

Design for Reappearance in Smart Technologies

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ABSTRACT

This short position paper outlines the REAPPEAR project, which seeks to prototype new metaphors and design patterns for smart devices allowing users to make informed decisions about privacy and security. As computers have increasingly “disappeared” and with it our awareness of their intent, we will ask instead how the computer might “reappear” in our interactions with IoT at three scales of interest: the body, the home, and the city. This is pursued through design research with the intention of producing reusable design patterns for designers and developers.

1 Introduction

The “disappearing computer” [9,14,16], a goal that has existed in ubiquitous computing for 30 years, is a perfect description of modern consumer IoT products. As the Internet has become more ingrained in our lives, it has also become more ingrained into the products we encounter. However, as we have come to understand, this ubiquitous computing is predicated on surveillance [17] – an invisible computer by way of a visible user.

While many smart devices resemble products we have used for a long time – like speakers – they are now intelligent devices with a complex web of connections across the world. These connections make them more intelligent and useful, but also make them behave in ways and bring about consequences that can be difficult to understand or predict. The opaque relationship between Things and the Internet makes it difficult for us to understand how personal data is being collected and used, or what other vulnerabilities devices might be introducing into our lives. This is visible in the difficulty of maintaining privacy and consent around devices like Amazon’s Echo: a person entering a home may not even be aware they are being listened to, let alone what data is being collected and how it might be used.

This issue is exacerbated by the nature of IoT, which is widely distributed in its structure and yet highly centralised in terms of control. Particularly when combined with artificial intelligence, the capabilities of these devices can be much greater than they appear and much less under our control. This inscrutability has

led to IoT being described as a hyperobject, so massively distributed in time and space as to be incomprehensible [7], or more colloquially as “TARDIS-like” – bigger on the inside [15]. The question is then how we relate as designers and users to this (possibly unknowable) complexity.

Design has been complicit in helping the computer to disappear by creating slick, “appy” [10] devices that work to hide the complexity of the “cloud” behind simple interfaces and familiar metaphors; indeed, as Fass et al. point out it is the literal function of an interface to create such “black boxes” [4]. However, such disappearance can give rise to “network anxieties” [10] in end-users about the hidden negative effects of devices. When considered alongside scholarship like Zuboff’s *Surveillance Capitalism* [17], these anxieties may not be unfounded.

To take a simple example, an Amazon Echo’s form borrows from speaker devices that exist only to play audio, but its most interesting and powerful features are its microphone, internet connection and the services it connects to. Rather than a smart speaker, it would be better understood as a smart microphone, a sophisticated internet-connected device centred on listening. Of course, had this been the metaphor employed by Amazon, it is difficult to imagine the Echo being as popular as it is today. In this sense IoT devices become containers for an almost infinite number of services and a vast array of sensors – containers in which much can be hidden.

Design is then capable of responding to these challenges and envisioning alternative approaches. Just as computers have ‘disappeared’ into common objects, our project will ask how we might cause the computer to ‘reappear’. REAPPEAR will use design research approaches to explore consumers’ understandings (or misunderstandings) of the activities of smart devices and bring together practitioners with end-users to develop a shared vision for the future of IoT that prioritises consent, transparency and understandability, allowing end-users to make more informed decisions about their privacy and security. Based on the outcomes of these discussions, we will develop examples of new design patterns and metaphors for smart devices that and develop demonstrator prototypes of what these might look like in action.

This short position paper outlines our REAPPEAR project, the method (design research) and the intended outcomes (reusable design patterns). Implicate in our approach is a close technical engagement with the systems we wish to critique, through which we develop our own designerly understandings.

2 Design Research

Our design research focuses on three interrelated human-centred scales of IoT: the body, the home, and the city. Initially we seek to stage a reappearance of some of this complexity with users as a provocation for situated discussion and speculation, through which we intend to surface anxieties and inspiration for alternative design patterns at each scale. This will be achieved through the development of probes for the use of participants, in the tradition of Cultural Probes [6]. Our probes will reveal some aspects of IoT that had previously been disappeared. As such they will be technically mediated, and, in this respect, are informed by probe designs such as the listening glass, dream recorder (digital memo-taker) and disposable cameras [2]. To indicate our current thinking let us briefly consider how this might be applied at our three scales of interest.

The Body. IoT intimately relates to the body through wearable technologies, equipped with a growing number of sensors and outputs, with opportunities to consume and produce data in the cloud. This seems in greatest tension for data that reflects the performance of employees – especially those with precariously casual contracts, who tend to be implicated in the delivery of very IoT driven services of our study. Sainato reports the words of an Amazon delivery driver, “*I’m very concerned about the AI technology being installed in the vans, and being seen while I am urinating is just one of my concerns*” [12]. As Qadri describes, once revealed there can be ways by which workers might then struggle with the system [11] and this is suggestive of the kind of probes we might make and the ethical concerns we must confront.

The Home. The privacy and security concerns of the home from the perspective of IoT have already received a good deal of attention, for instance in the issues raised by smart speakers. We intend to focus on the relatively new phenomena of corporate mesh networking, exemplified by Amazon Sidewalk (amazon.com/Amazon-Sidewalk), which will allow Amazon devices to reach the Internet via other Amazon devices, regardless of who owns them. Such networks are able to circumvent the home router and our mental model of the internet as a utility and thus operate without oversight. Our probe will attempt to illustrate this subtle, but important, shift in control.

The City. Likewise, our experience of public space is already being shaped by IoT, but in ways that are often not apparent [3]. We intend to ground our work in one particular shopping street in Newcastle-upon-Tyne, Northumberland Street – originally part of the Great North Road from London to Edinburgh. Through our early explorations it is clear that this street has a rich lively electronic landscape of local authority, commercial and private infrastructure. New arrivals, like an electronic scooter hire scheme, create new engagement opportunities that are defined by new opaque contractual and geographic (geo-fenced) relations. Our intended probe for the city will create situated experiences in which participants can engage in speculative interactions with the existing infrastructure – this will share some of the playful spirit of Pan Studio’s Hello Lamp Post (2013), as described by Nijholt [8].

3 Design Patterns for Reappearance

The intended outcome of the REAPPEAR project is a set of reusable design patterns that can be practically applied in commercial design and are generated through a process that furthers academic design research. These design patterns will prioritize ways of making the operation of devices reappear and so presumably more trustworthy and less anxiety inducing – or at the very least, more scrutable. Beyond the identification of the patterns themselves, that emerge from our design research, our challenge is to find forms that intermediate between us and commercial designers and developers.

While the notion of a design pattern tends to be colloquially understood in the HCI community, a closer inspection offers some guidance on their forms and formality. The *gang of four’s* hugely influential book *Design Patterns* [5] introduced 23 patterns for object-oriented software that are widely used today. For each they showed how they could be identified and then implemented through textual description, diagramming and code examples in the C++ language – each catalogued in the same formal way. The influence of Christopher Alexander’s *A Pattern Language* is acknowledged [1], which presented 253 interrelated patterns intended to form a language for architectural projects be they towns, buildings, or rooms. Again, these are presented formally and in rich detail. An explicit acknowledgement of scale and way of organising patterns accordingly is helpful to our understanding of design pattern in that it allows us to simply map our own scales of interest (the body, the home, and the city). It also allows us to consider large-scale design patterns – such as the reappearing computing or metaphors like the cloud.

Our challenge is to develop a set of applicable design patterns that address reappearance and trust, that can speak in the terms of commercial designers and developers with a degree of directness. This will start with careful pattern naming, will include examples of existing systems, then provide description and diagrams; for patterns with a high degree of specificity likely also sample code or reference to software libraries. Once in draft we will refine these with our commercial partners. We hope that these patterns ultimately might find wide adoption and influence future IoT products in which we can reasonably trust.

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