Assessing the Potential Use of Adaptive Multimedia (AM) as a Solution to Product Aesthetic Boredom (PAB)

Neville Ko* Heung Ryong Woo **

** Carleton University School of Industrial Design*
Ottawa, Canada, nko@connect.carleton.ca
*** School of Arts and Design, Seoul National University of Technology*
Seoul, South Korea, hrwoo@snut.ac.kr

Abstract: The foundation of this research study is built upon the extensive fieldwork of PAB. The research methodologies encompass a literature review, two-phase surveys and an explorative experiment to test the concept of Adaptive Multimedia (AM) as a potential solution to PAB. AM is a new concept defined as the ability to customize and personalize the physical and/or digital interface to meet the change in preference of aesthetic and functional requirements over a period of time. The finding of this research has deepen the understanding behind the malfunctional relationship between aesthetic pleasures and sustainability by way of testing hypotheses to deter PAB of digital and physical interface of mobile phones. The combination of AM and the renewal of Physical Interface is a new design approach that will provide consumers the liberty to customize and personalize their mobile phone to confront the fading excitement with respect to the physical and digital interface.

Key words: Adaptive Multimedia, Product Aesthetic Boredom, Digital Interface, Physical Interface, Refurbished Parts, Sustainability, Human Computer Interaction, Interaction Design

1. Introduction

Over 100 million mobile phones are disposed of each year causing great disturbance to the ecosystem and the environmental equilibrium [14]. Amongst the millions of fully functional mobile phones lie vast amounts of hazardous materials that can destroy the planet by polluting water, corrode the soil and cause ever-lasting harm to wildlife. Designers, architects and researchers play a major role in sharing the responsibility to make changes to this situation as they have failed to prevent it from happening thus being a contributor to the problem [9].

The objective of this research is to deepen the understanding behind the malfunctional relationship between aesthetic pleasures and sustainability by way of testing hypotheses on the potential use of Adaptable Multimedia (AM) as a solution to Product Aesthetic Boredom (PAB). For the purpose of this research AM is defined as the ability to customize and personalize the physical and/or digital interface with ease as an intention to meet the change in preference of aesthetic and functional requirements over a period of time. PAB, a theory developed by Makoto

Watanabe and Seyed Javad Zafarmand [13] has been found to have a strong correlation to the lifespan of material objects. In other words, this indicates that boredom can be a stimulus for creating appetite for novelty alluding to a lack of satisfaction of the product or system by the user. By utilizing efforts that can reduce the Aesthetic Boredom, and thus thriving to flourish lasting and pleasurable relationships between the user and the interface the replacement of products based on the use of input and display device for mobile phones can be greatly reduced. Prior research in this area has mainly focused on an ideology emphasizing that the aesthetic of products remains the same throughout the products' lifespan. This research will be carried out by testing user perceptions of aesthetic value from pragmatic perspectives and to identify solutions for problems that were previously overlooked.

This study is based on a combination of qualitative and quantitative research. To establish validity and reliability, a series of case studies, interviews, questionnaires, user observations and experiments were conducted. Case studies and purposive sampling from interviews provided qualitative data while questionnaires helped harvest quantitative data from large and geographically dispersed communities at a relatively low cost. A literature review on the relationship of PAB and the notion of sustainable interaction design were investigated to gather an in-depth understanding of human behavior and the association it has on products' aesthetic merit. Subsequently, experiments were conducted to test the new concept of Adaptive Multimedia used as a proposed solution for PAB. The level of research for this study will be focused on explorative inquiry in reference to the previously developed theory of PAB. It will apply the five stages of the intervention cycle in practice-oriented research which encompasses: 1) Problem finding, 2) Diagnosis, 3) Design, 4) Intervention and 5) Evaluation to answer the three main research questions (listed below):

i) What is the failure in the relationship between aesthetic and durability in reference to interaction design?

- If external factor(s) such as damages can affect the aesthetic perception then how can the versatility of upgrades and customizations to digital and or physical interface avert PAB?

ii) Can a (new) framework for Adaptive Multimedia develop a change on the current perspective of PAB theory?

- What are the attitudes of users towards the purchase of mobile phones with refurbished internal components?

iii) What does the future hold for Adaptive Multimedia as a key to maintaining user pleasure?

- If Adaptive Multimedia were to be implemented how would it change the face of sustainability?

2. Aesthetic Boredom and Sustainability

2.1 Importance of Aesthetics – Change in Perspectives

In regards to the traditional academia outlook, the process of creating objects with aesthetic value has been mystical; this is in reference to the notion that it was considered to be an elusive ability where techniques were exclusive to artisans. Aesthetics was evaluated independently from functionality. Fortunately, the field of HCI (Human Computer Interaction) has a larger breadth and maturing literature on the aesthetics of interaction design. Recent studies include the works of Japanese researchers Masaaki Kurosu and Kaori Kashimura [5], whom both have shown that aesthetics is influential on the perceptions of usability. This conclusion brought attention to the concept that apparent usability

was affected more strongly by aesthetics than inherent usability. In other words as Tractinsky [10] states, "among the various factors that affect system usability in particular and system acceptability in general, interface aesthetics play a major role" where visual appearance "may influence longer term attitudes towards the system." Such arguments stimulate debate, bringing the correlation of aesthetics closer with practical rather than theoretical considerations. The study was replicated in Israel by researcher Noam Tractinsky who found similar results which further strengthened and confirmed the need for a greater understanding in aesthetic values. Even Donald Norman expressed a change in perspective as evident from his influential book, *The Design of Everyday Things* [9], to his later writing, *Emotional Design* [7], where he acknowledges how emotion and cognition stimulated by aesthetics can play vital role in the use of products. Experts have confirmed that consumers are influenced by novel characteristics and visual graphic designs on packages when making purchase decisions [4]. Furthermore, studies have suggested that illustrations on packaging can foster positive emotions such as joy, pleasure and satisfaction [12]. It is apparent that there is more to aesthetics than meets the eye.

2.2 The basis for Adaptive Multimedia in regards to Product Aesthetic Boredom and Sustainability

The motivation for this research study is three-fold. First, the findings from preceding research show that the potential of aesthetics is promising and full of qualities that were previously overlooked. Secondly, the current global environmental condition is deteriorating and landfills are suffused with electronic waste (e-waste). Immediate action is needed in the view of the fact that more than 140.3 million mobile phone units were disposed of in 2007 [14] and there are no indications that this is on the decrease. According to the United Nations Environmental Programme [16], the number of mobile phone users in the world reached two billion in 2008. These numbers are alarming and it signifies a need for a holistic solution. The third reason comes from Seyed Javad Zafarmand and Makoto Watanabe's inspiring research. Zafarmand and Watanabe [17] have proposed the theory, Product Aesthetic Boredom (PAB), which is "the significant reducing of the aesthetic value of a product after continually or repeatedly using or looking at it".

In the conceptualized model regarding the causal structure of boredom, Watanabe and Zafarmand [13] clarify that the factors of boredom are differentiated in terms: 1) object status based on context, and 2) subject status based on sense. Moreover, the model connotes 'an event or activity' happening 'continuously' in a 'monotonous' manner causing a decline in 'meaning', lost of 'interest', 'arousal' and 'dissatisfaction', leading to boredom over an extended 'period of time' – *time being the most highly emphasized factor for boredom.*

In addition to the time factor, preceding studies prove that the influence of tastes and preferences for form-structural patterns are indeed different dependent upon social contexts and cultural backgrounds [13]. This conclusion is a significant indicator that aesthetic value is contingent on a cultural context, social trends and possibly individuality. However, even if these fore-mentioned factors were solved and the expectations of tastes and preferences were fully understood, the current concept of PAB has yet to account for the *reality of living* with these products. The act of *living* with a product such as a mobile phone undoubtedly invites the inevitable occurrence of scratches, discoloration, malfunction, wear and tear. These all have the ability to influence an individual's perception of a

product's aesthetic value. Furthermore if superficial damages were recoverable, it would be of great interest to learn whether an individual's satisfaction towards a product's aesthetics would equate to being more or less bored. Thus, the need to inquire more about the external causes that may affect the change in perception of aesthetic value is necessary for the elongation of mobile phones. Ultimately, keeping in mind the possibility that the aesthetic value of PAB is influenced by external causes, a new concept known as Adaptive Multimedia (AM) will be introduced and initially tested as a new reality-based aesthetic approach.

3.0 Research Methodology

3.1 Surveys

The type of data collected in the questionnaire included nominal, ordinal and ratio data. Nominal and ordinal provided demographic information allowing the researchers to see how closely the respondents replicated the population distribution. Questions included gender, product satisfaction, field of academic study/professional background and which make and model of mobile phone the user owned. Ratio data assisted in gathering information such as age, average monthly spending, cost and age of the user's mobile phone. Respondents had the opportunity to express their opinions by indicating their ideas (in addition to the choices provided) in designated areas of the questionnaire.

The sample frame was carried out to evenly distribute the respondents into two distinct categories. The first group was composed of professionals and students with specialization in Industrial Design, Architecture and Graphic Design. The second group included professionals and students with non-design specific backgrounds such as Engineering, Biology, Anthropology, Physics, Chemistry and History. Two iterations of pilot tests were carried out and a total of 102 respondents were contacted to conduct the two-phase survey.

3.2 Experiments

The results generated by phase-1 of the survey were collated and the findings gave guidance to create effective interview questions for phase-2 of the survey. All the information aided the construction of a conceptual model and experimentation for the concept of Adaptive Multimedia. To corroborate these findings, fieldwork in the form of a lab experiment was conducted with 20 participants to test the potential of Adaptable Multimedia. Participants were provided with a wide range of colour swatches, texture samples, magazines and a computer-generated model of a generic mobile phone. The goal of the exercise is to correlate any existing commonalities between the results of each participant and to see what role Adaptive Multimedia could play in meeting the specifications.

4.0 Results and Interpretations

4.1 Survey Phase 1 – In depth Inquiry towards Usage Pattern; Judgment on Aesthetic Boredom and Attitude Towards Sustainability of Mobile Phone

Phase - 1 survey was answered by 54 respondents which consisted of 27 males and 27 females with an even distribution of both university students and working professionals in design and non-design specific backgrounds.

The median age of respondents was 26 with the ownership of mobile phones varying amongst different manufacturers and types.

Question(s)	Response(s)				
1. How old is your mobile phone?	1 Year or Less	1 to 2 Years	More than 2 years		
	29.6%	55.6%	14.8%		
2. How excited were you when you acquired your mobile phone for the first time?	Not very excited	Not excited	Neutral	Excited	Very excited
	3.8%	3.8%	11.3%	37.7%	43.4%
3. How excited are you currently with your mobile phone?	Not very excited	Not excited	Neutral	Excited	Very excited
	20.8%	11.3%	34.0%	30.2%	3.8%
4. What specifically is causing your excitement with your mobile phone to fade with respect to the digital interface?	Missing functions	Out of style	Appearing worn out	Damaged	Other
	45.3%	26.4%	1.9%	9.4%	17.0%
5. What specifically is causing your excitement with your mobile phone to fade with respect to the physical interface?	Missing functions	Out of style	Appearing worn out	Damaged	Other
	9.0%	28%	4%	28%	30%
6. What attributes of your mobile phone do you become bored with?	Physical interface	Digital interface	The hackneyed technology	The features	Other
	39.6%	13.2%	3.8%	15.1%	28.3%
7. If you want to change one of the following attribute of your mobile phone what would it be?	Repair of scratches & damages	Shape of the outer casing	Digital user interface on screen	Color of the outer casing	Other
	32.1%	24.5%	22.6%	11.3%	9.4%
8. Would you consider purchasing a new mobile phone in the future with refurbished parts that are certified and are approved by the manufacturer?	Yes	No	Uncertain	Other	
	64.8%	16.7%	13.0%	5.6%	
9. If the changes you wanted in the previous question can be made, how much longer would you keep your mobile phone?	Longer due to change	Won't keep longer	Pending		
	63.0%	24.4%	12.2%		

Table.1 Summary of selected responses from Phase-1 Survey

Usage Pattern and Judgment on Aesthetic Boredom. Table 1 reveals that more than half of all respondents have had their mobile phones for between one and two years. From the time when users initially acquired their mobile phone, a total of 81% of respondents expressed that they were either 'emotionally very excited' or 'excited'. After an ownership of more than one year to less than two years, close to 30% of the original respondents who cited 'high excitement' changed their opinions. Furthermore, a significant portion – 39.6% - of respondents revealed a dramatic change of heart indicating that they were 'very excited'. These numbers represent an important change in aesthetic value for mobile phones users. Perhaps, this timeframe is indicative of how soon users become bored with their mobile phone after continuous use.

Furthermore, the data indicates that the 'missing of desired functions' and being 'out-of-style' to be the major causes of excitement loss when assessing the digital interface. However, a large portion of respondents felt surface 'damage' to be equally as crucial as being in 'style' for the physical interface. This 28% is astonishing as it suggests distinct and diverging ideas relating to current understandings of the causal structure of boredom. At the same time, this finding has merit from a user's perspective because it is unrealistic to expect the aesthetics of the physical interface to remain new and polished or unchanged for more than a year of continuous use due to the likelihood of damage. Considering that the physical appearance is more than three times as likely for users to get bored from

compared to the digital appearance (as the reason stated for boredom according to the survey), this information can be extremely valuable for the development of Adaptive Multimedia to avert PAB (Table 1).

Attitudes towards a Sustainable Future with Mobile Phones. Additionally, the survey also asked participants what attribute they would change of their current mobile phone if it were possible to only change one. Ranging from the most desired change to the least, attributes listed included: the repair of scratches and damages, shape of the outer casing, the digital interface on screen and colour of the outer casing. The inclination to repair and revitalize scratches and damages are signs of positive attitudes. By the same token, 63% of participants showed a willingness to retain possession of their current mobile phone if the requested changes could be fulfilled.

Another interesting finding from the survey relates to the responses received to a question regarding the purchase of new mobile phones with refurbished parts that are certified and approved by the manufacturer. There is a misconception that replacing interactive devices such as mobile phones gratuitousness is a common trend in our modern society salvaged by overabundance and over consumption. Although this idea might have been true in the past, the fact that approximately 65% of participants are receptive to the notion of purchasing a mobile phone in the future with refurbished parts is definitely an indication that attitudes are changing. As a matter of fact, many participants responded to the idea with alacrity and enthusiasm, stating *"the current treatment of mobile phones wasteful"* and they are *"likely to purchase phones with refurbished parts if it worked just as well as new parts."*

If mobile phone users are willing to retain possession of their current mobile phone, why is the number of phone units being thrown out everyday at such a staggering rate? What value would the understanding of Product Aesthetic Boredom do for the future if there were no possible method to promote aesthetic longevity? Given such a high and significant percentage of users insisting that they are willing to keep their mobile phones if the aesthetics can be reformed to its original state, it is imperative that the aesthetic quality be maintained or even enhanced.

4.2 Survey Phase 2 – Prolonging the Lifespan of Digital and Physical Interface Aesthetic with AM

The phase-2 survey attempts to distinguish between the aesthetic value individuals have for digital and physical interface by probing deeper into the functionality of Adaptive Multimedia. The study was comprised of the same university students and working professionals both in design and non-design backgrounds. The questions were generated from the findings of phase-1 survey, in particular, the different viewpoint users had by selecting 1) the 'missing functions' and being 'out-of-style', and 2) the repair of 'surface damages' and ' the outer shape' options to be the two most crucial factors for loss of excitement regarding the digital and physical interface, respectively.

As a strategy to learn more about Adaptive Multimedia, users were asked what they thought was the best way to keep the style of the digital interface 'modern' while also keeping the functions of the digital interface 'up-to-date'. Almost 80% of participants preferred that the design of the digital interface be fully customizable and that modernity to the style of the digital interface be made with ease without the aid of the manufacturer. It appears as though users are highly supportive for effortless digital interface customization for it is also the preferred method of maintaining

the functionality up-to-date as well. Users may aspire to personalize their layout for multiple reasons such as to improve the usability, workflow, location of buttons, reduction in extraneous features and perhaps, for convenience and the liberty to refashion according to one's aesthetic preference.

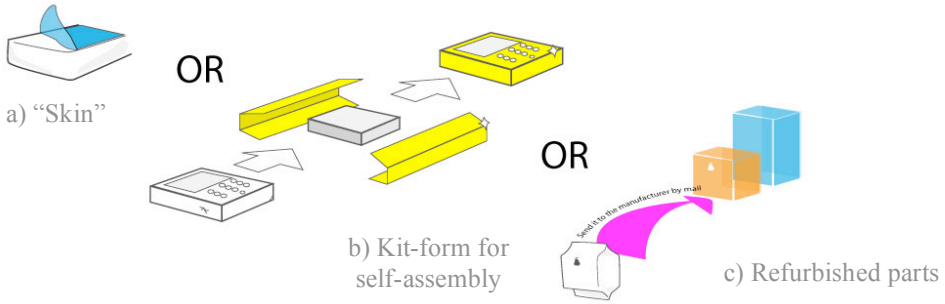

Figure.1 The renewal of the physical interface using various methods

The most favored selection for the modernization of the outer shape and the repair of scratches by respondents referred to the concept of mobile phones that are designed with "skins" where the colour can be changed or the damaged layer can be peeled off over time. With "skins" as a form of adaptive media, users who express the desire to customize visual appearances in relation to their personal tastes and preferences can achieve such results [11]. Moreover, "skins" can prolong the lifespan of interactive devices, such as mobile phones by restoring the aesthetic quality and physical condition to their original state. This factor of "recovery" was expressed as a major concern for users and it has enormous opportunity to deter PAB, thus extending the lifespan of mobile phones (Figure 1).

4.3 Experiment – Exploring the Concept of AM as a Harmony for Aesthetic and Sustainability

The objective of this experiment is to manipulate tangible models in the hopes of understanding how mobile phone users will customize their aesthetic preferences in regards to the physical and digital interface. A total of 20 participants took part in the experiment being asked to indicate a list of aesthetic attributes they deemed as important. This included: the texture of surface appearance, layout of buttons in relation to the display and various hardware components, colour variations and other visual characteristics to achieve their most ideal aesthetic configuration (Figure 2).

With users being given the opportunity to create their ideal design, it does not come as a surprise that the commonality from each design model differs immensely from one another. In spite of the position of keypad placement being conveniently located for ergonomic reasons as it is in existing designs, many users have arranged components in various compositions. It is seemingly impossible to design a specific product tailored for everyone because users' attitudes to certain features, preferences and priorities concerning interaction are not identical [1]. This is also true if designers continue to design mobile phones by applying present techniques to target aesthetic boredom because boredom can vary based on contextual background, social situation and arguably, cultural circumstances [13]. With Adaptive Multimedia, it is possible to design minimal amounts of varying platforms that would allow virtually every user type to customize and personalize his/her phone.

Figure. 2 Exploring the customization of Adaptive Media with individual users

5.0 Discussion

The failure in the relationship between aesthetics and sustainability. Despite the different taste of individuals' for form-structural patterns, cultural context, and all other factors that constitute aesthetic boredom, loss of excitement for mobile phone designs can be caused by variables that were unaccounted for in previous research. Other dimensions such as damage to the physical appearance, defacing of the outer shell or other external factors causing detrimental changes to the physical appearance can also change the aesthetic value from the user's viewpoint.

AM as an inevitable design solution to deter Product Aesthetic Boredom. Unlike automobiles, houses, computers and even watches, it is atypical to find readily available parts for mobile phones to repair or replace. However as the findings in this research study have identified, mobile phone users are inclined to repair and revitalize scratches and damages. As indicated in the survey, up to 63% of users would retain possession of their current mobile phone if the requested changes could be fulfilled; a positive signal towards product elongation. Given the significant percentage of users insisting that they would be willing to keep their mobile phones if the aesthetics could be rejuvenated to its original state, it is imperative that the aesthetic quality be maintained or even enhanced.

The physical interface is three times more likely to be the cause for boredom compared to the digital interface. Users expressed a desire to continue using their existing mobile phone if changes to the 'outer shape' could be made and/or the stylistic 'damages' could be repaired. Furthermore, there is a significant portion of mobile phone users who are receptive to buying mobile phones in the future with refurbished parts. This evidence suggests a change in attitude from an environmental perspective, however continually there is a lack of manufacturers that offer more environment-friendly alternatives? Do consumers actually want to buy a new phone as opposed to 'renewing' their existing mobile phone? One will not know because existing manufacturers have never made this option available possibly due to the misconception that selling less implies a reduction in profit. However, with proper planning and modification to the existing design process this false impression will prove to be the opposite.

All of the presented arguments are indicative of what the future holds for sustainable mobile living. As PAB reduces the aesthetic value of a product due to continuous use in a monotonous manner over a long period of time, it is obvious that designing to transcend time is simply not enough; at least not in this day's modern society of technological possibilities. Designers must design products that can adapt through time in order to prolong the lifespan of the object. Preferably, long enough to develop a sort of complex empathy-oriented relationship between the user and object [3].

The future for AM as a key to maintaining user pleasure. The arguments presented should inspire manufacturers and mobile phone designers to act by designing sensibly. The most promising potential for doing this lies in the concept of Adaptive Multimedia. It has the capability to drastically deter PAB, hence the ability to decrease the number of fully functional mobile phones that are thrown out every year, overflowing our landfills. Thinking and designing for a sustainable society does not have to equate tolerating boredom by neglecting the emotional desire for aesthetic change. Adaptive Multimedia can be materialized in a multitude of forms such as offering products with a longer life expectancy by virtue of focus on long-term upgrades; or by the practicality of effortless disassembly so that the outer shell, bought in kit-form, can be 'refreshed' to regain aesthetic value while all the internal components remain functionally in tact. It can even go so far as to creating multi-layered 'skins' to peel off superficial surface damages or even change colours. Design for AM will require changes to the current design framework, process and designer's mindset in terms of aesthetic boredom and sustainability.

6.0 Conclusion

Adaptive Multimedia can prolong the lifespan of products. It will allow versatility and plurality in updates to aesthetic features in regards to existing interaction devices such as mobile phones. By deterring Product Aesthetic Boredom, Adaptive Multimedia can help change the current deterioration of the environment caused by 'premature' wastage of mobile phones. The findings of the research are highly beneficial to the increasing concern for a sustainable future with the increasing popularity of interactive devices which have become one of the fasting growing types of electronic waste. The combination of Adaptive Multimedia and the renewal of Physical Interface is a new design approach that will provide consumers the liberty to customize and personalize their mobile phone to confront the fading excitement with respect to the physical and digital interface. The knowledge gained from this research will contribute to the field of HCI and user interface design. It also has the potential of establishing useful design guidelines that work towards a sustainable future. The results are intended to evoke a higher level of reality-based design research that is both practical and valuable to the development of humanity.

For the future, it will be beneficial to investigate further into the aesthetics of digital interface. The popularity of the recent touch-screen technology and integrated QWERTY keypad conceivably raises new and interesting thoughts. Secondly, close examination into new sustainable business and marketing theories will help strengthen the future possibility of AM to change current business practices. There is also a need for more studies surrounding the concept of Adaptive Multimedia in relation to refining the theoretical concept of PAB. Adaptive Multimedia is just at the forefront regarding innovation in relation to design methodology process with much more to inquire in the future, in

particular how it is intertwined with theories of aesthetic and sustainability. With more research, Adaptive Multimedia can become the successor to current design practice which can be adapted more widely as a new reality-based aesthetic component that was once mentioned by Dr. Papanek [9].

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