Planting and Tending Digital-nature Hybrids in a Walled Kitchen Garden

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Introduction

This paper presents various digital-nature artifacts that were designed to support visitor engagement with nature in a public garden environment. We refer to these artifacts as hybrids, as an acknowledgment of their combined digital and physical characteristics. Although selections from critical theory guided initial aspects of the inquiry, we examine here how a research through design (RtD) approach and attending the Research through Design (RTD) 2015 conference affected our subsequent design practice—notably, in relation to iterations of the artifacts. The paper discusses our RtD practice and the hybrid artifacts' place within it. In particular, we reflect on the ways in which each design iteration in the RtD process revealed knowledge about materials, values, engagement, and place.

Although we wrote this paper collaboratively, only the first author attended RTD 2015. Thus, the sections addressing the experience and influence of the conference are written based on the experience only of the first author, although the conference undoubtedly subsequently affected each of us through the research.

Background

In recent years, reports and articles from organizations, including the National Trust (NT) and the Royal Society for the Protection of Birds (RSPB), have expressed concern about citizens' (and particularly young citizens') lack of engagement, or superficial engagement, with the natural world.[1] Some have framed digital technology as problematic because of the captivating hold of the screen.[2] A perceived tension between nature and digital technology provided the starting point for our research reported here. We explored the possibilities of embracing criticisms of technologies as principles to advance the design of digital interpretation that would support people's connection to nature. The context for the research is the Walled Kitchen Garden, Clumber Park, in Nottinghamshire, UK, which is managed by the NT.

Our research began with a rejection of technological determinism and an acceptance that power systems can set the cultural horizon and mold digital technology.[3] In this frame any digital interpretation we design is influenced by values. Therefore, this frame allows for the possibility of designing differently if another set of values is prioritized. By accepting some of the criticisms of technology arising in selected philosophical writings by Heidegger, Borgmann, and Feenberg we created a set of design principles that address issues relating to digital technology and people's disconnection from the natural world [4] These principles are discussed here in relation to the individual design artifacts we created. We also reviewed literature in relation to natural history writings to identify qualities of "engaged" experiences in natural environments.

RtD, as described by Gaver, emerged as an appropriate approach for us because we found common ground with what we understood to be the epistemological commitments of our project.[5] These commonalities include Gaver's description of valuing making as a "route to discovery," understanding RtD as a generative way of producing knowledge, and recognizing the benefits of

participation in the design process. The individual methods used in our project were guided by this approach. Although we acknowledge that other researchers describe and use RtD differently, a discussion of the differences is beyond the scope of this paper.

RtD Praxis

This section addresses our RtD praxis, taking praxis to encompass our RtD approach and all activities undertaken during the research project. The RTD 2015 conference marked the two-year point in a three-year program of study involving a literature review, establishing the research context, and designing artifacts. At the time of writing, we are beginning "follow-up" research, although one aspect of the RtD approach is that the research is never really finished—especially in the context of a living, growing garden.

The research started with visits to the site to get to know the garden and its inhabitants, including the gardeners, volunteers, and visitors. An 18-month period of intense collaboration followed that then evolved into the current ebb and flow of engagement, responding to the seasonality of the garden. We established design criteria that embraced a critique of technologies, using literature that critically reflected on the effect of devices and technologies on human relationship with the world, with the intent of developing digital artifacts to support connection to nature. For example, referencing Heidegger, Edwards noted that devices do not interrupt us, nor do they prompt reflection.[6] Hence, we adopted "interruption" and "reflection" as design criteria.

The next phase involved making as a means to explore the design space. We sought to discover whether the criteria that emerged from critical theory could be embodied in a digital-nature artifact. Although this initial artifact—the Nature Meditation Egg—was developed outside the garden site, the prototype provided a focal point for reflection and helped the garden team understand some of the possibilities of the approach.

Our ongoing dialogue through artifacts has involved visitors, designers, gardeners, volunteers, and representatives from NT Clumber Park and, to a lesser extent, employees from other NT properties. NT sites. Versions of these artifacts have been installed in the garden, and they all are understood to be perpetual beta objects, always being refined. They mark points in the conversation and embody design decisions and grounding philosophies. Just like other garden artifacts, such as plant supports, they get repurposed and recycled to suit seasonal needs. Thus, these artifacts have been designed so that they might grow and evolve in their environment. This evolutionary becoming is a manifestation of a philosophy arguing that all people should be able to determine the meaning of technologies—not just the creators.[7] Our time in the garden, spent trailing gardeners, talking to people, and observing practices, has been key to the process. We have documented these experiences and our iterative development of artifacts in our digital diaries and reflective documents. The cluster of designs enables our reflection on the overarching research questions, although each artifact, in its own right, also is an example of "materials research," "action research," and "development work."[8]

Knowledge emerged through our particular process of observing, conversing and reflecting, making, observing, conversing and reflecting, altering, and making afresh. The embedded nature of the experiences stimulated some of our key insights. Our process was influenced by our attentiveness to a set of values and design criteria that are embodied in the artifacts and that include the recurrent themes of sensory engagement and *presence*.[9]

The spirit of the garden was at the forefront of decision-making.[10] This principle was drawn directly from Feenberg's "secondary instrumentalization," which reinforces the importance of context and values.[11] Other perspectives inspired by Feenberg's work included a conscious

effort to listen inclusively to a range of voices during the design and development process so that artifacts that could be redefined through ongoing use.

The RtD approach created the space for a "way of knowing" to emerge from people and context. The generative approach felt compatible with the philosophical, facilitating an understanding of the organization and context. It provided opportunities for reflection on the aspects of the designs that supported or detracted from engagement with nature.

Nature Meditation Egg

The Nature Meditation Egg, influenced by the work of Borgmann, was the first of the digital-nature artifacts, and the only one not designed in collaboration with NT gardeners; it was created as a tentative exploration of theory and practice, engaging with the previously established design criteria.

Figure 1

Borgmann criticizes technology, arguing that it provides instant gratification with little effort, thus supporting "paradigmatic consumption."[12] Borgmann states that technological devices are divorced from their context, and that their non-contextual nature emphasizes commodity over intrinsic value. In contrast, "focal things" and practices are grounded in context and so give our lives meaning. The kind of intimate engagement with a "thing" that characterizes a focal relationship requires skill and effort, which is experienced as both "burden" and "delight." In the digital age, focal practices have been eroded because devices are seen as dislocated from context, reducing awareness to context amongst technology users.

However, Borgmann sees a potential future in which focal practices might be asserted within a technological setting. If technologies leave space for these engagements, focal practices might "break the spell of paradigmatic consumption."[13] Deakin's writings about stoking stoves, whittling wood, and living in a rhythm set by the environment also allude to engaged, awakened senses and skills that Borgmann might deem focal practices.[14]

Taking these two perspectives into account,the aim of this design was to stimulate the focal practice of regularly walking one's *home patch* and listening to the natural world. Recordings were used as part of a meditation practice, with the wooden egg as a focal object. Holding the egg for a sustained period of time caused a recording of sounds gathered on previous walks to playback, while letting go caused the audio to fade. The interaction used capacitive sensing (i.e., sensing and detecting change in an electrical field to indicate change in the proximity of a conductive material or touch by the human body) and emphasized slowing down and giving time to the process, enabling reflection at times when the user couldn't be outside.

We made the egg from wood because of its sensory qualities: the way that wood warms in the hand; its smell, texture and weight; and (if partly seasoned) the way it *lives* and changes over time. Its resonant qualities are also attractive. The shape was designed to fit well in cupped hands. Critically, wood is a poor conductor of electricity, and users needed to focus to hold the object so that a change in capacitance could be registered by the metal contacts inside the egg. Similarities might be noted between the egg and the meditation globes of Thieme et al.,[15] which also use object-focused engagements for reflection, although in a different context. The act of designing caused us to reflect on focal practices and how we might draw upon them. Using the egg prompted a more focused attention on the auditory landscape. In addition, it acted as an exemplar of a design shaped by values and stimulated conversations with NT gardeners about the future design for interpreting the garden.

The Rhubaphone

The Walled Kitchen Garden conserves more than 130 varieties of rhubarb as part of the National Collection for two main purposes: Genetic traits are preserved, and the skills to grow and propagate the plants are maintained. However, many people are unaware of the existence of different types of rhubarb because it is often sold without reference to name. Even in the garden, noticing individual varieties can be hard because the broad leaves grow and flop over, covering both stems and plant labels. We decided that our first design should *make present* the overlooked rhubarb collection. This kind of "presencing" reoccurs in nature writing and often indicates a deep quality of engagement.[16] By drawing attention to sensory characteristics, we sought to interrupt or "disrupt" people so that they *noticed* the individuality of varieties like thin, delicate Greengage, and bright red Livingstone.[17] We wanted people to see the colors, feel the texture and shapes, smell freshly cut stems, and discover more about the plants, so we designed the Rhubaphone to encourage these interactions (see Figure 2).

Both the Meditation Egg and the Rhubaphone were presented at the RTD 2015 conference. The Rhubaphone design went through several iterations both before and after RTD 2015, responding to observations of its use in the garden and in the conference presentation spaces.

Figure 2

The current design uses oak from the NT estate to create a stand on which rhubarb stems are clamped side by side. Holding a stem of rhubarb prompts the rhubarb to *talk*; a recording of the Head Gardener telling its story is played through a hosepipe listening device. Letting go of the rhubarb causes the story to end, so sustained contact is required. We consider the Rhubaphone to be the most *finished* of the provisional designs, but it is still under regular review. Over time we have changed its structure, size, location, and digital components, keeping in mind the guiding principles inspired by critical theory: It should fit its context and should foreground the rhubarb collection. To illustrate, in the first season, the Rhubaphone was installed in rooms annexed to the glasshouse, away from the rhubarb beds. Collectively, we felt this placement was at odds with the guiding principles because the rhubarb was perceived as "standing reserve"—that is, a resource simply waiting to be used.[18] We moved the Rhubaphone to a shed adjacent to the beds to reinforce the connection to the rhubarb. We note that Heidegger also cited gardens themselves as "standing reserve," brought under control by technologies, and this conceptual tension remains in the project because we recognize gardens as sites for both life-sustaining and paradigmatic consumption.[19]

At the time of writing, iterations of the Rhubaphone have been operational over several seasons, providing a longitudinal opportunity to garner feedback about how it supports engagement with the natural world. The installation has been overwhelmingly popular with gardeners and visitors, who have variously described it as being "fun" and "innovative." It has satisfied some aims in terms of encouraging people to notice rhubarb and its particularities. Touch has been especially important in foregrounding the rhubarb. One visitor remarked that "it was great fun and it was actually using the raw produce and incorporating that into technology, which I thought was really interesting.… I thought that was really different because you can actually feel and touch the produce." The design also succeeded in highlighting the diversity of rhubarb, and many users found the number of varieties surprising. Most people listened to snippets from several stems; a few listened to all the recordings. Feedback from gardeners and

volunteers has been positive, particularly in relation to engagement with the garden. One gardener commented, "it's just a really, really good alternative way of engaging with different groups of visitors," while a ranger said, "they put their hand 'round it, and there's like this, 'Oh my God! Rhubarb's talking to me.'" Another talked about the "positive vibe" engendered among groups. The Rhubaphone has acted as a catalyst for discussing memories, experiences, and stories in the garden, which form a kind of reconnection through dialogue. Gardeners noted the "care over the materials" that we had taken, and "the fact that so much... is rooted in Clumber [Park]."

Audio Apples

The ideas of "dwelling" and presencing inspired the design of the Audio Apples.[20] Dwelling is almost integral to the practice of the NT gardeners and volunteers who nurture and cultivate the garden. The garden is revealed and made present as they work. The garden could even be understood as an example of a "thing thinging" through the social practice of gardening.[21]

The continuity in the garden was reinforced at a team meeting when a gardener read from the 1888 diary of a former gardener. Although the two were separated by more than a century, the sense of continuity and time compression were remarkable. As part of a lineage of gardeners who have dug the same ground and walked the same paths, the current gardeners are able to act as conduits, disclosing the world of the garden. We chose a mature orchard as the site for the Audio Apples because of its power to draw people off the gravel paths onto the grass. We hoped that the enveloping canopy of the trees would create a space where people's senses were awakened, lending stories increased resonance.

In the installation, "mortals" and "divinities" were brought to the fore through recollections shared by gardeners and volunteers.[22] These recollections were captured and stored on mp3 players enclosed in wooden apples hanging on the trees. When an apple is plucked stories play through a speaker in the base of the apple. The individual, personal stories have a presencing quality that unlocks unseen aspects of the garden. This capacity to make present is echoed in one of the gardener's realizations: "...when you started showing what you could use [the technology] for, then we were really engaged with [it]—and then [we realized that] the stories matter, that that could actually help us unlock the garden, and not just unlock the garden for visitors but share what we love about the garden."

Figure 3

The story-telling process was found to be key to the design. The initial stories, gathered on walks around the garden, had an engaging immediacy, but they were spoiled by auditory disruptions. We were concerned that the task of making a recording in a studio would create a sense of dislocation, and we learned early on that volunteers were reluctant to leave the garden because they loved their time there, and were always busy. Eventually, a quiet fruit store, inside the garden, became an ad hoc studio, so that gardeners and volunteers could walk straight into an audio-recording space connected to the garden.

To ensure the energy of a first telling, a sound technologist, who was new to the site, recorded conversations with volunteers and gardeners and then added ambient sounds from the garden to the recordings.

The first prototypes were made using wooden apples purchased online. Later iterations were made from wood from the park, turned by an Estate Team member who had experience in woodturning. By stepping in to the making process, he added to a communal sense of ownership of the design research, somehow reinforcing the material connection of the hybrid artifact to its

context. One gardener reported an emotional response to the fact that the "beautifully turned object" was made by one of their team members.

The process of making and interacting with the hybrids raised questions about their interventional purpose. The Rhubaphone offered a direct sensory connection to the rhubarb, whereas the Apples mediated to create a space in which a connection could be nurtured. We questioned whether the Apples would get in the way of experiencing the garden directly or they would inspire the emotional connections that contribute to place making. We wondered if the interaction was too "smooth" and effortless,[23] thus emphasizing the passive, paradigmatic consumption of the garden. These questions were unresolved at the time of RTD 2015, when the apples were presented.

Reflections and Developments Post-RTD 2015

With previously highlighted questions unanswered, and prior to the Audio Apples installation, the lead author attended RTD 2015 to share her work with the academic research community. The conference was found to generate both indirect and direct influences, as its insights continued to affect the project throughout the installation of the Audio Apples and significantly altered the author's understanding of the work.

Audio Apple Developments

In keeping with our methodological approach and theoretical grounding, we used open, semi-structured interviews to gather data from visitors, volunteers, and gardeners, and auto-ethnographic practices to reflect on knowledge derived while making artifacts and spending time in the garden. Data were analyzed qualitatively, addressing our initial aims and design lens. Visitor interviews began after installation in the summer following RTD 2015.

The data produced insights about people's experiences of the artifact and its effect on their connection to place: "It's like having a conversation. I mean that one [audio apple] in particular felt like you were having a conversation with the whole garden, and that was interesting as an experience." The same visitor commented that she wished she could take the content away on paper as "something to think about at different times of the year."

Our observations highlighted the difficulties of designing digital interpretation that *belonged* in the garden. Although visitors found the design appropriate, as exemplified by the comment, "[i]t fits in with the landscape really well…," many struggled with unfamiliar interfaces and interactions. Even after using instruction boards, some visitors were tentative and unsure about pulling the apples from the jacks until they had watched others do so successfully.

Our data revealed the different ways that adults and children interacted in the orchard. Adults tended to pluck apples that were closest to the edge of the orchard, listening to one full recording. Children often ran from tree to tree, finding and plucking apples, listening to snippets of content. "Obviously the boys are quite young.... They listened to a few minutes of it and then put it back and then explored the next one. I don't think they really took on much of the story...." Such observations made us consider the kinds of connection that can be made through interaction and content for different audiences and moved us to work with a writer and editor to develop stories rooted in the garden, specifically for children. Some children thought about the garden in light of the stories. For example, one child showed us which tree he thought the treasure (from the story) had been under and then reflected on the story: "[It would be] chaotic… think about it… trees dancing, all their apples would be flying everywhere, on the roof, hitting people in the face…."

Our data also revealed unexpected insights about the role of the artifact in revealing group and individual values within and beyond the team. For example, a gardener described learning about a colleague's relationship to a part of the garden through the Audio Apple recordings. "We usually talk about work in the garden, I never knew [name] felt that way." For this gardener, the artifact "made present" a previously hidden aspect of the garden. An insight about group values emerged through conversations during the development of the Apple prototypes. Gardeners and volunteers asked us: "How will you stop them being stolen?" We understood how seriously this would be felt when someone explained that the artifact was "from the garden and people," and a theft would be an affront. We realized faith in the project could be lost if care wasn't taken to address the potential risk. We responded by incorporating soft (audio reminders) and hard (Bluetooth tracking) design features.

Reflecting on Artifacts in Context

The hybrids have yielded different kinds of knowledge, including a greater understanding of the design and use of digital–nature hybrids for interpretation toward connection in a public garden.. From our observations and conversations, we have learned that Rhubaphone and Audio Apples stimulated new interactions in the garden and new awareness of different aspects of the garden. Some users are "interrupted" by the artifacts and report reflection on the content and garden. For other users, the interactions are novel but do not prompt greater contemplation. With one exception, the content was not designed specifically for children, but the children have enjoyed the interactions, whether they were touching, smelling, and "listening to" rhubarb or running between trees in the orchard. We see value in artifacts that encourage these activities. The artifacts stimulated reminiscence, discussion, inter-generational storytelling, and knowledge sharing, which we consider potentially powerful seeds for further engagement. These artifacts appear to have the greatest effect in bolstering and magnifying existing connections to place and awareness of the natural world. Both incrementally and cumulatively, the artifacts perhaps reinforce a relationship, or prompt effects beyond the visit, although further research over a prolonged period is needed to support the claim. We have seen that the artifacts can also be approached in a light, superficial way, so we have reflected on current designs to find ways to sustain, deeper, and more engaged interactions. These reflections have prompted a new phase in the collaboration.

Reflecting on Epistemic Knowledge in the Garden Team

The artifacts have generated epistemic effects for participants, prompted by their ability to see the designs take root, and mature, in the space. The artifacts catalyzed discussion and reflection about interpretation in the garden, including debate about the appropriateness of materials and which stories we are to be told. "Whenever we've had a conversation about interpretation, it's now really, really different. It's different in tone and it is different in content as well." Personal insights, gained through story sharing with the Audio Apples, have boosted awareness of the value of stories within the team. The garden team has always been active in developing interpretation, but the project has shown team members the potential value of using digital technologies to support *spirit of place*.

Reflecting on the Ongoing Presence of Artifacts

We have become aware of the infrastructure needed to support the growth of these hybrid artifacts and have begun to understand how the designs might be sustained and developed. Prior to RTD 2015, these questions were unresolved, and we were considering the use of spirit of place

exemplars, workshops and a program of visiting makers as ways to maintain and extend the interpretation. Since then we have decided on another strategy: engaging a volunteer who will be embedded in the garden to build understanding from the ground up, when tending to existing hybrids and when developing new interpretations. Spending time, working in the garden, builds fluency derived from practical, hands on experience of the place, a form of knowing-in-action.[24] Volunteers with this working knowledge of the place are potentially be more attuned to the spirit of a place and more sensitive when designing for the context, especially when combined with reflective practice.

Reflecting on the RTD 2015 Conference

The RTD conference series places "artifacts and processes of design at the heart of proceedings,"[25] foregrounding the multiple ways of generating knowledge through design. This perspective feels important because practice-led research can sometimes be treated as a superficial adjunct at conferences, reinforcing negative preconceptions about the value of research gained through making. Encountering and reflecting on diverse knowledge-generating activities at RTD was both inspiring and challenging. For example, Norris's work on polychronic objects made me question whether open exploration with materials would have yielded more about the character of digital–nature hybrids; this question is something I have taken on in my research.[26]

RTD 2015 created a uniquely valuable experience for a small number of researchers, and in so doing rejected "paradigmatic consumption" models of conference delivery. Instead, we as participants were given time and space to interrogate the implications of our shared methodological focus by gathering around the artifacts as the conference's "focal thing."

The RTD conference series is a work in progress—an act of RtD that produces knowledge toward the creation of a conference artifact. The conference provides an "inclusive platform" for "disseminating practice-based design research," according to a recent reflective piece by the conference organizers.[27] Although I acknowledge the critical feedback and reported weaknesses in the conference format discussed in, I also believe the attempts to open the conference design process—through "Town Hall" meetings, critical discussions, and surveys—can help the conference evolve toward its objectives, especially when the conference intent is transparently shared and evaluated. DiSalvo reports the value in this kind of documentation.[28] Indeed, it plays an important role in explaining and demystifying the rationale of conference artifacts to a wider academic audience, which is especially important when participant numbers are limited.

Reflections on the Influence of RTD 2015

RTD 2015 had a profound effect on me and continues to provoke me. I find myself returning to particular moments: notably, one of the Provocations and two roundtable ("Rooms of Interest") sessions, which I found challenging to my work and that raised questions in discussion around my presented artifacts. Does the use both of philosophy and of predefined questions at the start of the research project diminish the RtD process by driving or guiding it too rigidly, causing self-fulfilling design? Would designing more openly and seeing where the design process led have been a better approach, so that patterns and knowledge could be drawn out from the group of designs, as was shown in Peeters's annotated portfolio?[29] I reflected on these questions when I returned to the garden. Although the Audio Apples were developed to the point of installation, I reviewed my data collection process to try to ensure an openness that could challenge any tendency toward self-fulfilling prophecy.

RTD 2015 provided exposure to other approaches to design-led inquiry and how these approaches might uncover different kinds of knowledge. The questions I articulated at the start of the research process were held loosely, so that the project was able to set its own trajectory, revealing epistemic value outside my initial area of focus. Nevertheless, the conference has made me think about my process, the instances of knowledge generation, and how both might be communicated to others.

Drawing a parallel between the discursive spaces created by the conference and the garden projects demonstrates how some spaces are particularly well suited to sharing and co-creating understanding. At the NT property, volunteers and gardeners gather in the kitchen through the day for breaks, briefings, and chats about plans for the garden. The hybrid artifacts were brought to this roundtable at NT, just as the artifacts had been brought to the roundtable discussions in the RTD Rooms of Interest. Although the formality and intent differed in the two contexts, they echoed one another in the process of passing objects around a table for community interrogation and discussion.

Conclusion

In this paper, we describe a design-led inquiry in which we gathered insights from a charitable trust garden, the seasons, the weather, the visitors, the people who work and volunteer there, and the organizational structure and values. With all this input, we can design more sensitively so that the digital technologies of interpretation are not divorced from their context, but incorporate a wider set of values and voices, as advocated by Feenberg.[30] Our insights have been developed from a combination of the researchers' *embeddedness* in the setting and a methodological approach that prioritized making-in-place as a way to build knowledge. The artifacts and the process of their design created a space for conversation and experience where each design iteration could reveal understandings about materials, values, engagement, and place. Looking to the future, the artifacts' developments continue to prompt ongoing conversations that occur both in, and between, the research site and the academic conference. They are held in the experience of the researchers and then carried forward in their further making and contributions to academic discourse. The designs have had qualified success in prompting new understandings of the garden, but the depth of engagement appears to be influenced by existing connections to the garden or other natural places. Further research will explore design to inspire new connections or build longer-lasting engagements.

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[1] See Stephen Moss, *Natural Childhood Report - National Trust* (National Trust, 2012) www.nationaltrust.org.uk/documents/read-our-natural-childhood-report.pdf (accessed May 13, 2016); National Trust*, Reconnecting Children with Nature: Findings of the Natural Childhood Inquiry* (National Trust, 2012), www.nationaltrust.org.uk/document-

1355773744553/ (accessed January 16, 2015); and Royal Society for the Protection of Birds, *Connecting with Nature: Finding Out How Connected to Nature the UK's Children Are* (RSPB, 2013), www.rspb.org.uk/Images/connecting-with-nature_tcm9-354603.pdf (accessed 1/16/2015).

[2] Judith Burns, "Children Urged to Put Away Screens and Play Outside," *BBC*, October 25, 2013, www.bbc.co.uk/news/education-24670232 (accessed October 25, 2013).

[3] Andrew Feenberg, *Between Reason and Experience: Essays in Technology and Modernity* (Cambridge, MA: MIT Press, 2010).

[4] For example Albert Borgmann, Technology and the Character of Contemporary Life, A Philosophical Inquiry (Chicago, The University of Chicago Press, 1984); *Andrew Feenberg, Transforming Technology: A Critical Theory Revisited* (New York, Oxford University Press, 2002); and Martin Heidegger, *Poetry, Language, Thought* (New York: Harper & Row, 1971);

[5] William Gaver, "What Should We Expect from Research Through Design?" *Proceedings of the 2012 ACM Annual Conference on Human Factors in Computing Systems (CHI '12)* (New York: ACM, 2012), 937–46.

[6] James C. Edwards, "The Thinging of the Thing: The Ethic of Conditionality in Heidegger's Later Work," in *A Companion to Heidegger,* eds. Hubert Dreyfus and Mark Wrathall (Oxford: Blackwell Publishing, 2005), 456–67.

[7] Feenberg, *Between Reason and Experience*," 53–55 and 107–108

[8] Christopher Frayling, "Research in Art and Design," *Royal College of Art and Design Papers* 1 (1993): 1–5.

[9] Heidegger, *Poetry, Language, Thought,* 164–175; and Edwards, "The Thinging of the Thing," 456–67.

[10] Nicola J. Bidwell and David Browning, "Pursuing Genius Loci: Interaction Design and Natural Places," *Personal and Ubiquitous Computing* 14 (2009): 15–30; and Katy Lithgow et al., *Conservation Principles* (National Trust), www.nationaltrust.org.uk/documents/conservation-principles.pdf# (accessed October 12, 2016).

[11] Feenberg, *Between Reason and Experience*, 98–103.

[12] Albert Borgmann, "The Moral Complexion of Consumption," *Journal of Consumer Research* 26 (2000): 419–22. Paradigmatic consumption represents a physically, and mentally, debilitating destruction of focal practices and is inexorably intertwined with the culture of technology. Paradigmatic consumption describes an excessive, out of balance form of consumption where, disburdenment provides freedom from effort and the limitless availability of consumer goods provide prosperity at a price.

[13] Ibid., 422.

[14] Roger Deakin, *Wildwood: A Journey Through Trees* (London: Penguin Books, 2008), 105–9.

[15] Anja Thieme et al., "Design to Promote Mindfulness Practice and Sense of Self for Vulnerable Women in Secure Hospital Services," *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13)* (New York: ACM, 2013), 2647–56.

[16] Heidegger, *Poetry, Language, Thought*, 148.

[17] Edwards, "The Thinging of the Thing," 460, 465; Heidegger, *Poetry, Language, Thought*, 172. Heidegger describes things that "stay a while." Their presence is felt, in contrast with technologies which slip into the background, barely noticed. As an example Edwards describes the texture of the handle of a coffee cup that catches our attention and disrupts the usual flow of our routine as we stop to wonder about its creation. He contrasts it with a plastic toothbrush that disappears into the background through use and aids our speedy, unthinking progress through the day.

[18] Edwards, "The Thinging of the Thing," 458–460

[19] Borgmann, "The Moral Complexion of Consumption," 418–22.

[20] Heidegger, *Poetry, Language, Thought*.

[21] Ibid. 175 Heidegger describes a thing thinging as the result of a particular gathering that reveals both the thing and a specific world that exists temporarily around that thing.

[22] Ibid. 147–157 Mortals and divinities are two of the elements described in Heidegger's concept of the fourfold, which are central to his understanding of presencing. When a thing is at the intersection of the elements that make up the fourfold it becomes present to us, as a thing thinging and we become aware of its nature.

[23] Edwards, "The Thinging of the Thing," 456–67; and Borgmann, "The Moral Complexion of Consumption," 418–22. Edwards describes a set of mass produced products including coffee cups and Grape Nuts. The fact that they can't be distinguished means they disappear in use. We don't pay attention to these smooth, unconditional products so they are standing reserve, waiting to be called to use. We did not want our designs to be so smooth that they slipped from view, becoming standing reserve. Borgmann critiques the device paradigm in which modern technology provides easily available commodity. We wanted our designs to be effortful and distinctive enough to prompt interruption and reflection.

[24] For "knowing-in-action," see Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (Aldershot, England: Avebury, 1991). Schon explains knowing-in-action as tacit and often unconscious knowing, demonstrated in the skilled actions of experienced. Reflection-in-action occurs when one is surprised in the midst of an action, by something one does not expect because of embedded experiential knowledge (knowing-in-action). It prompts immediate reflection on what is happening, why it happened and it stimulates a response. Reflection-on-practice is a deliberate reflective process that takes places after action. The design frame we use is highly compatible with experiential, knowledge-in-action, combined with reflection-in and reflection-on practice.

[25] Abigail Durrant et al., "Developing a Dialogical Platform for Disseminating Research Through Design," *Constructivist Foundations* 11, (2015): 11.

[26] Jane Norris, "Making Polychronic Objects," *Proceedings of the 2nd Biennial Research Through Design Conference* (RTD2015), Cambridge, UK (2015): 2–8. See Norris's article in this issue of *Design Issues* 33, no. 3 (Summer 2017), insert page range. (

[27] Durrant, "Developing a Dialogical Platform," 8

[28] Carl DiSalvo, "Disseminating Research Through Design—Challenges and Opportunities Learned," *Constructivist Foundations* 11 (2015): 22–23.

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[30] Feenberg, *Between Reason and Experience*. 107 - 108