'URBAN & SUBURBAN NATURE INTERACTIONS', IMPACTS AND SERENDIPITOUS NARRATIVES OF THE MY NATUREWATCH PROJECT

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Abstract

The My Naturewatch project uses self-build wildlife cameras supporting new public engagements with nature & technology. The project used Open Design methods providing self-defined, bespoke making outputs, modelling 'environmental citizenship', transitioning beyond sustainability. By co-designing makers were encouraged to engage with ecosystems refocusing human habitats & perspectives driven by curiosity. The article shares a qualitative evaluation of the project's impact on participants, describing attitudes, understanding and behaviour towards technology & nature changed by participation.

Keywords: design activities, co-design, collaborative design, engagement, nature

1. Introduction

1.1. Research objective

A design led project, encouraging participants to actively engage with nature through technology, Open Design and making. The evaluation revisits My Naturewatch (NW) participants, documenting the project's impact(s) on them and their surroundings.

1.2. Introduction and background to research

Sustainable and Ecological Design often occupies symptoms of production, consumption and economic growth, it rarely *explicitly* undertakes design(s) intent on propagating bio-diversity or interrogating our consumer role as 'ecological citizens'. This paper advocates for Open Design as a route to 'Ecological Citizenship', transcending consumerism, undertaking challenges: intervening in cultural habits, enacting sustainable change and empowering resilience. We define 'Ecological Citizenship' as; proposals deployed within public communities, positively informing our actions toward sustainable ambitions, beyond our individual personal needs. An 'Ecological Citizenship' exemplar is voluntourism, in 2019 the Faroe Islands closed reducing visitor impacts on wildlife, conserving landmarks and habitats. Authors define 'Ecological Citizenship' as proposals, embedded in communities, informing our actions toward sustainable goals. Open Design (OD) encompasses "on- and offline design and making activities, describ[ing] a design process allowing for the participation of anybody (novice or professional) in the collaborative development of something" (Tooze et al., 2014).

OD democratises construction information access, presenting community opportunities for sustainable responses. OD unlocks; manufacture, repair, economies and sustainable trajectories. This paper reports upon a project which seeks to examine what the principles and practices of Open Design have to contribute to fostering the attitudes and behaviours characteristic of Ecological Citizenship, and from encouraging a cultural shift from the consumption of nature as a resource for humans to exploit to approaching it as a common good in need of stewardship. Through collaboration(s) with experts and grassroots communities, the My Naturewatch project fosters 'active community engagement' and embodies an Ecological Citizenship engagement activity, through OD.

1.2.1. Designed engagements / The My Naturewatch project

The NW project uses a research through design approach creating DIY devices supporting new ways to engage with nature through technology. The Naturewatch (NW) camera is a wildlife camera using computer vision, taking pictures when it sees movement (Figure 1.). The NW website publishes everything to make the devices, in easy-to-follow 'recipes', with retail links for parts and downloadable software. NW is a collaboration between Goldsmiths Interaction Research Studio and The Royal College of Art (RCA), Design Products programme. The Goldsmiths team, took the lead in engaging the BBC, designed the cameras and instructional materials, and focused on recruiting thousands of people. The RCA team focused on using the camera in a large series of open workshops, engaging: wildlife charities, schools and cultural institutions including a training programme for communities. The deployable designs featured on BBC SpringWatch in 2018, and (to date) 2,500+ have been made by UK residents and international climates, with varying technical expertise, wildlife knowledge and demographic characteristics. Some participants directly engaged in workshop activities from either; The National Trust, Victoria and Albert Museum, Wildlife Trusts etc. (Phillips et al., 2019).

Figure 1. The Naturewatch (NW) camera is a wildlife camera using computer vision, taking pictures when it sees movement

1.2.2. My Naturewatch evaluation study

This article reports on findings and analysis from the first of two evaluation phases of NW camera-making project. This phase focused upon individual experiences of NW taking place between April and September, 2019. The making of individual cameras and the project's overall shape was iterative, intuitive and guided by improvisation to make meaningful impacts as decided by each camera maker. Much of this individual and project-wide design remained tacit when evaluation work began. This study provided the first opportunity for researchers and participants to reflect upon how they had responded to the brief, materials and context to create each camera (Gaver et al., 2019). It was therefore essential that the study's research approach could "be open to incoherence and instability as part of [participants'] explanatory frameworks" (Simmons and Rush, 2017), that allowed this tacit and practice-based knowledge to be discussed. Meanings were explained with reference to the context in which it was created.

2. Method

There are two main areas of methodological difficulty in following up and evaluating NW camera making, or indeed any Open Design project, despite a long history of collaboration between

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ethnographers and participatory design practitioners (Blomberg and Karasti, 2012). The first challenge is in sampling a population that is inherently indefinable: there are no meaningful ways of tracking who has participated in the designing/ making activities if they are open in the true sense. In this particular case, the terms of participation in NW - anyone could download a how-to guidebook and toolkit, and these were free to copy, redistribute and share - meant that even if the project had demanded demographic data in exchange for the download (and such an approach arguably challenges the open design principles of the project) we would still have no idea of the true reach of the toolkit and therefore the cameras. We have some sense of the 'first degree' initial reach of the toolkit thanks to download figures, Twitter and Instagram data and user forum engagement, but anecdotally and by process of deduction this represents a smaller and only partly overlapping population as have used the NW hashtags on Twitter or Instagram. This is the perhaps inevitable price of setting design loose in this way: we cede not only control of the design process but also the means of demanding surveillance in return for participation. The second methodological difficulty in evaluating NW camera toolkits is that the type of impact this project set out to capture is in any case poorly suited to large-n standardised questionnaires or social media data scraping. The NW camera toolkit and associated training sessions were not created to improve discrete and specific metrics, but rather to have a transformative impact on users' understanding and attitudes to nature and biodiversity, resulting in new pro-biodiversity behaviours. In other words, this project sought to intervene in a complex psychosocial process. The process of making and building a camera was meant to gently disrupt personal and cultural assumptions about self and nature that are "taken for granted, are habitual and automatic" (Walsh, 2012: 246). Our choice of methodological orientation was driven by a desire to not merely describe our observation of changes in camera maker behaviour, but to try to learn what it has been like to be a camera maker and to work with our cohort towards describing complex practices and thought processes as they experienced them. An ethnographic sensibility allowed for unexpected findings to emerge in the analysis of the behavioural impacts of the NW project. It also allowed participants' own experiences and analysis of their behaviour to add to researcher-generated interpretations. "Seeing with an ethnographic sensibility," (Pader, 2006) means that researchers foreground the ways in which participants themselves understand their world, their relations and their behaviours at the same time as interrogating those folk explanations. To rely on what people say about what they believe and do, without also observing what they do, is to neglect the complex relationship between attitudes and behaviour (Hammersley, 1990). In other words, ethnography places culture, habit and lay knowledge at the centre of research. For all these reasons the findings reported in this paper are based upon an interpretive ethnographic study of three inter-related datasets drawn from different activities during the project's lifecycle. As applied to design these tools enable tacit knowledge involved in these processes to be made more visible, but it also offers powerful insights into actual rather than reported (and perhaps idealised) behaviours. Design ethnographic tools help comprehend "design territories" and the complex elements within them by systematically examining the interplay between environment, shared cultures and individual thoughts and behaviours. Kuniavsky describes ethnographic design tools as "finding the boundaries of people's needs and abilities", providing a framework for observing design insights (Kuniavsky, 2003). Ethnography is a powerful means of generating new concepts and theories and understanding a culturally and historically specific experience from the lay perspective. However, it is by its nature non-generalisable and works intensively with a relatively small, defined population. Within the broader ethnographic field, "focused ethnographies" are recognised as a specific sub-set of research which are time-limited exploratory studies of a specific group or community (Knoblauch, 2005), with particular relevance for applied or problem-oriented ethnography such as in the design world (Muecke, 1994). The study reported in this paper was designed as one of these focused ethnographies.

This study took an iterative inductive-deductive approach to constructing codes, second-level concepts and eventually theories using thematic analysis. This approach to analysing qualitative data combines descriptive "ground up" coding practices, usually derived from a close reading of primary data (such as interview transcripts, video or found documents) with an iterative process of sorting and grouping those first level codes into clusters derived from either existing scholarly literature or the researchers' own second-level code groupings (Braun and Clarke, 2006). This process occurs throughout the data collection and analysis phases of research, ceasing only when there is no more data to be analysed and

there are no new codes being generated by that close reading. Finally, a summative phase of broad third-level groupings of concepts are used to point towards more general or theoretical contributions. The aim of thematic analysis is to create a traceable, documented interpretive process for analysing complex patterns in large qualitative datasets without sacrificing a study's ability to speak to broader literatures; 'Most people begin with a very descriptive level of coding and work upwards in a systematic manner toward a more interpretive level' (Langridge, 2004: 267). As an analytical method with theoretical flexibility that keeps close description of primary data and the generation of interpretive concepts in intimate dialogue, thematic analysis was an appropriate choice for a study of this kind. The first phase in this process of generating both first- and second-level codes began with a content and qualitative analysis of all the threads on the NW user forum's message boards to identify common themes and ideas in the posts housed there. The raw data from forums was loaded into qualitative analysis software QDA Miner, which coded at source this and all other primary data collected during the project. This analysis produced an initial set of code groupings or concepts that formed the first iteration of our interpretive analytical framework, prioritised by both frequency of code within the dataset and representation of distinct, significant ideas (Clark and Braun, 2013). These initial themes helped create a "prompt pack" – a simple cultural probe (Gaver et al., 1999)- mailed to camera makers who agreed to form a cohort of ethnographic informants. The prompt packs consisted of four brightly-coloured postcards with selected quotes from the forum data and a short text inviting the cohort member to record their reflections on their own experiences of these themes. The postcards represented our initial preliminary coding based on the forum data: "Surprise and Delight", "Problem solving and creativity", "Nature" and "Technology". A mailing list of approximately 35 potential informants were approached. A pool of ten informants were originally selected by convenience sampling from a list of people who had had contact with the research team and had left their permission to be contacted in the future. This number fell to nine informants early on in the follow-up process due to a drop-out leaving us with a sample of six men and three women, ranging in age from early thirties to early eighties (six were fifty years old or older). There are two major limitations of this sample cohort. We have already discussed the extreme difficulty of using another, more representative or randomised sampling strategy in an Open Design project of this nature. This is a small sample size, even within the total users of NW toolkits. However, given the nature of our hoped-for impact a smaller number of prompt packs and ethnographic interviews with long-term participants, wherever possible conducted in the environment in which the cameras were either used or built, would yield more meaningful insights than a larger but shallower sample size. Furthermore, a convenience sample is not necessarily a generalisable sample of users even within the NW project. These informants had persisted with the cameras long enough to have become known to the research team through their activity or who had been motivated enough to attend how-to workshops. They were therefore to some degree self-selecting. They point to a better understanding of why NW worked for them, and prompt learning for this and other Open Design making projects identifying 'recipes for engagement'. These nine individuals were interviewed, all of whom had; built a camera and used it; previously participated in NW activities or forums; and who had given their prior consent for project follow up. The interviews typically lasted approximately 60 minutes, eventually totalling nearly nine hours of data. These interviews took place at the participants' home, place of work or a neutral location as agreed by them, although they were encouraged to meet with the interview team in a place relevant to their camera experience. Wherever possible, interview(s) included a visit to the site in which the camera was deployed. Most of the nine interviews were conducted with two members of the research team present: the evaluation lead and another member of the team who had a prior relationship with the participant. Each session followed a semi-structured interview outline to cover all the key themes and activities of relevance to the project, with the freedom for interviewees or the research team to follow interesting or unexpected lines of discussion relevant to the overall themes and research questions of the project. The broad structure of these interviews reflected the four initial coding themes included in the prompt pack postcards, and these postcards formed the basis of a portion of the interview discussions. The prompt cards themselves were also collected for further analysis. The data from these interviews was coded by the evaluation lead according to the initial codes and themes identified during the users forum phase using QDA Miner as before. At this stage new first-level codes were added and subsequently new conceptual groupings were proposed to better accommodate the additional codes. These new second-level concepts

were; "non-human perspectives" (five codes), "tech attitudes/ behaviours" (16 codes), "engagement styles" (11 codes), "nature attitudes/ behaviours" (11 codes), "emotions" (five codes) and nine uncategorised and unrelated miscellaneous codes. All research team members were able to read and respond to the concepts and themes within these transcripts, and the emerging codes were workshopped into key third-level overarching themes by the whole NW RCA research team.

3. Findings

After analysis of the raw data, three significant themes emerged about the way that the project's design approach impacted upon attitudes and behaviours towards both the natural world and using relevant technology. These were; the consequences of the project's principles of openness around use as well as customisation of the design; the way that this openness required participants to incorporate the natural world into their making practices; the way that the incorporation of 'non-human perspectives' in making and using the cameras changed what it meant to be 'in touch' with the natural world. In keeping with conventions of ethnographic writing, the quotations used in this text have been selected for their ability to encapsulate the theme or sub-theme they relate to as efficiently as possible, perhaps summarising other statements made across several documents. They are not exhaustive, but we have included brief quantitative summaries of frequency or spread of codes across cases to provide justification for our prioritisation of these themes. The NW design engagements developed Open Design dialogue and opportunities. NW participants informed their sustainable values leading to Ecological Citizenship.

3.1. Open approach to making/goals of making leads to deeper engagement

All but two interviewees cited their existing interest in nature as a spur to their own involvement, with one of the remaining two stating that it was an interest in photography that first engaged them and the other participant citing their interest in the coding used in the software. Without exception, however, participants reported adding new interests and goals around technology, understanding of nature and/ or design and making to their initial ambitions for their cameras. Interviewee INTA9, a professional conservationist in her early thirties, reflected on this flexibility in terms of recruitment and retention on the project: 'There are so many ways in which you can not only use the camera, but it will engage people in different ways'. She herself had used the camera initially out of a desire to create engaging photos of wildlife to share on social media, and had begun to use them in her professional work as a conservation officer. She eventually went on to build a camera as a present for friends or relatives, in common with all but one of the interviewees. While most participants interviewed had one initial interest or aim that led them to engage with the project, Interviewee INTA8, a retired town planner in his early eighties, was explicit that it was the ability to combine his interests in a way that felt intuitively exciting and right to him that first persuaded him to get involved:

> 'I think it's the package. I think it's an interesting package. It was not only a workshop to make a camera. It was more than that. It was how to use that, and introduce another interest, you know, at the same time.'

All interviewees reported adding new goals to their original motivation for making a NW camera, sometimes in ways that surprised them. INTA5 (an educator in her late fifties) was unusual in that she initially built a camera primarily out of curiosity about its use of Raspberry Pi and software coding, but rapidly became invested in the daily lives of the animals in her garden. Having previously regarded many birds visiting the garden as pests, her desire to understand how to make the camera work better led to her developing a good knowledge of common birds and their behaviours. One pigeon in particular became special to her and she began to check her camera regularly to monitor his wellbeing:

> 'Yes, so it wasn't really about the birds and things, but since I've had it, it has become about that. [...] I came down about two weeks ago, and there were five breast feathers on the grass, and I thought, "Oh no, Pidgey's carked it." I was so upset.'

INTA1 was another participant whose primary motivation was not specifically about wildlife or conservation. A keen amateur wildlife photographer in his late thirties, he engaged with the project in order to take unusual photographs. However, this had led to him deepening his understanding of the

habitat and dietary needs of the birds and insects he most wanted to photograph, and this led in turn to enriching the biodiversity of his garden: 'I've developed part of the garden more wild than the rest of it, to bring the other insects. Plus the birds will eat some of it, because I've seen them'. All participants reported making changes to improve the biodiversity of their garden or immediate environment to improve the chances of them taking the photos they wanted with their cameras. With the understandable exception of people working in conservation or an allied field, they all reported increased awareness of biodiversity or lack thereof in their environments. They also all reported capturing wildlife they didn't know existed in their gardens or immediate environment, including conservation professionals.

3.2. Process vs. product

Several of the camera makers interviewed reflected that the process of making a camera – and then making it work – was as important to them as any final outcome, if not more important for some. INTA7, a retired woman in her seventies with little pre-existing knowledge of either the natural world or the technology involved, considered making the camera to be integral to the purpose of her involvement:

> *Interviewer: What is it, do you think, about the fact that you did a workshop making one that's different to, say, going and buying one?*

> *INTA7: Oh, gosh, the world. Absolutely the world. [...] To make a thing, that was amazing.*

This sense of ownership is not unusual in co-design projects. What was distinctive about the way that process assumed significance in the case of NW was that the cameras had to be designed and modified in such a way as to constantly respond to the local environment they were in, and this foregrounded the triad of environment-maker-technology in a constantly changing interdependent cycle. It made for a process that was less means-end and more iterative and open than many participants were used to. INTA3 (a university laboratory technician in his late thirties), had used the camera at home in his garden with some success, and then had used it with a network of schools he ran conservation projects with. The teachers he liaised with were preoccupied with capturing "charismatic megafauna" like foxes and badgers. When these did not appear in photos, INTA3 reported that they described their cameras as "failures". He, however, wanted to reframe their experiences placing an emphasis on discovery and improved knowledge and understanding of the natural world: 'I did say that there might be a competition between schools, but not for the footage. But for the art, or creative work, that they make afterwards'. All participants attributed their on-going and deepening involvement with their cameras to a specific attitude to making. This was a willingness to make incremental improvements and to slowly improve their cameras and their use of them in response to what they learned about their environment, technology or photography. This was seen as a creative endeavour in itself by most, and by some it was seen as the point of the project, rather than any photos or discoveries (however pleasing these might be). INTA1 was a participant who described his build and camera modification as a creative photographic practice:

> *Interviewer: It's interesting listening to you talk about [creativity], because I think for a lot of people, you know the creative part of it would be taking a pretty picture.*

> *INTA1: It's not just that though is it? I mean that's the end product, but there's a lot that goes in before that. You're exploring how a picture would look to get that picture, but there's a lot of technology that goes into that.*

INTA4, a retired grocer in his sixties, reflected on his preference for building custom designs from scratch when so many products have reduced user modification to an absolute minimum: 'And I think that's possibly the problems with youngsters, I think - it's got to be instant, and if it's not quick enough, then they lose interest, unfortunately.' To him, the slow pace of getting results from the camera, the need to "show up" to it every day as a commitment and as a means of testing and improving the build, was integral to its success because these were means of tailoring it to the wildlife and environment it sat within and interfaced with: 'You've got to be in for the long game. You've just got to be prepared to be patient.' INTA2 was from a similar demographic to INTA4, and reported the same perception that attentive openness and patience were integral parts of the making process: 'it's a

long-term thing; you've got to be in for the long game. And things will turn up when you least expect it.' He too had an approach centred on experimentation and serendipity, of "making as a practice of inquiry", echoed by all but one of the interviewees across genders and ages. Since these were a self-selecting cohort in the sense that they had persisted with the cameras for long enough to have engaged with the project team or posted photos on social media, this may suggest that that either a) the project fostered this approach to technology and the natural world in participants b) that this project appealed to those who already thought about making in these ways or c) some combination of a) and b). My Naturewatch camera makers have not bought a product to do something for them but rather they've invested in an experience, a process with no single goal. It is not just the shape and form of their camera that emerges, but also a) the purpose they find for the camera and its technology and b) their own understanding of their relationship with the natural world around them.

3.3. A non-human perspective on nature – the intersection of disruptive technology and ecology

All interviewees reported that building and using the NW cameras allowed a perception of their environment that would normally be impossible for them to experience directly. The nature of a small, adaptable camera enabled new, non-human ways of seeing and experiencing the world. There was also the potential for the cameras to be used to get a "helicopter" or "objective" perspective on a garden, for example if used as a camera trap to gather data about the number of a type of animal in a defined space over a defined time (as over half of interviewees reported doing). Six of the interviewees mentioned these "non-human timescales" in their responses. INTA6, a farmer in his late fifties, reported using the camera to monitor a pond on his farmland where he suspected there might be mammal activity. This turned out to be a rare water shrew, only captured after a painstaking process of interpreting traces of animal behaviour at the water's edge and setting the camera for several nights: 'You would be hard pressed to see that sitting there. You would be there for hours, so the camera's quite useful.' He had not suspected the water shrew was there, and indeed had not been aware they existed in his part of Britain. INTA4 described photographing things he would have not had the stamina or time to capture otherwise as a dramatic shift in his relationship to wildlife:

> 'I appreciate seeing things but you're never there at the right time to take a photo. You can't get close enough and you're not there at the right time. To have it there taking its own as it happens is quite… [emphatic gesture].'

INTA2, a keen birdwatcher before using the camera, explained that the camera was his "extra pair of eyes": 'It gives me an extra insight, the ability to watch at times when you wouldn't be able to watch in the garden.' Several of the interviewees described existing or planned modifications to their cameras to extend this ability to see at times they could not, whether by using night cameras, timers or other additions. Six of the interviewees also reported using the cameras to observe the natural world from a position a human being could never normally inhabit. For example, INTA4 was in the process of building an iteration of his camera that could capture bee activity from inside the hive or a bug hotel. For him, going to places humans literally can't fit inside also connected to the idea of placing human awareness inside processes that are too gradual and long for us to experience meaningfully otherwise, in this case taking place over a whole year.

> 'People generally think bees just live in a big hive and that's it […] They have a lifecycle which is really quite interesting. To see that whole process, I think, would really illuminate people's idea of what a bee lifecycle actually is. […]I think that really brings it home and makes you think, "Okay, that's how they actually do it." It just creates this lasting memory that you can actually go back on, rather than someone just saying, "This is how it's done." Then forgetting it after five minutes.'

INTA8 was drawn to My Naturewatch cameras because he felt strongly that a change in perspective could reveal things we ignored, or things we take for granted, and the natural world was at risk of this as much as the built environment:

> *'People don't use their eyes. They tend to look either horizontally or down, but never look up. [...] That, I think, was the interesting aspect. That, in fact, by doing the photography, one might well see things that, with the normal naked eye, just sitting at your window [you would not].'*

This enhanced perception afforded by the camera led to an increased intimacy with nature, which is to say an increased sense of the daily routines and cycles of animal and plant life independent of their encroachment on human activity. INTA1, a keen wildlife photographer, had begun to focus on the smaller details of the natural world in his photography as a result of exposure to the rhythms of the insects he set out to capture: 'The potential for that for me now is, if I can find a nest I can then put that in and see what they're taking in and bringing out. That was one of the fascinating things'. Despite already being a keen bird watcher, INTA2 found that using the camera over a period of time had 'changed my knowledge of what's being used in the garden. How it's being used, who's there.' This intimacy with the natural world on a day-by-day, very localised level via the NW camera had changed INTA3's approach to his research as an academic, trying to replicate and amplify the intimacy he now felt with the species he studied:

> *'These projects have gone from national scale pollinator monitoring schemes to something which is just in a couple of people's gardens but then actually has, potentially, more impact because you can show people what it is and they can connect to that in a greater way.'*

This new intimacy led to a tendency reported by all interviewees to be mindful of nature in their own daily activities and mindful of the impact of those activities on the natural environment to a degree they hadn't been before. Indeed this "mindfulness" towards nature was the third most frequently used code in our analysis, behind "increased awareness of biodiversity" and "connections to others/ community of practice". For some this took quite practical forms. For example, prior to participating in the My Naturewatch camera project INTA7 described her relationship with the wildlife in her garden as 'acrimonious', and she focused on excluding it from her garden. She regarded birds and small mammals as garden pests because they uprooted seeds and tubers. After following their behaviour with the camera, she had now come to see this "problem" behaviour as a natural attempt to survive in an urban environment, one as valid as her own strategies for living in that space.

> *'I've come to some sort of acceptance of the foxes and the squirrels, and I've adapted my behaviour to accommodate their lifestyle, to protect my plants, and things like that. I used the plastic orange nets off fruit to cover the [bulbs]... if I can, to peg out and stop the squirrels digging...'*

For INTA8, this took the form of something more attitudinal, of trying to remember not to encounter other living things as objects, but as entities in their own right. He spoke about encountering snow monkeys at a popular tourist site on a recent trip to Japan, and realising that his experiences of photographing a mouse that lived in his garden had changed how he approached the monkeys and what his photographs were for:

> *'I think there is a parallel. Because you look at the mouse and you actually see what it's doing, and how it's rushing from here to there, from there to there. [...] There were people taking pictures of the snow monkey, saying, "Oh, take a picture, take a picture, take a picture." But what I tried to do is I tried to take pictures that went beyond just the snap. [...] So, I tend to look at things, I think, in greater depth and try to have a greater understanding about what's going on.'*

Even among interviewees with a good prior awareness and understanding of their environment and the issues facing the natural world using the cameras had revealed patterns and species of which they had not hitherto been aware, and this prompted new patterns of behaviour in participants themselves. Refocusing human experience by foregrounding other living things' habits and experience of the natural world re-contextualises us as part of a much bigger set of processes, and several interviewees reported this as a moving and beneficial aspect of the project: that this was the real meaning of "being in touch with nature".

4. Discussion

My Naturewatch participants are not users but makers. In common with all open design projects they were encouraged to modify, alter and add to the basic blueprint provided by the project team. But in addition to this, the overall purpose of participation was left deliberately open. People came to NW variously through their interest in the technology involved, their existing love of nature, their concern about climate and environmental degradation and also their creative interests, including photography and craft. Three of the interviewees stated explicitly that in their view having multiple purposes to the project increased engagement and retention for themselves and others. This project was conceived as an exercise in Open Design. The data from the interviews indicate however that a distinctive feature of this project was that it was 'triply open'. The build and making component was open to local and individual interpretation, which is a common feature of such design projects. But additionally – and unusually – the goals and purpose of this make were left open to interpretation as well. In other words, participants did not build a camera in order to achieve a specific and pre-determined outcome such as monitoring a particular species or achieving proficiency with a piece of kit. It made no judgement as to participants' motivations for taking pictures of nature or what they wanted to get out of it. They were asked to find their own goal – often evolving through iteration and experimentation during their time with the cameras – from within the intersection of broad categories of interest: nature, technology and making per se. They found their way into the project from a very wide range of starting points in terms of enthusiasm and expertise. These first two facets of openness were both produced by and intended to mirror the complexity of the ecosystems participants engaged with. This was not a project that designed a product to sit within a context and extract or add value to/ from that context. It was not tested and foolproofed to eliminate its vulnerability to local conditions like heat, cold, humidity or wind. The local environment was an integral component of the make. These cameras will *only* work if makers integrate local materialities into the design in ways unique to each maker's aims and each build. So in this final aspect – ecology – the design was open in a third way, perhaps most radically of all. This project had openness designed into it in response to the complexity and connectedness of ecosystems. This led to a different sort of engagement with the natural world, one which was less human-centric and transactional. My Naturewatch cameras are interdependent with the non-human habitats around us, rather than exploitative of them. In order to work at all, they must work for animals as well as humans. As participants' knowledge and enthusiasm for one domain of the project deepens, as they have new ideas for new uses for the cameras, they need their understanding of the others to deepen in order to progress their passions. As one participant put it, "I evolved with it" (INTA4). In this way, the radically open, iterative approach to design in this project harnesses joy, curiosity and creativity where it already exists to deepen understanding of how that source of passion is woven into other processes and places. Rather than erasing that complexity in the name of accessibility it celebrates connectedness and our reliance on the non-human, making it in fact more likely that participants will remain engaged despite set-backs. The design principles underpinning this project model a relationship with the non-human world, repositioning our human environment as only one of many overlapping habitats. As one participant put it, reflecting upon the way in which her knowledge and use of her garden had changed:

> *'There are things happening out there that is another world. There are whole other sets of living creatures alongside you. It's not just **your** garden.' (INTA5)*

The My Naturewatch camera used an innovative Open Design methodology to provide a self-defined, bespoke making project that modelled a specific form of environmental citizenship. By co-designing a machine that must work in symbiosis with its natural surroundings, makers were encouraged to engage with ecosystems in a way that decentred human habitats, desires and perspectives but which was still driven by their personal curiosity and passion. The evaluation work highlights the extent that designing 'Ecological Citizenship' takes long embedded interactions, it is not a simple territory but a design space that requires embedded design propositions. The more important element is building access, autonomy and agency. Through Open Design communities can appropriate environmental technologies and design propositions to thus inform our behaviour within the natural world.

5. Conclusion

Currently there is an emphasis on companies to provide corporate social responsibility, activities for tax purposes. Over time the transparency for products will go beyond production standards and provide transparency on designs sustainability impact. A good project example of this is (openstructures.net), a project that trades on its interoperability and overtime will replace current approaches to manufacture. The need to engage people in sustainable activities will be as important as 'user centred design' and or reliable communication values and in the near future, products and organisations will be bought and sold based on their ecological footprint. Transparency and ecological capital, presents industrial value in the form of brand loyalty enlightening purchasing habits. We believe that 'Ecological Citizenship' could be embraced to engage communities unfamiliar to this type of design led work. The outputs have highlighted that you can shift participants sustainable values, through direct action. This shift in sustainable values is contentious to say, as the sample size is small, however the impacts and reflections from participants were deep. Participants often made NW cameras for their colleagues, parents and or children after their own interactions with the project had been initiated. It can be seen in a short space of time, i.e. 6-8 months of camera usage. Repeatable lessons for socially responsible design within the context of engaging communities in nature are; 1) the ability to adapt design experiences to local goals and contexts, 2) the freedom to observe and enjoy the everyday 3) ensure that the level of accessibility is audience appropriate, 4) emphasise 'content' not product, and embed the exploration in OD processes.

Future work

Looking at Engaging Nature for 'science families', so outputs are more embedded with any family and not just wildlife concerned focused on breaking barriers for groups outside usual engagement.

Acknowledgements

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