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15. **ROBERT PHILLIPS, AMINA ABBAS-NAZARI, JAMES TOOZE**  
16. **AND NICK GANT**  
17. Royal College of Art  
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21. **Designing for active**  
22. **engagement, enabling**  
23. **resilience and fostering**  
24. **environmental change:**  
25. **Identifying challenges**  
26. **for ‘design-led, nature**  
27. **activities’ ... supporting design**  
28. **for environmental change**  
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47. **ABSTRACT**

48. *Contemporary societies are distancing themselves from nature, driven by urbani-*  
49. *zation, biodiversity loss, connection loss, industrialization and green space access*  
50. *... all reducing our empathy for nature. Conservation and grassroots report-*  
51. *ing highlight nature’s wellbeing, requires impactful citizen-led responses. Youth*  
52. *leaders are reflecting mirrors on humankind, stating ‘our world is on fire’ and*

**KEYWORDS**

social responsibility  
design for environ-  
mental change  
sustainability  
nature  
design for active  
engagement  
community  
conservation

*demanding action. Natural world interactions provide health benefits, resilience, proving transformative to our attitude, values and behaviour. The My Naturewatch project facilitates engagements with people's environment and, by doing so, helps its comprehension. Nature observations help connect, engage and foster custodians, at a time where separation with wildlife necessitates active engagement. Activities specifically challenge our understanding of 'designed engagement(s)', not as passive activities but as impactful active engagements, openly accessible. This article proposes criteria encouraging public participation within the natural world, presenting value to NGOs, design, funders and agents. Thirty experts from design, ecology, conservation, museology, engagement, rewilding, wildlife and community work were interviewed, informing 'design for environmental change through active engagement'. Work identifies design's role in creating interventions that better engage people with the surrounding natural world, yielding long-term mutual benefits. The objective fosters active public-nature engagement, identifying barriers, opportunities and pitfalls leading to nature-engaged interaction(s).*

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## **DEFINING 'NATURE'**

*The State of Nature Report* combines data and expertise from over 50 organizations, providing an update on how wildlife is faring across the United Kingdom. The 2016 report stated, 'between 2002 and 2013, 53% of species [have] declined, with 7% of urban species threatened with extinction from Great Britain'; wildlife is facing the biggest challenge of its time (Burns et al. 2013: 6). This context presents a design space requiring action to engage audiences who might not be aware of their impacts on wildlife, or even what their surrounding wildlife is. During the last twenty years, environmental issues have had more media coverage, and agencies authored 'enhanced environmental legislation' (Law Commission, Reforming the Law 2012: 52). The authors present 'Engaging Design' (ED), directly instigating our interaction with wildlife and the natural world, shifting beyond mere mitigation of consequence to design 'direct action' for the benefit of nature. The view is taken from a design perspective, comparing different approaches combining design and wildlife, and integrating co-constructive processes of trial and action (Koskinen et al. 2011: 18). Buckley identifies ecotourism and increased traffic as having adverse effects, including 'soil erosion and compaction, damage to vegetation, disturbance to wildlife, water pollution, vandalism and noise' (Buckley and Pannell 1990: 25). Whilst national parks encourage public engagement, 'biologists [comment] that protected areas are not playgrounds': wildlife 'parks are assets for tourism, but they are not tourism assets' (Buckley 2009: 26). The authors use design to foster community engagement through the prism of co-defined issues and questions situated within public contexts. The opportunity does not deal with consequence(s) but how you/we enable people to comprehend their impact(s) and, moreover, their role in the proliferation of species (rather than the dominating narrative of their demise). Naturalist Sir David Attenborough,



inclusion removes financial barriers, age or gender issues, and opens items to adaption, reducing barriers to all.

The authors present 'Engaging Design' (ED), an emerging approach going beyond 'product' and aiming for impactful positive engagement of audiences, with the exemplar being the *My Naturewatch* project. The perspective compares different approaches aligning design and natural world integration of co-constructive processes of trial and action (Koskinen et al. 2011: 45). Understanding the world beyond products as 'design can change or evolve behaviour', enacting transformation, even if it remains local (Lilley 2007: 3). In this context, ED instigates our interaction(s) with wildlife and the natural world, shifting beyond mitigation of consequence to direct design action for the benefit of nature. For example, engaging 'in a forest school can contribute to the development of collaborative learning skills, by encouraging children to work with others on challenging outdoor activities' (Coates 2019: n.pag.). These are designed experiences, interactions and engagements.

Design researchers often classify this approach as 'research in the wild' as it 'evaluates prototypes in context and integrated within people's lives' (Chamberlain et al. 2012: 795). However, it is about engaging audiences through those integrated prototypes. The authors acknowledge that 'sustainable development goes well beyond the level of the individual [as it is] too hard to alter by one person', so targeting engagements with communities is more successful (Grund and Brock 2019: 893). Co-design, however, is about material development in partnership with design(ers), and sometimes participants are 'test subjects' validating concepts. The authors see the powerful shift ED can bring. ED is not about designers co-habiting or just co-designing with participants. Instead, it is about providing 'designed agency' to the participants so they can empower communities by proxy, resulting in embedded interventions. It is more specifically about deeply 'activating audiences' (meeting mutual agendas) and then providing impact where they want and require it, from a grassroots perspective. The Natural England's *Access to Nature Report* stresses that nature engagements can 'increase communities' sense of ownership within local natural places, by establishing strong partnerships between communities, voluntary organizations, local authorities and others' (2010: 10). In *Citizen Designer, Perspectives on Design Responsibilities*, Heller and Vienne, advocating for human-centred design, highlight that '[h]uman-centred design develops solutions based on direct interaction with actual individuals [opposed to] user-centred design [that] relates to consumers' (2003: 22). The authors believe that to achieve 'ED' we should design for humans and communities, not scenarios and personas.

### DESIGNED ENGAGEMENTS IN NATURE/DESIGN CONTEXTS

Designers are questioning creative decisions and their impacts and looking for challenges focusing on specific affects rather than operating in traditional fields, that is, good manufacture, services, experience, etc. The latter requires stakeholder engagement at different levels and differing depths, nurturing long-term positive engagement. Design for 'active engagement' seeks to connect with audiences and cultures enacting change, a recognizable trait in a great deal of *sustainable design*. Flip-flopsam and Jetsam (Gant and Dean 2011) and Sea Chair (Jones et al. 2011) both seek to protect the marine environment by addressing issues of plastic pollution, but this is indirectly achieved through engaging 'publics' in a cultural conversation and connection. A digital design

1. engagement example is BBC's Weather Watchers – '[s]har[ing] what's happen-  
 2. ing to the weather' in your location. At the time of writing, it has '165,000  
 3. registered Weather Watchers across the UK' (BBC 2018b). Hackalay presents  
 4. 'DITOs Escalator', demonstrating seven levels of 'engagement' from everyone  
 5. to high engagement in DIY Science (2018). Hackalay states that the number  
 6. of people at the engagement level of BBC programmes Blue Planet II (BBC  
 7. 2018a) and Planet Earth II (BBC 2016) has viewing figures of fourteen million  
 8. and ten million, respectively, estimating these 'passive consumers' at 25 per  
 9. cent of the population (Hackalay 2018). The most engaged level 'include[s]  
 10. those in DIY Science, exploring DIY Bio, developing sensors, etc. estimat-  
 11. ing 0.001% of the UK population at most' are engaged (Synenergene 2014).  
 12. Engagement is in itself a designed process; the intension promotes sustain-  
 13. ability, environmental action or protection.

### 15. NATURE'S 'VALUE'

16. Placing a monetary value on nature is impossible, but elements can be meas-  
 17. ured, especially in global economics, for example, 'Mexico's mangrove forests  
 18. provide an annual \$70 billion, to their economy through storm protec-  
 19. tion, fisheries support, and ecotourism' (Sukhdev 2018). In 2001, the United  
 20. Kingdom suffered a foot-and-mouth disease epidemic, with '2,000 cases'  
 21. during the outbreak, when 'overseas visitors to the UK dropped by 10%' (Bates  
 22. 2016). Impacting tourism and outdoor recreation/sports highlight some of  
 23. nature's interdependencies. *The Natural Choice: Securing the Value of Nature*  
 24. presents economic values of nature, including 'eco-tourism is the fifth largest  
 25. industry in the UK support[ing] 2.2 million jobs, contributing £97 billion to  
 26. the [UK] economy' (HM Government 2012: 52). *What Has Nature Ever Done*  
 27. *for Us* presents natural health service(s), soil care, pollination, the oceans and  
 28. business cases, including '25–50%, proportion of \$640 billion pharmaceuti-  
 29. cal market is based on biodiversity' (Juniper 2013: 45). Juniper highlights that  
 30. 'statins [antidepressants] cost £9,500 per year, while exercise-based activity  
 31. costs about £440', twenty times less, offering a 'National Nature Healthcare  
 32. Service' (2013: 18). Juniper stresses that 'children with attention deficit disor-  
 33. der have been found to show significant improvements if they play in natu-  
 34. ral areas, or have views of trees and grass outside homesteads' (2013: 28).  
 35. Findings supported by the *State of Nature Report* unite 50 nature conservation  
 36. agencies 'giv[ing] a cutting edge overview of the [UK's] state of nature', high-  
 37. lighting 'between 1970 and 2013, 56% of species declined, with 40% showing  
 38. strong or moderate declines' (Hayhow et al. 2016: 12).

39. The National Trust's *Natural Childhood* presents nature's positive effects:  
 40. health benefits, mental health, reduction in ADHD, and comments that more  
 41. nature engagements could offer 'sav[ings] to the health service [to] the order  
 42. of £2.1 billion per annum in England alone' (Moss 2012: 5). Dr William Bird  
 43. (medical advisor to Natural England) comments, '[T]he outdoors can be seen  
 44. as a great outpatient department whose therapeutic value is yet to be fully  
 45. realised' (2007: 22). The Office for National Statistics made a 'first attempt to  
 46. put a monetary value on "nature capital" for the UK in 2011 as £1,573 billion  
 47. (over £1.5 trillion)' (Juniper 2013: 18). Britain's 'nature is an economic and secu-  
 48. rity asset with enormous social value' (Juniper 2013: 59). Finally, 'rural tourism  
 49. is believed to be worth £14 billion per year, with an estimated 17 percent of  
 50. all UK tourism trips involved nature or wildlife watching' (Juniper 2013: 23).  
 51. The recent 2018 *Living Planet Report* presents '[a]ll economic activity depends  
 52.

on services provided by nature, estimated to [annually] be worth US\$125 trillion' (Grooten and Almond 2018: 7). The report disseminates biodiversity's importance:

Without healthy natural systems researchers are asking whether continuing human development is possible, our health, food and security depend on biodiversity. From medical treatments to food production, biodiversity is critical to society and people's well-being.

(Grooten and Almond 2018: 11)

## CONTEXTUAL PERSPECTIVES ON NATURE

Nature is complex, polemical, generating contention and disagreement for best practice. Ragwort (a common English weed), prolific in abandoned urban areas, roadsides, countryside and gardens, divides experts and is a contextual reference (Butterfly Conservation Trust 2018). In 2003, the Ragwort Control Act was created restricting the weed spread (London Stationary Office 2003); if eaten by 'horses or livestock, ragwort can be poisonous with long term irreparable liver damage' (World Horse Welfare 2018). The plant also 'provides nectar for numerous butterfly species', so is favoured by wild gardeners, permaculture experts and rewilding projects (Nikon 2018). Designing 'natural engagement(s)' requires consideration and must be contextually approached. In *Can We Save Britain's Wildlife Before It's Too Late*, Cocker states that 'the overarching goal is to radically change the ethic and methods by which nature is governed', potentially influencing behaviour and comprehension over time (2018: 18). Miller suggests that 'more effort [needs to] be invested in making the natural world part of people's lives' (2005: 25).

## NATURE ENGAGEMENTS

*Securing Nature for Future Generations* questions, 'What role should the natural environment play in the UK's future', commenting, 'climate change, consumption, population growth, changing land use and competition for resources are already impacting nature heavily' (British Ecological Society 2018). Cornel supports this in *Deep Nature Play*, explaining that 'play is a great learning tool that energizes us, fosters creativity and helps build relationships'. We must 'awaken enthusiasm, focus attention, offer direct experience and share inspiration' (2017: 22), something that good nature engagements should embed. Bird defines 'the critical age of [nature] influence' as preteen (12 years old), as 'contact with nature in all its forms, in particular wild nature, appears to strongly influence a positive behaviour towards the environment' (2007: 22). Sterling comments in *Sustainable Education, Revisioning Learning and Change* that we must evolve 'educational culture which both develop and embodies the theory and practice of sustainability in a way, which is critically aware' (2001: 18).

In *Beyond Knowing Nature: Contact, Emotion, Compassion, Meaning, and Beauty Are Pathways to Nature Connection*, the authors list 'contact, meaning, emotion, compassion and beauty indicators of, pathways towards nature connectedness' as five strong indicators for a positive nature engagement (Lumber et al. 2017: 12). Robert M. Pyle defines the Extinction of Experience as 'the loss of neighbourhood species endangers our experience of nature. If a species becomes extinct within our own radius of reach, it might as well be



1. gone altogether. Local extinction has much the same result as global eradication' (Soga and Gaston 2018: 223). Miller presents Shifting Baseline Syndrome as a 'psychological and sociological phenomenon whereby each human generation accepts as natural or normal the situation in which it was raised. With ongoing local, regional and global deterioration in the natural environment, this results in a continued lowering of people's accepted norms for these environmental conditions' (Soga and Gaston 2018: 223).

8. Conservationist Chris Packham established the *Peoples Manifesto for Wildlife*, stating that 'we have plenty of tools in the conservation box – we can rebuild, restore, reinstate or reintroduce. But we have one collective [disability] – we shy away from seeing the bigger picture' (Packham et al. 2018: 5). These expert perspectives frame exploration and experience and foster practical embodiment of sustainable learning, transforming public resilience in environmental change. These engagements have different depths for the public:

15. **Observational engagements.** Wildlife-viewing – the RSPB's pioneering engagements, including 'The Big Wild Sleep out', 'encouraging anyone to spend a night immersed in nature' and 'The Big Garden Bird Watch' (with 600,000 participants in 2011), demonstrate the public's motivation to participate (RSPB 2018). 17,000 people participated in City Nature Challenge (Higgins 2018) and 73,000 in the Christmas Bird Count (BirdNote 2018).

21. **Participatory engagements.** Calls to action, for example, The National Trust's *50 Things To Do Before You're 11 ¾* (The National Trust 2018). Activities range from building dens to bug hunts around their national properties. Another participatory mechanism is *30dayswild*, a social media campaign run by The Wildlife Trusts, fostering activities for one month annually (The Wildlife Trusts 2018a). In 2016, 12,400 people formally signed up for *30dayswild* (The Wildlife Trusts 2018a).

28. **Equipped engagements.** Quitmeyer's work creates 'Digital Naturalists', 'helping ecologists design and build personal computational tools, extend[ing] their tool-making traditions into the digital realm' (2017: 185). Digital Naturalists empower experts with computational tools, investigating local content. A second example is the WonderSphere (Stoudemire 2018), a sealed mobile chamber empowering paediatric patients with scientific and 'natural wonders through multi-sensory learning experiences, promoting joy and well-being' (Stoudemire 2018: n.pag.). Built-in 'gloves enable hospitalized children (with compromised immune systems) to plant, dig, water, and touch nature without danger of infection, providing a bedside hands-on field trip' (Stoudemire 2018: n.pag.).

39. *My Naturewatch* is an example of Designing Active Engagement as it 'connects audiences young and old in fun or serious activity' (www.mynaturewatch.net). The My Naturewatch Camera is designed to capture pictures of wildlife when it detects movement; and as it uses off-the-shelf parts, it can be assembled on a kitchen table without tools. Inexpensive, easy for people to make themselves, and aligned to the interests of the BBC's Natural History Unit, it is specifically designed for use in people's gardens or local green spaces to record images of nearby wildlife. *My Naturewatch* engagements (to date) include film trailers with local independent cinemas, design workshops (Figures 1 and 2), passive engagements, expert engagement, television broadcasts, Bio-Blitz's, talks and an expert training scheme. The work has also fostered independent nature engagement activities documented live on social media. In *My Naturewatch Camera: Disseminating Practice Research with a Cheap and Easy DIY Design*, the authors commented 'the fact that so many



Figure 1: ED workshops with My Naturewatch Camera. Image credit: James McCauley.



Figure 2: Deploying Cameras in situ at National Trust Sites. Image credit: authors.

people have made My Naturewatch Cameras shows that, with appropriate design and adequate publicity, research products can circulate widely outside commercial markets' (Gaver et al. 2019: 302).



## 1. DESIGN SPACE SUMMARY

2. The authors have defined the coalescing themes as a 'design space', for exam-  
 3. ple, *Nature* is perceived as the natural world and ecosystem that surrounds us –  
 4. not solely the 'countryside' but all environments within reach. *Nature's 'value'*  
 5. is evident in material provision, health, wellbeing and preserving the ecosys-  
 6. tem relied on for life on earth. ED is a new strategy, offering a deeper level  
 7. of active engagement amongst audiences, created to instil 'active responses'  
 8. rather than mere 'participation', and considers the 'buy in' from audiences for  
 9. different levels of engagement. Open Design, and the transparency of making,  
 10. gives people agency and brings different complexities of repair, re-skilling,  
 11. assembly and appropriateness. Design is transforming to a more open and  
 12. sustainable system, enabling reuse or repurposing, and adding complexity by  
 13. substituting and adapting designs. To address this design space, the authors  
 14. required a cross-disciplinary position, as the theme combinations are excep-  
 15. tionally complex, sensitive and require expertise. Design is comfortable in  
 16. numerous areas of discourse. However, it needs to cope with the integration  
 17. of sustainable ecosystems and work in parallel with our natural world, instill-  
 18. ing ownership and responsibility into local communities that reside within it.  
 19. As the topic areas (Open Design, ED, Nature) unite, the complexities require  
 20. processes for navigation. The following question unites presented literature  
 21. and themes:

23. What role can design play in creating change/interventions that better  
 24. engage people with the natural world surrounding them – with the  
 25. specific intention of yielding long-term benefits to both people and the  
 26. natural world?

## 30. METHOD

31. The areas (Open Design, ED, Nature) combine and foster active engagement,  
 32. as motivation to preserve nature is intrinsic, but the interdependencies are  
 33. complex, with far-reaching impacts. The authors see the value in this design  
 34. space to enact change over time. The roundtable united national experts  
 35. (Figure 3) accompanied by facilitators and pre-trained interviewers. Senior  
 36. experts presented their fields with ten-minute 'topic shares'; this demon-  
 37. strated their perspectives on the interpretations of terms above to attendees.  
 38. The participants mapped their expertise to help define their interests, which  
 39. is included in the analysis. The method probed the combination of areas, as  
 40. there is topic bleed between experts. The agenda was not just a future casting  
 41. exercise, but unpicked how these design spaces function as our civic respon-  
 42. sibilities change over time. The authors do not see this as co-design as the  
 43. entire process was intent on encouraging active engagement with the public  
 44. and not just their 'participation'. The authors presented the opportunity for  
 45. the proposed design space uniting the elements and wanted to unpick poten-  
 46. tial pitfalls and opportunities. The participants were carefully selected based  
 47. on the research team's mapping of expertise, and participants then mapped  
 48. themselves (Figure 3).

49. The scoping presentations grounded audiences in each other's cultures  
 50. and approaches, creating an inclusive approach undetermined by a hierarchy  
 51. of knowledge. During roundtable discussions, all attendees were interviewed.  
 52. The participants were frontline workers and close to the issues at hand,



Figure 3: Expertise mapping of roundtable participants. Image credit: authors.

making them key stakeholders. Interviews with key informants ‘allow[ed] a free flow of ideas and information, interviewers frame questions spontaneously, probe for information and takes notes, which are elaborated on later’, providing information directly from experts (Binnendijk 1996: 83). Interviews with key informants ‘provide flexibility to explore new ideas and issues not anticipated during planning’ (Binnendijk 1996: 84). Participants were interviewed individually, avoiding the ‘Hawthorne effect’ where participants behave differently when they know they are being observed’ (Chipchase 2018: 41, original emphasis). The interviewees were briefed, initiating from an identical script ‘enabl[ing] strict comparison between interviews’ as it ‘is easier for a novice to follow’ (Chipchase 2018: 68). This process levelled all of the interviewees ensuring parity and clarity of activities. Questions were sent to interviewees in advance, avoiding participant discomfort or pressure. The topics went from ‘closed responses to answers that are more open’, keeping ‘the questions short’ (Chipchase 2018: 82). Questions covered measurements of success in engaging people with nature; occurrences of negative nature impacts; design’s role in this change; and potential long-term positive effects of change for society and mitigation of negative impacts. Interviews were recorded, transcribed and comparatively analysed through coding ‘covering key themes, concepts, questions and ideas’ (Binnendijk 1996). Key points and excerpts have been extracted, and should be read in context to the question and the expert’s discipline. The responses were then affinity-mapped into themes of importance. They were prioritized by topics and insights previously unidentified in design and nature literature. The experts of that area were then given priority, based on where they mapped themselves, during the accompanying activity.



Figure 4: Roundtable presentation. Image credit: Isaac Reeves.

## RESULTS

### **Q1: Identifying challenges for the public to engage with nature and barriers informing change?**

*Question context:* A 'disconnected relationship with nature is a consequence of an anthropocentric viewpoint'; this is compounded by 'busy lives', distance working and complex issues (Merchant 2006: 514). Current barriers to nature include peoples' perception of weather (Lumber et al. 2017), access to green space (Cox et al. 2018), perception of lack of knowledge (Schultz 2002), urbanization (Cox et al. 2018), social mobility (Maas et al. 2009), smartphone use (Richardson et al. 2018), lack of understanding (Barry 2009), people not having the time (Guiney and Oberhauser 2009), peoples' willingness/motivation (Kals et al. 1999), public perception that they have to 'go somewhere', motivation as people expect a certain type of interaction and/or the reward can be frustrating (Monroe 2003: 115), and an increase in indoor activities (Nordbakke 2019: 359). The following challenges are specific to the organizations; however, they have been extrapolated and key themes identified, which were then revalidated by stakeholders.

Lucy Robinson, Head of Citizen Science, Natural History Museum, highlights the key theme of large 'ill-informed or ill-managed' engagement(s). The public

perceive loads of people going to nature reserve[s] and trampling plants. Once people have a level of engagement with nature and understanding of it, they don't trample plants because they know the impacts. I think you have to accept that there might be a short-term negative impact, but it's for long-term positive gain [...] It's not that everyone has to love

Agent	Benefits	Pitfalls	Challenges	Opportunities
Jane Cooper, CEO, Countryside Education Trust	Encourage the exploration of new underexplored areas for interactions	Tourism, specifically repeat visits, i.e., car parks, result in mass habitat degradation.	Tourists not considering their impact and viewing it as someone else's challenge	GPS navigation and way-finding systems calibrating to footfall and impact
Kate Lewthwaite, Citizen Science Manager, Woodland Trust	Route-planning that can adjust with the season	Leaving the path and trampling the ground will have impacts on bulbs next year, even if they cannot be seen.	Visitors prefer to come to locations 'technology-free'.	Embedded experiences that cater to all ages and abilities and print-on-demand information
Nick Oliver, Engagement Manager, Wildfowl & Wetlands Trust	Design interventions for specific groups to include and encourage engagement	Vista segmentation, inviting attendance to different areas of wildlife sites	Increased footfall in sensitive areas of sites	Remote sensing and observation, deployed appropriately due to seasonality
Bernard Hay, Senior Learning Producer, The Design Museum	Creating a series of interactions that build on each other providing citizen science data over time with active participants	People require time, motivation and appropriate means to engage.	Creating a long-term sense of collective responsibility for nature and the urban environment	Encouraging all to participate in local community preservation
Chris Sandom, rewilding expert, Head of Sandom Labs	Reviewing the volunteering economy	Humans can have a negative impact on nature just through over-disturbance.	If everybody is connecting with nature and there is not a lot of nature left	We can deploy 'ecotourism' and encourage managed positive engagement through volunteering.

Table 1: Identifying challenges for the public to engage with nature and barriers informing change?

nature or [be a] super-nature enthusiast, but people appreciating that nature touches different parts of your life. It's the food you eat. It's if you have asthma, that could be something to do with pollen etc [...] We [the NHM] don't tend to look at what actual features of projects hinder learning or engagement, or foster it. I think evaluating it and recognising it would actually be digging into the specific designs of programmes and understanding impacts.

*Q1: Summary*

The experts continually highlighted that the biggest challenge is managing impacts over time in specific areas because untrained visitors do not foresee their impacts. There is an opportunity in perceiving impacts and encouraging responses during different seasons/specific events, often highlighting their

Agent	Benefits	Pitfalls	Challenges	Opportunities
Dr Julia Lorke, postdoc, Natural History Museum	My Naturewatch is the only example where I feel environmental education and connecting with nature overlaps.	Adding another activity that excludes locations and individuals due to geographic location	Finances, resources and facilities to achieve within the curriculum and/or parental learning	Explore the link between education and nature connectedness
Teresa Dent, CEO, Game and Wildlife Conservation Trust	Could lead to another economy for agricultural industry on a small/medium scale	Invite many 'nature enthusiasts to see it'	Finding ways to measure agricultural/nature trends from baseline to satisfy farmers that they are succeeding	Digital intervention that celebrates 'bragging rights' for individuals that can be safely shared
Chris Sandom, rewilding expert, Head of Sandom Labs	Increase in health and wellbeing	Only works in countryside locations	We need to consider how we design our nature connection back into our lives	Designing landscapes and/or daily interactions that build over time
Lucy Robinson, Head of Citizen Science, Natural History Museum	Top-down outputs have sustainable future and 'design for exit'.	Things naturally occur in a top-down way because organizations exist to achieve particular outcomes.	Outputs becoming 'top-down' and not reaching the appropriate audience	Co-create with the intended audience and find mutual intrinsic motivation for participation/engagement

Table 2: What can design (as a practice) do to transform/change how we engage with nature?

potential impact to the public. This could be through designing out challenges and/or educating participants to make wiser, less-impactful choices. Projects of this nature need to design out 'over-disturbance' in engagements, either in holiday-booking, visiting or education reducing high-level impacts.

**Q2: What can design (as a practice) do to transform/change how we engage with nature?**

Question context: Design can be a force for large-scale change, 'tackling the biggest challenges of our time, bringing about positive change in people's lives' (Design Council 2017). In the future, 'companies will need to demonstrate their products' positive contribution to society as well as minimizing their negative environmental/social impacts' (Shin et al. 2015: 368). These impacts can also be used to create engagements as a force for good (Shin et al. 2015: 368). Some examples of this 'design/nature' alliance include the following projects: The Animal Diplomacy Bureau (ADB), featuring designed game experiments that provide agency to participants; Pokémon GO (PokemonGo 2018); and 30dayswild (The Wildlife Trusts 2018b). Experts believe that increasing people's 'nature engagements' could lead to regenerative cultures, potentially affecting participants' mindsets (Phillips and Kau 2019).



Agent	Benefits	Pitfalls	Challenges	Opportunities
Bernard Hay, Senior Learning Producer, The Design Museum	People could be fostered encouraging more engagement over time, without guilt or peer-to-peer comparisons.	It could be a short-term engagement that does not evolve and does result in any impact.	Participants require background knowledge, or practice, to sensitively intervene in context.	Designing so volunteer efforts are acknowledged and they feel valued
Jane Cooper, CEO, Countryside Education Trust	Inform policy through grassroots action	Interventions get forced on communities	A mix of policy and local approaches building economic capacity	Defining at what scale a design intervention can inform policy and vice versa
Rachel Bicker, biodiversity consultant, Gatwick Airport	Designed interventions meet local need and requirement, working in parallel with international locations.	Outputs designed in isolation and not long-term	Designed to meet a need or a demand, rather than just trying to tick boxes in a funding opportunity	Include funding councils in the need and requirement for engagements to be designed
Lucy Robinson, Head of Citizen Science, Natural History Museum		One-size design solution does not always fit all.	Being formulaic because you know it will work	Open-source design to share and build from, reducing cost
David Lindo, The Urban Birder and television presenter	How we live within wildlife and can evolve our architecture		It feels like 'eating your greens' and is not embedded.	Design interventions that will bring us closer to nature, without actually realizing it

Table 3: How should change be nurtured to influence our approach to environmental transformation?

Bernard Hay, Senior Learning Producer, The Design Museum, describes the largest challenge. The bigger question is

how do we shift participants' awareness of the surrounding environment so that they're aware of nature and their impacts? That could be through spatial interventions, in terms of parks, that could be about signage or interaction design experiences [...] [We] need a greater commitment to thinking about how we change people's perceptions of what the natural world is, with design. I think there's a standard view of nature that focuses on beautiful mountains, or these unspoilt landscapes you see on Blue Planet [...] [It's] about adopting the aptitudes and skill sets that we have, for example empathic thinking, curiosity, being an amateur, prototyping, testing, getting feedback, iterating your products.

Agent	Benefits	Pitfalls	Challenges	Opportunities
Nick Oliver, Engagement Manager, Wildfowl & Wetlands Trust	Getting people on the site to see the bigger picture of what is happening		At home, parents say, 'Don't touch that worm, it's dirty'.	Getting people to look at conservation in a different way as well and giving people alternatives
Roberto Fraquelli, Head of Design, Schumacher College	Exploring legislation for positive benefits		Incentivization through legislation change	Change laws, incentivize people; if they positively impact nature, they can reduce their council tax
Helen Meech, Bronze Oak Project, previous director, Rewilding Britain	The government's 25-year plan for nature talks about a policy that will mean that every school includes an element of outdoor learning.	The time in which it takes to embed that culture	The key measure for people's engagement with nature is 'nature connectedness', which is the extent to which people see themselves as part of nature.	Outdoor learning has been proven to have huge benefits, both in terms of educational attainment and kids' wellbeing.
Adam Cormack, Head of Communications, The Wildlife Trusts	Give nature the best chance to thrive in garden and urban spaces		The notion of 'rewilding' is messy, and people often do not want to overcome the 'look'.	Encouraging people to treat gardens as small nature reserves as they are essential for biodiversity
Chris Sandom, rewilding expert, Head of Sandom Labs		Your decisions have lasting consequences for both good bits in life and bad in life.	Understanding your place in that system and trying to have a positive interaction with it	Creating inter-related international practices and approaches

Table 4: What is the best practice to establish and engage people in environmental change?

**Q2: Summary**

The experts highlighted the importance of going beyond their organizations and encouraging community agency for engagement, not just top-down 'participation' proposals. How we design nature engagement back into our lives is currently limited to resources and capabilities of NGOs. The opportunity is creating design/engagement proposals that are mutually beneficial for all, not just the organization.

**Q3: How should change be nurtured to influence our approach to environmental transformation?**

*Question context:* Behaviour-centred design (BCD) 'encompasses a theory of change, a suite of behavioural determinants and a programme design process' (Aunger and Curtis 2016: 426). Professionals 'including policy-makers,

marketers, educationalists, environmentalists, international development practitioners, governance and justice campaigners, health promoters, city planners, sports psychologists and web designers are all looking for advice on how to change behaviour' (Aunger and Curtis 2016: 426). The approach of BCD is transformational, but our (publics) approach has to change to engage with it. Parallel activities that have had a huge impact over time are the United Kingdom's plastic bag tax 'dropping consumption by 86%' (GOV.UK 2019), the public smoking ban that reduced emergency hospital admissions (GOV.UK 2019) and the potential up-and-coming sugar tax (Brownell et al. 2009: 10). The following are the key stakeholder responses.

Roberto Fraquelli, Head of Design, Schumacher College, shares the underlying point. By

designing opportunities for new paradigms that aren't about the existing world views that we have based around gross domestic product, but to design new curricular, new ways of living [...] more community living, thinking more about bioregions. We must move away from the culture we have manifested, particularly in urban spaces which tends to not focus on nature and the opportunities in nature.

### Q3: Summary

The challenges are providing motivation that goes 'beyond the self' to encourage participants – designing new paradigms, tax relief, design for transition, design to meet the need for 'sustainable change' and creating systems that enable agency and grassroots appropriation.

### Q4: What is the best practice to establish and engage people in environmental change?

*Question context:* The concept of best practice is to unify approaches that others can benefit from (Mao et al. 2005: 106). In *The Knowledge Gain and Behavioral Change in Citizen-Science Programs*, Jordan et al. comment that trial participants claimed the largest motivating factor for Citizen Science participation is 'content knowledge' (2011: 1151). Content knowledge is the education that users experience from exploring the world through the practice of Citizen Science. Part of Citizen Science practice is to offer training opportunities where volunteers can increase their skills, expertise and 'content knowledge'. In *The Rise of the Expert Amateur: DIY Projects, Communities, and Cultures*, Kuznetsov describes the main motivation of users contributing to DIY projects as the 'learning of new skills and communal sharing' (Kuznetsov and Paulos 2010: 1). Kuznetsov and Jordan et al.'s work aligns the main motivating factor in Citizen Science and DIY activities as learning new content. In November 2012, the Centre for Ecology and Hydrology (Natural Environment Research Council) commissioned and published a report, *Understanding Citizen Science and Environmental Monitoring* (Roy et al. 2012). Within this report, Roy et al. comment:

Volunteers are motivated by enjoyment of participation but also by having confidence in the utility of the data. Initiatives with specific aims for underpinning policy or contributing to hypothesis-driven research would be welcomed by, at least, some of the citizen science community.

1. It is important to respect the diverse motivations of volunteers. For  
 2. example, not all will be willing to modify their existing activities to  
 3. engage with policy-citizen science. Engagements should be innovative  
 4. and imaginative combining the collation of high quality and useful data  
 5. while appealing to the volunteer community.

(2012: 26)

6.  
 7.  
 8. Mathew Frith, Director of Conservation, London Wildlife Trust, defines  
 9. what we need from the next generation. We

10.  
 11. need ambassadors to show that things can be done. So it goes back to  
 12. that point about hope; it's not all a long, steep climb. One of the things  
 13. we suffer from is a funding world, which basically does short-term  
 14. projects. So we do something for three years, and then we have to walk  
 15. away. So you get – One of the big issues, and a particular interest for me,  
 16. are the quality of the landscapes around our housing estates in London  
 17. [...] So it's about marrying the local expertise, the local knowledge, the  
 18. experience that no one else can match from actually being in that place  
 19. and being part of that community, with the professional input, which is  
 20. to do with strategy, in some ways.

21.  
 22. *Q4: Summary*

23. Provide embedded motivation or provide influence through transparent  
 24. impacts. This can be through ambassadors who enable communities to build  
 25. sustainable futures. The important element is to unite local knowledge, exper-  
 26. tise and local communities through a clear approach and narrative.

27.  
 28. **DISCUSSION**

29.  
 30. The section is subdivided into four subthemes: spatiality, interactions, motiva-  
 31. tion and impact. These areas maintained the highest frequency amongst the  
 32. interview results. They also highlight the opportunities within the proposed  
 33. design space. The authors acknowledge there is no 'one size fits all' solution  
 34. as this area is complex, with legal ramifications, health and safety issues, and  
 35. more. This is an exceptionally multifaceted space to navigate with many long-  
 36. standing forces at play. Codes of conduct could help foster independence, that  
 37. is, 'take only pictures, leave only footprints', and encourage people to engage  
 38. in this space with expert care (Mears and McNutt 2002: 8). Richard Louv,  
 39. the leading nature journalist who coined '*Nature Deficit Disorder*', *The Nature*  
 40. *Principle* and *Vitamin N*, is a leading opinion in the area. Louv remarks on our  
 41. relationship between nature and technology in *Our Wild Calling*. Louv argues:

42.  
 43. Analogue and digital must merge in order to create a new space of  
 44. nature in which the positive, empathetic, loving relationship between  
 45. mankind and creation is the most important condition for the survival of  
 46. the species. And the Internet is the key to this new space.

(2019: 146)

47.  
 48.  
 49. ***Subtheme: Spatiality***

50. The World Wide Fund for Nature highlights issues with smartphone apps  
 51. recording wildlife sightings, specifically in Yellowstone, a national park in the  
 52.

United States. Not only does the app remove the 'wild nature of discovering wildlife' with 'grizzly bear sightings at such spots are especially challenging for park rangers, who have to both direct traffic and keep people a safe distance away' (Gaukel Andrews 2012: n.pag.). This is an extreme example of 'logging wildlife', but it does raise the issue of health and safety, drawing people who do not have the subsequent knowledge to cope with the environment to certain locations. The Dorset Wildlife Trust has reported that smartphone apps imitating bird song have been used negatively to lure species for amateur photography (Gonzalez 2013). Tony Whitehead, Public Affairs Officer for the RSPB, stated, '[R]epeatedly playing a recording of birdsong or calls to encourage a bird to respond in order to see it or photograph it can divert a territorial bird from important duties, such as feeding its young' (Gonzalez 2013). This intervention could have large impacts if inappropriately scaled. Finally, military-grade sonar usage has been linked to whale 'beaching' or 'stranding'. Reporting 'the number of whales known to have been harmed by sonar is relatively small, but until we know exactly how whales respond to sonar, and what sound exposure causes these responses, we cannot assess the full scope of the problem' (Cressey 2008). All of these touch points are scenarios where people have been unaware of their impacts. The question is, how do you make them aware of scenarios that do not exist yet, or should we be continuously fearful?

- *Semi-permanence* requires consideration, the free flow of movement and repositioning of interactions, touch points and over time not contributing to site-specific increased footfall.
- *'Wild' is messy and risky*; that is a good thing; do not sanitize it or design it out.
- *Wildlife is not just in the countryside*; it is also in your public space, garden, park, place of work or outside the window.
- *Designing new paradigms*, rather than looking at traditional ownership models, to engage people.

### **Subtheme: Interactions**

Hartig et al. discuss the health benefits of 'nature experiences', including physiological impacts, restorative aspects, learning, and personal development supporting 'views about nature and health, are using methods and theories now viewed as scientifically credible' (Nilsson et al. 2010). One gaming platform that surprised health experts was Pokémon GO, a 'Real World Gaming Platform us[ing] real locations to encourage players to search far and wide in the real world to discover Pokémon. Pokémon GO allows you to find and catch Pokémon as you explore your surroundings' (Tateno et al. 2016). This platform was designed to create profit and establish exploration; it never considered the health implications of simply getting people to explore the world around them. In studies, Igmarr et al. (Althoff et al. 2016) documented that 32,000 users 'added a total of 144 billion steps to the US physical activity'. There are further cases highlighting Pokémon players going to previously unvisited locations (Colley 2017) and helping people with social withdrawal (Tateno et al. 2016). Recently the National Trust commissioned a report, *Natural Childhood*, written by lifelong naturalist Stephen Moss, original producer of the BBC series SpringWatch. In the report, Moss highlights, '*Nature Deficit Disorder*:



1. *Causes and Consequences* focuses on the lives of Britain's children, particularly  
 2. with regard to their lack of engagement with nature. Three specific categories  
 3. are examined: physical health problems including obesity, mental health  
 4. problems, and children's growing inability to assess risks to themselves and  
 5. others' (2012: 10). Moss continues to identify:

6.  
 7.     Imagine a world where our children are physically and mentally health-  
 8.     ier, communities more cohesive and connected, and everyone enjoys a  
 9.     closer relationship with the natural world, and all its benefits. Reduced  
 10.    costs to the NHS, higher educational attainment in our schools, and  
 11.    happier, more fulfilled families are just the start. Ultimately, this would  
 12.    help produce generations of children with a more balanced approach to  
 13.    risk-taking, deeper bonds with their peers, and a genuine self-aware-  
 14.    ness and perspective on the wider world – ready to take their place in  
 15.    adult society.

(2012: 10)

16.  
 17.  
 18. - *Be aware*, this approach is not about replacing 'nature' but enhancing  
 19.    experiences.  
 20. - *Question how interactions function*, i.e., group, at a distance to build empa-  
 21.    thy? Group interactions; work at a distance; collective medium, etc.  
 22. - Design *appropriate steps* for proposals that are sensitive and attuned to  
 23.    their surroundings.  
 24. - As many people as possible need to have *access to the interventions* even if  
 25.    they are embedded into environments for all to use.

26.  
 27.  
 28. **Subtheme: Motivation**

29. - *Present a clear picture* of what audiences are contributing to with a consid-  
 30.    ered level of intrinsic motivation, as it should align to their interest(s) or  
 31.    need(s).  
 32. - *Create incentives that are opportunities* rather than regulatory-driven as a  
 33.    negative campaign.  
 34. - *Fostering grassroots connections* and projects that are embedded in local  
 35.    communities rather than just top-down mechanisms.

36.  
 37.  
 38. **Subtheme: Impact**

39.  
 40. Impacts are often hard to predict as they become highlighted on mass or over  
 41. time. The RSPCA has advised that 'Sky Lanterns' (flammable balloons released  
 42. at events) can cause 'ingestion, entanglement and entrapment to wildlife'  
 43. (2013). The public feeding of Mallard ducks with 'white bread causes problems,  
 44. as excess starch makes them lethargic, leading to health problems' (Furness  
 45. 2013: n.pag.). Overfeeding Mallard ducks can also cause 'over-populations of  
 46. males in environments leading to forced mating' (RSPB 2013: n.pag.). Recent  
 47. research has also shown 'that baleen whales [are] affected by military mid-  
 48. frequency sonar' (Goldbogen 2013: 1765). In 2011, the RSPB documented 'two  
 49. wildlife photographers fined £1,100 for disturbing a pair of nesting white-  
 50. tailed eagles on the Isle of Mull'. This case could have been amplified by  
 51. multiple users sharing information online. Would more awareness of codes  
 52.

of conduct and indirect impact in this area have a positive effect? A simple example of this unknown impact was the foot-and-mouth outbreak in 2001. Foot-and-mouth is spread by foreign contaminants transferred to footwear and freely distributed. The South Downs recreation area (1600 km<sup>2</sup>), located in East Sussex, was closed to reduce the spread of the disease. The public misunderstanding of their foot traffic's impact exacerbated its spread. The disease claimed farms and 'resulted in losses of £3.1 billion to agriculture' (DEFRA 2004: n.pag.). Another simple example is everyday bird feeders. *Trichomonas gallinae* is a common parasite to pigeons. Studies in 2012 documented a '30% reduction in green finch numbers' due to the transmission of parasites to other species (Robinson et al. 2010). The RSPB stated that *Trichomonas gallinae* 'is spread as birds feed one another with regurgitated food during the breeding season, and through food and drinking water contaminated with freshly regurgitated saliva' (2014: n.pag.). The cure relies on the 'public to clean their bird feeders, regularly', as this act of kindness could erode species over time (RSPB 2014: n.pag.). The authors think the following points are critical in mitigating against impacts for the types of ventures discussed.

- *Creation of ambassadors* on a local level that are arbiters amongst the most relevant peers, youth or community groups.
- *Change of public mindset*, creation of awareness that is more granular, informing potential actions or behaviours.
- *Public notion of diversity* in environment can be extended with more local knowledge.
- *Grassroots informing policy*, concepts need to be backcast, so grassroots opportunities can see what their work could inform.

## CONCLUSION

The activities have been independently validated by the *My Naturewatch* project via a research through design approach (Gaver 2012). Designing 'Active Engagement for Nature' provides agency but requires expertise, time, patience, deployment and appropriate constraints. Design was recognized by participating organizations as a valued tool and set of processes, and several identifiable, traditional and, perhaps, more emergent design disciplines were identified as having been deployed by the contributors. These included communication design, service and systems design, and landscape design – the contributors also recognized the need to 'design engagement' into many of their activities and approaches. Finally, the areas of Spatiality, Motivation, Impact and Interactions must be appropriate to their context of deployment.

## FUTURE WORK

1. Investigating the means to provide 'capability and capacity' to charities/ NGOs so they can undertake this type of 'engaging' work.
2. Designing for 'Science Families', ensuring interactions are not isolated but embedded in a community where guardians and children benefit through appropriate engagement.

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### 13. SUGGESTED CITATION

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### 21. CONTRIBUTOR DETAILS

22. Rob Phillips is currently a senior tutor at the Royal College of Art, Design Products + Futures Programme. Rob is a product designer with eighteen years of experience, working commercially and independently with a broad experience (to date), including five international patents, large-scale manufacture with over three million products in retail, life-saving fire-and-ballistics equipment, revolutionary material development, user-orientated proposals, and involvement in design for team GB. During his Ph.D. he informed a relationship between Open Design and Citizen Science, resulting in methods taught at MIT Media Lab, Stanford, Cornell and the BBC. His latest collaborative project with Goldsmiths University – Interaction Research Studio ([www.mynaturewatch.net](http://www.mynaturewatch.net)) – uses distributed design to foster people's interest in the natural world around them and was broadcast (earlier in the year) on the BBC's SpringWatch programme. His research seeks to 'Engage Design', to decrease people's impact, gaining insight into what people really do ... and not just what the 'world of design' does ... thinking how we can be FutureKind to HumanKind.
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38. Contact: Design Products + Futures, Royal College of Art, Kensington Gore, London SW7 2EU, UK.

40. E-mail: [robert.phillips@rca.ac.uk](mailto:robert.phillips@rca.ac.uk)

42.  <https://orcid.org/0000-0002-0743-6064>

44. Amina Abbas-Nazari is a designer, researcher and artist. She works as a research fellow at the Royal College of Art on the EPSRC-funded project, 'Citizen Naturewatch', in collaboration with the Interaction Research Studio at Goldsmiths University. She is also currently undertaking a Techné NPIF-funded Ph.D. in the School of Communication at RCA, in partnership with IBM, around the themes of artificial intelligence and voice. Amina has presented her work at the London Design Festival, Milan Furniture Fair, Venice Architecture Biannual and Critical Media Lab, Switzerland. Also, she has

given talks and workshops for industry, academia and government, including Harvard University, NESTA, Queen Mary University, Barbican Centre, Tate, V&A Museum and UAL, London.

Contact: Royal College of Art, Kensington Gore, London SW7 2EU, UK.

E-mail: amina.abbas-nazari@network.rca.ac.uk

James Tooze is the principle investigator of a British Council/AHRC-funded study into ethics in makerspaces (£35k) and was co-investigator then principle investigator on the EPSRC-funded Future Makespaces in Redistributed Manufacturing Network (£500k) running from January 2014 to June 2017. He is a founding member of the Distributed Everything Lab (DE Lab). The DE Lab was established to explore new approaches to design, distribution and modes of consumption that are calibrated to the transition to a circular economy by all sectors of society and all scales of enterprise. James is a member of the Fab City Collective, a global network that is advocating, developing and researching the concept of locally productive and globally connected cities. Previously James was a lecturer and researcher at Brunel University, working on projects funded by Horizon, Digital Economy Research Hub and RCUK Digital Economy. James is a graduate of design products at the Royal College of Art and the University of Plymouth.

Contact: Royal College of Art, Kensington Gore, London SW7 2EU, UK.

E-mail: james.tooze@rca.ac.uk

Nick Gant leads practice-based research into social and sustainable design and the relationship between them. He has collaborated with NGOs and charities, including Rural Community Council Network, Vision Aid Overseas, The Marine Conservation Society, The NHS, The UK Milk Bank, and has worked with global organizations as diverse as Philips, Vivienne Westwood, Veolia, Interface, Apple Corps, Dyson, Vodafone, ICI, The V&A and Natural History Museum, New Balance, PUMA and the BBC, and has presented research and consulted to regional and national governing bodies. He teaches and supervises doctoral research across design disciplines; he co-wrote the MA in Sustainable Design at The University of Brighton and has won funding from a range of industrial and research bodies.

Contact: Royal College of Art, Kensington Gore, London SW7 2EU, UK.

E-mail: nickgant@community21.org

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