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# Improving with Age: Designing Enduring Interactive Products

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**Abstract**

This study explores people's relationships with digital and non-digital objects in the home—with an eye toward the ways in which products improve rather than deteriorate over time—and how this knowledge might inform the design of more enduring and sustainable interactive products. We report our research in progress and provide a collection of initial design themes and design concepts inspired by user studies.

**Keywords**

Durability, interaction design, sustainability

**ACM Classification Keywords**

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**Introduction**

Interactive digital artifacts and systems increasingly populate contexts of everyday life in the industrialized world, and the home in particular represents a key site of consumption [3]. The field of human-computer interaction (HCI) has led and continues to lead to significant advances in making domestic interactive products more efficient, usable, and enjoyable. Moreover, these digital artifacts exist in many of our intimate settings, representing important signifiers of

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**Figure 1.** In-home card sorting exercises were used to probe perceptions of various domestic objects.



**Figure 2.** Wear-and-tear on these vintage objects cultivated an ongoing narrative and sense of mystique.

human relationships; they communicate stories about us and help construct notions of who we are and want to be. Nonetheless, artifacts embedded with the materials of interactive technology often remain impermanent in our lives, becoming obsolete far before their functional lifetimes have expired [3, 4, 6, 10]. This accelerated cycle of consumption and disposal of digital artifice is described by Huang and Truong as a *"disposable technology paradigm—characterized by technology that comes with the expectation of a short usage lifetime, despite the potential for a longer functional lifetime."* [6]:323. The wide-ranging effects of such short-lived usage continue to result in, among other things, substantial contributions of toxic materials to the global waste stream [3,4]. Thus, simply including less environmentally damaging materials in the design of interactive products is unlikely to be sufficient, and as T. Cooper writes, *"there is a need to slow the rate at which raw materials are transformed into products and eventually discarded, a process described as slow consumption."* [3]:54. Apropos the systemic effects of current levels of consumption—in terms of resources required to create digital things and that which they require while in use—nascent and growing research in the HCI community aims to link sustainability with interactive technologies [1]. In this paper, we are specifically concerned with developing new ways to extend the longevity of digital artifice.

In our ongoing study, we are specifically concerned with the ways in which domestic artifacts are perceived to improve rather than deteriorate with age—ultimately as a means to explore how to engender more enduring human-artifact relationships and potentially slow our disposal of digital things. In what follows, we (i) describe our ongoing study examining people's

attachment to artifacts and their perceptions of 'quality' over time; (ii) discuss initial findings, implications, and design concepts; and (iii) conclude with future directions of this research.

### Methods & User Research

Building on earlier empirical research by Blevis and Stolterman [2] and continuing with authors Odom and Pierce with Blevis and Stolterman [7], this study aims to examine people's relationships with digital and non-digital objects in the home—with an eye toward the ways in which products improve over time. More specifically, we examine differences in people's relationships with digital and non-digital artifice with respect to (i) strength of attachment and (ii) perceptions of quality over time.

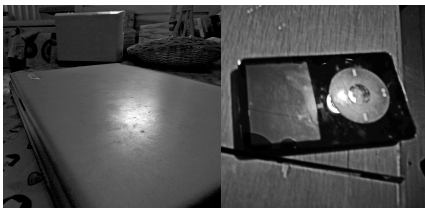
To date, we have conducted in depth semi-structured interviews in 8 households with 8 participants—5 female and 3 male. Our participants' ages ranged from early 20's to mid 50's, representing a key consumer demographic with respect to interactive technologies consumption in the industrialized world [3,4]. Prior to in-home interviews, we conducted disposable camera studies with our participants, asking them to take photos of a wide range of everyday things in their respective homes. An instruction sheet prompted participants to reflect on their various emotional connections and orientations to and relationships with digital and non-digital domestic things. We then conducted in-home contextual interviews, posing various questions to probe participants' reflections on the range of attachments they had with their things. During each interview, a card-sorting method with the images provided from each respective participant's camera study (Figure 1) was used to explore and



**Figure 3.** Information stored on digital objects was frequently perceived to increase in value over time, however the digital things themselves often were not.



**Figure 4.** Unique material histories emerged through use and caused this skateboard to be deeply valued



**Figure 5.** Patina on digital technology (laptop and iPod) adversely affected levels of attachment.

construct a global portrait of artifact relationships and attachments; these exercises were principally used to actively engage the participant and elicit deeper qualitative reflections. During these exercises, participants were asked to think aloud as they arranged images of their things along several semantic differentials, which prompted exploration of, among other things, (i) relative levels of attachment, (ii) perceptions of new vs. old, (iii) frequency of use, (iv) emotional vs. functional value, (v) level of physical involvement through use, (vi) emergent signs of use over time, (vii) relative ability to augment or personalize, (viii) and perceived durability. While these interviews and exercises have yielded large amounts of rich data to date, in what immediately follows we focus on presenting a specific subset of collected data emphasizing perceptions of digital and non-digital artifacts to highlight early noteworthy findings.

### Perceptions of digital and non-digital artifact

Generally speaking, participants (i) rarely expressed strong attachment to digital artifacts and (ii) rarely perceived digital artifacts to improve with age. In many cases, participants *did* express strong attachment to *non-digital* products, which oftentimes were perceived to improve with age. We elaborate further on these general observations in the following sections.

#### *Attachment to digital and non-digital artifact*

An important insight from our study highlights a distinction between people's attachment to *a thing itself* versus attachment to *what a thing provides*—a notion discussed at length by philosopher of technology Peter-Paul Verbeek [9]. Following Verbeek, by attachment to *a thing itself*, we mean to suggest that the attachment is based on a unique and particular thing—one, which is

not readily replaced by another, perhaps similar, thing. By attachment to *what a thing provides*, we mean to suggest that the attachment is based on something that is produced by the thing, such as music from an MP3 player or a warm, comfortable feeling from a sweater. With respect to non-digital things, all participants expressed strong attachment to at least several—and oftentimes many—non-digital things that they owned, both in terms of what a thing provides and in terms of a thing itself. With respect to digital things, participants often expressed strong attachment to what a digital thing provides but rarely if ever expressed significant attachment to the digital thing itself. For example, all 8 participants expressed they would not be upset if they lost their current cell phone; they were mainly concerned with the information housed on these devices. During a discussion illustrative of responses elicited from our participants, **P8** expressed strong attachment to his laptop, describing how important it was to him and how much he enjoyed using it. However, when probed further about how he would feel if a newer model replaced his current laptop, **P8** indicated he would indeed like to obtain a newer model laptop despite his "love" of his current laptop.

Additionally, participants often expressed a lack of trust for digital devices when compared to their cherished non-digital things. This notion was exemplified by **P4's** reflection on her cell phone (Figure 3): "*If I lost my phone, I would not be upset. It's too hard to change [appearance]; its style will not last. ... I try to use it as my diary, but it's been untrustworthy lately. [It] gave me no warning...you [phone] keep dying all over the place, making me focus too much attention ... It's saying 'give me love, give me love', asking me to pamper it ...but it doesn't give back.*" **P4** continued on

to compare her cell phone to her cherished guitar: *"I love my guitar. I can hug you and you're not going to break and die. I can't get too attached to electronics because they will break and die."*

#### *Perceptions of quality over time*

In general, many non-digital things that participants deeply cared for tended to improve with time. In many cases, this was due in part to the wear-and-tear of everyday use. For example, **P1** describes his skateboard (Figure 4): *"I've had this board the longest and I still use it. ... It's my favorite by far [out of collection] ... I put new tags [i.e., stickers] on because they rub off after a couple weeks. ... It's a unique board; I would definitely say it tells a story about me."* Similarly, **P4** and **P8** describe the endearing qualities of patina emerging on their respective musical instruments by virtue of everyday use over time: *"The guitar...and the ukulele, I'd say I'm strongly attached to the physical object just because a musical instrument, you know, it has all the dents and nicks that I've put it through. And it's been, you know, so many different places. ... That particular guitar, if it was lost or broken, it would be a big deal."* (**P8**); *"[my guitar is] like my baby. I know how to tune it and I can fix it if anything goes wrong. ... All the bumps at the pick board remind me how long I've been playing it; how much better I've become"* (**P4**).

In the case instances presented here, the emergent patina—a type of *material history* [7]—in part procured a deeper sense of care and involvement between participants and their things by inscribing a unique and personal semantic narrative into the objects through material experiences of use. In the case of these non-digital things, strength of attachment appeared to be

benefitted positively. However this was rarely the case with digital objects. Notable examples emerged in which participants were displeased with the patina on digital devices (**Figure 5**): *"[wear-and-tear] took away from its [MP3 player] character...and ruins its newness"* (**P5**); *"I hate them [scratches] on my iPod"* (**P2**); *"When you have the [new] technology...you feel better about it. ... It has to have no scratches [to show] hasn't been used much"* (**P3**).

Participants did tend to express strong emotions about long-term attachments to non-digital things, many of which had been owned previously by others and were described as 'heirloom', 'vintage', or 'antique'. **P4** elaborates on the endearing quality of her antiques: *"I like antiques because even though you don't know the person that had it before you, you feel like they took care of it and you can see they did and it makes you want to too. ... Antiques had a lot more 'work' put into them. New things...you can throw it out and replace it."* The sense of conscious care over time and mystique from an object's partially unknown past was similarly echoed by **P5**'s discussion of her vintage dress (Figure 2): *"I didn't think I was going to love this dress as much as I do when I first got it. ... After I received it [from ebay], each crease [in the material] made me keep wondering who had worn it and what they were doing."* **P5** similarly described the role patina played in making her antique purse more valued: *"...they [frayed edges] add to it [purse], they make it feel well worn in; more unique."*

#### *Rethinking 'durability' in the context of 'digital'*

The responses we have presented indicate that participants (i) rarely expressed strong attachment to digital artifacts and (ii) rarely perceived digital artifacts



to improve with age. We now present two noteworthy counterpoints to these findings—particularly salient with younger participants. First, many participants appeared to have a strong *desire* to develop a strong attachment to particular digital things such as laptops. For example, **P3** described his laptop as one his most “*important*” possessions, stating that his life “*revolves around the laptop.*” However, **P3** claimed he was not attached to the laptop itself and would readily replace it with a newer model if given the chance. Second, many participants felt that the software or information contained “within” their digital devices greatly improved with time, although precisely the opposite was perceived to be true of the physical devices themselves. For example, **P6** described her attachment to her phone as based solely on her customization of its software interface: “*...my phone is now becoming my baby. I have put lots of effort into it, and now I won’t just let it go. I have all my numbers and pictures the way I like them.*”

While findings presented earlier suggest significant barriers to the design of enduring digital artifacts, these counterpoints suggest design opportunities. Studying people’s relationships with enduring non-digital artifacts may directly inform the design of enduring digital artifacts but only to certain extent. We must ask ourselves, in what ways can designers of digital technologies exploit the unique properties of “digital-material” in order to design digital products with qualities that improve over time? For example, we can consider designing to more strongly couple digital information with physical devices in ways that promote attachment to digital-material things, or *computational composites*—Vallgård and Redström’s characterization of “computational material” [8]. Such an approach is

suggested by our findings, which indicate ways in which people grow attached to “things” constructed with digital information but not the physical technologies enabling such constructions.

### **Designing products that improve with time**

In this section, we present several themes drawn from cases encountered in our study thus far, which serve as inspirational themes for designing enduring digital products. We briefly motivate and describe each theme and a corresponding design concept.

**Design theme: Narratives**—associating with an object stories that relate personally and meaningfully to the object’s owner(s). This theme is motivated by the numerous descriptions given by participants of rich narratives surrounding objects. Oftentimes, these narratives evolved over time—unintentionally and unexpectedly. In what ways can we design for such idiosyncratic narratives to evolve around an object?

**Concept: Musical Passport** is a portable MP3 player that encourages the creation of narratives by recording its travels. Equipped with a GPS module, the MP3 player notifies its owner upon entering a new country or region. The owner is presented with the opportunity to “stamp” the device’s “musical passport.” Musical Passport explicitly records simple personal narratives tied to the device, while also encouraging its owner to travel and form implicit narratives around the object.

**Design theme: Character**—improving a product’s appearance in ways that communicate its age and usage in dignified ways, which its owner(s) may take pride in. This theme is motivated by the numerous descriptions of objects with strong character developed with use over time. Oftentimes, this character can be

described in terms of a physical patina that develops on a well-worn and well-loved object. In what ways can digital products form aesthetic and meaningful symbolic representations over time? **Concept: Television Patina** is an aesthetic data-visualization displayed on the television's screen, representing the cumulative programs viewed on the screen in its lifetime in. Frames are sampled every second and the colors are averaged to form a representation of viewing patterns, which grows and evolves over time. In this way, a unique character develops on the television screen over time, abstractly representing its owner's viewing habits and experiences with it over time.

These concepts highlight a critical issue that we intend to further investigate and address in future work: the likely tensions between product attachment and rapid technological change. One route to explore is combining the approaches described in this paper with other sustainable design approaches, e.g., modular and upgradeable design and product-service systems (PSS).

### Conclusions and Future Work

We have described some initial findings from our ongoing study investigating people's relationships with digital and non-digital artifacts in the home. We have presented design themes and corresponding design concepts illustrating speculative approaches to the design of enduring interactive digital products. We plan to continue using methods described in this paper to develop design exemplars that may inform the design and evaluation of more enduring and sustainable digital products—products that improve rather than deteriorate with time.

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