Pace Layers and Research Products

David Chatting
Open Lab, Newcastle University
Newcastle upon Tyne, UK
david@davidchatting.com

Caroline Claisse
Open Lab, Newcastle University
Newcastle upon Tyne, UK
caroline.claisse@newcastle.ac.uk

Sara Wolf
Chair of Psychological Ergonomics,
Julius-Maximilians-Universität
Würzburg
Würzburg, Germany
sara.wolf@uni-wuerzburg.de

Ben Morris
Open Lab, Newcastle University
Newcastle upon Tyne, UK
ben.morris@newcastle.ac.uk

Abigail C Durrant
Open Lab, Newcastle University
Newcastle upon Tyne, UK
abigail.durrant@newcastle.ac.uk

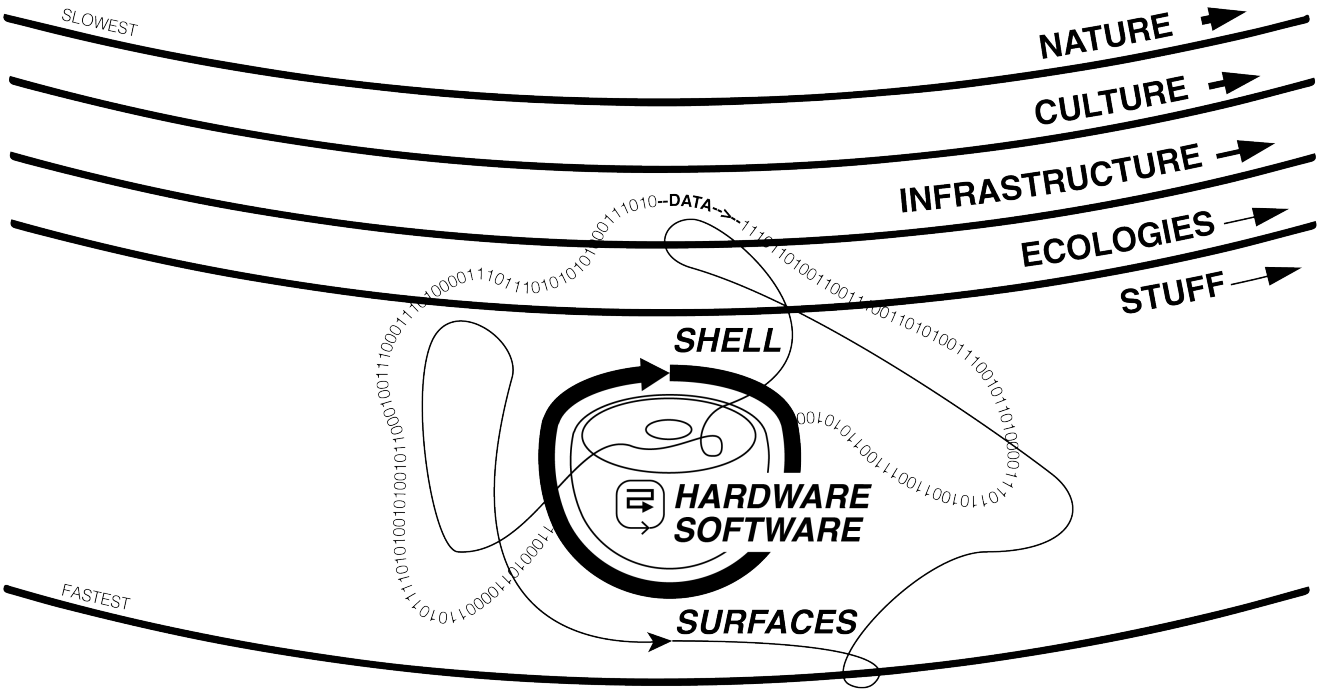

Figure 1. The Pace Layers of Research Products, after Brand [3].

Abstract

This short paper for the CHI '25 workshop on *Research Products and Time: When, For How Long, and Then What?* is intended to name some of the ways our designs can encounter and manipulate different rates of change, either as an *inquiry-driven* Research Product or as a design proposition for an alternative. This is necessarily a work-in-progress, a form of our research thinking seeking a reflective and critical public. Having introduced our Research Through Design inquiry, we will consider the Pace Layers present in our design and influence its operation, before offering some questions to the workshop. In doing so, our intention is to broaden our conception of how our design and design research can operate in and with time.

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1 The Resound Sphere

Building on our autoethnographic work in a Buddhist community responding to the COVID pandemic [8], we have previously described our Research Through Design (RTD) response that proposes an alternative techno-spiritual practice of remote chanting, mediated through a connected Research Product, our Resound sphere [7]. The sphere contains a speaker, microphone, and WiFi-connected microcontroller, capable of abstractly reproducing the frequency of the chants from remote community members. For this CHI '25 workshop on *Research Products and Time: When, For How Long, and Then What?* [1] we want to consider the sphere in terms of the Pace Layers [3, 5, 6] of its design and operation, as both an *inquiry-driven* Research Product [12] and a design proposition.

2 Pace Layers

Figure 1 situates and decomposes the Resound sphere in and into layers operating at different paces of change, drawing on Stewart Brand's original conception [2, 3]. This includes layers we have previously identified in the Resound sphere, namely: the *Shell*, *Hardware*, *Software*, and *Surfaces* [7], where each layer was designed with deliberate affordance to change enabling an emergent RTD inquiry [5, 6, 9]. The additional layers of *Stuff*, *Ecologies*, *Infrastructure*, *Data*, *Culture*, and *Nature* situate the Research Product in large-scale and longer-term processes – which can shape or be shaped by our design work.

Using the example of the Resound sphere, we will now enumerate these layers and offer some initial consideration of each.

2.1 Shell, Hardware, Software and Surfaces

These layers constitute the immediate and tangible aspects of the Resound sphere, which would be readily considered to materially be the Research Product. The *Shell* physically encloses the internal components of the sphere and creates its visible external presentation to users; it is the subject of much of our efforts in creating the *fit* and *finish* demanded by a resilient Research Product.

The *Hardware* includes the electronics and sensors, defining the range of technical effects that can be achieved. The ways these elements are interconnected can be more or less resistant to change – in that more or less work and time is required to enact change. Here the design and manufacture of a PCB solidifies some behavioral potential of the sphere – both against deliberate modification or accidental wear and tear in the field. The *Shell* and *Hardware* were defined early in our inquiry and helpfully constrained the design work that followed.

The *Software* layer is the most malleable layer of the Resound sphere, allowing for explorations of alternative orchestrations and configurations of the *Hardware* or even changes in use once deployed. We can also make decisions about the form of the *Software*, be it a compiled binary (hard) or an interpreted script (soft), that orients to change over time in different ways.

The *Software* layer also defines much of the fast-paced interaction with the user, that is experienced through the *Surfaces* layer. The *Surfaces* layer defines the design's inputs and outputs, including its use of sound and light, that create *Sensory Volumes* around the Research Product.

2.2 Stuff, Ecologies, and Infrastructure

The Resound sphere can be seen as an example of domestic connected electronic *Stuff*. We borrow this term from Stewart Brand's related architectural conception of the *Shearing Layers*, where *"Stuff – Chairs, desks, phones, pictures; kitchen appliances, lamps, hairbrushes; all the things that twitch around daily to monthly."* [2, p. 13].

While Research Products tend to operate as *Stuff* [4], they will frequently implicate and require an *Ecology* or assemblage of other *Stuff* for their operation. Furthermore, networking technologies allow this *Ecology* of reliant *Stuff* to be remotely constructed. In this way, the Resound sphere requires the paraphernalia of the existent chanting practice (an altar, bells, beads), electricity adapters for power, a remote community using compatible devices, and remote Internet servers. It is tempting to see these servers as infrastructural, but they are not as permanent as we might like to think. Unless these servers run specific software services at known locations, the domestic connected electronic *Stuff* can be rendered useless. A common fate for commercial IoT devices.

Nonetheless, Research Products will no doubt meet some true *Infrastructure*, operating at a slower pace of change and with more reliance than *Ecologies*. For the Resound sphere, these *Infrastructures* include mains electricity, data networks, and arguably the availability of local WiFi networks.

2.3 Culture and Nature

The slowest pace of change is to be found in the *Culture* and *Nature* layers, which contextualise and ground all the previous layers. The *Culture* layer contains the long-term values and systems by which we live and that make a design seem *useful* or not. For the Resound inquiry, this importantly includes the concerns of spiritualism and religion, and specifically Buddhism. The *Nature* layer then contains the more-than-human [13] and situates our designs in the context of the climate crisis, and its use of resources and materials. For Resound the *Culture* and *Nature* layers demand that we consider how our design responds to time periods beyond an immediate short-term deployment and study, how it would be relevant and useful in ten or fifty years, and how a device might be repaired or remade. In doing so, it changes the design proposition we make today.

2.4 Data

Finally, *Data* operates between the layers (at least *Infrastructure*, *Ecologies*, and *Stuff*) and as such demands some alignment – data seems to have quite a different quality to the other layers described here. In designing Research Products, we must design data – what representations it makes of the world, where it leaves traces, and for whose cost and whose profit. In this spirit, the Resound proposition seeks to produce and store the least possible amount of data, which in turn simplifies the server design and minimises the potential for surveillant practices[14].

3 Questions for the Workshop

In working with these pace layers our designs attempt to serve a dual purpose: as Research Products that support emergent inquiries and then as propositions for an alternative. This creates tensions for us as design researchers, especially when slower-paced layers go beyond the reach of empirical methods, into more speculative territories. In what designs can we see these two purposes successfully coexist?

As we seek ways to do design research that responds to the slower layers of *Culture* and *Nature*, what can be learned from previous conceptions of temporal design, such as Slow Technology [10, 11]?

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