Wear and Affect: Cosmetic Obsolescence of Plastics in Digital Products

"The allure of the product is created and sold on the basis of a look that does not survive physical contact."

(Sudjic, 2008)

A. Manley, D. Lilley, K. Hurn – Loughborough University, Loughborough Design School
[a.h.g.manley@lboro.ac.uk]

Abstract

The relationship we have with materials is built up over time and includes a complex array of variables that contribute to a material having preconceived functional and aesthetic qualities that are specific to certain products and within certain materials (Demirbilek & Sener, 2003, Dunne, 2005; Chapman, 2015). The relationship we have with plastic is a short one and has not yet been fully understood in terms of our material culture. The use of plastics for the manufacture of digital goods is interesting, as the brevity of our relationship with plastics as a material is mirrored by our short lived contact with rapidly obsolescing digital products. As a result the opportunities to engage with the material and to understand how it ages over time are limited. If we are to encourage the extension of digital product lifetimes, it is imperative that we understand the way plastics age within this context.

The disposal of digital products (of which significant proportions are manufactured using a variety of plastics) contributes to a substantial problem of e-waste. The most recent estimation is that around £200m of digital products per year are sent to landfill (WRAP, 2015). The physical condition of these devices is an important factor in product replacement, which leads to significant product turnover (van Nes, 2004; Cooper, 2010). To understand the reasons for disposal of these digital devices, cosmetic obsolescence is the area that this paper is concerned with and through empirical studies, the paper establishes how smartphones [in this instance] wear over time and what the attitudinal reactions to those instances of wear are. By conducting these studies, a taxonomy of wear is established that occurs within plastics used in digital products and begins to understand the attitudinal reactions which give an indication of the affect that these types of wear have on the perceptions of plastics in terms of newness and tolerance of wear.

Key Words

Wear, Affect, Plastics, Obsolescence

Introduction

Our collective material knowledge is subject to a significant wealth of culturally formed norms and semantic baggage built up over time. This tacit knowledge of how a material is expected to perform is described as a material script (Latour, 1996). If we consider a constant product form of a drinking vessel or cup and switch out differing materials we begin to see that the use of different materials has significant impacts on how we imagine the cup to perform. A 3rd Century B.C. silver goblet has a very different set of expectations to that of an ABS mass manufactured cup. This is due to a learnt history of materials that has been established over millennia of material human interaction (MHI). In the history of materials and our relationship with using, modelling and making with them, the introduction of plastics into the catalogue is relatively recent. If the history of our MHI goes back to a conservative 10,000 BC, we have a material history devoid of plastics for 99% of our history (Ashby, 1987). Given that this is the case it is easy to claim that our material knowledge is understandably naive. We have not had the time to establish a tacit relationship with plastics.

Also our relationship with plastic as a material is conditioned by the fact that our physical interaction as a consumer is mediated by manufacturing processes. The materials that are cherished for their longevity tend to be the ones that encourage graceful ageing and are conducive to craft manufacturing methods (Van Hinte, 1997; Sennet, 2009,). Wood, leather, ceramics, fabrics are all able to be made in localised settings with a source of raw material. Our knowledge of the 'raw state' of plastics (an illustrative example can be seen in figure 1 from Thomas Thwaite who explores the aesthetic nature of raw materials, and in this case, raw plastic when used as a raw material) is never part of our material interaction with plastics. The material is always presented in its manufactured state with very little relation to a raw or craft material.

FIGURE 1: TOASTER PROJECT BY THOMAS THWAITE (THOMASTHWAITE.COM, ACCESSED 2015)

As mentioned previously, the product plays an important role in our perception of how a material is supposed to function. This can be termed the *product script*. The difference in how materials are expressed in their form gives indications to how the material should perform. A sophisticated digital product like a smartphone and a toy piggy bank (both can potentially be made from polypropylene) are understandably different. The smartphone is *premium*, *sophisticated*, *sleek* etc, the piggy bank is *cheap*, *toy-like* and *fun*. These semantic descriptors can be different across product categories. Karana and Hekkert identified the differences in the semantic relationship to metal and plastic objects. Through their study they identified that the function of an object directly affects the way we perceive the materials it is made of and what these materials express. Pedgley (2009) confirms this by proposing six aspects of materials that can change the meaning of a product due to a change in a design brief [Hierarchical Market, Niche Market, Improved Performance, Material-Inspired Innovation, Simplification and Bespoke Offerings]. These are provided with product examples and the meaning of the material changes due to the product context and the inherent product script. For example the use of explicitly engineered materials like carbon fibre, express a certain attention to the mechanical properties of the product and can establish a predetermined level of quality depending on the product [Improved Performance] (Pedgley, 2009). To understand the meaning of how materials accumulate wear we require a fundamental and reductive understanding of how wear actually occurs through use. After we understand how these materials wear over time we can then elicit attitudinal responses to different patterns of wear. By doing this we begin to establish a relationship between types of wear and types of affective responses.

Method

The empirical studies consisted of two stages of data collection. The first stage was a photographic analysis of 50 mobile phones. The participants were taken from a batch of first year undergraduate students at Loughborough University, aged between 18 and 25. During a scheduled tutorial session as part of their studies, the researcher approached students and photographed their devices, recording material changes on the phones that were distinct from new. After the 50 devices were photographed, a retrospective analysis of the devices took place and the material change types were identified. *(Due to the focus of this paper the results were refined to only include devices where plastic was used in their external casing; leading to a final data set of 35 devices.)* These took the form of four tribological indicators; impact

(breakage or removal of material), abrasion (scratching or rubbing of a surface), ablation (chipping or minor removal of surface finish) and accumulated dirt (noticeable accumulation of dirt or foreign material on the device). A cumulative damage score (CDS) was attributed to each of the devices which indicated which types of wear had occurred. For example if a device showed evidence of impact and ablation, the CDS score was 2. If the device showed evidence of just ablation, the CDS score was 1.

During the first study, participants were asked to sign up to a short, semi-structured interview to establish their attitudinal reactions to the material changes that had occurred on their devices. These participants were self-selecting from study 1 and totaled 12 in number. The interviewees were asked to list the material changes that had occurred on their device, recall how the material change (MC) had occurred, how they felt when the MC occurred and if their reaction would have changed of it had happened at a different stage of their product ownership. The interviews allowed topics of interest to form as the conversation progressed and employed *what if* scenarios if the devices had no MC's on them.

Results

Part A – Material Change Analysis

From the identification of the types of MC that had occurred on the 35 devices, it could be seen that Abrasion was the most common MC with it occurring in 68% of the participants' devices. Impact was seen in 50% of the devices that were looked at. Accumulated Dirt occurred in 36% of the phones and Ablation occurred in 30% of the devices.

A selection of the typical images collected for each of the MC's can be seen in Figure 2.

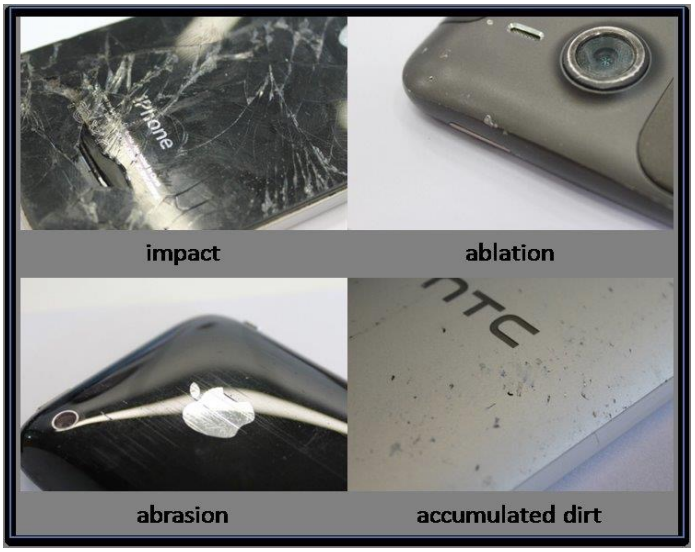

FIGURE 2: EXAMPLES OF MATERIAL CHANGES BASED ON TRIBOLOGY INDICATORS (AUTHORS OWN IMAGES)

During Study 1 it was found that there were a significant proportion of devices that were being used that had an instance of wear on them (92%). Impact damage predominantly occurred (or originated from) on the corners of the phone and resulted in cracks, separation of material and splits in the screen component.

The same location on the device across the sample (the corners) saw the majority of instances of ablation where material had been chipped from the surface and material had been deformed or removed, however, this was not as common where plastics were being used. Abrasion occurred on most parts of the phone but due to the definition of Abrasion including scratching and rubbing, there were significant instances of scratching on the flat areas on the back and front of the phones, and rubbing which mainly occurred on the edges and corners. Accumulated Dirt was found to be common on the phones that had been kept in cases and where there were indentations or ridges in the exterior of the phone into which dirt could accumulate and be prevented from being removed during regular use; i.e. physical switches, recesses and joins in the material components.

Each phone was attributed with a Cumulative Damage Score (CDS) which corresponded with an overall assessment of the wear. If a phone had only one instance of Ablation, for example, it scored 1 on the CDS. If it had Ablation and Abrasion, it scored 2; and so on until the maximum CDS score achievable was 4, if the phone exhibited all types of wear. Figure 3 illustrates the instances of CDS scores across the cohort number.

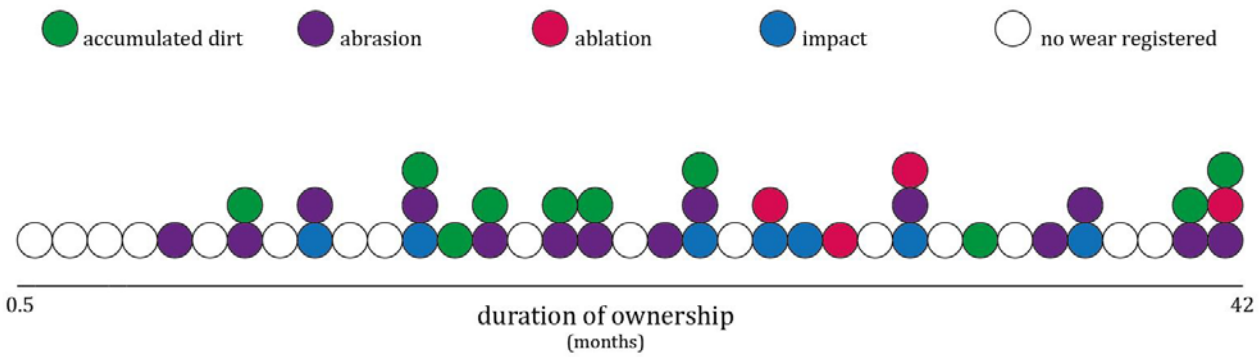

FIGURE 3: CUMULATIVE DAMAGE SCORE ACROSS DEVICES

The CDS did not include an assessment of the severity or variability of the wear. For example, if a device had one scratch or many, it was given 1 mark on the CDS. This is an issue that needs to be addressed in further iterations of the study. There was seen to be a relationship between the uptake of protective devices and the damage that was occurring on the phones (see Figure 4). There was an interesting difference between the start, middle and end stages of use and when the protective devices were being adopted, indicating that the protective devices were being used less in the initial and end stages of use and the uptake of their use was in reaction to damage occurring at the preliminary stages of ownership.

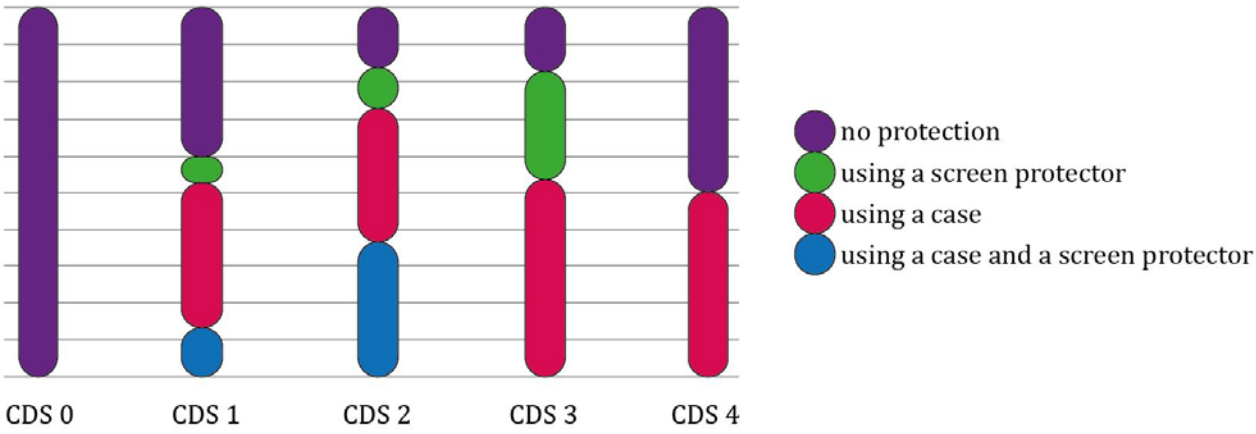

FIGURE 4: CUMULATIVE DAMAGE SCORE (CDS) AND UPTAKE OF PROTECTIVE PRODUCTS

Results Part B – Qualitative Interviews

From the qualitative interviews, which followed the visual inspection of the devices in Study 1, the participants reflected on incidents of material change (MC) that had occurred on their devices since the beginning of ownership. In the majority, participants reflected that if the MC that was being discussed (which was conducted for each example of MC on their device) had occurred in the early period of ownership, their attitudinal reaction would have been more negative. For example Participant (P)1 stated that on reflecting whether an impact MC which was evident on the back of their phone had occurred within the first month of ownership, "[I would have been] *more annoyed, I would have probably got it fixed.*" This is supported by a comment by P2, "*that would annoy me, yeah you kind of expect things to be tougher than that*". This was a common occurring response to any MC that had occurred on the participants devices. Annoyance of the expected build quality of the device at an early stage seems to be an overriding factor. This would indicate that the inbuilt product script of the smartphone

includes an appreciation of the materials to be durable during the early stage of ownership. This however was not seen in the devices owned over a longer period and was less obvious at the end of contracts or when damage had already occurred on their device.

Reflections on the physical changes

The participant's attitude towards the types of damage on their devices ranged from '*non-plus*' to '*annoyance*'. Responses were often influenced by the working condition of their phones; if the device still functioned as desired then the damage was not seen to be as bad.

Damage occurring earlier on in ownership was often described as '*annoying'* and elicited more negative attitudinal reactions. The results indicate that there was a moment of relief in being able to use the product without restraint after the first significant piece of wear had occurred. P2 stated *"...I'm pretty protective over it for the first couple of weeks and then after that you don't really notice damage so much.*" which is supported by P6 who stated "*when it's new you're like it's fresh and stuff but if you've had it six months, it becomes just part of the furniture.*"

There was a noticeable difference between responses depending on whether the phone was new or not new. As P7 stated "*Obviously when you first get it you're really sad, because you're like 'oh my god it's new' but now it's just like 'what else is new?'*". This tipping point of '*care*' was seen to occur either after a significant first instance of wear or after a period of time when the novelty of a new device had worn off. There is an inference here that the expectations of the product change over time and the product and material scripts are influenced by how long the product has been used. The duration for the period of novelty was different for each participant but a '*few months*' was a common response when prompted by the interviewer.

What if...reflections

It was identified that if participant devices had received the same damage at the beginning of ownership then the reactions would have been more extreme. When asked if the most prominent type of damage on their phone had occurred at the start of their ownership, P4 stated "*I think I would have been more annoyed.*". P9 supported this by stating that "[I] *think I'd be more annoyed about it, if it had happened straight away*". The reaction to the fictional scenario of the wear occurring at the start of ownership also elicited disappointment in the construction of the devices; P5 explained "*..I wouldn't have trusted the phone then, it'd be like it's just going to break after then, if it starts breaking now it's not going to work.*".

Overall, there was an indication that damage occurring at the start of a contract was deemed worse than damage at the end. This confirms that the expectations of the product script are

different from start to finish. Within the context of smartphones as a product, the expectations of a material to maintain its out of the box condition is very high at the start but is lessened by the necessity for it to function and the level at which the user has got used to their device.

The importance of performance

A significant amount of respondents' reaction to the types of cosmetic damage that was occurring was justified by the disclaimer that "*as long as it doesn't affect how the phone works it doesn't bother me*" (P11). Given the access that a smartphone provides to the user, the requirement to make calls, send texts, access social networks, capture and share images of everyday life; the necessity of functioning software seemed to increase user tolerance for cosmetic damage. This needs to confirmed or denied by further studies that will look at differing product types that may or may not have a connection to functioning software.

Discussion

The studies that have taken place as part of this paper provide evidence that there is a link between the types of wear that is occurring and the attitudinal reactions that are elicited. The differences between the four types of material wear can be seen to change depending on the position of the damage and the period at which the damage occurred. The taxonomy of the damage and the responses to them need to be backed up by further empirical studies and the inclusion of more product types and more materials will provide greater depth in terms of our understanding of the attitudinal responses elicited by worn and damaged materials and products.

From the exploratory studies outlined in this paper we can begin to see a relationship between three main factors; the perception of newness, the level of tolerance of wear and tear and the importance of stable function. As the perception of newness can be seen to depreciate as soon as the product is used, tolerance of wear increases. The necessity for stable function is a constant and is the consequence of studying an object like a smartphone where the content and the function is a priority in many cases.

To explore the impact of these attitudinal reactions to the damage and to confirm the findings gathered from these two studies, the researcher will be conducting a real-time study which tracks the use of four product types over the course of nine months. This will establish how wear and tear occurs and at which point it has an effect on the user. The extended and non-edited version of the study data detailed in this paper also looks at the devices that are

manufactured from non-plastic materials. Here comparisons can be made to reinforce or contradict the findings of this paper within the context of alternate materials and wear.

Conclusions

To understand the relationship between the cosmetic condition of plastics and the way that their patterns of wear affect the way we see the products we own, requires a reductive understanding of the mechanics of the way things age and the attitudes connected to these instances of wear. Material changes that occur on plastics, within the realm of smartphones, accumulate on a surface, which often starts life as shiny, blemish-free and monochromatic. These surfaces are susceptible to the smallest physical changes and more so in their shiny state when first purchased. The unrealistic perfection of new, shiny plastic is an issue and as soon as the material is touched for the first time, with a smudged fingerprint, the traces of human interaction begin (Maffei & Fisher, 2014).

In different contexts the use of plastics needs to be better understood to establish the correct way in which this poorly understood material can be used appropriately to encourage acceptable ageing. The time when plastics reflect their true script is in the moments between unboxing and placing your hand on your product for the first time. Any time after that and users are battling to retreat back to the moment when their device had not yet been held. This is unsustainable and detrimental to a family of products that need to be designed to last longer. The cosmetic condition of them is a significant factor in why they are discarded so quickly, therefore to encourage aesthetically durable products; plastics need to be used sympathetically with knowledge of how the material changes occur and how it affects our perceptions of the products. There is some interesting space for material culture research and design to explore finishes, textures and patina that could be built into materials such as plastic that trigger positive attitudinal reactions to wear and extend the lifespan of digital products.

Acknowledgements:

Thanks to Loughborough University, Design School staff and students for their cooperation during the study and to Loughborough University for providing the funding for the PhD study which has enabled this work to be undertaken. The authors would like to acknowledge the Closed Loop Emotionally Valuable E-waste Recovery project funded by the UK EPSRC who provided support for this PhD research (EP/K026380/1).

References:

Ashby, M. F., Johnson, K., (2009) Materials and Design: The Art and Science of Material Selection in Product Design. UK: Butterworth-Heinemann.

Chapman, J. (2015). Emotionally durable design: objects, experiences and empathy. Routledge.

Copper, T. (Ed.). (2010). Longer Lasting Products: An alternative to the Throwaway Society, Surrey: Gower Publishing Limited.

Demirbilek, O., & Sener, B. (2003). Product design, semantics and emotional response. Ergonomics, 46(13-14), 1346-1360.

Dunne, A., (2008). Hertzian Tales: Electronic products, aesthetic experience, and critical design. MIT Press, USA.

Karana, E., Hekkert, P., (2010) user-material-product interrelationships in attributing meaning. International Journal of Design, Vol.4 No. 3 pp.43-52.

Karana, E., Hekkert, P., & Kandachar, P. (2009). Meanings of materials through sensorial properties and manufacturing processes. Materials & Design, 30(7), 2778-2784.

Latour, B. (1996) Aramis, or The Love of Technology, USA: Harvard University Press.

Maffei, N. P., & Fisher, T. (2013). Historicizing Shininess in Design: Finding Meaning in an Unstable Phenomenon. Journal of Design History, 26(3), 231-240.

Odom, W., Pierce, J., (2009), Improving with Age: Designing Enduring Interactive Products, CHI, April 4-9. Boston, MA, USA.

Pedgley, O. (2009). Influence of stakeholders on industrial design materials and manufacturing selection. International Journal of Design, 3(1), 1-15.

Rognoli, V., Karana, E., (2014). Toward a New Material Aesthetic Based on Imperfection and Graceful Aging, In Material Experience: Fundamentals of Materials and Design. Oxford: Elsevier. pp. 145-153.

Sennett, R. (2008). The Craftsman. Yale University Press.

Sudjic, D. (2008). The language of things. Penguin UK.

Thwaite, T. (2015). thomasthwaite.com, accessed on the 15th May.

Van Hinte, E. (1997). *Eternally Yours: visions on product endurance*. 010 Publishers.

van Nes, N., (2003). Replacement of Durables: Influencing Product Lifetime Through Product Design. Rotterdam: Erasmus University.

WRAP, (2015). www.wrap.org.uk/content/facts-and-figures . Accessed on 10th June.