To Repair or Not to Repair: What is the Motivation?

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ABSTRACT:

As researchers and policy makers explore ways to promote consumption decisions that are beneficial for consumers and sustainable for the environment, one important avenue is frequently overlooked: lengthening product lifespans via repair. If repairing products is able to have positive effects on consumers and the environment, then the motivations of repair decisions should be assessed to determine how to encourage the behavior. However, despite the importance of repair decisions for consumers and for the environment, little research has examined the usage stage of the product life cycle, especially in regards to repair propensity and its motivational factors. This research attempts to fill this gap by developing a repair propensity scale and investigating the market, product, and consumer factors related to repair propensity among consumers with higher and lower levels of repair propensity. Results show only three differences existed between the two samples: replacement cost and initial item cost was significant for the average repair propensity sample while attachment to a product was significant for the high repair propensity sample. For both samples, inconvenience of repair, stewardship and innovativeness were significantly related to repair propensity, with stewardship and innovativeness being the strongest predictors. All three categories of factors (market, product, consumer) contributed significantly to repair propensity. The findings of this study provide interesting insights into repair behavior which will be valuable to marketers and policy makers, especially those concerned with enhancing consumer well-being and environmental sustainability.

KEYWORDS

Repair, sustainability, product lifespans

The lights on the dishwasher panel blink and then go dark. No amount of pushing, prodding, or opening and closing the dishwasher door succeeds in restoring life to the now-defunct home appliance. The consumer faces a decision: should he try to extend the lifespan of the appliance by having it repaired or repairing it himself? Or should he dispose of the broken dishwasher and replace it with a new one? While a significant amount of marketing research has focused on how and why consumers choose to buy new products, relatively little research has focused on product usage and disposal generally and repair specifically. However, repair decisions have an important bearing on environmental sustainability; if more consumers choose to repair rather than replace degraded items, the demand for new items and the natural resources they contain could potentially be reduced, thereby improving the environmental sustainability of consumption. Thus, this research seeks to explore a crucial decision consumers frequently face: when a product no longer functions as it did when it was purchased, should it be repaired or replaced?

Perhaps because of the floundering economy in the past few years, repair services are seeing an increase in business. According to the U.S. Census Bureau (2011), American consumers and businesses spent $137,733 million on repairs in 2007, a 16.42% percent increase from 2002. One possible explanation for this increase is that people are becoming more frugal in their spending and consuming behaviors. These consumers are discarding the "everything-is-disposable attitude" and are trying to make products last in order to save money (Abelson 2009). Consumers are not just fixing big ticket items like dishwashers and TVs but also smaller appliances, including microwaves, that they would have never considered fixing before (Abelson 2009). In addition to the financial constraints brought on

by the economic downturn, consumers may find themselves needing more repairs in recent years because one-fifth of gas ranges, dishwashers and washing machines break down within three years of purchase, according to data from Consumer Reports (Scelfo 2009). Even once long-lasting TVs have become a relatively disposable item, many lasting only a few years, with parts that are hard to replace because of the drive for bigger, cheaper TVs (Deggans 2009). At the same time, however, consumers often find having products repaired inconvenient, costly, and frustrating (Consumer Reports 2005). In contrast, self-repair might be empowering and enjoyable to consumers; according to the manifesto on one repair website, "If you can't repair it, you don't own it!" (iFixit.com 2013). With over 400 "Repair Cafés" worldwide, participants are committed to reducing waste and increasing solidarity amongst neighbors by repairing broken items together (repaircafe.org 2014). Although it is uncertain whether the increased interest in repair will last, some experts suggest that this behavior could linger long after the economy recovers (D'Innocenzio 2009).

Repair behavior is also gaining attention from researchers and consumers concerned about environmental sustainability. One main cause of environmental problems, such as global warming, ozone depletion, and loss of species, is the overconsumption of natural resources (Tanner and Kast 2003), such as those invested in the production of consumer goods. As researchers and policy makers have explored ways to facilitate sustainable levels of consumption, one important avenue is frequently overlooked: lengthening product lifespans (Cooper 2005). In fact, it has been suggested that the life span of many consumer durables has decreased over the last few decades and that product life cycles continue to shrink in product categories such as household equipment, cars, personal computers and

clothing (Kostecki 1998). However, extending the lifetime of a product leads to a reduction of the environmental impact of our consumption patterns (van Nes and Cramer 2006). If consumers hold on to their possessions longer and delay the decision to buy a replacement, the overall material throughput in provision systems would be reduced (Cooper 2005). Thus, it is important for researchers and policy makers interested in promoting sustainable consumption to understand factors that influence a consumer's decision to repair or replace a product.

Despite the increased consumer interest in repair and its potential benefits to society, little research has examined the propensity to repair products, its antecedents, and its outcomes. This research attempts to fill this gap by developing a measure of repair propensity and conducting a survey to assess important antecedents and outcomes of repair propensity among U.S. consumers. The findings of this study will contribute to research on consumer behavior and sustainability by expanding our understanding of repair decisions, an important and little-researched aspect of consumer behavior that has significant implications for sustainability and consumer well-being.

Conceptual Development

When a consumer chooses to replace a product, it is typically the result of an evaluation that finds the product obsolete in some way. The product may be obsolete in an absolute (or technical) sense if it no longer performs the function(s) for which it was acquired (Granberg 1997). However, it may also be obsolete in a relative sense, that is, it is found wanting compared to a potential replacement. Relative obsolescence can be

conceptualized as having three types: psychological (the product is no longer satisfactory symbolically or aesthetically), technological (the product is no longer satisfactory in terms of technological function), or economic (the product no longer offers sufficient value relative to cost of ownership) (Cooper 2004). "Voluntary" product replacements motivated by relative obsolescence are of primary concern from a sustainability perspective because they represent situations where new products are demanded even though the products they replace have not reached the end of their useful life (Cooper 2004).

Within the general category of replacement decisions, items in need of repair occupy an interesting gray area between relative and absolute obsolescence. On the one hand, the item technically is not functioning as it was when it was originally purchased (absolute obsolescence), but on the other hand, the product can be restored to that state, thus making the purchase of a new replacement item discretionary. One study shows that consumers categorized 21% of the household appliances they replaced as "in need of repair" rather than "damaged beyond repair" (Cooper 2004). Increasing the prevalence of repair would thus improve sustainability by extending product lifecycles and reducing material throughput (Cooper 2005). In terms of sustainability, repair is much preferable to recycling, which requires a much greater resource investment in transportation and processing (Bekin, Carrigan, and Szmigin 2007; King et al. 2006).

Existing research on voluntary replacement in general, and repair in particular, suggests that the influences on repair behavior fall into three broad categories: factors related to the repair market, factors related to the product in need of repair, and factors related to the consumer making the repair decision.

Repair Market Factors

In spite of the increased consumer interest in repair and its potential benefit to the environment, there are factors in today's economy that may make consumers less likely to repair their products even if they are motivated to do so. Because of structural problems with the repair industry, the repair process can be difficult for customers to navigate. To stay profitable, repair companies book multiple appointments a day and do not carry all of the possible repair parts with them (Scelfo 2009). Manufacturers frequently outsource warranty service to other companies, which subcontracts out the work to another company, making getting any work done difficult (Scelfo 2009). As a result, repair is often a time consuming and inconvenient process for consumers; in a 2000 survey of consumer electronic repairs, 30% of respondents indicated that the repair process took longer than two weeks (Consumer Reports, 2001). To mitigate these issues, Bekin et al. (2007) finds that social communities facilitate repair by providing increased access to repair expertise, thereby reducing the effort and/or monetary costs associated with repair. Because of the possible inconvenience issues associated with repair behavior, we expect the perceived inconvenience of repair to influence repair decisions:

H_1: Perceived inconvenience of repair will be negatively related to repair propensity.

Another potential result of the complexity and uncertainty of the repair process is a lack of trust that a product can be effectively repaired. In fact, a recent consumer survey indicated that 25% of respondents had been dissatisfied with prior repair (Consumer Reports, 2001). Therefore, we expect that a lack of trust in repair efficacy will influence repair propensity:

H_2: Lack of trust in repair efficacy will be negatively related to repair propensity.

Product Factors

As predicted by economic choice models, there may be a rational economic comparison of the costs and benefits associated with continued ownership of an item to the costs and benefits of replacing it (Okada 2001). In fact, the cost of repair is frequently cited as the primary factor in the repair vs. replace decision (Cooper 2005). Thus, we expect consumer perceptions about the general costliness of repairs to be related to repair propensity.

H_3: The perceived cost of repairs will be negatively related to repair propensity.

The other side of the cost comparison in a repair decision involves the replacement product. Retailers and service technicians often advise customers to use the 50 percent rule: if the repair cost is half or more of the cost of a replacement, than the product should be replaced (Scelfo 2009). Furthermore, the frequency of new product introductions can itself make new products more attractive to consumers and heighten perceptions of technological obsolescence (Guiltinan 2009). The opportunity cost of foregoing the enhanced performance of a new product appears to loom larger than a concern about deteriorating performance of an old item (Cripps and Meyer 1994). Therefore, we expect that if people perceive that it is generally more cost-effective to replace a broken item, then propensity to repair will decrease. However, as replacement costs increase, repair propensity should increase as well.

H_4: The perceived cost of replacement products will be positively related to repair propensity.

In addition, Okada (2001) demonstrates that a utility-maximizing consumer might also consider a perceived loss of the "mental book value" of the product being replaced, which is a function of the original cost of the item and the perceived utility it has provided to the owner. As a result, we expect the initial investment of the broken product will influence consumers' repair decisions:

H_5: Consumers will perceive a positive relationship between the initial cost of an item and their propensity to repair the item.

Belk (1988) and others have noted how consumers can become attached to products, and research in the area of consumer culture indicate that products have more than just financial value to consumers (Arnould and Thompson 2005). Thus, it seems logical to expect that there would be a positive relationship between product attachment and likelihood of repair:

H_6: Consumers will perceive a positive relationship between attachment to an item and their propensity to repair the item.

Consumer Factors

As noted earlier, short product lifecycles and early product replacement have been identified as an environmental concern (Cooper 2004; McCollough 2010), leading to claims that the U.S. has become a "throw-away society" (Cooper 2005). One way for consumers to be more sustainable, therefore, is to increase a product's useable lifespan via repair. Thus, those who are more environmentally concerned may be more likely to repair products to increase the product's lifespan and avoid increasing landfill waste.

H_7: Environmental concern will be positively related to repair propensity.

Anecdotal evidence indicates that the prevalence of repair is increasing during the current economic slump (e.g. Abelson 2009). Furthermore, one of the most well-established factors in repair and replacement decisions is economic aspects, such as the cost to repair and the cost to replace (Bayus 1991; Okada 2001). In addition, Bayus (1991) finds that consumer frugality makes early replacement of products less likely. Thus, cost may figure predominantly into the repair decision so that those who are more frugal may be more likely to repair products to save money.

H_8: Frugality will be positively related to repair propensity.

Another consumer trait related to repair behavior is product retention tendency, which is a consumer lifestyle trait characterized by an individual's propensity to retain consumption-related possessions (Haws et al. 2011). Because of this desire, consumers are less likely to throw away broken products (Haws et al. 2011) and thus may be more likely to repair them in order to keep them.

H_9: Product retention tendency will be positively related to repair propensity.

Repair behavior may also be related to the consumer trait of use innovativeness. Use innovativeness is a consumer's receptivity to and creativity with using products in new ways that "include the invention of a new use for a currently owned product or the adaption or reuse of a product to suit a new purpose" (Ridgway and Price 1994, p. 70). Although this does not describe repair behavior per se, there is a certain amount of curiosity and creativity involved in repair since it typically involves gaining a greater understanding of how the product works as well as the development of new skills (iFixit.com 2013). A scale that

measures use innovativeness includes items such as "I never throw something away that I might use later" and "I do not enjoy a product unless I can use it to its fullest capacity" (Girardi, Soutar, and Ward 2005), which imply that use innovativeness could be related to a desire to repair rather than replace damaged products. The innovativeness and creativity involved in repair may serve as a motivation to engage in this behavior, making it possible that this trait will be positively related to repair propensity.

H_{10}: Use innovativeness will be positively related to repair propensity.

Research on repair and replacement decisions has indicated that demographic factors might also be related to propensity to repair. Specifically, research has indicated that as income increases, replacement becomes more likely relative to repair (Bayus 1991; McCollough 2007, 2010). In addition, age has been positively correlated with repair (McCollough 2010). Interestingly, there is conflicting evidence on the influence of educational attainment; Bayus (1991) finds that higher educational attainment was correlated with delayed replacement, while McCollough (2010) finds that higher educational attainment is correlated with early replacement. Although prior research conflicts on predictions related to education, because education and income are positively related, it appears more likely that repair propensity will be negatively related to educational attainment. Based on this demographic research, three hypotheses are proposed:

H_{11}: Income will be negatively related to repair propensity.

H_{12}: Age will be positively related to repair propensity.

H_{13}: Educational attainment will be negatively related to repair propensity.

Outcomes of Repair Propensity

In addition to these hypothesized influences on repair behavior, there is also evidence that repair propensity might be related to product acquisition and usage. First, the consumer may impact the likelihood of repair by choosing to consider (or not) the reparability of a product in the initial purchase decision (Guiltinan 2009). Prior research suggests consumers who are more likely to repair their possessions may consider reparability when making initial purchases (e.g. Nieuwenhuis 2008).

H_{14}: Repair propensity will be positively related to consideration of reparability during acquisition.

Secondly, research on household logistics (Boyd and McConocha 1996) indicates that consumers who plan to keep and use products over an extended time devote effort to storing and maintaining these items. While this study does not concern repair, it implies that consumers who intend to repair an item (as opposed to replacing it when it breaks down) will take better care of these items in order to forestall a breakdown. Furthermore, Okada's (2001) research indicates that consumers consider future costs and benefits when making replacement decisions, so it is not unlikely that they may engage in similar patterns of thought when considering the future costs and benefits of additional efforts to maintain products and prevent future breakdowns. Thus, the last hypothesis proposes those who are more likely to repair products will also be more likely to take care of them during the usage stage.

H_{15}: Repair propensity will be positively related to product care.

Method

The purpose of this research is to explore antecedents and outcomes of repair behavior. Two samples were selected for the purpose of understanding repair behavior: those who have an average repair propensity (MTurk) and those with a high repair propensity (iFixit). These two samples were selected to compare potential differences among those who already are highly engaged in repair behavior versus those that may have given less consideration to repairing products.

MTurk

To gain a better understanding of repair behavior and the attitudes and motivations that influence it among those with average repair propensity, a panel of U.S. consumers was recruited through Amazon Mechanical Turk (MTurk). The survey was set to have a maximum of 300 respondents, after which it was no longer available. To identify respondents that were not answering appropriately, two attention check questions were added. Responses that failed the attention checks were discarded, creating an opportunity for seven more responses. Out of the 300 responses that passed the attention checks, two were discarded after the survey closed due to missing or conflicting answers, resulting in a total of 298 valid surveys. Fifty-five percent of respondents were female, 21.5% were aged 25-29, and 55% were 35 years old or younger. Forty-four percent had at least some college education and 60% made $40,000 or less in annual income. Most respondents, 52%, lived in either the northeast or southeast.

iFixit

An additional sample was gathered for a known-groups comparison of consumers very likely to engage in repair behavior. This sample consisted of people who had purchased

a repair part from iFixit.com, a website focused on helping consumers repair their possessions. After each order on the website, a confirmation email was sent out with a link to the survey and an invitation to participate; these e-mails were sent until the desired number of responses was reached. The same questions were used for the iFixit sample as the MTurk sample. However, to increase the response rate, five $20 Amazon® gift cards were given away based on a random drawing. A total of 492 people completed the survey but one respondent was removed for significant missing data for a total of 491 respondents. Respondents were 91.3% male, 58.5% were under the age of 40, 36.2% had a bachelor's degree, 20.6% had a master's degree, and 59.5% made $60,000 or less. As compared to the MTurk sample, the iFixit respondents were more likely to be male, have more education, and have higher incomes.

Measures

In order to explore the various factors that might be related to repair propensity, the survey included measures of motivations for repair, traits, and demographic measures, as described in detail below.

Repair propensity. Six questions were developed to measure the general likelihood of a respondent repairing a product (e.g. "If a product can be fixed, I feel obligated to repair it instead of replace it"). These items were assessed on a 1-5, "strongly disagree" to "strongly agree" scale.

Perceived inconvenience of repair. Respondents were asked to indicate their agreement with the following statement: "Repairing products is such a hassle. It is just easier to get a new

one." This item and the following five items were assessed on a 1-5, "strongly disagree" to "strongly agree" scale.

Lack of trust in repair efficacy. Respondents were asked to indicate their agreement with the following statement: "I don't trust repair businesses to do the job right."

Perceived cost of repairs. Respondents were asked to indicate their agreement with the following statement: "Having a product repaired is too expensive."

Perceived cost of replacement product. Respondents were asked to indicate their agreement with the following statement: "It is often cheaper to buy a new product than to have an old one repaired" (reverse-coded).

Relationship between item cost and repair. Respondents were asked to indicate their agreement with the following statement: "The more I paid for a product, the more likely I am to have it repaired."

Relationship between attachment to item and repair. Respondents were asked to indicate their agreement with the following statement: "The more attached I am to a product, the more likely I am to have it repaired."

Environmental concern. The 4-item scale developed by Ellen (1994) was used to measure respondent's concern for protecting the environment. Questions were assessed on a 1-5, "strongly disagree" to "strongly agree" scale.

Frugality. The 8-item scale developed by Lastovicka et al. (1999) was used to assess frugality. Questions were assessed on a 1-5, "strongly disagree" to "strongly agree" scale.

Product retention tendency. The 4-item scale developed by Haws et al. (2011) was used to assess a person's desire to keep a product. Questions were assessed on a 1-7, "strongly disagree" to "strongly agree" scale.

Innovativeness. The 9-item scale developed by Girardi, et al. (2005) was used to measure the consumer trait of use innovativeness (i.e. the extent to which the consumer finds new and different uses for existing products). Questions were assessed on a 1-7, "strongly disagree" to "strongly agree" scale.

Demographics. Questions to assess income, age, and education were also used in order to explore relationships between these characteristics and other constructs measured in the survey.

Consideration of reparability during acquisition. Respondents were asked to indicate their agreement (on a 1-5, "strongly disagree" to "strongly agree" scale) with the following statement: "When I purchase a product, I look for ones that can be repaired."

Product Care. Four questions were developed to assess the degree to which a person attempts to keep their products in good care and away from harm (e.g. "Keeping my material possessions in good working order is very important to me"). Questions were assessed on a 1-7, "strongly disagree" to "strongly agree" scale.

Results

Scales were first assessed for their adequacy using confirmatory factor analysis with LISREL 8.80. Hu and Bentler's (1999) combination rule was used to determine adequate fit. This rule suggests that standardized root mean square residual (SRMR) should be below .08

and comparative fit index (CFI) should be at least .95 or root mean square of approximation (RMSEA) should be .06 or below. In some cases, items had more variance in common with each other than the model allowed for (i.e., several item pairs were slightly more correlated with each other than with the rest of the items in the scale; see Rigdon (1998)). Thus, one item of the highly correlated pairs was removed based on an examination of model residuals and face validity considerations. Items were removed until the best fitting model was obtained. One item had to be removed in the frugality scale (tightwad subscale – see following) and three items were removed in the innovativeness scale to achieve acceptable fit. To achieve acceptable fit for the model for frugality, two latent constructs had to be used. These were called stewardship, which included items dealing with using resources efficiently, and tightwad, which dealt with saving money. For the repair propensity scale, two items ("I enjoy fixing products" and "To keep my products lasting longer, I always try to fix them") were removed to achieve acceptable fit, resulting in a scale with four items. As expected, the iFixit sample was significantly higher in repair propensity (M = 4.20, SD = .779) than the MTurk sample (M = 3.82, SD = .790), $t(755) = 6.57$, $p < .001$. Final items and CFA results for each scale are shown in Table 1.

TABLE 1
Final Scale Items and CFA Results

Scale Items and CFA Results	MTurk Path Est.	iFixit Path Est.
Repair Propensity		
MTurk: χ^2 = 1.26, p = .53, GFI = 1.0, SRMR = .01, CFI = 1.0, RMSEA = .00, α = .84		
iFixit: χ^2 = 4.91, p < .09, GFI = 1.0, SRMR = .01, CFI = 1.0, RMSEA = .06, α = .87		
1. If a product can be fixed, I feel obligated to repair it instead of replace it.	.82	.84
2. I am more likely to have a product repaired than to replace it.	.70	.78
3. It is important to try to fix a product before getting rid of it.	.67	.77
4. I always try to fix a product myself or have someone else fix it.	.77	.71
Environmental Concern		
MTurk: χ^2 = 1.33, p = .51, GFI = 1.0, SRMR = .01, CFI = 1.0, RMSEA = .00, α = .85		
iFixit: χ^2 = 1.39, p = .50 , GFI = 1.0, SRMR = .01, CFI = 1.0, RMSEA = .00, α = .79		
1. Compared to other things in my life, environmental problems are not that important.	.84	.73
2. Environmental problems are of great concern to me personally. (reversed)	.68	.77
3. Environmental problems are not that serious because in the long run things will balance out.	.67	.75
4. I can think of many things I'd rather do than work toward improving the environment.	.72	.49
Frugality		
MTurk: χ^2 = 46.02, p < .001, GFI = .96, SRMR = .07, CFI = .96, RMSEA = .09		
iFixit: χ^2 = 50.46, p < .001, GFI = .97, SRMR = .04, CFI = .98, RMSEA = .08		
Stewardship (α = .71, .79)		
1. If you take good care of your possessions, you will definitely save money in the long run.	.51	.62
2. There are many things that are normally thrown away that are still quite useful.	.66	.66
3. Making better use of my resources makes me feel good.	.73	.82
4. If you can re-use an item you already have, there's no sense in buying something new.	.67	.72
Tightwad (α = .82, .84)		
1. I discipline myself to get the most from my money.	.65	.72
2. I am willing to wait on a purchase I want so that I can save money.	.82	.92
3. There are things I resist buying today so I can save for tomorrow.	.79	.71
Product Retention Tendency		
MTurk: χ^2 = 16.23, p = < .001, GFI = .97, SRMR = .02, CFI = .98, RMSEA = .16, α = .93		
iFixit: χ^2 = 1.29, p = .53 GFI = 1.0, SRMR = .01, CFI = 1.0, RMSEA = .00, α = .91		
1. Getting rid of stuff is difficult for me.	.90	.87
2. I tend to hold onto my possessions.	.90	.86
3. Unless I have a really good reason to throw something away, I keep it.	.84	.74
4. I do not like to dispose of my possessions.	.85	.78
Innovativeness		
MTurk: χ2 = 21.84, p = .01, GFI = .98, SRMR = .04, CFI = .98, RMSEA = .07, α = .80		
iFixit: χ2 = 51.86, p < .001, GFI = .97, SRMR = .04, CFI = .96, RMSEA = 1.0, α = .82		
1. Even if I don't have the right tool for the job, I can usually improvise.		
2. I never throw something away that I might use later.	.48	.58
3. In general, I would rather alter an old product to work in a new situation than purchase a new product	.51	.60
specifically for that purpose.	.69	.68
4. After the useful life of a product, I can often think of ways to use its parts for other purposes.		
5. I do not enjoy a product unless I can use it to its fullest capacity.	.79	.76
6. I use products in more ways than most people.		
Product Care	.48	.54
MTurk: χ^2 = 10.23, p < .001, GFI = .98, SRMR = .02, CFI = .99, RMSEA = .12, α = .88	.71	.63
Ifixit: χ^2 = 33.76, p < .001, GFI = .97, SRMR = .04, CFI = .97, RMSEA = .18, α = .87		
1. I work hard to protect my material possessions.		
2. Keeping my material possessions in good working order is very important to me. 3. Material things		
should be guarded from harm.		
4. I am very conscious about keeping my material possessions safe.	.79	.63
	.77	.79
	.83	.82
	.76	.76

Three analyses were conducted to explore the antecedents and outcomes of repair propensity. The first analysis was designed to test the 15 hypotheses. Using correlational analysis, each of the 15 variables was correlated with repair propensity for each sample. For the MTurk sample, 10 of the 15 hypotheses were supported in the predicted direction. Inconvenience of repair (H_1), cost of replacement (H_4), initial cost (H_5), attachment (H_6), environmental concern (H_7), frugality (stewardship and tightwad) (H_8), product retention (H_9), use innovativeness (H_{10}), consideration of repair during acquisition (H_{14}), and product care (H_{15}) were all significantly related to repair propensity. For the iFixit sample, 11 of the 15 hypotheses were supported in the predicted direction. Inconvenience of repair (H_1), lack of trust in repair efficacy (H_2), initial cost (H_5), attachment (H_6), environmental concern (H_7), frugality (stewardship and tightwad) (H_8), product retention (H_9), use innovativeness (H_{10}), education (H_{13}), consideration of repair during acquisition (H_{14}), and product care (H_{15}) were all significantly related to repair propensity. Comparing the two samples, only three relationships were different: lack of trust in repair efficacy (H_2), cost of replacement (H_4), and education (H_{13}). For the MTurk sample, cost of replacement products was significantly related to repair propensity while for the iFixit sample, repair efficacy and education was significantly related to repair propensity. See Table 2 for final values.

TABLE 2
Analysis 1: Correlational Results

	MTurk			iFixit		
Hypothesis	**Correlation**	**Sign**	**n**	**Correlation**	**Sign**	**n**
H1: Inconvenience	-.35**	.00	293	-.28**	.00	462
H2: Trust	.02	.75	292	.10*	.04	462
H3: Cost repairs	.04	.49	292	.06	.17	461
H4: Cost replacement	.25**	.00	292	-.04	.37	462
H5: Cost item	.27**	.00	293	.27**	.00	463
H6: Attachment	.31**	.00	293	.41**	.00	462
H7: Environmental concern	-.21**	.00	289	-.10*	.04	455
H8a: Stewardship	.50**	.00	291	.60**	.00	457
H8b: Tightwad	.29**	.00	293	.35**	.00	459
H9: Retention tendency	.16**	.00	289	.20**	.00	461
H10: Innovativeness	.49**	.00	289	.52**	.00	459
H11: Income	-.09	.13	292	-.09	.05	435
H12: Age	.01	.94	293	.05	.30	457
H13: Education	-.07	.25	292	-.12*	.01	459
H14: Acquisition	.25**	.00	292	.37**	.00	463
H15: Care	.25**	.00	287	.37**	.00	458

Note: *p < .05, ** p < .01

The second analysis examined which of the significant correlates from the first analysis were most strongly related to repair propensity when analyzed together. For each sample, the significant variables were entered into a regression model. Because consideration of repair during acquisition (H_{14}), and product care (H_{15}) were hypothesized as outcomes of repair propensity, they were not included in the analysis. Multicollinearity for each sample's model was examined using the Variance Inflation Factor (VIF) which indicated an absence of multicollinearity effects with VIF statistics all under 2.0, well below the guideline of 10 (Hair et al. 1998). For the MTurk sample, five variables were significant: inconvenience of repair (H_1) (t = -2.69, p < .01), replacement costs (H_4) (t = 2.51, p < .02),

initial cost (H_5) (t = 2.39, p < .02) stewardship (H_{8a}) (t = 4.32, p < .001), and use innovativeness (H_{10}) (t = 6.40, p < .001) (R^2 = .45). For the iFixit sample, four variables were significant: inconvenience of repair (H_1) (t = -4.09, p < .001), attachment (H_6) (t = 3.40, p = .001), stewardship (H_{8a}) (t = 8.47, p < .001), and use innovativeness (H_{10}) (t = 6.63, p < .001) (R^2 = .49). Only three differences existed between the two samples: replacement cost and initial item cost was significant for the MTurk sample while attachment to a product was significant for the iFixit sample. For both samples, inconvenience of repair, stewardship and innovativeness were significantly related to repair propensity with stewardship and innovativeness being the strongest predictors. See Table 3 for standardized beta coefficients and t values for each sample.

TABLE 3
Analysis 2: Regression Results

	MTurk			iFixit		
Hypothesis	**Beta**	**t**	**Sign**	**Beta**	**t**	**Sign**
H1: Inconvenience	-.14	-2.69	.01**	-.15	-4.09	.00**
H2: Trust	---	---	---	-.02	-.52	.60
H4: Cost replacement	.13	2.51	.01*	---	---	---
H5: Cost item	.12	2.39	.02*	.05	1.17	.25
H6: Attachment	.09	1.63	.10	.15	3.40	.00**
H7: Environmental concern	-.09	-1.81	.07	.02	.40	.69
H8a: Stewardship	.26	4.32	.00**	.409	8.47	.00**
H8b: Tightwad	.03	.52	.61	-.02	-.53	.60
H9: Retention tendency	-.05	-.91	.36	-.05	-1.21	.23
H10: Innovativeness	.34	6.40	.00**	.292	6.63	.00**
H13: Education	---	---	---	-.05	-1.39	.17

Note: *p < .05, ** p < .01

The third analysis investigated whether each category of factors (market, owned product, consumer) would each contribute significantly to repair propensity. To investigate

this proposition, each variable in the category (whether previously significant or not) was entered into a four stage hierarchal regression model for each sample. Consumer factors were entered in the first two steps with the three demographic variables (H_{11}, H_{12}, H_{13}) entered in Step 1, the four trait variables (H_7, H_8, H_9, H_{10}) entered in Step 2, owned product factors (H_3, H_4, H_5, H_6) entered in Step 3, and market factors (H_1, H_2) entered in Step 4. Factors were added in this order based on their probable influence on subsequent factors (e.g. market factors do not influence traits). For the MTurk sample, the hierarchical multiple regression analysis revealed that Step 1, the demographic variables, did not account for significant variance in repair propensity. Adding the trait variables in Step 2 explained 38.3% of the variation in repair propensity, and the change in R^2 was significant, F (5,268) = 33.68, $p < .001$. In Step 3, the owned product factors explained an additional 5.7%, and the change in R^2 was significant, F (4,264) = 6.81, $p < .001$. Finally, the addition of the market factors explained 2.1% of the variance in repair propensity, and the change in R^2 was significant, F (2,262) = 5.17, $p < .01$. For the iFixit sample, each set of factors significantly added variation in repair propensity. In Step 1, demographic factors accounted for 2.1% of the variance in repair propensity and contributed significantly to the regression model, F (3,394) = 3.80, p = .01. The trait factors added in Step 2 explained an additional 43.6% of the variation in repair propensity, and the change in R^2 was significant F (5,389) = 63.35, $p < .001$. In Step 3, the owned product factors explained an additional 3% of the variation in repair propensity, and the change in R^2 was significant F (4,385) = 5.78, $p < .001$). Lastly, market factors in Step 4 added 1.4% additional variance in repair propensity, and the change in R^2 was significant F (2,383) = 5.40, $p < .01$). Results are shown in Table 4.

TABLE 4
Analysis 3: Hierarchical Regression Results

	MTurk				iFixit			
Model	**Adj R2**	**ΔR2**	**ΔF**	**ΔF Sign**	**Adj R2**	**ΔR2**	**ΔF**	**ΔF Sign**
Step1: Demographics	-.00	.01	.68	.57	.02	.03	3.80	.01*
Step 2: Traits	.37	.38	33.68	.00**	.45	.44	63.36	.00**
Step 3: Product factors	.42	.06	6.81	.00**	.48	.03	5.78	.00**
Step 4: Market factors	.44	.02	5.17	.01**	.49	.01	5.40	.01**

Note: *$p < .05$, ** $p < .01$

Discussion

The overall purpose of this study was to provide insight into consumer repair behavior. This study developed a scale for repair propensity and examined possible predictors and outcomes. To the researchers' knowledge, there have been few, if any, attempts to create and validate a scale for repair propensity, and this study represents a first step in that direction. A measure of repair behavior would be of interest to consumer behavior researchers, particularly those interested in consumer issues related to sustainability. Furthermore, the relationships between this new scale and other established scales observed in this study provide interesting insights for marketers and policy makers. Ultimately, if an increase in repair leads to longer product lifespans and decreased use of natural resources, all consumers could benefit from the positive environmental effects of a more sustainable economy. The results of this study provide support for a number of interesting relationships between repair propensity and consumer, product, and market variables.

The comparison between the MTurk and iFixit samples reveals more similarities than differences between consumers with average repair propensity and those with higher repair propensity. Ten of fifteen factors were significantly correlated with repair propensity in both samples, which may indicate that our findings are robust to the absolute level of repair propensity. In other words, the same antecedents and outcomes of repair propensity appear to be present whether consumers are relatively more or less likely to repair their products. This is in keeping with prior research that posits that repair is related to personal traits (e.g. Bayus 1991), not just situational influences or economic factors. This finding is also in keeping with research on related traits, such as product retention tendency (Haws et al. 2011), which supports the conceptualization of repair propensity as an enduring consumer trait. The differences that do exist between the samples in the regression analysis suggest that economic factors, such as the cost of the item or the cost of replacement products, are more influential for consumers relatively lower in repair propensity. In keeping with prior research (e.g. Okada 2001), economic cost appears to be a significant driver of repair decisions, but this study indicates that economic factors may be relatively more important for those at lower levels of repair propensity. This finding suggests that reducing the cost of repairs relative to new products would be an effective way to promote repair behavior to those less likely to repair, and marketers could do so by making affordable replacement parts and repair manuals more available to consumers. Policy makers may also have an opportunity to facilitate repair by increasing the relative cost of new items by requiring manufacturers or consumers to internalize the cost of product disposal, as with California's electronic waste recycling fee (ca.gov 2014). Efforts like these

to make repair more affordable could benefit consumers financially. Considering that many consumers use the "50 percent rule" (Scelfo 2009), consumers are, in many cases, spending more on replacement products than would be required for repair. By reducing the cost of repairs and making it more likely that the cost of repair would be less than 50 percent of the cost of a replacement product, consumers would be more likely to repair and thus have more money to use in pursuit of other goals. In addition, given that value perceptions are a function of both monetary and non-monetary costs (Zeithaml 1988), it is possible that by reducing the non-monetary costs of repair (e.g. inconvenience, distrust), the conventional wisdom of the 50 percent rule might be revised such that the monetary cost of repair would have to be closer to 100 percent before a consumer would consider a replacement product a good value. Here again, the result would be increased repair activity and more discretionary income for consumers.

In contrast, product attachment appears more prominent among consumers with relatively higher repair propensity. Thus, it is possible that repair propensity might be linked to a consumer's general view of products as functional/instrumental versus expressive/personal. If so, there could be an interesting relationship between repair behavior and the types of non-functional product meanings explored in consumer culture research (Arnould and Thompson 2005). Additionally, it would be interesting to know whether repairing a product (or having it repaired) itself increases attachment to the product, and if marketers have an opportunity to build brand equity and brand loyalty by helping consumers repair their products. Since product attachment implies a positive emotional connection with a product (Ferraro, Escalas, and Bettman 2011), repair could

improve consumer wellbeing by extending the life of products that elicit positive emotions or even by imbuing products with positive associations where there were none before. These potential relationships between repair propensity and product meanings provide fruitful avenues for future research.

Results across the two samples suggest that two variables appear to be particularly important in predicting repair behavior: stewardship and innovativeness. Stewardship involves seeing the value and potential in material possessions while product innovativeness is the extent to which the consumer finds new and different uses for existing products. Interestingly, both of these variables involve facets of creativity, suggesting that to increase repair behavior, people should be encouraged to be innovative with their possessions and to see the potential that others might not see. The idea that repair behavior could be a form of self-expression or identity creation would be of interest to consumer behavior researchers, particularly those interested in consumer culture (Arnould and Thompson 2005). In contrast, neither environmental concern nor tightwad were significant when analyzed with other factors, suggesting that a general concern for saving money or preserving the environment may not be as important to repair propensity as previous literature suggests (e.g. Bayus 1991; Cooper 2004). This creative dimension of repair behavior and the specific links to consumer innovativeness and stewardship could mean that repair is an avenue for increasing consumer well-being by empowering consumers to express their ideals and values. In that case, policy makers and marketers can make consumers' lives better by making repair resources, such as parts, tools and instructions,

more readily available to consumers. These expressive and emotional potentialities of repair warrant further exploration in future studies.

The results of this study indicate that all three hypothesized categories of factors, market, product and consumer, have a significant influence on repair propensity (see Figure 1). This finding, along with the broad support for the various hypothesized relationships, indicates that repair propensity is a multifaceted trait subject to a variety of influences. It is also notable that the regression model containing all of the variables exhibits relatively high explanatory power in accounting for the variance in repair propensity. However, this study also indicates that within each category, there appears to be one or two variables that predominate. In terms of market factors, perceived inconvenience of repair seems to be the most influential. This finding would appear to indicate that marketers and policy makers interested in increasing repair behavior, either for sustainability or business purposes, should consider making repair parts and services more convenient to consumers. As noted previously, cost and attachment appear to be the most important product factors, but at different levels of repair propensity. Finally, as discussed earlier, the consumer traits of stewardship and innovativeness are strongly related to repair propensity in both samples. These findings also suggest avenues for promoting repair behavior as well as opportunities for further research.

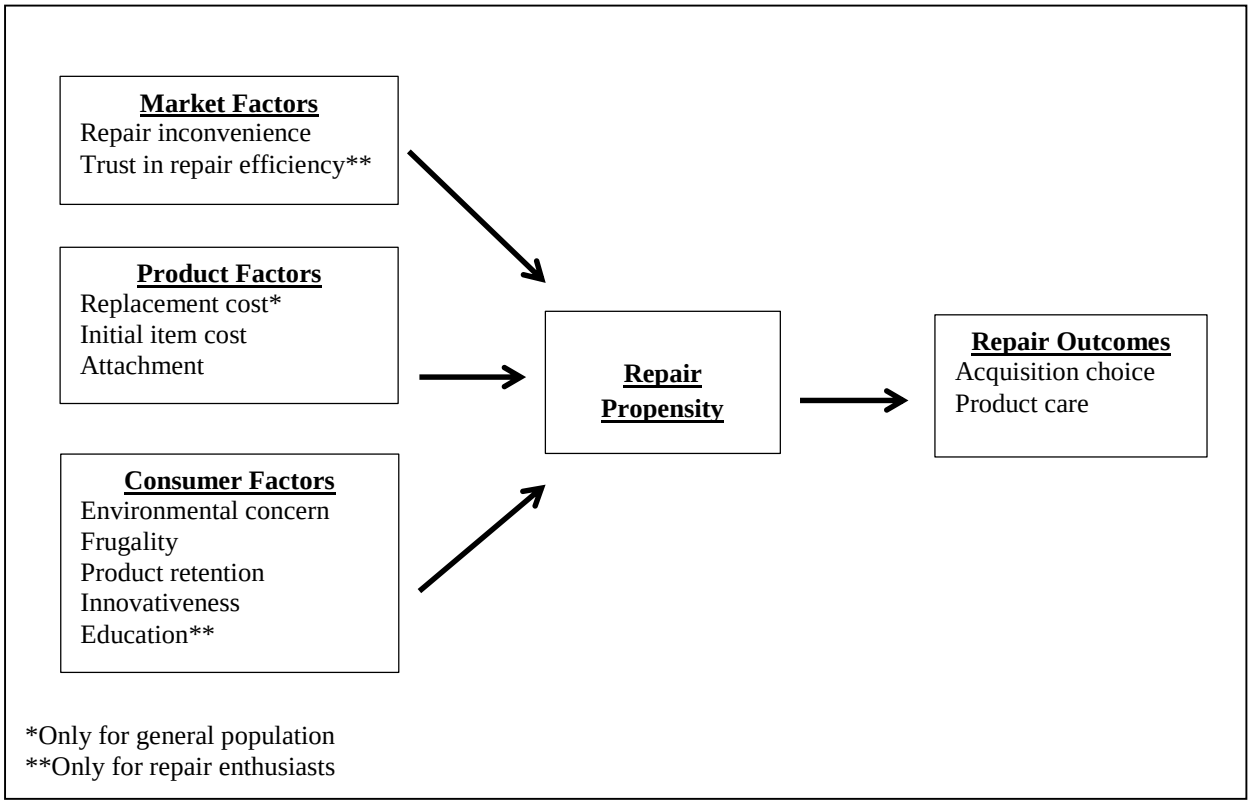

Figure 1: Predictors and Outcomes of Repair Propensity

The results of this study also suggest that repair propensity may influence product choice and product usage (see Figure 1). Although the cross-sectional nature of this study limits the extent to which the direction of causality can be established, it is at least plausible that a trait like repair propensity is a cause rather than an effect of behavior. Specifically, this study suggests that repair propensity may influence acquisition choice and product care. Thus, if people are interested in repairing their products in later stages of consumption, they will be more likely to pick out products that can be repaired and take care of them so there is less of a chance of needing to do so. This is consistent with previous research that suggests that consideration of the reparability of a product in the initial purchase decision may impact the likelihood of repair later (Guiltinan 2009). If repair

propensity does influence product choice, marketers and policy makers could promote repair by giving consumers a signal of reparability, such as the smartphone reparability index recently created by iFixit (Crabbe 2013), that would be available to consumers prior to purchase. Again, consumer well-being would be improved by giving consumers the information they desire when making product choices, potentially reducing consumer frustration or confusion. However, additional research is needed to explore these relationships and parcel out the directionality of the proposed paths in Figure 1. For example, experimental studies manipulating reparability and structural equation analyses of the entire model could make important contributions to our understanding of the processes underlying repair behavior.

Conclusion

This research represents a very early and exploratory investigation of repair propensity and the market, product, and consumer factors related to repair. The findings reported here should be of interest to consumer behavior researchers who are concerned with sustainability generally and repair behavior specifically, and they provide valuable insights to marketers and policy makers, especially those concerned with enhancing consumer well-being and environmental sustainability. This study can provide a foundation for future efforts to create a more comprehensive model of repair behavior that includes antecedents, mediators, moderators, and outcomes. Repair can be a fruitful field for further research that could help improve the well-being of consumers individually and collectively, and the authors hope that this study will be the first step in that direction.

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