

Mobile Phone Consumption Behavior and the Need for Sustainability Innovations

Wendy Wilhelm
Western Washington University

Alice Yankov
Western Washington University

Patrick Magee
Western Washington University

Mobile phones have the shortest product lifetime of any U.S. electronic consumer product. Two studies with college students explored phone disposition behavior and replacement motives, with the objective of identifying business strategies that could mitigate the environmental and social impacts associated with their disposal. The findings indicate that phone replacement is primarily driven by industry marketing strategies that encourage individuals to replace their phones more frequently than they need or prefer to. Discussion focuses on how sustainability innovations in phone design and marketing, and changes to industry practices are needed if lifetime extension strategies are to be effective.

INTRODUCTION

As high tech markets mature, replacement purchases represent an ever-increasing proportion of sales. For example, over 60% of mobile phone (cell and smart phone) sales are replacement sales, and 90% of phones are still in functioning condition when they are discarded (Geyer & Blass, 2010; Gordon, 2009; Hanks, Odom, Roedl & Blevis, 2008). In fact, cell phones have the shortest product lifetime of any electronic consumer product, being discarded within eighteen months of purchase in the U.S. and U.K., and within one year of purchase in Japan (Smith, 2010; Slade, 2006). With increasing numbers of functioning durable goods ending up in landfills either here or abroad, it's important to understand forms of product disposition and replacement motives so that marketers and designers interested in encouraging more sustainable consumption¹ behavior can develop innovative strategies that do so. Unfortunately, we know very little about the disposal process or replacement motives for mobile phones or other durable goods, in spite of calls for more research on consumer behavior related to product disposition (de Coverly, McDonagh & O'Malley, 2008; Jacoby, Berning & Dietvorst, 1977; Gultinan, 2009; Raghavan, 2010).

The research presented here aims to explore product disposition behavior and replacement motives for mobile phones, with the hopes of identifying innovative business strategies that could mitigate the environmental and social impacts currently associated with their disposal. Mobile phones were chosen for several reasons: (1) over 80% of Americans own a mobile phone, 90% of 18-29 year olds (Smith, 2010);

(2) mobile phones have a very short replacement cycle, as noted above; (3) over 140 million units are discarded annually in the U.S., while only 10% of them are recycled (EPA, 2008; Smith, 2010; Slade, 2006); (4) mobile phone waste is toxic, including such persistent, bio-accumulative toxins (PBTs) as antimony, arsenic, beryllium and lead; and (5) globally, mobile phone penetration is increasing rapidly – there are over 5 billion mobile phones currently in use (CBS news, 2010).

There are few empirical studies that have explored replacement motives for mobile phones, especially among college-aged students. This age group – 18-25 – is the heaviest user of mobile phones and is in the process of forming their long term consumption habits (Smith, 2010). If we can understand why they replace their phones, we may be able to develop strategies to lengthen replacement cycles or persuade them to engage in other, less harmful forms of use or disposal.² Of course, current industry practices need to be examined too with regards to how they may encourage short replacement lives for mobile phones. Two studies were designed to address these issues, with the objective of exploring answers to the following research questions:

- What are the current product lifetimes for mobile phones among 18-25 year olds, where product lifetime (or replacement life) refers to the time period between an individual's purchase of a product and its replacement by another product with the same function?
- How do individuals dispose of their mobile phones?
- What are individuals' motivations for replacing their mobile phone? Do they form an emotional attachment to a particular phone?
- What product re-design and other marketing strategies might encourage individuals to replace their phones less frequently?

The next section of the paper reviews current industry trends and practices with regards to mobile phone disposition/replacement and pro-environmental policies. This is followed by a summary of conceptual and empirical research on forms of product disposition and replacement motives. Two empirical studies are then described and the findings summarized. The paper concludes with a discussion of how the findings might inform business strategies designed to encourage consumers to extend the replacement life of their mobile phone.

BACKGROUND

Current Industry Trends and Practices

To more closely examine industry practices relating to phone disposal and replacement policies, the managers of four of the major U.S. mobile phone service providers with local offices in the Northwest (Verizon, T-Mobil, AT&T/Cingular and Sprint) were interviewed. Each interview was recorded (with permission) and later transcribed. Provider websites were also reviewed for relevant information.

As Table 1 indicates, all four providers offer free or steeply discounted new phones when individuals sign or renew a two year contract, a strategy that encourages continued brand loyalty. While many customers choose to pay for more expensive phones that are not covered in contract signing/renewal promotions, such promotions do foster frequent phone replacement. Other negative influences on product longevity are the short six month technology/fashion cycle, the limited 1 year warranty, and the general lack of repair/maintenance information or services at point-of-purchase or on corporate websites. Customers can change the battery in their mobile phones (except for iPhones), but there are no instructions on how to dispose of the old battery (AT&T does state on its Website that batteries can be recycled, and Verizon admonishes customers to “dispose of their battery responsibly” on the packaging).

**TABLE 1
CURRENT MOBILE PHONE INDUSTRY PRACTICES***

Attribute	Verizon	T-Mobil (U.K.)	AT&T/Cingular	Sprint
Cost of Phone?	Basic:\$0-50; Smart:\$0-250 Free phones offered with plans	Basic: Free w/ 2yr contract Advanced:\$50 avg. Smart:\$100+	Basic:\$0-20 with plan Smart:\$0-150 Free and discounted phones offered with plans	Basic:\$0-50 Smart: \$0-150 Free and discounted phones with plans
Design Life?	No standard, up to 2 yrs.	No standard, could last up to ten years	No standard	No standard
Warranty Period?	1 year standard	1 year standard	1 year limited standard	1 year standard
Repair/Maintenance Info Provision?	No maintenance info given at purchase-if 3 rd party performs repairs, warranty is void	No maintenance info given at purchase	No maintenance or repair info available, customers prompted to buy refurbished	Offers in store repair services
Environmental Impact Claims on Packaging?	Box prompts consumers to dispose battery responsibly and that box is recyclable	None on packaging, used to include recycling bag in box but no longer	Will accept any phone regardless of carrier or manufacturer at any store for EPA partnered, Plug-In To eCycling campaign	HTV 4G phone made with recyclable plastics and organic packaging (one option)
3 rd Party Certification of those claims?	Claim on website that refurbished phones are tested by 3 rd party	No	Claim on website that refurbished phones are tested by 3 rd party	No
Technology Cycle?	3-5 years for network technology and every six months for cosmetic and feature upgrades	Every 1.5 years for network advances and six months for cosmetic and slight feature upgrades	Approximately every six months	Approximately every six months
Governed by EPR in U.S.?**	No	No	No	No
Can Consumers change battery/do other repairs themselves?	Consumers can change their own battery which is available online and in stores, but cannot in iPhone	Consumers can change their own battery and occasionally do software upgrades	Website states battery can be recycled	Consumers can download new backgrounds, consumer can change their own battery

If phone breaks, repair or replace?	Can purchase refurbished phone, phone is replaced if under warranty	If covered by warranty phone is replaced and sent back to manufacturer, if not, phone remains with consumer.	Can purchase refurbished phone or new phone, phone is replaced if under warranty	Can purchase refurbished or new phone, phone is replaced if under warranty
How often are customers given free phones?	Free phone when consumer renews service contract	After a year customer receives partial discount, after 22 months customer receives full discount	Free phone with contract renewal	Discounted phone with contract renewal
What happens to returned phones?	If possible returned phones are refurbished and donated to charity; if not, phone parts are recycled	Returned phones are refurbished and give to charity (60%); balance are recycled/disposed of in an “environmentally friendly manner”	Returned phones are refurbished to factory standard for resale at discount with 90 day warranty; unusable parts are recycled into base material	Can be refurbished and resold, donated to charity, or bought back for account credit
Internet Eco-Friendly Promotions?	Promotes paperless billing	None	Displays refurbished phones next to new phones	Promotes refurbished phones on main webpage

*Data collected from interviews and corporate websites (accessed April 2011).

**EPR = extended producer responsibility

What happens to phones that are returned to the provider? All four providers stated that if possible, returned phones are sent back to the manufacturer to be refurbished and resold, donated to charities, or recycled. Two of the providers claim (on their website) that the refurbished phones they sell are certified as functional by an independent 3rd party. Only T-Mobil sells Nokia phones; Nokia is the global market share leader (35%) and designs its phones to be disassembled and re-manufactured (it is also the largest purveyor of phones made from recycled parts). None of the providers are part of an Extended Producer Responsibility (EPR) program in the U.S., in which manufacturers and providers take responsibility for disposing of their electronic products at the end of their useful life, typically refurbishing the product for re-sale or recycling its components. In Europe, electronics manufacturers are required to take back all electronic products when customers are ready to replace them.³ T-Mobil, however, does accept any phone for recycling, regardless of brand or service provider; they are a partner in the EPA’s Plug-in To eCycling Program.⁴ As phones become “smarter” and more expensive, some industry players (manufacturers, service providers, refurbishers and retailers) are implementing buy-back programs to capture sales of used phones that might otherwise be resold by customers through booming consumer-to-consumer (C2C) secondary markets such as eBay and ReCellular (Mobiledia, 2011).⁵

Overall, providers and manufacturers appear to be making some efforts to be (and be perceived as) sustainable. However, there is little doubt that the marketing strategies currently employed by the mobile phone industry are aimed at persuading customers to replace their phone frequently; increasing replacement rates has a favorable impact on sales and profits.⁶ Thus, any initiatives to lengthen product lifetimes must include incentives for the manufacturers and providers; a focus on changing consumer behavior alone is insufficient.

Forms of Product Disposition and Their Environmental Impact

Different forms of mobile phone use and disposal have different environmental consequences; Table 2 ranks the different disposition options according to their environmental impact.⁷ Discarding a mobile phone for disposal in landfills has the most severe impact, given the quantity discarded each year and the

toxicity of their components. Mobile phones may often be thrown away because of consumer perceptions that each new version or model performs significantly better on some dimension (performance, features, fashion). Competitive consumption (“keeping up with the Jones,” Schor, 1998) and novelty-seeking also make individuals susceptible to marketing strategies that encourage frequent replacement of still functioning phones. These strategies include short technology and fashion cycles, mobile phone trade-in programs for new free or low-priced phones (see Table 1), and low quality construction (to enable lower price points) so that phones break frequently and need replacement. Since technology is always advancing and styles are always changing, we end up with a “perfect storm” of negative environmental impact in the form of e-waste.⁸

TABLE 2
FORMS OF PRODUCT USE/DISPOSAL RANKED ACCORDING TO
ENVIRONMENTAL IMPACT*

Product Form	Description	Findings for Mobile phones or Electronics**
Disposal (greatest impact)	Does the product-service system*** encourage the disposal of primary, physical materials?	<ul style="list-style-type: none"> • Short design life (e.g., low quality, fragile) • Short replacement life (technological/fashion obsolescence) • 53% store old mobile phones; most unwilling to throw away electronics
Salvage	Does the product-service system enable the recovery of previously discarded material?	<ul style="list-style-type: none"> • Difficulties because of failure to design for material recovery + toxic components
Recycling	Does the product-service system make use of recycled materials or provide for the future recycling of materials?	<ul style="list-style-type: none"> • 10% of phones recycled • Revenues (from gold and copper recycling) decreasing; low profit margins
Remanufacture; Refurbish for reuse by new owner	Does the product-service system provide for the renewal of materials for reuse or updated use by new owner?	<ul style="list-style-type: none"> • Most go to developing countries; demand outstrips supply • Refurbished phones offered by most manufacturers in U.S.; demand is low
Repair for use by original owner	Does the product-service system provide for the repair of the product for continued use by current owner?	<ul style="list-style-type: none"> • No repair options for mobile phones except for changing battery • Repair costs higher than replacement costs
Resell as is; secondhand markets	Does the product-service system provide for transfer of ownership?	<ul style="list-style-type: none"> • Most phones in good working conditions when discarded; 90% need no refurbishing • Consumer- to-consumer (C2C) resale market via the internet small but growing • Cannibalization rate unknown
Achieving longevity of use (product lifetime extension)	Does the product-service system allow for long term use of materials by a single owner without transfer of ownership?	<ul style="list-style-type: none"> • Planned obsolescence discourages longevity of use; advances require new hardware • Mobile phones not designed to be durable (last longer than 1-2 years); durability not important in choice

Sharing for maximal use; decoupling ownership and identity/access	Does the product-service system allow for use of materials by many people as a construct of dynamic ownership?	<ul style="list-style-type: none"> • Technically feasible • Most not willing to share laptops or mobile phones
Achieving heirloom status	Does the product-service system create artifacts of long-lived appeal that motivate preservation such that the transfer of ownership preserves the quality of the experience?	<ul style="list-style-type: none"> • Electronic devices not items they would pass down to their children • Design engenders little emotional attachment
Finding wholesome alternatives to use	Does the product-service system eliminate the need for the use of physical resources, while still preserving the same function (e.g., electronic journals)?	<ul style="list-style-type: none"> • Mobile phones do substitute for landlines; unclear whether this reduces amount of physical resources used
Active repair of misuse	Is the product-service system targeted at repairing harmful effects of unsustainable use, substituting sustainable use in its place?	<ul style="list-style-type: none"> • No

*Adapted from Blevins, 2007; this is an approximate ordering.

**Cooper, 2010; Geyer & Blass, 2010; Guiltinan, 2009; Hank et al. 2008; Slade, 2006; Wagner, 2009

*** Product-service systems are a set of products and services capable of jointly fulfilling a user's needs, with the objective of reducing a product's environmental and social impact (e.g., sharing: zipcar), frequently through dematerialization.

As displayed in Table 2, **disposal** (in landfills either in or outside of the U.S.) is the most common end-of-life scenario for mobile phones and also has the greatest environmental (and social, given the toxicity of materials) ⁹ impact. There is also evidence that some individuals store their cell phones indefinitely, either because they feel badly throwing them out or because they are unaware of other disposal options (EPA, 2008; Hanks et al. 2008). **Salvage** and **material recycling** are difficult due to toxic components, small (but growing) markets, and product designs that often prevent easy separation of components. In Europe, however, bar codes (the IMEI number) on mobile phones are linked to web-based databases that provide disassembly instructions, and design for disassembly is well-established given WEEE regulations (see endnote #3). As noted earlier, service providers in the U.S., as part of their contract renewal process, are implementing remanufacturing programs that collect, **refurbish and resell** mobile phones (Mobiledia, 2011; Ongondo, Williams & Cherrett, 2011). However, this is a form of voluntary extended producer responsibility (EPR) that accounts for less than 10% of the current sales of each brand of mobile phone (Wagner, 2009). **Secondhand** markets for used mobile phones are well-established and experiencing significant growth in part because of the growth of consumer-to-consumer (C2C) sales. Extending the product lifespan through re-use of existing phones can reduce their environmental impact if the product is designed to last more than 1-2 years.

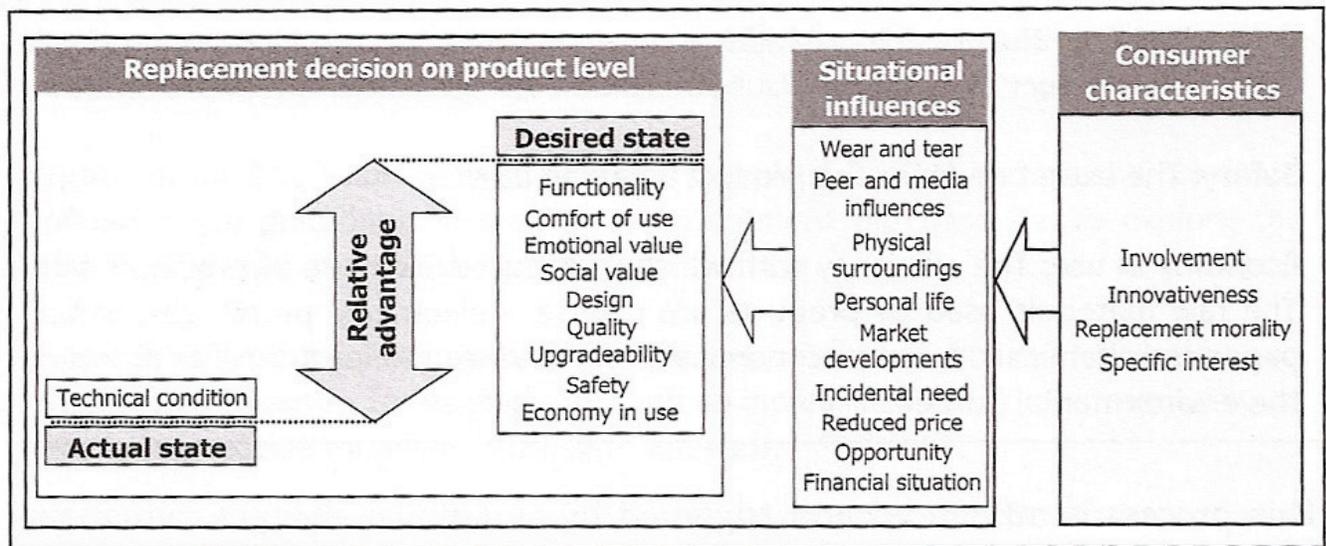
Other forms of use/reuse with lower environmental impacts (**sharing, achieving heirloom status**) are either culturally inappropriate at present (Hanks et al. (2008) reported that 50% of the college students surveyed said they would never share mobile phones) or inconsistent with current product designs (a mass-produced plastic product rarely achieves heirloom status). A recent study found that respondents did not perceive their mobile phones to improve with age, unlike a musical instrument, for example (Odom & Pierce, 2009). Even if mobile phones were designed so they could be easily **repaired**, planned obsolescence on the part of manufacturers and the high cost of repair relative to replacement currently limit the feasibility of this option. **Longevity of use** (product lifetime extension) would appear to be a feasible form of use with a lower environmental impact than disposal, recycling or re-sale, but short technology cycles (that currently require hardware upgrades), poor quality and consumer desires for the latest model make this a difficult sell. Further, studies report that product durability is not a particularly

important attribute in choice, even for so-called durable products (Cooper & Christer, 2010; Gultinan, 2009).

Reasons for Product Replacement

A model of the factors influencing the arousal of the replacement need is displayed in Figure 1 (van Nes, 2010). Based on empirical research and an extensive literature review covering the disciplines of consumer behavior, industrial design, and diffusion of innovations (e.g., Okada, 2001; Roster, 2001; Cooper, 2005), the model identifies product attributes, consumer characteristics and situational influences affecting the replacement process. Table 3 displays a typology of replacement motives and considers the applicability of each motive to the replacement decision process for mobile phones (van Nes & Cramer, 2005). As noted earlier, most mobile phones are still functioning when they are discarded, thus motives based on “wear and tear” may not be the primary reason for replacement. Instead, the replacement decision may be driven by a desire to improve perceived utility or enhance self-expression.

FIGURE 1
MODEL OF FACTORS INFLUENCING PRODUCT REPLACEMENT
 (adopted from van Nes, 2010)



Several studies report that, for durable products like dishwashers or bicycles, individuals have a difficult time abandoning their existing well-functioning products because of the “mental book value” or mental cost associated with replacing it (Okada, 2001; van Nes, 2010; van Nes & Cramer, 2005). According to van Nes, people tend to form an emotional attachment to durable goods, and postpone replacing an item until they feel they “really need to.” Reasons given for “needing to” are because they are afraid of emerging defects, the product has lasted a satisfactory amount of time (perceived), or they feel they are deserving of a new model; these justifications for product replacement represent the “replacement morality” characteristic in Figure 1. Trade-in programs, common with mobile phones, may also encourage replacement when individuals feel they have not gotten “their money’s worth” out of their current product (Okada, 2001). Other studies have found that some possessions are considered irreplaceable because of memories or present enjoyment associated with them; these products (e.g., photographs, quilt) may be perceived as part of an individual’s identity or “extended self” (Belk, 1988; Schifferstein & Zwartzkruis-Pelgrim, 2008). Affective barriers to product replacement such as this may not be relevant for mobile phones or other consumer electronic products because individuals generally fail to form an emotional attachment to this type of product (Nieuwenhuis, 2008; Odom, Pierce, Stolterman &

Blevis, 2009; Odom & Pierce, 2009; Walker, 2006). Electronics don't normally carry meaning at the level of the individual item (e.g. a particular mobile phone) but only at the brand name level (iPhone, Nokia).¹⁰

TABLE 3
REPLACEMENT MOTIVES AND THEIR APPLICABILITY TO MOBILE PHONES

Reason for Product Replacement*	Factors Influencing Product Replacement (Figure 1)	Applicability to Mobile phones**
Wear and Tear	<ul style="list-style-type: none"> • Existing unit does not function properly; fear of emerging defects • Replacement morality: not difficult to abandon existing unit • Situational influences (other than factors that lead to loss of functionality) not important 	<ul style="list-style-type: none"> • Fragile materials; surfaces easily damaged • Not easy to maintain or repair; people unwilling to do either (“time famine”) • Cost of repair is higher than cost of replacement • Most electronics discarded while they still function • Not difficult to abandon product • Situational influences not important
Improved Utility	<ul style="list-style-type: none"> • Existing unit does not function properly; fear of emerging defects • Replacement morality: not difficult to abandon existing unit • Desired state: more safety, comfort of use, upgradeability, and/or economy in use (more features or durability, save money, lower environmental impact) • Situational influences(reduced price, market developments,*** changes in personal life) somewhat important 	<ul style="list-style-type: none"> • Hard to identify a long-lasting product; price and brand not good indicators • Owner does not perceive product to be long-lasting or preserving of personal history • Product does not “age w/dignity” • Not difficult to abandon product • Situational influences (reduced price, market developments) very important
Improved Self-Expression or New Desires	<ul style="list-style-type: none"> • Existing unit does function properly • No fear of emerging defects • Replacement morality: difficult to abandon existing unit • Desired state: better quality/design, higher social status (publicly consumed good) • Situational influences (media/peer, market developments, changes in personal life) very important 	<ul style="list-style-type: none"> • “New” is motivator; other social markers un-developed • Transitional nature of cultural meaning (“fashion”) prevents emotional attachment • Visual appearance of phone very important in choice • Little modification or customization possible at present • No difficulty abandoning product • Situational influences (peer/media, market developments) very important

*This typology is adapted from van Nes & Cramer, 2005

** Sources: Bloch et al. 2003; Evans & Cooper, 2010; Hanks et al. 2008; McCracken ,2005; Nieuwenhuis, 2007; Walker, 2006.

*** Market developments include price promotions, design/technology changes, and other marketer-initiated strategies.

As summarized in Table 3, the failure to form a strong emotional attachment with a mobile phone may be due to several factors. First, it is difficult to personalize the external casings of a mobile phone, the components that are publicly seen and convey social/positional value. The ability to personalize or

customize a product increases satisfaction levels and reduces replacement frequency; it is a form of product co-creation (Ho & Lee, 2011). Personalizing the phone's software is, of course, easily and frequently done; if an individual purchases a new mobile phone, it is a simple matter of data transfer to regain that level of customization (e.g., ring tone, screen design, contact list, software apps). Second, the inability to fix or repair most mobile phones oneself (or even to replace the battery on some models), to "tinker" with it and make it your own can lead to a sense of loss of control and alienation from the product (Nieuwenhuis, 2008).¹¹ Further, the material qualities of electronic products (injection-molded, mass produced plastics, smooth and cold surfaces that damage easily) do not have the potential for timeless beauty and preservation of personal histories that a product made out of wood or metal might. Manufacturers alter the visual appearance of mobile phones frequently in order to stay in style, convey innovativeness and distinguish their product's appearance from those of competitors (Bloch, Brunel & Arnold, 2003).

Last, market developments/strategies such as frequent technological advances, short design lives and style changes may encourage individuals to consider mobile phones transient fashion items rather than durable goods (Slade, 2006). Cripps & Meyer (1994) found that, even for durable goods, individuals were more likely to replace the product because of technological obsolescence than because of product deterioration. Examining the motives for cell phone replacement and the role that emotional attachment might play in this decision are two of the objectives of our research.

METHOD AND SAMPLE

Study 1: In-Depth Interviews w/Customers

Personal interviews were held with fifteen undergraduate and graduate business students (7 men/8 women) at a Northwest U.S. university to learn about their consumption behavior related to mobile phones. Each interview was conducted by a graduate student who is very knowledgeable about mobile phone technology and provider policies; each interview lasted at least 30 minutes. In addition to basic questions about how many mobile phones they had owned and how often they replace them (and what prompts them to do so), respondents were asked about how they feel when they acquire a new phone and discard another, the extent to which their phone was an important part of their life (and their emotional attachment to a particular phone), and the relative importance of market developments (new technologies, styling or pricing) versus physical deterioration in the replacement decision. They were also asked to identify "anything that might persuade you to keep your phone for a longer period of time than you do now." Findings were used to develop the survey for Study 2 and also to obtain in-depth information on mobile phone consumption behavior.

Study 2: On-line Survey w/Customers

Qualtrics was used to design a fifteen minute online survey to gather information on mobile phone consumption behavior and replacement motives. Undergraduate students at the same Northwest university were randomly selected to receive an email requesting their participation. No incentives were provided other than informing them that their responses would contribute to our understanding of mobile phone consumption behavior. Of the 1000 email requests sent out, 254 completed surveys were received, for a response rate of 25%. Table 4 compares the sample characteristics to those of the general student population at the university; the sample is fairly representative except for the fact that respondents are slightly older (21.5 vs. 20 yrs.) and females are somewhat over-represented (69% vs. 55%). Respondents may be somewhat more sensitive than the general U.S. college population to environmental issues surrounding mobile phone disposal and replacement: they frequently re-cycle at school and at home (a behavior that is the norm throughout the Northwest U.S.), they are somewhat concerned about e-waste and are very concerned about global climate change. Women are more likely than men to participate in pro-environmental activities ($p < .01$).

TABLE 4
SAMPLE CHARACTERISTICS

Characteristic	Sample	Student Population
Median Age (yrs.)	21.5	20
Gender	69% female	54% female
Major	25% Business	27% usiness
Year in School	50% Juniors/Seniors	45% Juniors/Seniors
Ethnicity	90% Caucasian	90% Caucasian
Average HH Income	\$80,000	\$78,000
Recycle?	Often (mean = 4.4) *	--
Participate in Outdoor Activities?*	Sometimes/Often (mean = 3.5)	--
Concerned about e-waste? **	Somewhat Concerned (mean = 4.36)	--
Concerned about Global Climate Change?***	Very Concerned (mean = 4.88)	--

*1=Never, 5=Always **1=Not at all concerned, 5=Very concerned

FINDINGS

Mobile phone Product Lifetimes and Disposal Behavior

The sample's ownership profile is summarized in Table 5. 75% of respondents have owned from 3-6 phones in their 20 years on the planet and 60% of them replace their phone every 1-2 years; this finding is consistent with that reported by Hanks et al. (2008) with a similarly aged sample. Those who reported higher family incomes are more likely to replace their phone more frequently (chi-square = 30.4, $p < .05$), as are those who never recycle (chi-square=36.7, $p < .05$). The most popular brands are Samsung and LG; men are more likely to own a smart phone (e.g. iPhone, Blackberry) than women (chi-square = 44.63, $p < .01$). When asked how long they expect their mobile phone to remain functional (design life), half say 2 years, while a third believe the phone will last for 3-4 years (if they don't lose it first). The belief that the phone will function for only 2 years is consistent with EPA data (EPA 2008) and with the responses given by the provider managers when asked how long their mobile phones were designed to last. All four managers said there is "no standard design life," and one noted that "they seem to break after 2 years for some reason." Notably, over 50% of respondents would like their mobile phone to be designed to last three or four years, and another 30% would prefer a phone durable enough to last five or more years. Most of those interviewed stated that they make an effort to ensure that their phone is not damaged through their own behavior.¹²

TABLE 5
MOBILE PHONE OWNERSHIP PROFILE

Number of Mobile Phones Owned:	<ul style="list-style-type: none"> • 1-2 (11%)* • 3-6 (74%) • more than 6 (15%)
Replacement Frequency:	<ul style="list-style-type: none"> • less than 1 year (2%) • every 1-2 years (62%) • every 3-4 years (31%)
Fate of “old” phone:	<ul style="list-style-type: none"> • keep it as backup (67%) • recycle it (12%) • sell it or give it away (9%) • throw it away (4%)
Expected Product Lifetime:	<ul style="list-style-type: none"> • 1 year (7%) • 2 years (54%) • 3-4 years (32%)
Desirable Product Lifetime:	<ul style="list-style-type: none"> • 2 years (12%) • 3-4 years (56%) • 5 years (13%) • 6 years or more (15%)

* i.e. 11% of respondents have owned 1-2 phones

Similar to findings from previous research (EPA, 2008; Hanks et al. 2008), most respondents (67%) keep their old phone as a “back-up” in case their new one breaks or they lose it, although a sense of guilt about throwing the old phone away comes through quite strongly and may play into this tendency. Respondent comments suggest an unconscious aversion to discarding a phone in the trash: “I forget that I have it and leave it in a drawer somewhere until the end of time,” and “I never get around to disposing of them so they float around my room and car.” This finding indicates that throwing away a still functioning product is inconsistent with individuals’ replacement morality with respect to mobile phones.

A few respondents (12%) do say they recycle their old phone (Radio Shack, service provider), but only after it has been “kicking around the house” for a while. Recycling as a disposal option suffers from a lack of information; a majority of respondents are not sure where to take their phone to be recycled.¹³ Women (13%) are more likely to recycle their phone than men (9%), while men are more likely than women to give away or re-sell their old phone (men=17%, women=7%;chi-square = 20.79, p < .05). Since men are more likely to own more expensive smart phones, it’s logical that they would make more of an effort to re-sell them. These findings reflect the fact, noted earlier, that the C2C market for mobile phones is just beginning to take off.

Emotional Attachment

None of the respondents interviewed indicate any kind of emotional attachment to a particular phone that would make them reluctant to replace it with a new one: “you sort of forget about the old phone quickly when you have a new phone in your hands.” The only emotion associated with discarding an old phone is one based on guilt and mild shame. Respondents appear to feel guilty for throwing away a phone that still works just because they can obtain a new one for free when renewing their contract or because they want a new and more fashionable/technologically advanced product. It seems that the excitement of having a new phone supersedes any guilt associated with discarding the old one, however. When asked specifically about how they feel when they acquire a new phone, respondents report being “excited about learning the new technology” and “happy about having a new toy.” Voluntary product replacement due to technical obsolescence engenders more excitement in the purchase process than involuntary replacement due to product failure (Grewal, Mehta & Kardes, 2004).

Some products are perceived as “special” because they have symbolic value (e.g., heirloom, fancy car), mood-altering properties (e.g., a favorite music CD) or because they have instrumental importance, i.e. are extremely useful (Csikzentmihalyi & Rochberg-Halton, 1981). In this study, respondents uniformly spoke of how important their phone was as a “tool” for communicating with others: “I guess it’s like the most valuable tool in my life, I need it for work and school to communicate. ...It’s the one thing I don’t go anywhere without,” and “I’m completely dependent on it. It goes for anyone these days, they don’t just show up to your place, they always text or call beforehand.” Its importance extends beyond just communication: “It wakes me up every morning with the alarm and I schedule appointments and class on it,” and “I use the internet all the time to find the answers to class questions, to check the weather, to make travel plans.” Consistent with the findings reported by Odom & Pierce (2009; see endnote #10), respondents are attached to the benefits provided by the mobile phone, but not to the phone itself.

Replacement Motives

The survey data reveal two important reasons for replacing a current mobile phone: (1) the discount on a new, upgraded phone received during contract renewal (42% overall) and (2) the need to replace a lost or severely damaged phone (40% overall) (see Table 6). Technological advances, new styles or lower prices motivate fewer survey respondents to trade-in their old phone for a new one, although men, those who enjoy higher family incomes (chi-square=37.4, $p < .05$) and those who never recycle (chi-square=26.43, $p < .05$) are significantly more likely to be motivated by the introduction of new phone styles or technologies. The gender differences are quite pronounced: 30% of men are motivated by new technologies/styles (vs. 11% of women), while 44% of women (vs. 30% of men) replace their phone because it is damaged or lost (chi-square = 19.3, $p < .05$). However, the upgrade discount with contract renewal is the number one motivator for men (37%) and just as important as replacing a broken/lost phone for women (44%). These data do suggest that men are more enamored of new technologies and upgrades; clearly there are social rewards associated with owning the latest model of mobile phone (Cripps & Meyer, 1994).

TABLE 6
MOST IMPORTANT MOBILE PHONE REPLACEMENT MOTIVES

Upgrade discount with contract renewal	42%
Damaged or lost mobile phone	40%
New technology or version	16%
Low price on new phone	1%
More likely to buy a new phone when yours breaks or when a new version comes out?	Breaks: 91%

Those who participated in the in-depth interviews have mixed feelings about the role of technology and style changes in their replacement decisions. Half of the respondents stated that they never pay attention to periodic technological or style advances, while the other half say they always replace their phone with a new version as soon as it appears on the market: “...the iPhone 3 was great when it came out and when the iPhone 4 came out it was even better...when the iPhone 5 comes out it will be much better than even the 4” and “everybody knows I always have the latest phone.” These findings suggest that marketers have convinced at least some customers that mobile phones are a fashion item that requires frequent renewal and updating in order to maintain or enhance one’s self-image.

Strategies to Extend Product Lifetime

Survey respondents were asked which manufacturers’ incentives might persuade them to keep their current mobile phone longer than 1-2 years (see Table 7). Increases in phone durability, financial rewards for staying with their current phone, and the ability to upgrade the phone they already own (e.g., software

upgrades, modular design) were rated as be the most effective incentives. Next to retail price and performance (e.g., speed, coverage), respondents consider product durability to be an important attribute in mobile phone choice. These findings are inconsistent with previous research, mentioned earlier, that has found durability to be a low priority in the decision making process for durable goods (Cooper & Christer, 2010; Guiltinan, 2009).

TABLE 7
MOST PERSUASIVE INCENTIVES TO DECREASE REPLACEMENT FREQUENCY

Make mobile phones more durable	71%*
Offer a financial reward for staying w/existing phone	68%
Allow me to bring in phone for software upgrade	67%
Allow me to add new features to current phone at low cost	52%
Raise prices on new mobile phones	14%

* 71% of respondents stated they would keep their current mobile phone longer if it was more durable; respondents could select more than one incentive.

Turning to the customer interview data, several individuals stated that the contract renewal period would have to be extended to three years in order to discourage phone replacement, while others feel that there is “nothing they can do to make me hang on to my current phone because I want the new technology.” One individual stated that the quality of the phones would have to be improved; when shopping for a new phone he always asks for the brand that prior customers have complained about least. This is not surprising, given that mobile phones head the list of product categories generating consumer complaints in the U.S. (Better Business Bureau, 2010). Many of these complaints relate to the tendency for mobile phones to sustain damage even under careful use conditions.

DISCUSSION

Findings from these two studies suggest that consumer behavior related to the disposal and replacement of mobile phones is primarily driven by industry marketing strategies that encourage individuals to replace their phones more frequently than they need or prefer to. Modifications to the design of mobile phones and to other marketing strategies would certainly lengthen product lifetimes, but it may require public policy efforts to persuade the industry to implement such changes.

Product Re-Design

Findings from our research indicate that many 18-25 year olds have a strong desire for more durable phones (see Table 7). There is no question that doing so is technically feasible – witness the Nokia 1100, a mobile phone that is “rugged, simple and dust-resistant...with an embedded flashlight” (London & Hart, 2011, p. 173). This phone is currently available only in developing countries, where it has maintained its position as the best-selling phone over the past decade. Phones could be designed to last at least as long as individuals want them to -- 3-5 years as suggested by respondents in this study. Similarly, Cooper (2004) found that a “reasonable” lifespan for electronic products was two or three years more than the age of the product when it was discarded. The fact that respondents feel guilty about discarding a still-functioning, supposedly durable product suggests that this age group would be amenable to design strategies that extend the lifetime of mobile phones well beyond the current lifetime of eighteen months. Other research on Millenials’ consumption behavior indicates that they are more likely to consider the environmental and social impacts of their purchases than older generations, and are more prone to buying secondhand products than other groups (Botsman & Rogers, 2010).

Other design for environment (DfE) strategies that would increase product lifetimes are summarized in Table 8. These include designs that permit technological upgrades to be delivered via software instead of requiring new hardware; modular designs that make it easy for customers to change the appearance or

features of their phone; designs for easy maintenance and repairability; and phone personalization/customization options that would increase emotional attachment. While some progress is being made here (e.g., many different apps can be downloaded for the iPhone), most phones cannot be repaired or maintained by the user.

TABLE 8
STRATEGIES TO ENCOURAGE MOBILE PHONE LIFETIME EXTENSION

Product Design Strategies

- Increase durability; design with desired product lifetime in mind (3-5 years)
- Use recycled and recyclable materials; design for disassembly
- Deliver technological upgrades through software or independent modules (e.g., downloadable iPhone apps)
- Make it easy for user to maintain and repair
- Eliminate toxic ingredients
- Make it easy to customize/personalize phone (co-creation)

Marketing Strategies

- Incorporate life cycle thinking into all product marketing (adopt WBCSD approach)*
- Initiate voluntary “take-back” or Extended Producer Responsibility (EPR) programs
- Work on de-materialization through development of product-service systems (PSS), e.g., widely available repair stations
- Eliminate current contractual arrangements; move to pre-paid strategy
- Offer incentives to keep current phone as opposed to current trade-in programs; extend renewal period to 3+ years
- Lower recovery transaction costs: provide collection bins, mailers, labeling
- Persuade consumers that refurbished phones are “cool;” lower prices on such phones
- Educate customers about e-waste and the need for longer product lifetimes

Public Policy Strategies

- Pass EPR legislation similar to EU WEEE and RoHS Directives**
- Require manufacturers to meet international end-of-life standards for mobile phones as laid out in the Basel Convention’s Initiative***
- Require a deposit on phones; impose a fee on purchase to fund phone recovery programs
- Develop curricular materials on the need for sustainable consumption and disposition of mobile phones
- Ban toxic ingredients; ban mobile phones from landfills
- Incorporate environmental requirements into government purchasing specifications

*World Business Council on Sustainable Development. Encourage industry innovation, choice influencing (awareness-raising campaigns) and choice editing (removal of unsustainable product/services from the marketplace) strategies (WBCSD 2005;

http://www.wbcd.org/DocRoot/19Xwhv7X5V8cDIHbHC3G/WBCSD_Sustainable_Consumption_web.pdf)

** Waste Electrical and Electronic Equipment Directive (WEEE), see footnote 3; Regulations on Hazardous Substances (RoHS)

*** Basel Convention’s Initiative for a Sustainable Partnership on Environmentally Sound Management of End-of-Life Mobile Phones: <http://www.basel.int/industry/mppi/gdfd30Jun2010.pdf> . Not yet legally binding.

The need for “emotionally durable design” to extend product lifetimes has received a significant amount of attention in the eco-design literature (e.g., Chapman, 2005; Cooper 2010; Odom & Pierce, 2009). To increase emotional attachment to a particular phone, it would need to be designed to reflect and adapt to users’ needs and circumstances, and to permit users to collaborate with manufacturers on phone design. Product co-creation, or “customer-made,”¹⁴ is part of an emerging trend toward collaborative consumption, as well-documented in a recent book on this subject (Botsman & Rogers 2010). While several of the design strategies summarized in Table 8 could deliver a certain level of personalization (e.g., modular design), true innovation in phone design has yet to address the consumer desire for customization.

Move to Product-Service Systems

The overarching industry transformation necessary for sustainable consumption is a wholehearted adoption of a product service system (PSS) approach to marketing planning and implementation (Lovins & Cohen, 2011; Lubin & Esty, 2010; McDonough & Braungart, 2002). In an extended-life PSS, firms move from being product sellers to being service providers, assuming responsibility for a product from creation through disposal. Taking such a systems approach requires life cycle or cradle-to-cradle thinking, i.e., a “waste equals food” mindset that mimics natural cycles. A majority of company profits (with significantly higher margins) come from the provision of after sales services such as maintenance, repair, software/modular upgrades, and take-back programs (reverse logistics) rather than from sales of new products.

It is important to remember in this context the classic marketing adage, “customers want the hole, not the drill.” At least for Millennials, the consumption experience is all about access, not ownership (80% of the items people own are used less than once a month; Botsman & Rogers, 2010). How can we design a PSS for mobile phones that delivers a great experience and meets customer needs while minimizing negative environmental and social impacts? Our findings indicate that firms that are able to move in this direction will enjoy a competitive advantage among the 18-25 age group, particularly if they are offered incentives to stay with their current phone or are able to easily access software or modular upgrades (see Table 7).

Need for Radical Transparency

Additional marketing strategies that would encourage more sustainable consumption are listed in Table 8. There is a critical need for education about the link between consumption and its environmental and social impacts (Kilbourne & Carlson, 2008; Schaefer & Crane, 2005), and about where and how phones can be recycled/returned – recycling rates are low in our study due to respondents’ lack of recycling information. It is important that marketers take the initiative here through eco-labels, return mailers and other marketing communications before regulation is passed that requires more industry transparency and adherence to EPR standards. Goleman, in his recent book on ecological intelligence (2009), notes that consumers are beginning to demand radical transparency from companies so that they can make better buying decisions, and the popularity of “shopping guides” that rank firms on their environmental and social performance highlights the significance of this trend (e.g., www.GoodGuide.com; www.BetterWorldShopper.org).

Public Policy and Changes to Industry Marketing Practices

Of course, the current industry practices of requiring two year contracts and providing “free phones with contract renewal” will require modification along with the product re-design and PSS innovations suggested above if significant changes in mobile phone consumption are to take place. For this to happen, new regulations and other public policy efforts such as those listed in Table 8 may be necessary. For example, phone industry Extended Producer Responsibility (EPR) programs are already required in the EU, and may be required within a few years in the U.S. as the public becomes more aware of the problems associated with e-waste. Under EPR, producers take steps to manage their products properly at the post-consumer stage. It involves both sustainable product design (less use of toxic materials, use of

recycled and recyclable materials, upgrade potential, and ease of disassembly for repair and recycling) and participation in take-back and recycling programs. It recognizes that manufacturers are in the best position to control the longevity, content and recyclability of the products which they design and market.

Future Research

While our research explores aspects of mobile phone consumption related to disposition and replacement, the relative importance of current and potential phone attributes/benefits in choice of a phone was not directly examined. Findings from this study and others are inconsistent with regards to the relative importance of phone durability in choice, and little is known about the preference structure related to potential new attributes (e.g., modularity, degree of customization). A discrete choice experiment that estimates the utilities associated with various current and potential phone attributes would provide the data necessary to address this issue. Given the gender differences uncovered in our research, any future conjoint studies should be sure to examine gender differences in attribute preference with an eye toward using gender as a segmentation variable in marketing planning. This may be particularly important as smart phone penetration increases; 24% of Americans currently own smart phones, a 50% increase over 2010 (InfoTrends, 2011).

A second avenue for future research has to do with emotional attachment and interactive digital products – anecdotal evidence suggests that many individuals develop such an attachment to their laptop, based on customization of the software interface. How can mobile phones be transformed into meaningful possessions that encourage longevity of use? For example, industrial designers Odom & Pierce (2009) have conceived of a Musical Passport, “a portable MP3 player that encourages attachment by recording its travels. Equipped with a GPS module, it 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” (p. 5).

The degree to which re-distribution and re-use strategies will reduce new mobile phone sales, i.e., increase cannibalization, is another important issue that offers a fruitful area for future research. To what extent do used phone sales displace potential new phone sales? If evidence for cannibalization is found, this could be a strong disincentive for manufacturers and service providers to support any type of product lifetime extension strategy. In general, more research is needed on what combination of incentives and regulations will encourage the mobile phone industry to integrate sustainability into its business model.

CONCLUSION

Sustainability has been characterized as a “megatrend” that is driving businesses to develop innovative strategies to address the environmental and social impacts of their products in order to remain competitive. With escalating public concern over climate change, increasing numbers of consumers demanding more sustainable products, and new regulations that directly affect businesses (e.g., the EPA’s ruling that greenhouse gases be regulated as a pollutant), “firms (must) engage in widespread redesign of products, processes and whole systems” (Lubin & Esty, 2010, p. 5). Sustainability innovations such as those discussed here can be a source of new revenues and growth for firms who understand the imperative of moving their customers toward more sustainable consumption.

ENDNOTES

¹ Sustainable consumption (SC) is defined as consumption that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report, United Nations 1987, p. 8). To contribute to SC, businesses must take a “triple bottom line” approach to goal setting, with equal attention paid to achieving economic profitability, minimizing environmental impact and fostering social equity (Elkington, 1998).

² As a culture, we are socialized from a young age to “hide” our waste from sight by placing it in the trash. Weekly garbage collection services, frequently early in the morning or late at night, whisk our garbage away so that we never have to face the ever-increasing mountain of waste we are generating (de Coverly et al. 2008). Waste management is a growth business.

³ The **Waste Electrical and Electronic Equipment Directive** (WEEE Directive) is an EU regulation passed in 2003 that places the responsibility for the disposal of waste electrical and electronic equipment on the manufacturers of such equipment. Those companies have established an infrastructure for collecting WEEE from users in private households (at no cost to the user) and must dispose of the collected waste in an ecologically-friendly manner, either by ecological disposal or by reuse/refurbishment of the collected WEEE. It is estimated that two thirds of WEEE is still finding its way to landfills, so the WEEE Directive is currently being revised. (Source: http://ec.europa.eu/environment/waste/weee/legis_en.htm)

⁴ Plug-In To eCycling is a partnership program between the EPA and leading consumer electronics manufacturers, retailers, and mobile service providers that fosters and promotes opportunities for individuals to donate or recycle their electronics. (Source: <http://www.epa.gov/osw/partnerships/plugin/>)

⁵ EcoATM is testing an interesting approach in California. Kiosks allow people to choose the phone they want to sell and then place it in an inspection bin (w/a cord to attach to the phone). The machine makes a trade-in offer based on the condition of and going rate for the phone. If accepted, the phone is kept and the customer receives the cash instantly (an iPhone 4 gets up to \$300, 60% of its original value) (Hiskes, 2011).

⁶ Product lifetime extension by definition lengthens the repeat purchase cycle, which in turn slows the rate of sales growth (Guiltinan, 2009).

⁷ There are other models and typologies of voluntary product disposition (e.g., Jacoby et al. 1977; Hanson, 1980; Young & Wallendorf, 1989); the present model is used because it highlights the relationship between disposition form and environmental impact.

⁸ “Most consumers select mobile phones based on features and pay relatively little attention to the environmental and social impacts associated with their production and use.” www.GoodGuide.com, accessed on 6/3/11.

⁹ Mobile phones have a significant heavy metal content that is released upon incineration or recovery efforts undertaken without proper protective clothing (Lim & Schoenung, 2010).

¹⁰ People can be attached to the thing itself or to what the thing provides (Chapman, 2005; Verbeek, 2005). Odom & Pierce, (2009) found that respondents are attached to the information stored on their mobile phones and to the communication it enables, but not to the particular mobile phone (i.e., it has instrumental importance).

¹¹ See www.freedom-to-tinker.com to understand the significance of this freedom to physically engage with the product.

¹² The author has observed many college students throwing and dropping their phones, belying, to some extent, the validity of this self-report data.

¹³ One global study, sponsored by Nokia, reported that more than 50% of respondents were unaware that mobile phones could be recycled at all (Raghaven, 2010).

¹⁴ “Customer-made is the phenomenon of corporations creating goods, services and experiences in close cooperation with experienced and creative consumers, tapping into their intellectual capital, and in exchange giving them a direct say in (and rewarding them for) what actually gets produced, manufactured, developed, designed, serviced or processed” (<http://trendwatching.com/trends/CUSTOMER-MADE.htm>).

REFERENCES

Belk, R.W. (1988). Possessions and the extended self. *Journal of Consumer Research*, 15(Sept.),139-167.

Better Business Bureau (2010). *Complaints to Better Business Bureau up nearly ten percent in 2009*. Retrieved on June 10, 2011, from <http://www.bbb.org/us/article/complaints-to-better-business-bureau-up-nearly-10-percent-in-2009-18034>

Blevis, E. (2007). Sustainable interaction design: invention and disposal, renewal and reuse. *Proceedings of the 2007 Conference on Human Factors in Computing Systems (CHI)*, San Jose, CA, 503-512.

CBS News (2010). *Number of cell phones worldwide hits 4.6B*. Retrieved on May 26, 2011, from <http://www.cbsnews.com/stories/2010/02/15/business/main6209772.shtml>

Grewal, R., Mehta, R. & Kardes, F. R. (2004). The timing of repeat purchase of consumer durable goods: the role of functional basis of consumer attitudes. *Journal of Marketing Research*, 41(February), 101-115.

Bloch, P. H., Brunel, F. F. & Arnold T.J. (2003). Individual differences in the centrality of visual product aesthetics: concept and measurement. *Journal of Consumer Research*, 29(March), 551-565.

Bottsman, R. & Rogers, R. (2010). *What's mine is yours: the rise of collaborative consumption*. New York: HarperCollins.

Brundtland Report (1987). *Our common future*, World Commission on Environment and Development. Oxford: Oxford University Press.

Chapman, J. (2005). *Emotionally durable design: objects, experiences and empathy*. London: Earthscan.

Cooper, T. (2004). Inadequate life? Evidence of consumer attitudes to product obsolescence. *Journal of Consumer Policy*, 27, 421-449.

Cooper, T. (2005). Slower Consumption: reflections on product life spans and the “throwaway society.” *Journal of Industrial Ecology*, 9(1-2), 51-68.

Cooper, T. (Ed.). (2010). *Longer lasting products: alternatives to the throwaway society*. Surrey, England: Gower Publishing Limited.

Cooper, T. & Christer, K. (2010). Marketing durability. In T. Cooper (Ed.), *Longer lasting products* (pp. 273-296). Surrey, England: Gower Publishing Limited.

Cripps, J. D. & Meyer, R. J. (1994). Heuristics and biases in timing the replacement of durable products. *Journal of Consumer Research*, 21(Sept.), 304-318.

- Csikzentmihalyi, M. & Rochberg-Halton, E. (1981). *The meaning of things: domestic symbols and the self*. Cambridge, England: Cambridge University Press.
- de Coverly, E., McDonagh, P., O'Malley, M. & Patterson, M. (2008). Hidden mountain: the social avoidance of waste. *Journal of Macromarketing*, 28(3), 289-303.
- Elkington, J. (1998). *Cannibals with forks: the triple bottom line of 21st century business*. Gabriola Island BC: New Society Publishers.
- Environmental Protection Agency (EPA) (2008). Statistics on the management of used and end-of-life electronics. Retrieved May 21, 2011, from <http://www.epa.gov/wastes/conserva/materials/ecycling/manage.htm>
- Evans, S. & Cooper, T. (2010). Consumer influences on product life-spans. In T. Cooper (Ed.), *Longer lasting products* (pp. 319-350). Surrey, England: Gower Publishing Limited.
- Geyer, R. & Blass, V. D. (2010). The economics of cell phone reuse and recycling. *International Journal of Manufacturing Technology*, 47, 515-525.
- Goleman, D. (2009). *Ecological Intelligence*. New York: Broadway Books.
- Gordon, B. R. (2009). A dynamic model of consumer replacement cycles in the PC processor industry. *Marketing Science*, 28(5), 846-867.
- Grewal, R., Mehta, R. & Kardes, F. R. (2004). The timing of repeat purchase of consumer durable goods: the role of functional basis of consumer attitudes. *Journal of Marketing Research*, 41(February), 101-115.
- Guiltinan, J. (2009). Creative destruction and destructive creations: environmental ethics and planned obsolescence. *Journal of Business Ethics*, 89, 19-28.
- Hanks, K., Odom, W., Roedl, D. & Blevis, E. (2008). Sustainable Millennials: attitudes toward sustainability and the material effects of interactive technologies. *Proceedings of the 2008 Conference on Human Factors in Computing Systems (CHI)*, Florence, Italy, 333-342.
- Hanson, J. W. (1980). A proposed paradigm for consumer product disposition processes. *Journal of Consumer Affairs*, 14(1), 49-67.
- Hiskes, J. (2011, May). Deconstructed: ecoATM. *Sustainable Industries*, p. 16.
- Ho, J. C. & Lee, C. (2011). Factors underlying personalisation adoption: case of mobile telephony. *International Journal of Services Technology and Management*, 15(3/4), 281-297.
- Jacoby, J., Berning, C. K. & Dietvorst, T. F. (1977). What about disposition? *Journal of Marketing*, 41(April), 22-28.
- InfoTrends (2011). *Smartphone adoption growing at astonishing rate*. Retrieved on June 10, 2011, from <http://www.infotrends.com/public/Content/Press/2011/05.25.2011.html>
- Kilbourne, W. E. & Carlson, L. (2008). The dominant social paradigm, consumption, and environmental attitudes: can macromarketing education help? *Journal of Macromarketing*, 28(2), 106-121.

- Lim, S. & Schoenung, J. M. (2010). Toxicity potentials from waste cellular phones, and a waste management policy integrating consumer, corporate, and government responsibilities. *Waste Management*, 30(8-9), 1653-1660.
- London, T. & Hart, S. L. (2011). *Next generation business strategies for the base of the pyramid*. New Jersey: Pearson Education, Inc.
- Lovins, L. H. & Cohen, B. (2011). *Climate capitalism*. New York: Hill and Wang.
- Lubin, D. A. & Esty, D. C. (2010). The sustainability imperative. *Harvard Business Review*, May, 1-9.
- McCracken, G. D. (2005). *Culture and consumption II: markets, meaning and brand management*. Bloomington: Indiana University Press.
- McDonough, W. & Braungart, M. (2002). *Cradle to cradle: remaking the way we make things*. New York: North Point Press.
- Mobiledia (2011). *Used phone market thrives*. Retrieved on June 22, 2011, from <http://www.mobiledia.com/news/82699.html>.
- Nieuwenhuis, P. (2008). From banger to classic – a model for sustainable car consumption? *International Journal of Consumer Studies*, 32, 648-655.
- Odom, W. & Pierce, J. (2009). Improving with age: designing enduring interactive products. *Proceedings of the 2009 Conference on Human Factors in Computing Systems (CHI)*, Boston, MA, 3793-3798.
- Odom, W., Pierce, J., Stolterman, E. & Blevis, E. (2009). Understanding why we preserve some things and discard others in the context of interaction design. *Proceedings of the 2009 Conference on Human Factors in Computing Systems (CHI)*, Boston, MA, 1053-1062.
- Okada, E. M. (2001). Trade-ins, mental accounting, and product replacement decisions. *Journal of Consumer Research*, 27(March), 433-446.
- Ongondo, F. O., Williams, I. D. & Cherrett, T. J. (2011). How are WEEE doing? A global review of the management of electrical and electronic wastes. *Waste Management*, 31, 714-730.
- Peattie, K. (2010). Rethinking marketing. In T. Cooper (Ed.), *Longer lasting products* (pp.243-272). Surrey, England: Gower Publishing Limited.
- Raghavan, S. (2010). Don't throw it away: the corporate role in product disposition. *Journal of Business Strategy*, 31(3), 50-55.
- Roster, C. (2001). Letting go: the process and meaning of dispossession in the lives of consumers. In M. Gilly and J. Meyers-Levy (Eds.), *Advances in Consumer Research*, 28. Provo, UT: Association for Consumer Research, 425-430.
- Schaefer, A. & Crane, A. (2005). Addressing sustainability and consumption. *Journal of Macromarketing*, 25(1), 76-92.
- Schifferstein, H. N. & Zwartkruis-Pelgrim, E. P. (2008). Consumer-product attachment: measurement and design implications. *International Journal of Design*, 2(3), 1-14.

Schor, J. (1998). *The overspent American: upscaling, downshifting, and the new consumer*. New York: Basic Books.

Slade, G. (2006). *Made to break: technology and obsolescence in America*. Boston: Harvard University Press.

Smith, A. (2010). *Mobile access 2010: a project of the PewResearchCenter*. Retrieved April 3, 2011, from: <http://pewinternet.org/Reports/2010/Mobile-Access-2010.aspx>

van Nes, N. (2010). Understanding replacement behavior and exploring design solutions. In T. Cooper (Ed.), *Longer lasting products* (pp.107-132). Surrey, England: Gower Publishing Limited.

van Nes, N. & Cramer, J. (2005). Influencing product lifetime through product design. *Business Strategy and the Environment*, 14, 286-299.

Verbeek, P. P. (2005). *What Things Do –Philosophical Reflections on Technology, Agency, and Design*. University Park: The Pennsylvania State Press.

Wagner, A. (2009). Statistics show we are all voracious cell phone users. Retrieved on June 1, 2011, from <http://www.phonedog.com/2009/09/23/statistics-show-we-re-all-voracious-cell-phone-users/>

Walker, S. (2006). *Sustainable by Design: Explorations in Theory and Practice*. London: Earthscan.

Young, M. & Wallendorf, M. (1989). Ashes to ashes, dust to dust: conceptualizing consumer disposition of possessions. *Proceedings of the 1989 Marketing Educators' Conference*, Chicago: American Marketing Association, 33-39.