Fostering IoT Repair Through Care: Learning from Emotional Durable Gaming Practices and Communities

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ABSTRACT

Electronic waste (e-waste) has become the fastest growing waste stream in the world. So called 'smart' Internet of Things (IoT) devices, now ubiquitous in our homes, are increasingly contributing to this waste stream, due to their lack of repairability and consumer cycles driven by planned obsolescence. However, other electronic household products, such as gaming devices, are often used and *cared* for by their owners for far longer than other IoT devices, whose protean lifecycles are driven by fast moving, profit-focussed consumer markets. This paper argues that by developing a deeper understanding of the relationship between *gamers* and their devices, and the communities they inhabit, design practitioners and researchers can learn to engender the design of IoT products that foster emotional durability and care, and support the development of more sustainable repair practices, to tangibly improve the lifespans of next generation IoT products.

CCS CONCEPTS

• **Human Centered Computing, Collaborative and social computing, Collaborative and social computing theory, concepts and paradigms**;

KEYWORDS

Gaming Communities, Repair, Emotionally Durable Design, Internet of Things

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1 INTRODUCTION

In 2021, there was 57.4 MT of electronic waste (e-waste) produced globally, of which less than 20% was recycled, and the majority was instead often sent to landfill and/or exported to Global South countries [1]. E-waste is now the fastest growing waste stream in the world [2], and the UK is generating the second-highest amount of e-waste per capita globally [3]. Rising quantities of e-waste is being produced by so called 'smart' Internet of Things (IoT) devices [4]. Combining material hardware with digital functionality, everyday IoT products, like thermostats, watches, speakers, washing machines, doorbells, security systems and sockets, have become commonplace in households across the globe [5] but most prominently in more affluent Global North societies. By appearing to offer improved efficiency, safety, health, and entertainment benefits [6] IoT devices can be a compelling purchase option for of many today's consumers. However, these products are also environmentally, socially and economically problematic due to their 'hidden', implicit design specifications: like lack of repairability [7]; poor worker welfare and lack of fair trade during their production phase [8]; and the growing cybersecurity and privacy risks they pose [9]. These design constraints regularly lead to the planned obsolescence [10] of such devices. IoT devices are also susceptible to becoming bricked, referring to the device becoming non-functional (as useful as a brick). This can happen for many reasons, such as companies deciding to remove access to the systems supporting a product so it is no longer able to function [11, 12], or malware rendering a device inoperable, or technology advancing more than the device can support without hardware upgrades [13]. Many of the causes for IoT devices becoming bricked are imposed on consumers by companies, and are premeditated, as opposed to unpredictable malicious attacks (i.e. Silex Malware [14]) or actual damage to the device. In addition to their poor design and unhealthy consumer cycles that encourage replacement or upgrading of IoT products, unsustainable end-of-life management [15, 16] is another problematic facet of the IoT product-service paradigm. This includes how IoT products are disposed of, where, if, and how, which raises questions about ownership, and corporate vs consumer responsibility for end-of-life management. The potential harms IoT products pose [5, 17] are further compounded by the way most IoT devices are designed to operate seamlessly and inconspicuously as part of our everyday lives, in keeping with ubiquitous computing ideals [18]. This can mean that users are less likely to feel emotionally connected to their IoT devices, and therefore are less likely to maintain and repair them if they become damaged or non-functional [19, 20], and are also more likely to replace devices prematurely even if still functioning [21] further supporting a throw-away culture.

However, this disconnect between users and their product is not true of all devices that fall within the IoT paradigm. For example, computer gaming devices (which represents some of first devices to possess IoT attributes including connectivity, sensory, and telemetry competencies) are often used and cared for by their owners for far longer than other IoT devices, whose protean lifecycles are driven by fast moving, profit-focused consumer markets. This paper explores how these more profound relations between

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people and their material/digital products are forged and the benefits this knowledge may bring to the design of future consumer IoT devices – specifically regarding fostering better sustainable care and repair. In 2023, we conducted a series of Participatory Design workshops [22] with cross-sector stakeholders including technologists, waste management experts, policymakers. We also invited members of gaming communities[1] and facilitated this set of participants in exploring sustainability issues like repair, care and broader circularity through the lens of their gaming devices, practices and communities. Our aim was to better understand individuals' gaming identities, their community networks, and their perceptions and experiences of hardware/software repair. This paper argues that by developing a deeper understanding of the relationship between gamers and their devices, and the communities they inhabit, design practitioners and researchers can learn to engender the design of IoT products that foster emotional durability [23, 24] and care, to support the development of more sustainable repair practices and improve the lifespans of next generation IoT products.

2 EMOTIONALLY DURABLE DESIGN

This paper principally draws upon literature from Emotionally Durable Design [23, 24] and Participatory Design [22]. Regarding the former, Haines-Gadd, Chapman, Lloyd, Mason and Aliakseyeu identify that Emotionally Durable Design:

> "examines and articulates the unspoken emotional experiences that occur between products and consumers, seeking to uncover the complex emotional drivers for why we use, consume, and discard some products faster than others. This view encourages a reduction in consumption and waste of natural resources by encouraging more durable, resilient relationships with products; highlighting, that Product longevity needs to be concerned with not only the physical lifetime but also the psychological lifetime of the product as there is little use in designing products to last longer if the user has no desire to keep them." [23]

3 WORKSHOP SERIES

Building upon the above key theories, in 2023, we ran a series of workshops as part of the broader IoT repair research agenda we are conducting through the Fixing the Future: The Right-to-Repair and Equal IoT project. Workshop 2 invited members of gaming communities, including casual gamers, academic researchers, fan fiction writers, content creators and people working in professional gaming industry. It was necessary to keep the workshop to a small number of participants as they were being invited to engage in storytelling [25] to share their experiences. This format afforded each participant the time and space to provide detailed insights. The workshop was audio recorded as well as participants recording their thoughts on sticky notes using the digital whiteboard website Miro. A combination of narrative inquiry [26] and thematic analysis [27] was used to analyse the data collected. The workshop was divided into three main activities to elicit insights regards the relationship between IoT, gaming and sustainability: a self-reflection, a discussion on repair, and worldbuilding exercise [28].

The self-reflection activity asked participants to explore questions on the themes of community, ownership and play. Participants were given time to reflect on the questions individually and then each person's profile was explored as a group. This process invited participants to share stories about their gaming identities, memories and aspects they highlighted as important. Themes that strongly emerged here were Memories and Nostalgia. Participants were able to recall specific memories with family members, such as Participant 4 playing Snake on their phone with their Grandma, or Participant 3 who recalled that their Dad "has always been a gamer - I remember him playing Doom on the family PC when I was little, and he let me watch him play Half Life before he bought me and my brother our first console". And Participant 2 said their favourite game was "World of Warcraft, for all the memories and thousands of hours on it and gameplay". These shared experiences with family members highlight the deep emotional association the participants share with their devices, as does participants dedicating large quantities of time to play demonstrates how prominently gaming has featured in participants lives.

Activity 2 was a focused discussion on repair, inviting participants to consider aspects such as lifespan, modding[2], upgrading and repair of gaming devices and ultimately consider the similarities and differences between their relationship with their IoT devices and their gaming devices. Participants highlighted a key difference was how they interact with these different devices, describing how gaming devices use "kinaesthetic interaction - doing rather than asking". They asserted this creates a "better, more meaningful interaction" between them as a user and their game device(s), compared to their other IoT device interactions, which are largely verbal or app based. Another facet of gaming devices that generated emotional connection was the customisability of games. Participants felt that using game mods (see footnote 2 - modding) helped to support roleplaying in games, and personalisation allows them to create "the thing I want to see in the game". One participant also said: "keeping hold of older games is important to me because game companies lose IPs or refuse to sell them beyond a certain point because they don't want to continue support for them. Abandonware is such an important archiving process for gamers." Many games companies have started to capitalise on this, by offering remastered versions of classic games (though there is obvious financial gain to making these available, so how philanthropic an act this is, is questionable). However, it does highlight the role games manufacturers play in gaming communities. Many games companies are highly receptive to their users and establish official lines of communications (such as feedback forums, or early access passes) with them to help improve users play experiences. Finally, participants highlighted that they would also often choose "replacement over repair" of IoT devices because it's "very difficult to repair [them] ourselves" and there is a risk of "breaking warranty and [the] device itself", whereas they indicated they would feel more motivated to attempt to repair their gaming devices.

[1] By members of gaming communities, we are referring to gamers - individuals that play with/own/ are fans of computer games/gaming devices or their work is related to computer games or gaming devices.

[2] The act of modifying hardware or software to perform new functions, not intended by the original designer/programmer.

Figure 1: Participant 2's Nintendo Gameboy Colour circa 1998.

All of the participants we sampled still owned gaming consoles dating back to as early as the late 1980s. They described how they had tried to keep these functional, from simple methods such as buying adapter cables, to more comprehensive repair methods such as following instructional repair videos. Participant 2, who works for a gaming company, shared "I have a Gameboy Colour [bought at age 16] that I've repaired myself, and is still in working condition" (see Figure 1), explaining they recently fixed it by following a YouTube repair tutorial.

Activity 3 posed the question "How can we build a better, more sustainable world?" inviting participants to engage in a worldbuilding discussion, exploring "What would better designed IoT and gaming hardware and software look like?" and "How could people be encouraged to keep their IoT devices for longer?" Participants identified that repair is difficult due not only to the complexity of devices but also how that information is communicated to consumers and how finding it can be a "very manual [process]- you have to search for it – [it's] hard to find". They felt "making information easier for laymen to understand" would also help to encourage repair attempts, but the fact this information is difficult to locate highlights a broader issue that manufacturers are not routinely providing this information to consumers, so are actively discouraging repair. Another potential solution that the participants highlighted for tackling software issues was utilising "community patches[3]" to create updates for devices so they could "run on newer systems". This is something which manufacturers could support by making software open source. The participants also suggested the "removal of planned obsolescence" and that "we need to slow down" our rate of consumer consumption, but it is also very difficult for a consumer to make informed choices, as they are often encouraged to buy more rather than buying what they really need or actually want. One participant also suggested that a way to create a connection between consumers and their IoT devices could be through game incentives [29], using the example of a Tamagotchi, and the dopamine hit you are rewarded with by keeping the digital pet alive.

We posit that gaming devices are a good example of a product which can have high emotional durability in comparison to IoT devices. Gaming devices facilitate play, the games they offer also often facilitate relationship building [30]. For example, different game modes that connect you to other players online such as Multiplayer Online games or in person such as Couch Co-Op or Local Multiplayer. These offer the opportunity to interact with other people, forge friendships, share hobbies and interests; but also participate in unique social experiences specific to a game, for example the We are all Bananas videos that trended during early 2024 on TikTok, in which 5 Fortnite players wearing the Peely Banana Skin (a Fortnite character outfit that looks like a banana) spontaneously decide to dance together rather than shoot each other, contravening Fortnite's Battle Royale gameplay. Gamers also usually belong to gaming communities, and even if they play a passive role, this membership also helps to foster an emotional connection with their gaming devices. These communities also often bridge the gap between entertainment and socializing, but also work (there are now many careers specifically about gaming), so become significant across different facets of people's lives. Gaming communities have a long history of engaging in virtual conversations and knowledge exchange via forums and online platforms (i.e. Discord), such as sharing how-to guides to get past difficult sections of games, or reporting bugs in games, or to connect with likeminded people.

The design of IoT devices does not help to foster a sense of care for them. They operate seamlessly and inconspicuously, the interactions that occur between user and device are usually directives, and they often operate in closed systems (perhaps to protect users' security) but resultantly does not facilitate social activities. In comparison, computer games are often played with people (or at least have the capability to), and through these shared interactions the devices often become imbued with memories, further strengthening the connection a user feels to their device. This sense of care and warmth a user has for their device does not seem to be as common with IoT devices, in fact relationships between user and IoT devices are often highly dysfunctional, for example if the verbal abuse an Amazon Alexa is subject to when they fail to function correctly [31, 32] was aimed at a person, it would likely be considered abusive.

The creation of, and participation within gaming communities contributes to device owners finding it more difficult to dispose of their devices, as they view them as more than just a source of entertainment but a tangible reminder of their connection to others [33], and some in gamer communities argue that games should be played on the original devices they were designed for rather than simulators if the same experience is to be truly replicated [34]. This is starkly contrasted with IoT devices which are often viewed more passively [35], as inanimate, or a tool to be used to perform a task.

[3]Community patches refer to unofficial fixes generated by third parties (not the original developer) to fix bugs or shortcomings in software.

4 CONCLUSION

Whilst this research is emergent, it represents a novel opportunity to explore barriers to IoT repair by considering edge case users. To summerise our findings thus far:

- Gaming devices often have longer lifespans than their consumer lifespan due to their intrinsic personal value.
- Gamers are often part of vast communities and networks forged by a shared interest in gaming devices and computer games.
- Gamers may be more likely to attempt to repair their gaming devices than their IoT devices.
- Games are inherently designed to provide a meaningful experience through play.

We argue that if it is possible to better understand why and how a user's view of an IoT device changes, future products could be designed aiming at this, which could result in reducing premature disposal of IoT products and increase repair attempts. Additionally, if repair is more prominently on the consumers agenda when making buying decisions, manufacturers may more routinely design products to facilitate this, and meet consumer demands. Consequently, the next step for this research is to continue to understand the different dimensions of emotional durability that are fostered between users and their gaming devices, the impact of gaming communities in developing this, and crucially how this knowledge and expertise might support better practices in both design and the repair of IoT.

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