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Title:

Technology-nonhuman-child assemblages: Reconceptualising rural childhood roaming.

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Abstract

This paper argues for reconceptualising how children use technology 'outdoors' as a technology-nonhuman-child assemblage, or *roaming pathway*. Founded in contemporary fears about children's reduced opportunities to access nature and roam in rural environments, in part due to the ubiquitous presence of technology in their lives, we instead illustrate how the agencies of technologies and plants are folded into children's outdoor roaming. Combining visual methods, video analysis and qualitative geovisualisation, and in collaboration with the Brecon Beacons National Park Authority, this paper exposes how assemblages are contingently brought into being through the actions of what technologies, plants and children do together. We demonstrate how the agentic capacities of non-humans and technologies are assembled through children's imaginative interaction with them, and how these imaginative interactions make such agencies visible.

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Introduction

There is a widely recognised moral assemblage between childhood, rurality, nature and technology, one in which children are positioned as disconnected from nature in part due to the increasingly ubiquitous place of technology in their lives. This assemblage has fuelled dichotomies of children/nature/rurality as innocent, pure and healthy, and technology/culture/urbanity as corrupting and unhealthy, leading to calls for children to be 'reconnected' with nature and rurality whilst simultaneously 'switched off' from technology (Louv 2008; Moss 2012). Recent studies of childhood have sought to dismantle these anxieties through examining the co-constitution of agencies between children and nonhumans, particularly animals (Taylor and Pacini-Ketchabaw 2017), and the wider assemblages of agents entangled with children's experiences of outdoor environments (Kraftl 2015). This paper explores the assemblages of childhood, rurality, nature and technology through a focus on agencies that are relatively understudied, those of now mundane technologies (cameras, GPS devices) and plants. This paper is concerned with how children, technologies and plants assemble in order to produce specific relational happenings, and how their assembled agencies are made visible.

Childhood roaming, rurality and nature

It is widely accepted that children's opportunities to roam independently and to access 'natural' environments have been curtailed in the late 20th and early 21st centuries (Jones et al. 2003; Skelton 2009), to the detriment of their physical and mental health (Witten et al. 2013). Reasons for these curtailments include heightened parental fears (Thompson and Philo 2004) and perceptions of outdoor risks in educational institutions (Mũnoz 2009; Vasalou et al. 2012), the popularity of indoor entertainment technologies (Valentine and McKendrick 1997), the commodification and privatisation of the countryside (Philips 2001) and government divestment in outdoor facilities (Mikkelsen and Christensen 2009). This constellation of influences has contributed to an overall perception of 'crisis' about idealised notions of childhood in the UK and elsewhere. An increasingly indoor, inactive childhood culture muddles with widely held notions of childhood as active, outdoors, in nature,

innocent (Jones 1999; Jones 2007), but also where children have spatial 'freedom to roam' (Vanderbeck and Dunkley 2003). In the UK, national organisations including the National Trust, the Forestry Commission and the Association of National Park Authorities, have acted on these concerns, advocating for a greater extension to children's outdoor freedoms (Moss 2012; Mũnoz 2009). A UK Government White Paper *The Natural Choice* (DEFRA 2011) recommends use of the natural world to improve children's learning and health. Alternative education spaces, such as Forest Schools, are underpinned by principles of reconnecting children to nature (Kraftl 2015).

Despite the positioning of independent outdoor roaming as morally 'good' (Mergen 2003), precisely how children roam in rural, outdoor environments is poorly understood. Mikkelsen and Christensen (2009) argue that assumptions about childhood independence reflect Western cultural norms of individuality and autonomy, perpetuated by childhood development theory (Plowman 2016), and chiming with popular notions of the rural child roaming in solitude (Philo 2003). Yet the plethora of nonhumans that compose 'the environment' act on and with children (Bennett 2010; Mũnoz 2009). How these agencies are entangled in the assemblage between children, rurality and various nonhumans is the focal point of this paper.

Evolving digital technologies

Technology is often discursively assembled with rurality, nature and childhood, as responsible for sedentary behaviour (Plowman 2016), and a 'threat' to children's wellbeing (Ergler et al. 2016). The place of technologies in previous debates about children's lives was in the home, enticing children to stay indoors (Holloway and Valentine 2001). Some assume that such technologies contribute to 'Nature Deficit Disorder' (Louv 2008), reducing children's environmental literacy (Ergler et al. 2016). However, digital technologies have progressed significantly since the early 2000's, increasingly mobile and omnipresent. Sophisticated mobile technologies, with capabilities to take pictures and film, telephone, access the internet, and with location sensing technology, are now commonplace (McGookin and Magnisson 2012). Smartphones are such a device, whilst others, such as digital

cameras and GPS (Global Positioning Systems), have similar capacities. Their small size, high processing power, mobility, ability to geo-locate, and low cost, means that they are increasingly spatialised (Jones et al. 2003). Yet their significance in children's roaming and engagement with nonhumans is relatively uncharted (Powell et al. 2013).

These technologies are bound up with discourses not dissimilar to anxieties around the neoliberal individualisation of childhood and the separation of children from nature. The core concern is that technologies individualise and decontextualised the subject, through increasing focus on screens rather than 'real' spaces, such that direct interaction is discouraged (Robinson et al. 2012). Rurality is commonly associated with 'natural' and 'authentic' landscapes (Taylor 2011), where certain technologies are 'out of place' because they are 'unnatural'. The discursive assemblages of 'reconnecting' children with nature seeks to reinstitute boundaries between nature, culture and technologies (Taylor and Pacini-Ketchabaw 2017).

However, evidence suggests that mobile technologies might enhance rural roaming. Human Computer Interaction (HCI) research has explored forms of digital navigation that play with vagaries of human roaming (McGookin and Magnisson 2012). 'Social navigation' systems, for example, promote exploration through directing individuals to otherwise unexplored places (Robinson et al. 2012). Technologies can, thus, augment the physical world (Harris et al. 2004), providing access for some children through overcoming physical, socio-economic or cultural barriers (Ergler et al. 2016), and through making outdoor roaming novel and enjoyable (Jarkievich et al. 2008). Encouraging creative expression, through photography, filming, and social media, also may enhance children's claims to spaces through 'digital possession' (Jones et al. 2003). However, studies of these technologies have largely been applied to indoor and urban settings (Ding et al. 2012).

As technologies become pervasive, boundaries between technology and other elements of children's lives are less distinct (Plowman 2016). HCI has long recognised that technology, people and context are relationally entwined (Dourish 2004). However, relational theories proliferating throughout the

social sciences, including Actor Network Theory and assemblage theories have contributed to an increasingly nuanced conceptualisation of human-nonhuman relations (Plowman 2016). This work, the 'new wave' (Kraftl 2015) or 'new materialist' approach to childhood, seeks to de-centre the child from analysis to allow other agencies to be encountered and assembled with children. Emerging from recognition of a relative lack of theorisation of nature in childhood studies (Taylor 2011), this 'new wave' of scholarship is still relatively limited. Kraftl (2015) goes some way towards conceptualising the 'natural' spaces of Forest Schools as 'more-than social' places, including nonhuman agents. Similarly, Pacini-Ketchabaw et al. (2014) explore neoliberal and neo-colonial assemblages of children and deer. These studies have highlighted the imperfect, messy and mundane ways in which children's agencies are entangled with nonhumans.

Assembling the human/non-human

In this paper we explore the relationship between human and nonhuman agencies through assemblage theory. Assemblage theories, accredited to Deleuze and Guattari (1987), offer a relational framework that has been employed within environmental studies to incorporate nonhuman and material agencies (Bennett 2010; Gibbs 2013). Assemblages are conceptualised as a contingent coming-together of agents with relations that are exterior to their terms (Delanda 2006), such that an agent's capacities and relations are not pre-determined. Assemblages have been employed to conceptualise nonhuman agency, such that they reject nature-society divides (Braun 2006), illustrating how various matters have agency to 'call a response' from others (Bennett 2010). Assemblage theory suggests that constituent parts acquire their identity, form and meaning through their relations, but also that an assemblage represents more than the agencies of its elements.

Assemblage theory offers a way to de-individualise childhood away from the paradigmatic focus in childhood studies on the 'individual child', instead reconceptualising child-nature relations as hybrid (Prout 2005). Technologies are also part of this hybrid assemblage of childhood, nature and rurality. Deleuze and Guattari (1987: 41) state that "assemblages have elements (or multiplicities) of several

kinds: human, social, and technical machines", suggesting assemblages are inclusive of the agencies of machines and technologies. In studies of childhood, technological agencies have not been interrogated to the same extent as nonhuman animals. Previous work has emphasised kinship between humans and nonhuman animals fostering 'ethics of recognition' (Taylor 2011; Taylor and Pacini-Ketchabaw 2017). These connections may not be so apparent with technologies, nor with non-animal biological organisms such as plants. The agencies of animals are often highly visible, for example, through conspicuously intruding into the urban environment as Pacini-Ketchabaw and Nxumalo (2015) illustrate with Racoons. Bennett (2010), on the other hand, conceptualises the agencies of mundane, everyday matter, and it is this exploration of less-animal-like agencies that this paper draws on. This study interrogates how the relations between technologies and plants might enliven each other's agencies, bringing them closer to human attention.

Whilst sophisticate mobile devices offer increasingly complex ways to interact, this study focuses on the role of a technology that is increasingly 'everyday', the digital camera and GPS device, alongside other discursive and material components of children's roaming outdoors, including plants. Focusing on 'momentary, embodied microgeographical encounters' (Kraftl 2015: 222) of children, nature and technology, and forms of intra-action that produce emergent relational agencies (Barad 2007), this paper aims to interrogate the way in which assemblages are constituted.

Methods

The project from which this paper draws engaged children in a mixture of methods, harnessing creative, visual, video and spatial mapping techniques, and was conducted in collaboration with the Brecon Beacons National Park Authority (BBNPA). The research took place over four days at a 'summer club' for children (aged 4-11) whose parents worked for the BBNPA. All were 'rural children', living within or proximate to the National Park. The summer club was located at *Craig Y Nos* Country Park, 40 acres of a range of environments, including fields, woodlands, ponds and rivers. Some of the children were familiar with this space, whilst for others it was their first visit.

The children engaged in activities including geocaching using GPS devices, navigation, den-building, pond dipping and bug hunting. We gained parental written consent and it was explained to the children that we were researchers and would be observing alongside 'helping out' with summer club activities. We undertook overt participant observation through assisting the children and staff, and during some activities we recorded GPS traces of the children's movements. We introduced two activities: a self-directed video and photography exercise with GPS-enabled cameras, and a creative mapping exercise. The first exercise is the focus of this paper, and draws on participatory observations, GPS traces, photographs and video recordings produced by the participants.

The relatively unstructured photographic and video exercise was conducted twice, each time with six children in three pairs. Each pair had a digital camera capable of taking photographs and video. The cameras' GPS tracked movement and the location of each photograph. The children could go wherever they liked within the boundary of two fields and to take pictures and videos, allowing them as much freedom as possible without adults directly observing unless in line of sight, such that impromptu experiences might emerge and be recorded (Plowman 2016). The children took 450 photographs and 55 films, between 10 seconds and 5 minutes in length. Some children knew the park, so it was not necessary that they had to remain in sight, allowing them more unstructured access than normal. Founded in a concern for understanding how diverse agents produce events, the methodological strategy attended to the 'nonrepresentational' (bodily movements, practices, nonhuman agencies), and representational modes of expression produced by children (Kraftl 2015). The data gathering and analysis drew on visual methods and assemblage theories, borrowing partly from ethnomethodology and conversation analysis, and qualitative geovisualisation of spatial data.

Visual methods have been used with children because they are largely child-directed (Jorgenson and Sullivan 2010), reducing power imbalances with adult researchers (Kullman 2012). Photographs can be used to decode what interests children, and may express embodied experiences, as well as 'non-activities' that may not take place around adults (Leonard and McKnight 2014; Philo 2003), or are not

expressed verbally (Änggård 2015). Photographic methods are often linked to 'photo-elicitation', where participants explain their images. Due to the time constraints of the summer club, this was not possible. However, what and where children choose to photograph is revealing of in-situ decision-making (Beilin 2005), and visual motifs may express what they find interesting (Briggs et al. 2014). Insisting on verbally expressing the meaning of images may conceal their affective, multi-sensuous qualities (Kullman 2012).

Video recording can document interactions that might bypass other methods (Brown et al. 2013). Recordings were analysed using ethnomethodology and conversation analysis (EMCA), which seek to understand social situations through sequences of conversations and 'ordinary actions' (Beilin 2005; Brown et al. 2013). Ethnomethodology shares with nonrepresentational geography a concern for defamiliarising the familiar, and how meaning is shaped through everyday practices (Laurier 2014). In attending to how actions and talk are made meaningful through the spaces in which they take place, EMCA analysis allows us to 'get at' how children make experiences of nonhuman 'vitalities' meaningful. Whilst EMCA is not fundamentally different to ethnography, using video allows the rewatching of encounters to enhance the analyst's 'noticing', and permits the ethnographer to 'be' in other places (Laurier 2014), in this case, virtually accompanying independent children, without intruding on their experience. Typically, EMCA has been used in indoor spaces (Laurier and Philo 2006), urban environments (Brown et al. 2013), and vehicles (Laurier et al. 2008). For this study, talk and actions were transcribed using the conventions EMCA (Heath et al. 2010), addressing the interplay of talk and visual conduct, but equally attending to actions of nonhumans (Brown et al. 2013). The 55 films were reviewed and fragments transcribed. In this paper, we focus on one of these interactions in detail. The children shot the footage, making the activity more 'fun', but also allowed us to observe how the camera was assembled relationally.

Finally, GPS traces were recorded of the children, coupled with ethnographic observation. Geo-locating of evidence produced by children may visualise previously 'unrecorded' encounters (Cooper et al. 2010; Freeman 2016). Our 'mapping' of children's roaming responds to calls to map the intra-

actions of assemblages (Pacini-Ketchabaw et al. 2014). We do this at the micro-scale, through

interrogating the ways GPS and camera technologies map, reveal and represent the agencies of

children and nonhumans.

Technology-roaming-child assemblages

Figure 1: GPS traces of children's movements: 1. Geocaching using GPS; 2. Groups 1-3 of the photo exercise; 3. Groups 4-6; 4. Groups 1-6 expanded view.

GPS traces of the children's movements were used to create visualisations of their roaming over aerial

imagery of *Craig-Y-Nos* Park. Figure 1 compares one of the children's movements during geocaching

with the movements of the six groups doing the photo exercise. For geocaching, the children used a GPS device to find pre-programmed waypoints. Once a waypoint was selected, the device displayed an arrow pointing to it. The children then followed the arrow until they were in the correct area, where they would then hunt for a hidden box. The GPS trace illustrates a specific technology-child-nature assemblage, which enacted a specific form of roaming. Following the GPS arrow normally involved walking on a pathway that approximated the correct direction, although in one instance the children had to walk across an open field (figure 1-1), and later diverted from the direction of the arrow to cross a river (bottom right, figure 1-1). At each waypoint, a more 'messy' movement is apparent, as the children hunted for the geocaching box.

The GPS, as a device for geocaching, and the activity instructions, sent the children on a pre-defined pathway. As waypoints were pre-established by adults through pre-programming the device, the children could be directed to explore areas across wider scales. The affects of the GPS device, to simultaneously guide roaming through the directional arrow, coupled with it's inability to precisely negotiate environmental terrain, led to a specific assemblage of roaming in which children's trajectories were directed by the device, but they were left to negotiate environmental obstructions. The emphasis on efficient and rapid navigation between waypoints focused the children on the macro-environment (the park landscape), particularly obstructions and pathways. However, on reaching the waypoint location, the device became useless for locating the geocache box, forcing the children to engage in micro-interactions 'on-the-ground', turning over stones and looking behind tree roots and vegetation. In this assemblage of technology-children-nonhumans, the children only partially attended to the device, as successfully doing geocaching required micro- and macro-attention to the environment, whilst the agencies of nonhuman elements to 'hide' things also had a role in 'doing' geocaching. In this assemblage too are the instructional discourses of adults, through programming waypoints, and hiding geocaches, but again these decisions are relational, accompanied by the capacities of the device, the vegetation and terrain.

Thinking of the GPS device as a less-than-animal like matter, which has 'vitality', but never 'acts alone' (Bennett 2010), is productive of how particular *roaming pathways* are assembled between the macro- and micro-attentions of these children. The GPS's vitality is pre-assembled from its manufacture and pre-programming, but it's vitality to animate children's roaming and the properties of macro- (landscape) and micro- (stone, tree-root) assemblages, emerges procedurally as children move between macro- and micro-assemblages. Although Bennett (2010) writes of vitalities as more-than the impediment of human will, the GPS devices deficiencies are also productive of micro-attentiveness to other matters: it's capacities for *geocoaching*, to guide roaming, can only take the children so far in 'finding the box'.

The children's movements during the photo exercise demonstrate greater divergence and 'messiness'. In figure 1, from point A, the children moved in divergent directions. Whilst one pair moves around the border (figure 1-2), the other two proceed to move around point B, where adults stood to observe. The second group (figure 1-3) take a different trajectory. Two pairs explore the boundary south of point A, whilst one pair moves into the first field. In group 1 (figure 1-2), a pair of boys was followed by a pair of girls, whilst a second pair of girls go in a different direction. In group 2, almost the same processes occurred, a pair of boys headed off along the border, followed by one pair of girls, whilst the second pair of girls explored the middle of the field. The GPS traces not only represent a social map of spatial roaming interactions between human agencies (Mikkelsen and Christensen 2009; Robinson et al. 2012), and spatial appropriations by the children (Beilin 2005), but also a mapping of the relationships between humans and nonhumans.

The technology of the cameras and the less spatially directive instructions accompanying their use affected a different form of roaming assemblage. Without instructions to follow a pre-defined route, and with a technology that enabled the children to capture what interested (rather than directed) them, there was more divergence between where the children chose to go. The activity of 'capturing' photographs in the environment appeared to motivate the children to pursue their curiosity and 'find' things around them to photograph, producing a less directed form of roaming (figure 1). Equally, this

diversity in roaming may have been motivated by the novelty of the activity, whereby the children had relatively more freedom compared to other 'summer club' activities. Yet, this independence may have led to more constrained spatial roamings for some. All of the children, apart from one pair, gravitated towards point B, where the adults were standing, remaining within adult sight (figure 1-4).

Despite being given more freedom to roam, many of the pairs chose not to go out of sight of the adults. Whilst the technological affects of the camera may appear to encourage more creative and independent exploration as opposed to GPS-directed roaming, without this directional input from the device, the children appeared to partially restrict their roaming. This agency of the technological device, however, was inseparable from the agencies of adults and children. On the second day (figure 1-3), we were accompanied by a different adult volunteer, who was more anxious about the children's safety than the staff on the first test (figure 1-2). This anxiety might have prompted less exploration by the children. With pairs of children following each other, the decision to 'roam' in any direction was partially directed by the agency of others. These actions are illustrative of the interdependence of child-child and child-adult agencies in outdoor roaming (Cristensen et al. 2011; Mikkelsen and Cristensen 2009), and the maps represent the spatial expression of this interdependence. These spatial articulations of children's movements express the dual functioning of interdependent relations, established through the discursive expression of adult rules, as Linzmayer and Halpenny (2014) suggest, but equally the material bodily relations of being in sight of, and proximate to, adults and other children. These lines of sight were partly determined by the positioning of nonhumans, including trees and the lengthy grass and undergrowth that could hide children. The density of trees at point B, where the adults stood, could restrict lines of sight, which may have encouraged some children to move closer to the adults. The reduced macro-spatial exploration of the camera activity compared to geocaching is therefore contingent on specific assemblages of pre-established human relations, the agentic capacities of technologies to direct roaming, and the positioning of nonhumans.

The technology of the camera enabled other assemblages between children and nonhumans. Figure 2 illustrates children's spatially linked photographs overlaying their roaming pathways. Figure 2-1

shows the area where the adults stood, and where the children congregated. Whilst the children were proximate to each other, a game of what Jarkievich et al. (2008) call 'photowar' began. The children attempted to 'capture' photos of others, whilst simultaneously attempting to avoid having their own pictures taken, running to hide behind tree trunks or bushes. The game stimulated rapid movement, with sharp changes in direction, resulting in more 'messy' roaming pathways (figure 2-1). The pictures taken during this period became blurry, and the photographs became primarily concerned with children and adults as the subject. One group, who pursued an independent trajectory around the boundary (figure 2-2), followed a 'smoother' roaming path. Their photographs during this period are clearly framed, consisting of images of the field boundary, landscapes, clouds and close-ups of plants. Other than a picture of their feet in the grass, these pictures were less concerned with human subjects.
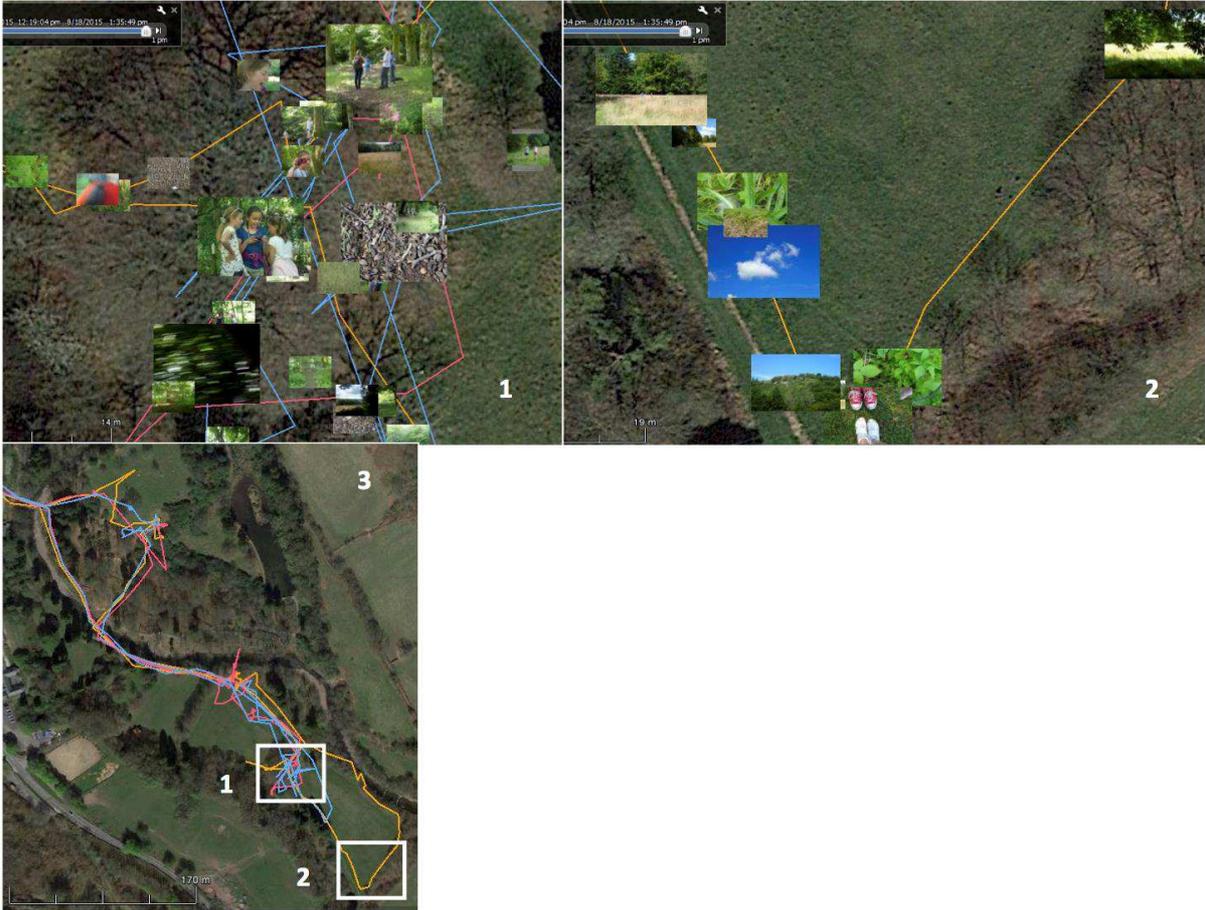

Figure 2: GPS traces of children's movements overlaid by their photograph locations: 1. Area around the adults; 2. South East corner of the second field; 3. Overview of pathways and location of figures 2-1 and 2-2.

These roaming pathways and geolocated photographs illustrate the intra-activity (Änggård 2015; Brown et al. 2013) produced by the agency of the technology and human subjects. The camera's ability to 'capture' any moment has a performative role in structuring the 'photowar' game as a form of roaming. Its affectual properties of immediate visual capture are valuable, 'capturing' and 'shooting' a picture of and at peers, in relation to the abilities of children to move rapidly, to wilfully hide and appear. The camera therefore can augment and amplify children's everyday activities (Harris et al. 2004), providing a novel motivation to traditional 'hide and seek' through the capacities of the technology interwoven with the biological agencies of human movement (Thrift 2005). The pair in figure 2-2 suggest that, in the absence of their peers, 'capturing' turns towards nonhumans, including plants, clouds, fields, and their place within these things (the feet together – figure 2-2). In the absence of the agency of humans (to taunt, hide, run, demand attention), their gaze turns towards nonhumans, the agency of the camera-as-technology becomes affectual in a different manner, to frame and record features of the nonhuman world. The camera affects this mode of looking, framing what might be socially learnt photo-motifs (Änggård 2015). Yet, these can be subverted by children's own agency, as in the example of 'photowar' (Jarkievich 2008). Some independence from adult supervision did appear therefore to inspire imaginative interaction (Philo 2003; Skelton 2009) with plants, although children remained interdependent with adults and other children. This interdependence is also assembled with technologies and plants, which enable and capture curiosity and define lines of sight.

Roaming pathways are one expression of the 'vitalities' (Bennett 2010) of technologies and plants, which are variously foregrounded and backgrounded as their affects work with children's curiosity and somewhere between their macro- and micro-attentiveness. This assemblage of technology-plant-child agency is only partially represented in this data, and now we turn to the children's video data to extrapolate on these agentic capacities.

The tunnel and the river

One pair of girls (A = Abby, shooting the film and B = Beverly) recorded a 36-second film, during their roaming around the field boundary. Prior to filming, they have taken two pictures, through the trees towards the river. The following transcription draws from this film, whilst figure 3 provides three snapshots.

Figure 3: Video snapshots from Abby and Beverly going through the 'tunnel'.

A: (holding camera) walks
towards 'tunnel': a path between
bushes & under trees to river

00:01.20   A: hhh::: Look at the tunnel!

B: Right co(me)   All right come through the tunnel=

B: begins to run into
shot from A's left

A: continues to walk   A: Walks past B to
along path to river   point camera at river

00:04.60   A: Let's go through the tunnel Beverly=

B: =Do a picture of me going-

B: runs along path in front
of camera ducking under
tree branches

B: arrives at riverbank,
turns to face A

B: signals with arm sweep
towards river

Shot frames the river
& opposite bank

B: going-

A: hhh Look at river (0.8) that is so cool:::!   (2.0)

In this sequence, the feature created from low branches, vegetation either side, the path on the ground and the view through to the river (framed shot one, figure 3) captures the girls' attention. Their excitement at the discovery of 'the tunnel' is expressed in Abby's initial exclamation, and the overlap of speech where Beverly interjects: *"Right co(me)"*, before she is cut-off by Abby, who seems to want to be first to state that they should go through the tunnel. Although Beverly only enters the shot at the end of her first utterance, she is already moving past Abby, to come into shot at the same time as Abby moves forwards. Beverly runs in front of Abby, ducking down to 'enter' and 'go through' the tunnel. As movement through the tunnel has begun before either pronounce that they should *"go through the tunnel"*, the decision to do so has probably been made before filming, further suggested by two photographs taken of 'the tunnel' prior to filming. Rather than a spontaneous response, choosing to film seems based on a prior decision that the tunnel experience is worth recording, and their talk reaffirms the actions, which are already underway, as the action takes place simultaneously to the suggestions of *"let's go through the tunnel"*. Rather than a 're-enactment' of activity for the camera (Jorgenson and Sullivan 2010), the filming is simultaneously 'staged' and a recording of events as they happen, with talk re-affirming action.

This sequence suggests that 'the tunnel' is deemed significant enough to shoot a film through, rather than take a static picture, emphasising a choice of medium that reflects the moving interaction with the vegetation and the river. This points to how children might choose the functions of a particular technology to reflect on, and structure their interaction with the environment. The girls appear to use filming to signify an act of 'doing in', rather than static 'capture of' of the environment. By filming their movement through the tunnel, Abby and Beverly demonstrate the entanglement of bodily motion, the present affects offered by the nonhuman plants and materials that inspire that motion and indeed frame it (through a 'tunnel'). If assemblages are ontologically unique and historically contingent (Delanda 2006), then this assemblage of 'the tunnel' might itself be an expression of the specific production of a discrete, momentary assemblage (Braun 2006). 'The tunnel' is composed of non-humans: trees, bushes, leaves, the river viewed through it, the path created by previous human and

animal movement. Perhaps part of the attraction of the tunnel is the physical altering of bodily movements required to go through. Whilst the camera, which affords the recording of 'going through', equally creates the tunnel in this assemblage, acting as the medium through which the assemblage is composed as an immediate process.

Once the pair passes through the tunnel, Abby is preoccupied with filming the river, overriding Beverly's attempt to position herself in front of the camera to 'present' to it. Beverly runs in front of Abby, stopping at the riverbank and turning to the camera. She makes a gesture with her left arm and hand whilst turning, stating *"do a picture of me going-"* suggesting that a particular shot should be captured of her doing something in relation to the river. Abby is intent on getting the river central to the shot, ignoring Beverly and positioning herself on the riverbank, so that the river completely fills the frame. Her interest in the river is at first clear through this action of filming, and thereafter her exclamation reaffirms this with *"that is so cool!"*, following seconds of silence where she films the river, then zooms into the running water.

Shot zooms in on running water
at centre of river channel

00:11.70   A: (zoooom) (1.0) Look at the=

B: =you can actually go down y' know (1.5) ^{O}(say   )^O

(1.5)

00:20.40   A: Water looks really cool running! (1.0)

B: ^{O}(Auw I found a block I can throw)^o

A: I love the countryside!

(2.2)

B: Presume B is preoccupied with
stones on bank & picks up stone

In this sequence, Abby zooms into the river. Beverly, who seems to have accepted that the focus of the filming is on the river rather than her interaction with it, says *"you can actually go down y'know"*. Beverly seems to be responding to the 'zooming' of the camera (which Abby reaffirms with *"zoooom"*), suggesting that they could get physically closer, rather than zooming-in from a distance. The technology of the camera affords a way of accessing the water when it might seem inappropriate to get closer to or even in the river. The zoomed image on the video footage offers a perspective on the shimmering surface of the running water that could not be gained without physically getting in the river. Beverly's suggestion, cut off by Abby, might qualify as a personal disappointment that they are not choosing to get closer, as Abby substitutes this experience for zooming-in with the camera. Technology somewhat frames the interaction with the river, providing opportunities (of seeing closer), whilst shutting down others (of being closer), acting as a performative agent in the assemblage (Änggård 2015). This produces some affinities, the attention to flowing water, but reduces others, such as physical proximity or interaction.

Unlike the incidents of photography (figure 2) where humans are the focus, Abby is interested in the river, its movements and sounds, which take precedence over Beverly's actions. This is suggestive of the affectual capabilities of the water to act upon these children and hold their attention. Abby is drawn to the material agency of water (Gibbs 2013) more so than to Beverly's actions. Similarly, it is the 'tunnel' of vegetation that draws Abby's attention, rather than Beverly's actions in it, illustrated through Abby's persistence in overriding Beverly's talk with her filming actions. These children are not 'numb' to the affectual possibilities of plants, water and other material components of the environment, the supposition of 'Nature Deficit Disorder' (Moss 2012). Indeed, Abby is more attuned in this instance to the affectual properties of these material agents than she is of her human partner. This suggests that those things that are most 'human' and perceived to be 'alive' in an anthropocentric sense do not always capture children's attention. Bennett (2010) suggests that the ontological imaginary required to recognise 'life' in 'matter' is difficult to square with everyday encounters with perceptibly stable bodies. These children seem not only attracted to the instability of matter in the

river, but, through applying their own imaginary of the 'tunnel', seem to engage with the affectual properties of other nonhuman matters, through imaginative interaction.

Part of this imaginary is assembled with the technology of the camera. Abby appears preoccupied with the visual experience of the tunnel and river. She states *"look at the tunnel"*, *"look at the river"*, and *"water looks really cool running"*, referring to what she can see and record through the camera. Beverly is not directing the camera, and makes more reference to 'doing'. Whilst Abby is stating *"look at the tunnel"*, Beverly is beginning to say *"come through the tunnel"*, and later when Abby is zooming in on the river and is about to say *"Look at the…"*, Beverly states *"…you can actually go down y' know"*. Using the camera appears to draw Abby's attention to the visual, to gazing on things. Beverly, unable to manipulate the technology, seems more concerned with physical interaction, although she also orientates towards the visual in terms of how she might be captured in the video representation. These utterances may express individual preferences; however, the camera's agentic capacity may also be structuring Abby's engagement with the assemblage of the tunnel and river in a way that is different to Beverly's. Although the device is socially shared, it is only partly orientated towards the non-operator, and collaboration through interaction with the technology is only partially achieved. Beverly's co-presence in the device use (Brown et al. 2013) is partial, as Abby chooses to film and look at her 'natural surroundings' rather than what Beverly is doing. The mutual attunement achieved between Abby, the camera, and the nonhuman materials she engages (Thrift 2005), assembles a roaming pathway in which Abby engages more visually than Beverly. The technology of the camera, as a tool, as matter, and as social object, which presupposes forms of gazing, but also, through its visual display screen, the framing of the lens and the physical interactions it demands, all structure Abby's engagement with other nonhuman components of the tunnel and river assemblage. The tool engages her with material matter over what a human is doing, yet also perhaps prohibits her from tactile forms of proximal engagement, keeping her at a distance from the river, rather than going down to it.

Conclusions

Conceptualising the technology-nonhuman-child relationship as an assemblage has the advantage of enabling analysis that is attuned to what technologies and nonhumans are doing in these relationships alongside the agencies of humans. If assemblages are 'spaces of possibility' (Delanda 2006) in that their capacities are not pre-determined, and their causality is an emergent, temporally contingent process (Bennett 2010), then there is a need to understand how specific roaming pathways form around particular agents, how they emerge at specific times and scales. For technology-nonhuman-child assemblages, this requires querying assumptions that independent 'free roaming' in nature is inherently 'good' for children (Moss 2012; Witten et al. 2013). The spatial extent of children's roaming is contingent on these different assembled configurations, however this does not presuppose that wider territories of roaming are necessarily 'better' than narrower ones. Different assemblages arose when children explored at different scales, some negotiating macro-scale nonhuman assemblages (rivers, woodland, fields), others composed of micro-geographical assemblages where children engaged with things 'on-the-ground' or 'through the tunnel'. No form of roaming is independent in an absolute sense, nor is human independence necessarily desirable for children or adults. Whilst other studies have illustrated that children's agency is composed relationally with animal life (Taylor 2011), and interdependent relations with other children and adults (Christensen et al 2011), here we illustrate that less-familiar (less-animal/human-like) agents, including technologies, plants and water, are equally interpolated in the relational assemblage of outdoor roaming. Rather than think of technologies and outdoor roaming/nature as opposed forces in children's lives, regarding technologies as part of roaming pathways reveals their relations with children and nonhumans. Placing plants in this assemblage likewise interrogates what it is about interactions with plants that might spark children's curiosity.

This paper has elaborated on the relations that technologies and plants enter into with children. Technologies are performative agents that produce affinities with nonhumans, as Abby and Beverly's different encounters with the tunnel and river through the act of filming illustrate, as do the divergent

roaming pathways of children using different technologies. The effects of technologies are not pre-determined and, thus, will not lead to predictable territorialisations of assemblage (Deleuze and Guattari 1987). Children's own agentic capacity and bodily relations with peers may co-opt technological agencies to their current focus of curiosity or play, as illustrated during 'photowar', in the 'tunnel', and the capturing of natural features whilst away from peers. More-than-human elements are folded into the agentic capacity of technologies: the attraction of running water, the enticing tunnel space, the capacity of trees to hide and reveal. The technology of the camera co-operatively produces certain roamings and interactions between nonhumans and children, such as encouraging attention to the properties of plants, whilst simultaneously discouraging others, for example, the privileging of 'looking' rather than physically interacting. Neither of these expressions of the assemblage is 'better' than the other, it is important instead to understand the specific modes of assemblage that appear as co-produced interactions.

In reconceptualising childhood roaming as procedurally composed technology-nonhuman-child assemblages, or *roaming pathways*, we have demonstrated that technologies are deployed by children to enhance specific environmental pathways. Roaming pathways direct us away from the dichotomies of Nature Deficit Disorder (Louv 2008; Moss 2012): nature/culture, urban/rural, indoor/outdoor. Abby and Beverly's encounter is emblematic of how such dichotomies fall apart during practical accomplishments of roaming. Abby's more attentive or affectual response to the river is framed by the visuality afforded by the technology, whilst Beverly's encounter attends more to 'doing', partly structured by her performativity to the camera. Rather than enacting dichotomies of 'authentic' engagement/Nature Deficit Disorder, each child exemplifies different expressions of a roaming assemblage. Although research has established the benefits of 'being outdoors' for children's wellbeing (Cooper et al. 2010), such evidence should not be leveraged for the dismissal of technologies from possible roaming pathways. In the UK countryside, 'rights to roam' have been established through 'trespass' in the early 20th Century, and arguably certain technologies assembled as part of new roaming pathways for children might re-establish their 'rights to roam' in a society where these rights are increasingly curtailed. Roaming pathways are assembled in other contexts

where children roam, including urban, digital and virtual spaces. If, in the contexts described in this paper, technologies offer possibilities for the *geocoaching* of outdoor roaming pathways, what forms of geocoaching might children benefit from in virtual spaces or urban environments? Thinking about the possibilities of technologies for geocoaching along roaming pathways may offer novel possibilities for children to enact new rights to roam across physical and virtual landscapes.

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