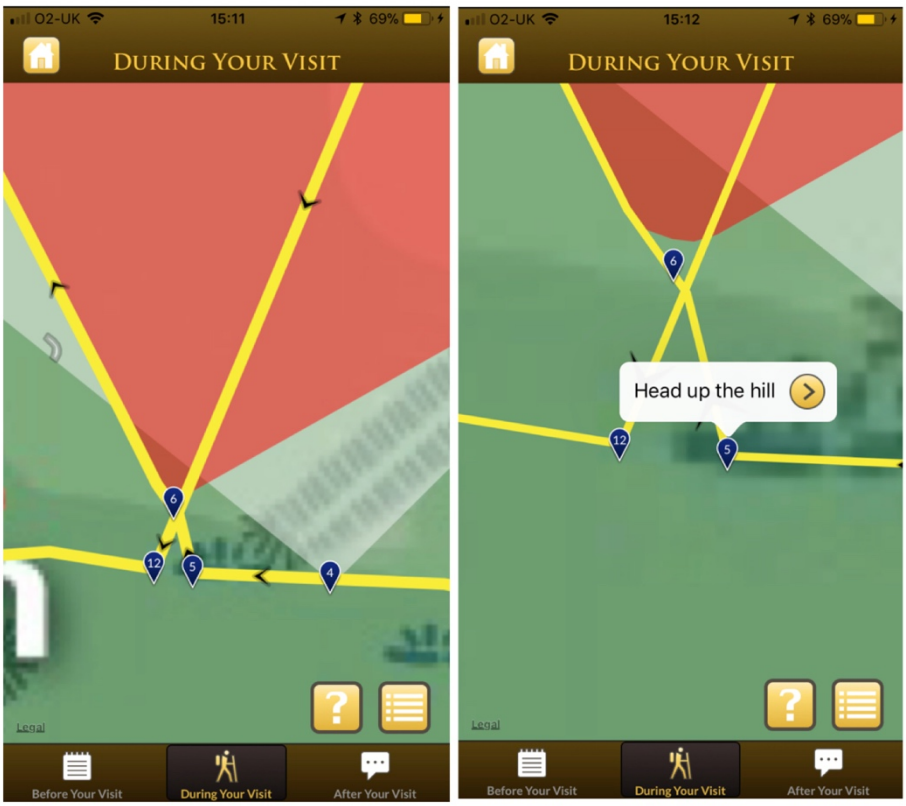


Figure 2: [A] Section where leaving the road is suggested; [B] 'Head up the hill' waypoint selected

For Aled and Bryn, the significance of the final moment in fragment 1c, departing from the well-worn vehicle track, is in losing the track itself as a wayfinding resource. It is not just that a vehicle track provides one simple way to proceed. It is also that the track is visible prominently on the WWR map (Figure 2A). Yet, simultaneously, the various misalignments between the representations in this map and the moorland environment *must* be continually worked at (in this case, locating where to leave the vehicle track). The authority of the digital map is not taken for granted, and the accuracy of associated device functions such as GPS orientation might be questioned in acts of orientation. The fragment showed the joint and different ways in which navigational work gets done. Whilst Aled is preoccupied with consulting and making sense of the app, Bryn attempts twice to progress the walk through 'moving on' (physically and conversationally). Moving forward along the track acts as a way of progressively discovering 'where they are', which then must be made sense of in relation to Aled's attempts to repair the disjunctures presented by the map app's depiction of where they are.

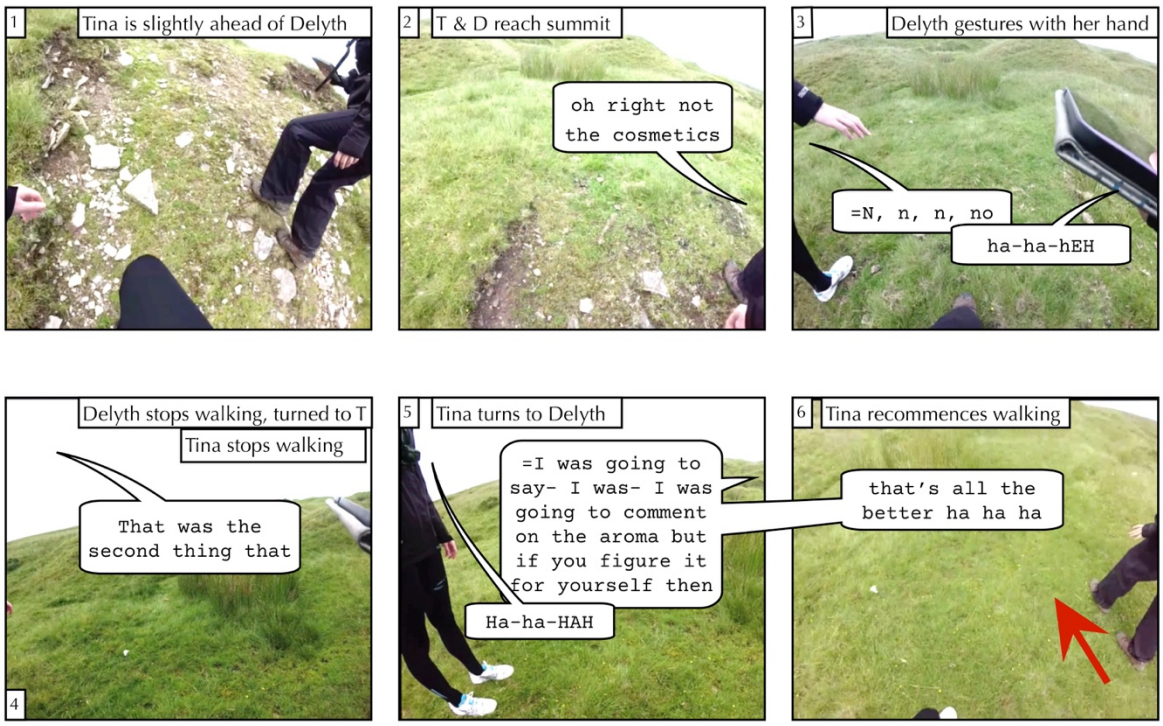
What becomes apparent, in this first fragment, is how wayfinding in open moorland environments presents particular navigational challenges for walkers that are different from urban environments (see Laurier and Brown, 2008; Laurier et al. 2016; Tolmie et al., 2015). Moving from the surface of the track (well-aligned with the WWR map, and clearly visible on the ground), onto the unclear and ill-determined surfaces of the moorland, our walkers find the environment beyond the track semiotically poor (the "bit of track", or "nothing there"). This apparent paucity of environmental

resources is partly dealt with by our walkers in their talk, and orientation to the moorland landscapes, in moving from the general (staying on the track versus “going up”) to the more detailed inspection of the nearby slope and candidate features (the “bit of track”). We can witness the struggles of wayfinding in this environment in Aled and Bryn’s progression in fits and starts—of walking forward, of stopping to consult the device and the topography of the moorland—all accompanied by navigational propositions in talk, and all part of the process of deciding not only ‘where we are’ but also ‘where we go next’. The use of the device relates to Aled’s need to make his device-based judgments accountable to Bryn and latterly to involve Bryn in the sensemaking. In our next fragment, we move off the track and onto the moorland.

4.2 In amongst the hillocks and tussocks: Developing perspectives (Fragment 2)

When walking in hilly countryside, the way ahead is often hidden because the slope of the terrain conceals features. The progression of a walk provides for, successively reveals, hides and sequences perspectives on the landscape (cf. Ingold, 2000; Wylie 2002). In this next fragment, we explore how those perspectival changes, generated by the progression of the walk, provide a chain of resources that are potentially relevant to navigating. We will attend to the ways in which the *character* of moorland surfaces is reflexively tied to finding the way. Specifically, the moorland’s surface displays informal paths made by walkers and grazing sheep, which routinely meander, split, run parallel, merge, and fade out. The moorland surface is itself composed of small hillocks and tussocks, and the channels or gullies between them, through which such paths weave, further complicating matters. By examining our walkers’ activities, once they have left the vehicle track and are on the perspicuous setting of the moorland proper, we can deepen our insights into how walkers navigate with a map app.

Fragment 2 involves Tina and Delyth who, as we join them, are reaching the brow of a small hill and having a humorous exchange about soaps and personal hygiene. As we did for Fragment 1, we have divided this fragment into shorter more easily followable sections.



Fragment 2a: Reaching a summit

We might summarise the sequence shown in fragment 2a in the following way: Tina and Delyth reach the summit of the hill, pause for a moment, and then move off. Yet a complex set of coordinated actions unfold while their friendly teasing continues. On arriving at the summit (panel 2), Tina is responding to Delyth's previous utterance. Using the summit as a place to pause their walking, Tina and Delyth continue joking with one another. Tina moves off first (panel 6) just after Delyth bends over, laughing. We can note that throughout the pause in walking, the device is kept out of relevance: Tina grips it at an angle in her right hand and does not consult it.

Where and how Tina and Delyth come to a stop here is revealing. Tina and Delyth's shared pause in walking (panels 4 & 5) suggests a joint analysis of the relevance of *this* particular place, this summit, as a 'good place to stop' both as a place to share a moment of more focussed conversation (a new interactional space (Mondada 2009)) and potentially acting as a possible viewpoint for the terrain ahead, along with other associated relevancies, such as checking 'where we are' on the map. It is also notable that this point of stopping coincides with a change in the surface as the worn, rock-strewn pathway (visible in panel 1) comes to an apparent end (panel 2), and the pair pause on a grassy, 'pathless' point (panels 3-6). Digging into how they stop, we can notice that Delyth stops *before* Tina, offering this both as a place to further expand the prior sequence of talk (which Delyth initiates with "that was the second thing") and as a place relevant to wayfinding. It is the new perspective afforded by the summit; coupled with a reduction in path visibility, which makes wayfinding relevant. Tina does indeed take up the offer of stopping to begin a check on their route (taking one more step then stopping herself, panel 4); we don't witness the 'yo-yo' of walking back-

and-forth of Bryn and Aled here. Yet, the device remains to Tina's side and the joint stop becomes a moment of continuing their joking.

The current summit-perspective establishes the availability to the walkers of two parallel and less visible paths: one on each side of a bed of reeds (see panel 7 in fragment 2b, below). At this point, Tina does not consult the map and instead reinitiates walking onwards (panel 6). This onward progression continues the trajectory taken during their ascent and so there is no accountable departure from that trajectory at this point. In short, while there are places where walkers are sensitive to as wayfinding relevant, and might expect map consultation to possibly take place, in this case this did not happen. In the next part of this fragment, we will see this happening and use it as an opportunity to examine the particular way a check of the guide's map is done. Tina and Delyth continue to walk onwards on a faint path. Fragment 2b continues the pair's joking about washing, smell and cleaning, until Tina checks the WWR app's map (panels 11 & 12).

Fragment 2b: Through the hillocks

Having followed the two tracks ahead, ascending slightly and moving through a shallow channel, Tina and Delyth reach another minor hillock where the path forks and fades. The joking continues as

the pair moves on (panels 8 & 9). They emerge into terrain with less visible paths (panel 10). Tina slows down and says “um” when she is looking at the screen (panel 11). The “um” from Tina, and its close timing with her consultation of the device, makes it apparent that it is a navigational inquiry. Delyth orients to the problem with a suggested path choice—“right”—though with a questioning intonation (panel 12). While Delyth pauses, Tina is still walking forward, so this time, it is not a joint stop. In fact, Tina’s ongoing walking produces a different form of map consultation that shows this moment *not* to be an occasion requiring detailed inquiry (as was the case for Aled and Bryn), nor indeed a joint decision. Moreover, Tina’s brief check of the map is designed in ways that suggest a minimalisation; in other words, it has been crafted carefully to avoid forming an interruption and instead towards progressing the walk and continuing the joking discussion.

It should be apparent now that navigation itself is not a continuous activity for our two pairs of walkers in fragments 1 and 2, however even when they are not conspicuously struggling with where they are, there is still an ongoing sensitivity displayed to the *possibility* of navigational matters becoming salient by making the device relevant. As with Aled and Bryn, the developing course of Tina and Delyth finding their way on the moorland comes to be made intersubjectively available through each walker’s observable stopping, starting, and changes in trajectory. These actions are seen as pointers to wayfinding-relevant features such as new perspectives (summits), forks in the path, vegetation (the reeds), and entering less certain moorland terrain. Whilst in fragment 1 we saw Aled and Bryn complaining about the apparently semiotically poor nature of the moorland slope, Tina and Delyth demonstrate how these various features of moorland surfaces, comparatively subtle to those of urban terrain, are jointly-orientated to as relevant to wayfinding and walking together. How such subtle features are recognised as relevant to the archaeology of the WWR tour is the subject of our next and final fragment.

4.3 Arriving at a destination (Fragment 3)

While our first two navigational events explicated how walkers locate the right path and continue to follow it on the moorland, this final event allows us to investigate the finding and recognition of a point of interest—a *destination* of sorts—as described by the audio on the app. Our final pair of walkers, Ceri and Rhys, are attempting to locate the archaeological features that form the ramparts and ditches of the ancient Roman fort. These features are difficult to identify. The WWR app’s audio dialogue, which Ceri and Rhys listened to just before fragment 3 begins, described the feature as “a ditch about one and a half metres wide and a metre deep; a ditch called a rampart”. The audio dialogue ends with “let’s walk along the boundary of the camp”. Taken together, the description of the feature and the instructions to walk along it, connect identifying the rampart with finding the right path.

It is not such a great surprise that all of our walking groups shared difficulties in aligning a map lacking in detail with a terrain that has few distinctive features. As we noted earlier, moorland’s surface properties make it distinct from urban ground, but they also differentiate it from other types of countryside such as forests, beaches and scrubland. Its grasses, reeds, tussocks and undulations both show and hide its smaller geomorphological features. It is only in walking across it that walkers discover certain undulations that are candidates for a rampart. We will examine in the next fragment how Rhys’s legs, in finding footing upon the surface, also find the feature. Ceri then confirms his finding through a visual survey of the feature.

Fragment 3: Finding the rampart

Rhys's discovery: "maybe this is it" (panel 3) is produced through walking over a shallow depression in the undulation (panel 1) and then stepping deeply down (panels 2 & 3). The ridge-as-rampart is then recognised through the surface shape that he finds in the course of crossing it, dipping, and so feeling a deeper form. As he feels with his feet he is, all the while, maintaining a

perpendicular glancing at the ground, now seen in more detail from directly above. Walking down into the ditch simultaneously shifts his perspective on the surface, elevating this particular undulation and seeing it as an entity with a more significant height: the ridge. It is this movement that makes its identification as a ridge, and more specifically as a component of the ramparts, more certain. It is not so much ambulatory vision here (Goodwin 2000; Ingold 2000), as 'undulatory vision', seeing, from walking up and down, the qualities of surface and depth. This up and down of walking, coupled with seeing, *is* the very grasping of the landscape as an archaeological feature.

Continuing to develop his discovery, Rhys provides incomplete formulations of the archaeological qualities of the ground as rampart, "you can see little" (panel 4). However, he returns surprisingly quickly to progressing the tour (panels 5-7). Meanwhile, Ceri remains at the site of Rhys's discovery. Her subsequent careful examination of the ground for confirmation of the ridge-as-rampart uses the dimensions stated by the audio guide earlier (panels 8-10). Ceri's examination begins by producing a request for Rhys's attention ("if you look at this", panel 8). It is only on Rhys's subsequent looking towards her (panels 8-9) that she begins gesturing over the ridge. With his attention now on the ridge (note he remains in a body torque, panel 8, and so projects his desire to continue walking), Ceri not only uses the reported metrical dimensions from the guide ("a metre and a half wide"), she also accounts for why the rampart had been hard to discern: "it's all overgrown". In the meantime, Rhys seeks to re-establish their progress on the tour by shifting his attention back to the device.

Like finding a path off the main track, or monitoring progress across the moorland, recognising that a point of interest in the guide has indeed been arrived at, also relies on bringing the terrain features into alignment with the WWR app. This alignment is not only accomplished from visually scrutinising the moorland landscape, but pedestrian-ly and processually too: moorland features and archaeology are felt and realised through walking *amidst*, *over* and *on* them. Ceri and Rhys find the Roman feature by losing their way and so also find the way ahead; Tina and Delyth progress through different perspectives monitoring the characteristics of the path so that they do not lose the way; Aled and Bryn walk back and forth on the track trying to identify their point of departure and how the route of the app corresponds to barely marked paths on the ground. Our walkers' ambulatory and undulatory inquiries of the moorland's surface are interwoven with consultations of the app as a resource in finding the way because, not only does movement reveal new terrain, which may provide the necessary alignment or certainty, but it also shifts the you-are-here dot and draws a route line on the map app.

The clarity, obscurity or accuracy of the information provided in the app can only be found on the ground during each occasion of finding the way. The navigational guidance assumed in the audio text—for example, "let's walk along the boundary of the camp" or "head up the hill"—only come to make sense *in* the practices of walking on the moorland. In turn, the moorland landscape, and its subtle archaeology, are made sense of through visual and ambulatory perception of it, led by the guidance of the WWR app. While we earlier suggested that our walkers may initially find moorland landscapes 'semiotically poor' environments, relatively inexperienced as they are in navigating this terrain, our three fragments suggest that instead moorland landscapes offer a rich

array of surfaces and features, which, under careful examination by our walkers, can be successfully navigated through to a destination.

5 CONCLUSIONS

The new navigational resources available through map and guide apps may change the "ordinary skills of wayfinding" (Ingold, 2007; 2000: 236) but apps do not supplant the skills of wayfinding. That practical reasoning is required, is evidenced in the work of following and finding the route along a skein-work of tracks, drawing upon the resource of the location dot and other conventional features of a guidebook (e.g., the audio commentary, the point of interest label). As Lorimer (2011) commented, navigating in the countryside is more limited and less systematic than urban environments, here we have documented the methods of finding ones' way within such a landscape that constitutes navigational work, even with a GPS enabled digital guidebook and map, as a significant and ongoing challenge. The methods of wayfinding through the landscape attune walkers to the features that make up the moorland surface. These surfaces—slopes, hilltops, tussocks, faint paths, overgrown ditches—provide subtle wayfinding resources. We observed this in how our first group of walkers treated the moorland surface as initially semiotically poor, and then how they configured a 'proper path' (Brown, 2015) and how for our second and third groups the character of the moorland surface is encountered and responded to, through the particular kind of mobility that moorland affords, both ambulatory and undulatory. As such, when walking in unfamiliar moorland, walkers seek to confirm the correctness of their path through progressing further along it, as this progression enables new terrain to be revealed, through new perspectives being gained, or through pedestrian's gestalt perception (including their legs) of surfaces that reveal features of the landscape.

Pauses and restarts in walking have as much significance as the pauses and restarts studied in talk. They show how each walker perceives the landscape and whether they know where they are going, or whether they are looking to the other for help in finding the way. Walking, stopping and pausing are all used to progressively discover where walkers are, as a method of wayfinding, but also to either progress the walk or to propose a point where navigation becomes relevant. These moment-by-moment adjustments, previously observed in urban and indoor environments (Mondada 2009; 2014) are, in moorland terrain, responding to and making available to others the relevance of terrain features for wayfinding purposes. Entering more uncertain terrain, or reaching a place where a new perspective is offered, are opportunities to stop or pause to re-assess a particular course. Our walker's mutual attention to the subtle and complex nature of moorland surfaces suggest their perception of, and responses to the intricacies of such surfaces are critical to the skilled practices of wayfinding in such environments.

We have also demonstrated how the technology of the map app and audio guide might assist moorland navigation, yet present their own challenges as knitted into wayfinding practices. On the one hand, the resources available through these technologies can reveal qualities of moorland surfaces that otherwise might be overlooked, as we see in Rhys and Ceri's discovery of the rampart, and Aled and Bryn's finding of the way off the track. Yet we also see how such technologies must be worked into the ongoing practice of walking together in the countryside: so, at times checking the device is minimised, at other times it may be used to draw others into the

process of navigation, or consulted on by the map reader to confirm the adequacy of navigational decisions. GPS enabled guides and maps are one feature that composes the practice of navigating moorland terrain, as walkers choose when to make the device relevant, displaying an ongoing sensitivity to maintaining the sociability of walking together, and to the ongoing potential for the resources of the device to become relevant to the terrain. The usefulness of the device features for wayfinding only become apparent in the progress of the walk and the context of the visibly available terrain.

The authority of the map, readily deconstructed in critical cartography (Kitchin et al., 2009), is drawn on as a resource *and* is gamely questioned by users in ways that cannot be read off from scholarly inquiries into its production of space. Our study offers an indirect comment on the state of digital mapping technologies and the relative imbalance of their development towards urban navigation. Currently, digital mapping services provided by major technology companies (e.g., Google Maps, Bing Maps, Apple Maps) as standalone software or embedded by developers within a range of software including mobile device apps, do not support the complexities of navigating moorland surfaces, even when using custom overlays as found in the WWR app. Of course, as we see here, such mapping may nevertheless provide just enough resources to successfully navigate through certain parts of the moorland. Indeed, we find the relative 'emptiness' of the mapped representation of the moorland and fort does not close down opportunities for 'surprise', or the unexpected, nor indeed ordinary practices of discovery, as dominant understandings of mapping sometimes assume (Massey, 2005). If anything, the lack of resources in the WWR app draws our walker's attention to the moorland surface, although we wonder if this was a deliberate design decision. A key a challenge for future digital mapping services is in bringing not only richer representations to non-urban use, but also to begin accounting for the intricacies of how mobile devices come to be used and embedded within wayfinding in such environments. These, as we have noted before, involve substantially different kinds of ambulatory activity (typically, physically demanding and involving the use of hands and arms in ways that impact intricate touchscreen interaction), and different ways of seeing the environment and aligning that with representations being presented. It is clear from our study that digital mapping, as deployed on mobile devices, replete with increasingly sophisticated sensor and camera technology, could do more to take into account complex surfaces, such as moorland, and the significance of these surfaces as relevant features for wayfinding practices.

While we have considered how technologies, surfaces and the sociability of outdoor walking are organised as and alongside wayfinding practices, we have missed the long durations during which the acquisition of attunement which leads to Ingold's wayfarers of the familiar. Much might be gained from examining navigation across wider terrains and longer durations, where inclement weather hampers wayfinding, or where other 'unmapped' features, beyond what we have discussed here, are traversed. Yet, we have seen in their moment-by-moment unfolding, just how it is that walkers edge one step at a time from unfamiliarity to familiarity with terrain, mapping resources and the skills of wayfinding on unfamiliar ground.

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