When and Why Consumers "Accidently" Endanger Their Products

Abstract

In this research, we examine whether consumers may "accidently" endanger a product they own when a new version of the product is introduced. We propose owners endanger their product when they want to upgrade to a new version but have difficulty justifying the upgrade and that owners find justification more difficult when a new version offers an improved design but does not offer a significant technological improvement. Owners endanger their product hoping it will be "fortuitously" damaged. Product damage provides owners with a good reason to upgrade. Focusing on iPhone as a case study, field data and experiments reveal product endangering, and they support the role of justification in three ways. First, as hypothesized, endangering occurs when the new product offers an improved design but does not offer a significant technological improvement. Second, owners are less likely to endanger a product that is under warranty; therefore, damage to it will not enable upgrading. Third, owners are more likely to endanger their product when their justification concerns are heightened.

Introduction

Many companies introduce new versions of products over time. For example, from 2007 to 2017, Apple launched 15 new iPhones, Samsung launched over 30 variants of Samsung Galaxy S, and Canon released 10 new versions of the EOS Rebel camera. Companies introduce new versions to entice new customers, and to sway customers that own older versions to upgrade. In the cellphone market, each launch of the iPhone and Galaxy S is associated with secrecy about the new versions features, and much marketing hype around the launch and introduction. From the companies' perspective, striking the right note on which features and benefits to offer with each new version, is critical to peak customer demand and sales. In this research we examine how these company product-related decisions may have an unexpected influence on the behavior of owners of older versions toward their product. We propose that in some cases, the features of the new version create a customer desire to own it, but weak justification for product replacement. We focus on a specific case in which justification may be weak—when the new version offers improved design but does not offer significant technological improvement. We find owners may endanger their product when justification is difficult. The fortuitous damage that product endangering may cause "frees" owners to upgrade to the new version.

Focusing on Apple's iPhone smartphone as a case study, we demonstrate product endangering in field data and in experiments. In the field data, we compare the introductions of the white iPhone 4 and iPhone 4S and reveal the fortuitous consequence of product endangering—damaged products. The data support the justification account. Product endangering is observed only when the new version does not provide a meaningful technological improvement over the owned product: coming in a new product color (the white iPhone 4). The lab experiments show the new version's improvement characteristics moderate product

endangering and provide additional support for the product-endangering account by showing the endangering effect attenuates when owners' product is under warranty, and therefore damage to it will not enable product replacement, and by showing that product endangering is more likely when owners' purchase-justification concerns are made salient.

Previous studies and theoretical considerations

Shani and Shachar (2011) provide initial evidence for product endangering. In their lab experiment, participants received a *basic* shot glass that they were asked to position on the highest point of a metal rail from which it would then be dropped. Prize money was associated with positioning the glass as high as possible on the metal rail. Before placing the shot glass, all participants were informed they could purchase another basic shot glass in order to complete a set of two such glasses. Critically, half of the participants were given an additional option of purchasing a pair of *premium* shot glasses. The authors argued that participants in the premium condition would find product endangering attractive because a broken basic glass would free them from feeling wasteful about purchasing a pair of premium shot glasses. Indeed, participants endangered their basic glass more by placing it higher on the metal rail in the premium condition than in the basic condition.

Recently, Bellezza, Ackerman, and Gino (2017) provided further support for product endangering in a series of studies that included one with a setting similar to that of Shani and Shachar (2011). In their study 2, mugs replaced shot glasses, and the game Jenga replaced the metal rail. Importantly, in Bellezza et al.'s other studies, individuals did not endanger their products but, rather, acted carelessly with them. Bellezza et al. went beyond documenting careless behavior and provided some evidence for its cause. For example, using a hypothetical

scenario, they found that providing consumers with product-replacement justification (e.g., your product will be given to a person you care about) moderates careless behavior among individuals who score high on the lay-rationalism scale (Study 4).

Our research goes beyond careless behavior and provides evidence for product endangering. Furthermore, it builds on these earlier findings to more systematically examine how the new version's characteristics moderate product endangering. We posit that product endangering is more likely when justifying an upgrade to a new version is difficult. In this case, upgrading appears wasteful. We propose that owners find upgrading harder to justify when the new version offers design improvements than when it offers technological improvements.

Previous research demonstrates consumers have justification concerns regarding consumption and that they may feel guilty when choosing a difficult-to-justify option (Okada, 2005; Keinan, Kivetz, and Netzer, 2016; Sela, Berger, and Liu, 2009). For example, some research shows consumers feel wasteful and guilty when choosing a hedonic product over a utilitarian product. As Okada (2005) notes, "People try to construct reasons for justification (Shafir, Simonson, and Tversky 1993), and it is easier to construct reasons for utilitarian consumption than for hedonic consumption" (p. 44). Providing support for this idea, Hsee (1995) shows individuals find it difficult to justify selecting a tempting option superior on a factor not central to the accomplishment of a given task over an option superior on a factor directly related to the task. To avoid guilt in such cases, consumers "are willing to pay more in time for hedonic goods and more in money for utilitarian goods" (Okada, 2005, p. 43), and they overvalue small utilitarian features of a luxury product that serves as a "functional alibi" (Keinan, Kivetz, and Netzer, 2016).

These distinctions are important for our research question. They suggest that when owners face a new version technologically superior to theirs, product replacement is less likely to evoke feelings of wastefulness and guilt than when the new version is superior in design. An assumption in our theorizing is that consumers associate utilitarian/functional benefits with technological features more readily than with design features. Accordingly, we expect owners will engage in more product endangering when they encounter a new version superior to theirs mainly in design than mainly in technology. This logic resonates with that of Keinan, Kivetz, and Netzer (2016), who show that adding utilitarian product features provides justification, or a "functional alibi," for purchasing luxury products that tend to be weak on utilitarian aspects.

We compare the prevalence of product endangering in conditions where the new versions offer mainly technological improvements versus mainly design improvements. This departure from previous work, which enables us to more finely test the role of justification in product replacement, also helps us test an alternative hypothesis whereby owners endanger their product because they value it less after comparing it with the new version. According to this alternative comparison-devaluation account, the better the new version is in comparison to an owner's product, the more devaluation should occur, and consequently the more product endangering. Our findings are inconsistent with this alternative account. We find owners value a new version more when it offers improved technology than when it offers improved design, but they engage in more product endangering when the new version offers improved design than when it offers improved technology. This pattern indicates product endangering serves to justify product replacement and is not a consequence of comparison devaluation.

Our studies and their contribution

We examine how the characteristics of a new version influence product endangering. We use iPhones as a case study for several reasons. Because our research focuses on the effects of introducing a new version, we needed a product category with frequent updates and new versions. Smartphones qualify in this respect. Within the smartphone category, iPhone is the most suitable brand to study because (1) its launches receive a lot of attention, making product introductions common knowledge, (2) its market size allows for enough data to test the research questions, (3) its impact on society goes beyond its huge market share (45.3% in the US, and 23.8% globally in the last quarter of 2011; Statista (2019a; 2019b)) as demonstrated by Karcz (2017) , and (4) demonstrating product endangering with Apple products is a particularly stringent test because Apple markets design as a functional benefit, and therefore owners of Apple products may feel design improvements provide sufficient justification for product replacement. Thus, if we find that even among Apple owners, a design improvement leads to more product endangering than a technological improvement, we expect the endangering effect to generalize to non-Apple products and to non-Apple consumers who feel design improvement offers weaker justification for product replacement than do Apple consumers.

In Study 1a, we use field data to examine damaged products, the fortuitous consequence of product endangering. We compare consumer sales listings of damaged versus used iPhone 4's after the launch of the white iPhone 4 compared with after the launch of the iPhone 4S. Critically, the white iPhone 4 differed from its predecessor, the black iPhone 4, only in color (an aesthetic design feature), whereas the iPhone 4S offered many technological improvements over its predecessors, the white and black iPhone 4's. Consistent with our theorizing, after the launch of the white iPhone 4, the number of damaged relative to used iPhone 4's listed for sale increased. By contrast, after the launch of the iPhone 4S, the number of damaged relative to used black and

white iPhone 4's listed for sale decreased. We speculate that an increase in product endangering after the launch of the white iPhone 4 underlies these different patterns. Furthermore, we find the increase in the listings of the damaged black iPhone 4 after the introduction of the white iPhone 4a develops gradually, taking about two weeks. This finding suggests owners endangered their product but did not intentionally break it. Thus, product endangering might happen unconsciously.

In Study 1b, we used a survey to validate our claim that relative to the iPhone 4, iPhone owners perceived the iPhone 4S as offering technological improvements and the white iPhone 4 as offering design improvements. Further, we find participants were willing to pay more to upgrade to the iPhone 4S than to upgrade to the white iPhone 4, and they rated the upgrade as less wasteful and more justified.

The aim of the next three studies was to test for generalizability of the findings. In Study 1c, using a survey almost identical to that used in Study 1b, we find that consumer perceptions that an upgrade offering technological improvements is less wasteful and easier to justify than an upgrade offering design improvements is not specific to Apple products.

In Study 1d, using the same field data as those used in Study 1a, we tested for product endangering of the iPad 2 after the launch of the iPad 3. The iPad 3 offered relatively modest improvements over the iPad 2 (improved screen resolution). The findings were similar to those observed for the white iPhone 4. Namely, the number of damaged relative to used iPad 2's offered for sale increased after the launch of the iPad 3. By contrast, and as was the case for the iPhone 4S, following the launch of the iPad 4, which offered significant technological improvements over the iPad 3, the number of used relative to damaged iPad 3's offered for sale increased.

Finally, in Appendix A, using the same field data as those used in Studies 1a and 1d, we tested for product endangering of the Samsung Galaxy S II after the announcement of the Galaxy S III. The Galaxy S III differed from the S II mainly in design. The findings were similar to those observed for the white iPhone 4 and the iPad 3. Namely, the number of damaged relative to used consumer sales listings of the S II increased. These findings suggest product endangering is not specific to Apple products.

Study 2 examined the effect of a new version's characteristics on product endangering by experimentally manipulating those characteristics. In one condition, the new iPhone was described as offering mainly design improvements, whereas in the other condition, it was described as mainly offering technological improvements. We compared iPhone owners' self-reported willingness to endanger their iPhone in these two conditions. We were primarily interested in the iPhone owners without a warranty, because damaging an iPhone that is *not* under warranty "frees" the owner to purchase a new iPhone, whereas damaging an iPhone that is under warranty does not (i.e., the phone can be fixed at no cost). Consistent with the field data, consumers were more willing to endanger their iPhone (take it on a scenic outdoor trek full of water crossings where it could get damaged) after exposure to the launch of an iPhone that offered mainly design improvements as opposed to technological improvements, but only if their iPhone was not under warranty. Note these findings also show that product endangering happens not only when an upgrade offers *only* design improvements (as in the case of the white iPhone), but also when it offers *mainly* design improvements.

The aim of Studies 3a and 3b was to demonstrate the role of justification in product endangering. In Study 3a, we manipulated justification considerations before making participants aware of the new iPhone 8 that (purportedly) would offer mainly design improvements, whereas

in Study 3b, we manipulated justification considerations before making participants aware of the new iPhone 8 that (purportedly) would offer mainly technological improvements. In both studies, we used an incentive-compatible measure of product endangering. Specifically, we offered all participants the opportunity to purchase up to 10 raffle tickets (at 1 US cent per ticket, taken from their $1 participation fee) to increase their likelihood of being chosen to participate in a pre-launch event that required them to toss their iPhone at a balloon that was floating at a height of about 10 feet. If they were to hit the balloon, they would receive a significant discount on the new iPhone 8.

Consistent with our theorizing, in Study 3a, in which the new version purportedly offered mainly design improvements, we found participants purchased significantly more raffle tickets when justification considerations were made salient relative to when they were not, but only if their iPhone was not under warranty, in which case they would have to replace it if damaged. We contend that because product endangering is due to justification concerns, intensifying such concerns should increase product endangering. By contrast, in Study 3b, in which the new product purportedly offered mainly technological improvements, we found participants purchased a similar number of raffle tickets in the justification and no-justification conditions. We contend participants did not have difficulty justifying the purchase of a new product that offered technological improvements over an owned product.

To summarize, our findings contribute significantly to understanding the effects of new product introductions on consumer behavior. First, we find evidence for product endangering. Second, we find product endangering happens more when the new product offers design improvements than when it offers technological improvements. Third, our findings suggest product endangering serves to justify product replacement.

Before we proceed, we provide an overview of our hypotheses that are explained in more detail in the sections that follow. In Study 1, we test the hypothesis that owners will endanger their product when a new version improves in design but not when it improves in technology. In Study 2, we test the hypothesis that only owners without warranty on their product will engage in product endangering when the new version improves mainly in design. In Studies 3a and 3b, we test the hypothesis that when an upgrade offers mainly design improvements, owners for whom justification concerns are made salient will be more likely to endanger their product than owners for who justification concerns are not made salient. By contrast, when the upgrade offers mainly technological improvements, owners will not endanger their product, regardless of justification salience or warranty status.

Study 1a: Damaged products

In 2011, Apple introduced two new iPhones: In April, the company launched the white version of iPhone 4, which differed from its predecessor, the black iPhone 4, only in color, and six months later, in October, Apple launched the iPhone 4S, which offered significant technological improvements over the black and white iPhone 4's. These two launches present a unique opportunity to examine our hypothesis that product endangering is more likely when a new version offers design improvements (the white iPhone 4) than when it offers technological improvements (the iPhone 4S), because owners have difficulty justifying product replacement based on improved design alone.

We start by providing more details on these iPhones. When iPhone 4 was launched on June 24, 2010, Apple offered it only in black. On April 27, 2011, Apple announced the launch of the white iPhone 4, which was available for purchase one day later on April 28, 2011. This white

iPhone 4 differed from the black iPhone 4 only in its color (see Appendix B).[1] As one reporter wrote, “There's nothing special about it except that it's white. No new features, no more storage space—aside from the color of its case and home button, the white iPhone 4 will be exactly the same as the black iPhone 4” (Jackson, 2011). In fact, Apple’s own press release stated, “The white iPhone 4 has finally arrived and it’s beautiful” (Harrison and Kerris, 2011).

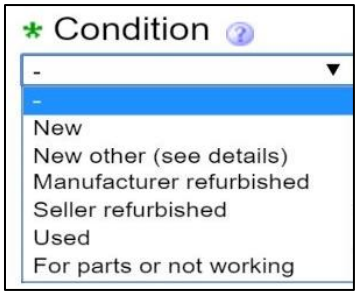
By contrast, the iPhone 4S, which was announced on October 4, 2011, and was launched 10 days later on October 14, 2011, was identical in appearance to the original iPhone 4 but offered significant technological improvements—it was a faster device with new and innovative features (e.g., digital personal assistant, superior camera and memory; GSMArena, 2011).

Measuring product endangering

Used and even damaged phones have a market. To examine our hypothesis, we scraped daily-level data on all listings of iPhones offered for sale in the US from one of the largest e-commerce websites worldwide for a one-year period (January 1 to December 31, 2011). In this period, the website had tens of millions of unique users and listed products ranging in asking price from a couple of cents to more than $1 million. In addition to listing iPhones, the website listed over 5.5 million smartphones from other companies. During the data-collection period, consumers who listed a phone for sale had to indicate their asking price and the phone’s status from a multi-option list (see Figure 1).

Figure 1: Item-condition options for listed items on the platform

[1] The black and white versions of iPhone 4 are presented as identical on Apple’s webpage, Wikipedia, and on GSMArena, a mobile phone tech website that compares the minutiae of various phone models.



Because we are interested only in phones that consumers used, we do not consider new or refurbished phones in our analysis. We create two categories: "used" and "damaged." The "damaged" category includes all phones listed with the item condition of "For parts or not working" (i.e., non-functioning or physically broken phones). To confirm this classification, we sampled text listings for these items. Many listings specified broken screens and a nonworking condition. None of the listings advertised that a phone was in working condition. Our data include 412,402 phones: 382,036 used and 30,366 damaged.

Hypothesis specification

We speculate iPhone owners had difficulty justifying replacing their iPhone 4 with the white iPhone 4, because the latter offered only an aesthetic change and no technological improvements (we validate this claim in Studies 1b and 1c). Thus, we expect increased product endangering, indicated by an increase in the number of damaged relative to used iPhones listed for sale. Formally:

H1: We expect an increase in the number of damaged relative to used iPhone 4's offered for sale after the introduction of the white iPhone 4 compared to before.

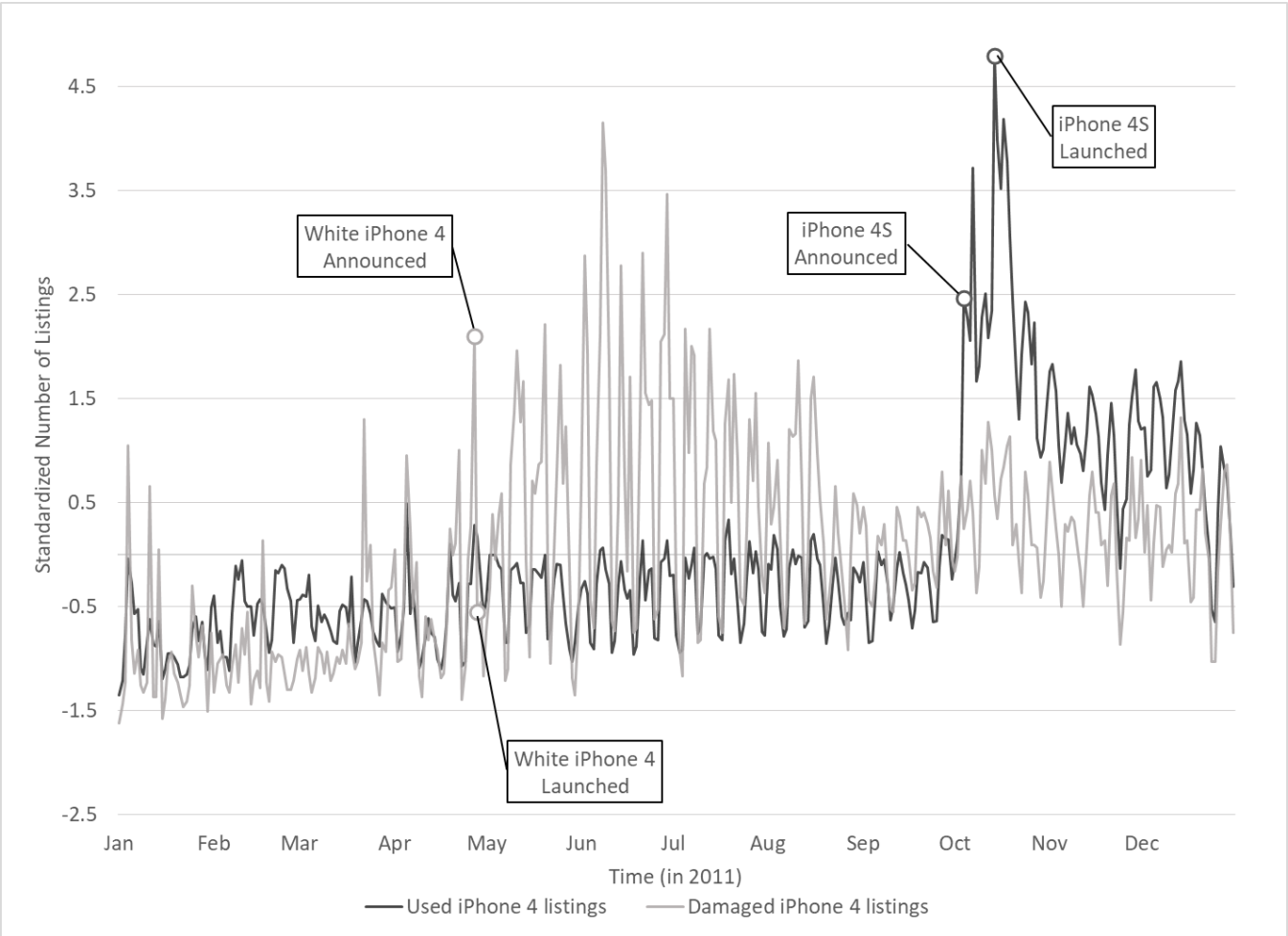
By contrast, because the iPhone 4S is technologically superior to the iPhone 4, we expect owners were less concerned with justification and wastefulness issues when considering product replacement. Thus, those who wanted to replace their iPhone 4 with the 4S model would not endanger their iPhone and would sell it as "used." Accordingly:

H2: We expect an increase in the number of used relative to damaged iPhone 4's offered for sale after the introduction of the iPhone 4S compared to before.

Method for testing the hypotheses

Figure 2 provides preliminary support for H1 and H2. The figure, which presents the standardized time series for damaged and used iPhone 4 models listed in 2011 (damaged listings in gray and used listings in black), shows two opposing trends: Whereas the introduction of the white iPhone 4 in April primarily affected the *damaged* listings of iPhone 4, the introduction of the iPhone 4S in October primarily affected the *used* listings. Note the figure also shows a dip in listings over weekends, affecting damaged phone listings more than used ones, which we account for in our formal analysis. Because these observations are casual, we next specify the formal method we use to test our hypotheses.

Figure 2: Standardized time series for used and damaged iPhone 4 models



We use difference-in-differences (DiD) analysis to formally test our hypotheses. DiD is equivalent, in spirit, to doing a 2x2 analysis (damaged vs. used; before introduction vs. after) for each of the hypotheses. The basic idea is to see whether a focal event (introduction of a new phone) has a significant differential effect on the damaged versus used phones listed for sale.

In the spirit of Meyer (1995), we formulate the regression as follows:

$$y_{it} = \alpha + \beta_1 \cdot Damaged_i + \beta_2 \cdot Event_t + \beta_3 \cdot Damaged_i \cdot Event_t + \gamma_1 \cdot Weekend_t + \gamma_2 \cdot Weekend_t \cdot Damaged_i + \varepsilon_{it,}$$

where

- the subscript *i* is either "used" or "damaged."
- the subscript *t* is an index for days since the beginning of the series. Series start either 28 or 14 days before the introduction of the new phone, as discussed below.
- the dependent variable *y* is listings.
- all the independent variables are dummies, defined as follows:
    - if the observation is for damaged iPhones, the dummy variable $Damaged$ is equal to 1; otherwise, it is equal to zero.
    - if the observation is taken after the introduction of the new iPhone, the dummy variable $Event$ is equal to 1; otherwise, it is equal to 0.
    - if the observation is taken in the weekend (Saturday or Sunday), the dummy variable $Weekend$ is equal to 1; otherwise, it is equal to 0.

Because we observed a fluctuation in website activity over the weekend, and more so for damaged models, the regression includes a dummy for weekends and an interaction for weekends and damaged.

The parameter β_1 captures the difference between "damage" and "used" across all t (positive values mean damaged iPhones were listed more than used iPhones, whereas negative values mean the opposite). The parameter β_2 captures the difference between the period after the event versus before the event (positive values mean more iPhones, damaged and used, were listed after the event than before it, and negative values mean the opposite). In other words, β_1 captures one difference in the data ("damaged" vs. "used") and β_2 captures another (after vs. before). Because we control for these two differences, we can examine, via β_3, our main hypothesis. Specifically, the parameter β_3 reflects the increase in the difference between "damage" and "used" after the event (i.e., the introduction of the new phone).

According to **H1**, β_3 should be positive after the introduction of the white iPhone (i.e., an increase in the difference between "damaged" and "used" after the event relative to before). According to **H2**, β_3 should be negative after the introduction of the iPhone 4S (i.e., a decrease in the difference between "damaged" and "used" after the event relative to before).

The analysis is based on comparing the two series (damaged and used) within a time window of the same length before and after the event. We first use a four-week (28 days) time window in the analysis, and standardized the time series, using a standard z-score, subtracting the mean of the time series from each observation and dividing the result by the standard deviation of the time series. In other words, our initial sample includes a 56-day period, 28 days before the introduction of the new iPhone and 28 days after. Accordingly, this analysis contains 112 observations (56 observations with listings of damaged iPhones for sale and 56 observations with listings of used iPhones for sale).

Results

Because the iPhone 4S was launched 10 days after it was announced, we perform the analysis for both the announcement day and the launch day (as the "event"). We do not separate the analysis for the white iPhone, because it was launched one day after it was announced.

The number of iPhones listed for sale in the 56-day period used for the analysis of the white iPhone 4 is 51,109 (46,528 used and 4,581 damaged). The equivalent number for the analysis of the announcement of the iPhone 4S is 94,184 (88,899 used and 5,285 damaged) and is 101,492 for the analysis of the launch of the iPhone 4S (96,106 used and 5,386 damaged).

The regression results, which are based on a simple OLS, are shown in Table 1. These results support both **H1** and **H2**. Specifically, β_3 is positive after the introduction of the white

iPhone (.42, $p < .05$) and negative after the introduction of the iPhone 4S (-2.3 after the announcement date and -1.29 after the launch date, both p's < .01).

The positive β_3 after the introduction of the white iPhone implies consumers listed more damaged (non-functioning) black iPhone 4's after this event and that this increase is over and above any change in the listing of used iPhones (supporting **H1**). This effect is both statistically significant and economically meaningful. Specifically, the gap between the damaged and used phones offered for sale is .42 standard deviations (recall that both series were standardized before estimation). This finding serves as an indication of product endangering stimulated by the introduction of the white iPhone 4, which is technologically identical to the black iPhone 4. As argued above, the launch of the white iPhone 4 placed owners of the black iPhone 4 in a difficult-to-justify purchase situation, and product endangering "solved" this dilemma.

The negative β_3 following the introduction of the iPhone 4S supports **H2**. Because the iPhone 4S is technologically superior to both the black and white iPhone 4's, replacing them with the new one would not have raised concerns of being wasteful, and consumers listed their old device for sale in the second-hand market.

As a robustness test, we extended the window of the analysis from 28 days to 42 days. The findings remain the same and the magnitude of the effect is much stronger, $\beta_3 = 0.66$, with a standard error of .17. The full table is reported in Web Appendix A.

Table 1: The effect of introducing the white iPhone 4 and the iPhone 4S on used and damaged iPhone 4 models using a 28-day window

	White iPhone 4	***iPhone 4S***	
Event	**Announced**	**Announced**	**Launch**
Intercept	-.46 (.10) **	-.05 (.11)	.88 (.18) **
Damaged Dummy	.37 (.14) **	.34 (.16) *	-.42 (.26)
Event Dummy	.35 (.13) **	2.59 (.15) **	1.30 (.23) **

Damaged x Event Dummy (β_3)	.42 (.18) *	-2.30 (.21) **	-1.29 (.33) **
Weekend Dummy	-.57 (.14) **	-.45 (.16) **	-.57 (.26) *
Weekend x Damaged Dummy	-.71 (.20) **	-.16 (.23)	-.02 (.37)
Adjusted R^2	58.8%	77.9%	41.4%

N=112; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

Results: Timing of damage

The results shown in Table 1 suggest the announcement of the white iPhone led to product endangering. The results reported in Table 2 shed light on the timing of damage. Instead of treating post-announcement as one period, we extend the analysis from 28 days to 42 days and conduct analyses for three successive 14-day time periods (1-14 days after the announcement, 15-28, and 29-42). We compare the listing in these shorter windows with a 14-day window immediately prior to the announcement.[2]

Table 2: DiD regression results for three successive 14-day windows compared to 14 days before the announcement of the white iPhone 4

Event	***White iPhone 4***		
Compared to:	***1-14 days after***	***15-28 days after***	***29-42 days after***
Intercept	-.47 (.14) **	-.48 (.13) **	-.48 (.19) *
Damaged Dummy	.38 (.20) ·	.42 (.18) *	.41 (.27)
Event Dummy	.42 (.18) *	.31 (.17) ·	.11 (.24)
Damaged x Event Dummy (β_3)	.03 (.26)	.77 (.24) **	.89 (.35) *
Weekend Dummy	-.61 (.20) **	-.57 (.19) **	-.56 (.27) *
Weekend x Damaged Dummy	-.66 (.28) *	-.78 (.26) **	-.78 (.38) *
Adjusted R^2	51.4%	69.2%	49.6%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

[2] As a robustness test, we reran all regressions in Table 2 using windows of 15-28 days and 29-42 days prior to the announcement. The estimates of these regressions were even more supportive (as reported in Web Appendix B).

The results are illuminating. In the first 14-day window after the announcement, the difference between the listings of damaged and used iPhones is not significant. However, in the following two 14-day windows, the difference is not only significant, but also larger than the difference estimated in Table 1, and its magnitude is almost one standard deviation (.77, $p < .01$ and .89, $p < .05$ in Table 2 vs. .42 in Table 1, an increase of 38% and 43.9% in the effect from the result in Table 1, respectively).

These estimates are interesting both because of the magnitude of the effect and, perhaps more importantly, because of its timing. The fact that it took time for black iPhones to be damaged (as suggested by when they were listed) suggests consumers did not intentionally break their owned phone around the time of the launch (e.g., by stomping on it or throwing it at a wall), but rather took less care of it (e.g., by taking its protective case off) or endangered it (e.g., by taking it with them on a trek full of water crossings). Such behaviors should increase the likelihood of damage but are unlikely to result in immediate damage.

A seasonality concern: Was April 2011 special?

A potential concern with the results presented in Tables 1 and 2 is that the increase in damaged phones is not due to the introduction of the white iPhone, but rather to the season of the year. The introduction took place at the beginning of summer (March 30 – May 24 in Table 1 and April 13 – June 7 in Table 2), and summer activities may have led to the increase in damaged phones. For example, water damage may be more common in the summer because people engage in more water-related activities.

We address this concern in several ways. The first two ways rely on the idea that if seasonality explains the increase in damaged phones, we should observe an increase in damaged

phones also when we use data on phones other than the black iPhone 4 after the launch of the white iPhone 4. For example, seasonality effects should also be observed when we use data on iPhone 3, iPhone 3GS, and any other phone.

We collected data on the listings of used and damaged iPhones 3 and 3GS in 2011. The data include 295,270 iPhone 3's and 350,929 iPhones 3GS's (about 100,000 were listed in the timeframe of the analysis). We reran the analysis using these data. If seasonality underlies the results in Tables 1 and 2, it should show up in this new analysis as well. In other words, β_3 should be positive after the introduction of the white iPhone 4 even when we study the listings of iPhones 3 and 3GS. But if, as we hypothesize, the increase was due to the type of improvement offered by the new phone, β_3 should be either zero or negative.[3]

Table 3 presents the results of this analysis. The parameter β_3 is negative and does not significantly differ from zero. In other words, when the analysis is done with iPhones 3 and 3GS, the number of damaged phones being listed after the introduction of the white iPhone does not increase. Thus, the data do not support a seasonality explanation for our results.

Table 3: The effect of introducing the white iPhone 4 on used and damaged iPhone 3 and 3GS models for three successive 14-day time periods

Event	***White iPhone 4 announcement***					
Compared to:	***iPhone 3***			***iPhone 3GS***		
	1-14 days after	***15-28 days after***	***29-42 days after***	***1-14 days after***	***15-28 days after***	***29-42 days after***
Intercept	.68 (.22) **	.60 (.18) **	.57 (.19) **	-.30 (.16) ·	-.32 (.15) *	-.33 (.18) ·
Damaged Dummy	.90 (.32) **	.87 (.25) **	.81 (.26) **	1.00 (.22) **	.93 (.25) **	.96 (.26) **

[3] β_3 might be negative for the following reason. Because iPhones 3 and 3GS are technologically inferior to the white iPhone 4, replacing them with the white iPhone 4 is not hard to justify and should not raise wastefulness concerns. This observation suggests β_3 should be negative. β_3 might be close to zero for the following reason. Owners of iPhones 3 and 3GS already had the opportunity to upgrade their iPhone to the advanced technology of iPhone 4 when the black model was introduced. Thus, the introduction of the white iPhone 4 might not have been relevant for those interested in better technology, and thus β_3 should be close to zero.

Event Dummy	.14 (.29)	-.43 (.23) ·	-.99 (.24) **	.44 (.20) *	.24 (.20)	-.10 (.24)
Damaged x Event Dummy (β_3)	.00 (.41)	-.04 (.32)	-.08 (.34)	-.31 (.28)	-.21 (.28)	-.16 (.34)
Weekend Dummy	-1.21 (.32)**	-.93 (.25)**	-.83 (.26)**	-.71 (.22)**	-.65 (.22) **	-.60 (.26) *
Weekend x Damaged Dummy	-.81 (.45) ·	-.70 (.36) ·	-.49 (.37)	-1.12 (.31) **	-.86 (.31) **	-.98 (.37) *
Adjusted R^2	52.3%	57.2%	59.4%	62.8%	55.5%	47.5%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

Next, we broaden our scope and re-examine the potential effect of seasonality using the listings of all phones in the market (other than iPhones). This dataset includes 5,588,246 phones listed in 2011 (about 1,000,000 of them in the timeframe of the analysis). The results appear in Table 4. Again, because none of these phones is technologically identical to the white iPhone 4, we expect β_3 to be either zero or negative. Indeed, this parameter does not significantly differ from zero. In other words, when the analysis is done with all non-iPhones, we no longer get an increase in the number of damaged phones following the introduction of the white iPhone.

In summary, our three analyses show the increase in the number of damaged phones is unique to the black iPhone 4 (which is the only phone in the market that differs from the white iPhone 4 only in design). This finding is consistent with our justification hypothesis, but not with an effect of seasonality.

Table 4: DiD regression results for non-iPhones for three successive 14-day windows for the effect of introducing the white iPhone 4 on used and damaged non-iPhone models

Event	***White iPhone 4 announcement***		
Compared to:	***non-iPhones***		
	1-14 days after	***15-28 days after***	***29-42 days after***
Intercept	.93 (.15) **	.97 (.12) **	.94 (.13) **
Damaged Dummy	-.26 (.21)	-.41 (.17) *	-.42 (.18) *
Event Dummy	-.12 (.19)	-.02 (.15)	-1.07 (.17) **

Damaged x Event Dummy (β_3)	.14 (.27)	-.33 (.22)	.23 (.24)
Weekend Dummy	-.85 (.21) **	-1.01 (.17) **	-.90 (.18) **
Weekend x Damaged Dummy	-1.10 (.30) **	-.58 (.24) *	-.52 (.26) ·
Adjusted R^2	67.3%	75.2%	74.2%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

We also examine the potential effect of seasonality by rerunning the analysis, excluding all the phones with reported water damage (10%). The results did not change (i.e., β_3 remained the same; see Web Appendix C for the results). In other words, water damage did not cause the increase in the number of listed damaged iPhone 4's.

Finally, we use our data to assess the cost of product endangering. Whereas the average price asked for used iPhone 4's was $340, the average price asked for damaged iPhone 4's was $217. This finding implies the average cost of product endangering in this case was $123. Put differently, resolving a difficult-to-justify product replacement that is technologically the same as one's owned iPhone, but is more aesthetically appealing, comes with a steep price tag.

Study 1b: Perceptions of the white iPhone 4 and the iPhone 4S

We suggest iPhone 4 owners viewed the iPhone 4S as offering better justifications for product replacement than the white iPhone 4, which is why product endangering was more likely after the launch of the white iPhone 4 than after the launch of the iPhone 4S. We validated this claim in a survey. We recruited 100 iPhone owners (**M_{age}** = 33.4, 69% women) from prolific.com to complete an online survey in return for 1 euro. In a between-subjects design, we asked participants to imagine they were owners of a black iPhone 4 they had purchased for $499, and then we asked half to imagine the launch of the white iPhone 4 and the other half to imagine the launch of the iPhone 4S, describing the features of the respective phone (see Appendix C).

Next, we asked all participants to indicate how wasteful purchasing the white iPhone 4 / iPhone 4S would feel (1= *Not Wasteful at all*, 7 = *Very Wasteful*), how justified purchasing the white iPhone 4 / iPhone 4S would feel (1 = *Not Justified at all* , 7 = *Very Justified*), and how much money (in US$) they would be willing to add (above the $499) to replace their black iPhone 4 with the white iPhone 4 / iPhone 4S ($0, $50, $100…$500). Participants were then asked to assess the new iPhone (either 4 white or 4S) relative to the black iPhone 4 on the extent to which it was functionally better / technologically better / more aesthetically appealing / looked better (1 = *Not at all*, 7 = *Very Much*). Last, participants reported their income in reference to the before-tax household income in 2017, their past usage of their phones (e.g., wake up; take pictures; make online purchases; make calls over the internet; play games; listen to music) (1 = *Never*, 7 = *A lot*), and whether they had owned the iPhone 4, white iPhone 4, or the iPhone 4S.

We compared participants' evaluations of the new iPhone (either 4 white or 4S) relative to the iPhone 4, with their average past usage score as a covariate. Relative to participants in the iPhone 4S condition, participants in the white iPhone 4 condition thought purchasing the new version would be more wasteful ($M_{\text{white iPhone4}} = 6.29$, $SD = 1.68$ vs. $M_{\text{iPhone 4S}} = 5.29$, $SD = 1.74$; $F(1, 97) = 8.39$, $p = .005$, partial $\eta^2 = .08$) and less justified ($M_{\text{white iPhone4}} = 1.82$, $SD = 1.57$ vs. $M_{\text{iPhone 4S}} = 2.84$, $SD = 1.83$; $F(1, 97) = 9.06$, $p = .003$, partial $\eta^2 = .085$), and they were willing to add less money to upgrade to the new version ($M_{\text{white iPhone4}} = \$41.32$, $SD = 94.47$ vs. $M_{\text{iPhone 4S}} = \$72.35$, $SD = 63.37$; $F(1, 97) = 3.82$, $p = .053$, partial $\eta^2 = .038$).

Participants in the white iPhone 4 condition were also less likely than those in the iPhone 4S condition to think the new version was better functionally ($M_{\text{white iPhone4}} = 1.20$, $SD = .86$ vs. $M_{\text{iPhone 4S}} = 4.25$, $SD = 1.24$; $F(1, 97) = 198.56$, $p = .001$, partial $\eta^2 = .67$) and technologically ($M_{\text{white iPhone4}} = 1.24$, $SD = .87$ vs. $M_{\text{iPhone 4S}} = 4.25$, $SD = 1.27$; $F(1, 97) = 185.34$, $p = .001$, partial η^2

= .65) than the black iPhone 4. Cronbach's alpha for these two items was .95, so we aggregated them to a "technological" index. By contrast, participants in the white iPhone 4 condition were more likely than those in the iPhone 4S condition to think the new iPhone was more aesthetically appealing ($M_{\text{white iPhone4}}$ = 3.00, *SD* =1.93 vs. $M_{\text{iPhone 4S}}$ = 2.33, *SD* = 1.72; $F(1, 97) = 3.38$, $p = .069$, partial $\eta^2 = .034$) and looked better ($M_{\text{white iPhone4}}$ = 3.02, *SD* = 1.89 vs. $M_{\text{iPhone 4S}}$ = 2.18, *SD* = 1.53; $F(1, 97) = 6.60$, $p = .01$, partial $\eta^2 = .059$) than the black iPhone 4. Cronbach's alpha for these two items was .95, so we aggregated them to an "aesthetic" index.

Next, we conducted mediation analyses using the PROCESS bootstrapping method (Model 6, with 5,000 resamples; Hayes 2013) to explore the mediating roles of the *technological* and *design indexes* on (1) participant evaluations of how wasteful purchasing the new iPhone would feel (white vs. 4S), (2) how justified it would feel, and (3) their willingness to add money to purchase the new version. In line with our expectations, the indirect effect of the new version (white vs. 4S) conditioned on how *justified* purchasing the new version would feel was significant through the technological index (*b* =2.87, *SE* = .53 CI: 2.02 to 4.12), whereas via the design index, it was not significant. Consistently, the indirect effect of the type of iPhone introduced (white vs. 4S) conditioned on how *wasteful* purchasing the new version would be was significant through the technological index (*b* = -1.38, *SE* = .72 CI: -3.02 to -.21), whereas via the design index, it was not significant. In other words, when a product is perceived as technologically superior, wasteful concerns attenuate. Finally, the indirect effect of the type of iPhone introduced (white vs. 4S), conditioned on participants' willingness to pay through the technological index, was significant (*b* =65.83, *SE* = .22.38 CI: 11.25 to 99.99), whereas via the design index, it was not.

In summary, relative to the black iPhone 4, participants perceived the iPhone 4S as offering more technological improvements than the white iPhone 4, whereas they perceived the white iPhone 4 as offering more design improvements than the iPhone 4S. In addition, participants perceived upgrading to the iPhone 4S as less wasteful and more justified, and they were willing to pay more to upgrade to it than to the white iPhone 4. Mediation analyses indicate participants felt this way because the iPhone 4S offered more technological/functional improvements than its predecessor, the iPhone 4, than the white iPhone 4 did. These findings validate our earlier assumptions.

Study 1c: Perceptions of non-branded design and technological upgrades

To provide further evidence that consumers have more difficulty justifying an upgrade to a new cellphone that offers design improvements relative to technological improvements, we conducted a study identical to study 1b except that we replaced the iPhone with a general, non-branded cellphone description. We recruited 101 cellphone owners **(**M_{age} = 31.2, 48% women, 42% iPhone owners and 58% Android owners) from prolific.com to complete an online survey in return for 1 euro. In a between-subjects design, we asked all participants to imagine they were owners of a cellphone of a brand they really liked that they had purchased a year ago for $550. Then, we asked half to imagine the brand had launched a new model that was almost the same as theirs, except it had a nicer shape and it came in some new, really nice colors (design condition), and we asked the other half to imagine the brand had launched a new model that looked like theirs, but was a much faster device with a lot of new and innovative features (much more memory, a better camera, etc.)

Next, we asked all participants to indicate how wasteful purchasing the design / tech upgrade would feel (1= *Not Wasteful at all*, 7 = *Very Wasteful*), how justified purchasing the design / tech upgrade would feel (1 = *Not Justified at all*, 7 = *Very Justified*), and how much money (in US$) they would be willing to add (above the $550) to replace their phone with the new phone (tech or design upgrade) ($0, $50, $100…$500). Participants were then asked to assess the new phone relative to their phone on the extent to which it was functionally better / technologically better / more aesthetically appealing / looked better (1 = *Not at all*, 7 = *Very Much*). Last, participants reported their income in reference to the before-tax household income in 2018, their past usage of their phones (e.g., wake up; take pictures; make online purchases; make calls over the internet; play games; listen to music) (1 = *Never*, 7 = *A lot*), and the model of cellphone they presently owned.

We compared participants' evaluations of the new phone (either design or tech upgrade) relative to their phone, with their average past usage score as a covariate. Whether participants were iPhone or Android owners did not affect the results for all analyses, so we dropped this factor from the analysis. Relative to participants in the tech-upgrade condition, participants in the design-upgrade condition viewed purchasing the new version as more wasteful (M_{design} = 5.80, SD = 1.63 vs. M_{tech} = 5.12, SD = 1.50; $F(1, 98) = 4.76$, $p = .033$, partial $\eta^2 = .05$) and less justified (M_{design} = 2.25, SD = 1.41 vs. M_{tech} = 3.42, SD = 1.65; $F(1, 98) = 14.12$, $p < .001$, partial $\eta^2 = .126$), and they were willing to add less money to upgrade to the new version (M_{design} = $63.88, SD = 88.92 vs. M_{tech} = $124.72, SD = 128.52; $F(1, 98) = 7.34$, $p = .007$, partial $\eta^2 = .069$).

Participants in the design-upgrade condition were also less likely than those in the tech-upgrade condition to view the new version as better functionally (M_{design} = 2.21, SD = 1.50 vs. M

$_{tech}$ = 4.90, *SD* = 1.51; *F*(1, 98) = 78.93, *p* = .001, partial η^2 = .44) and technologically (M_{design} = 2.29, *SD* = .1.36 vs. M_{tech} = 5.02, *SD* = 1.42; *F*(1, 98) = 185.36, *p* = .001, partial η^2 = .49). Cronbach's alpha for these two items was .96, so we aggregated them to a "technological" index. By contrast, participants in the design-upgrade condition were more likely than those in the tech-upgrade condition to think the new phone was more aesthetically appealing (M_{design} = 4.68, *SD* =1.17 vs. M_{tech} = 3.48, *SD* = 1.87; *F*(1, 98) = 15.86, *p* < .001, partial η^2 = .14) and looked better (M_{design} = 4.78, *SD* = 1.25 vs. M_{tech} = 3.38, *SD* = 1.72; *F*(1, 98) = 23.10, *p* < .001, partial η^2 = .19). Cronbach's alpha for these two items was .95, so we aggregated them to an "aesthetic" index.

Next, we conducted mediation analyses using the PROCESS bootstrapping method (Model 6, with 5,000 resamples; Hayes 2013) to explore the mediating roles of the *technological* and *design indexes* on (1) participant evaluations of how wasteful purchasing the new phone would feel (design vs. tech upgrade), (2) how justified it would feel, and (3) their willingness to add money to purchase the new version. In line with our expectations, the indirect effect of the new version (design vs. tech upgrade) conditioned on how *justified* purchasing the new version would feel was significant through the technological index (*b* = 1.52, *SE* = .27 CI: 1.03 to 2.15) and through the design index (*b* = -.31, *SE* = .14 CI: -.63 to -.06). Consistently, the indirect effect of the new version (design vs. tech upgrade) conditioned on how *wasteful* purchasing the new version would be was significant through the technological index (*b* = -.88, *SE* = .26 CI: -1.44 to -.39) and through the wasteful index (*b* = .39, *SE* = .17 CI: .10 to .79). In other words, when a product is perceived as superior on technology, wasteful concerns attenuate, and when a product is perceived as superior on design, wasteful concerns become more salient. Finally, the indirect effect of the new version (design vs. tech upgrade), conditioned on participants' willingness to

pay, was significant through the technological index (*b* = 76.19, *SE* = 20.24 CI: 39.94 to 118.98) and through the design index (*b* = -25.45, *SE* = 2.84 CI: -55.70 to -4.63).

In summary, relative to their phone, participants perceived the tech upgrade as offering more technological improvements than the design upgrade, whereas they perceived the design upgrade as offering more design improvements than the tech upgrade. In addition, participants perceived an upgrade to the tech version as less wasteful and more justified, and they were willing to pay more to upgrade to it than to the design upgrade. Mediation analyses indicate participants felt this way because the tech upgrade offered more technological/functional improvements to their phone than did the design upgrade. These findings are consistent with those reported in Study 1b.

Study 1d: Is product endangering unique to iPhone?

To examine whether product endangering is unique to iPhones, we sought evidence from another product category. We chose tablets as the product category of interest because the e-commerce website saw a significant trade of iPads. Furthermore, because iPads were the lead product in this category, we focused on them. Fortunately, two introductions of iPads enabled us to examine our main hypotheses.

The iPad 3, announced on February 29, 2012, and launched on March 16, 2012, was described as "identical in form factor, size, thickness and weight to your iPad 2. It runs the same operating system with the same applications from the same App Store" (Gilbert, 2012). The major improvement the iPad 3 offered over the iPad 2 was an increase in screen resolution from 132 ppi to 264 ppi (i.e., screen pixels per square inch). Apart from this difference, the two iPads

were virtually the same. Thus, the iPad 3 did not offer a significant technological improvement over the iPad 2.

Eight months later, on October 23, 2012, Apple introduced the iPad 4, which had a new Lightning connector that made all previous iPad devices and accessories obsolete. The iPad 4 was launched on November 2, 2012. Furthermore, it had a new processor that was twice as fast as that of the iPad 3, and a better front-facing camera. The iPad 4 was described as being "clearly a better tablet, with a faster processor, upgraded Wi-Fi, and a better front-facing camera" (Nations, 2017). Thus, the iPad 4 offered major technological improvements over iPads 2 and 3. Based on our theory and evidence (H1, H2, and the study 1a findings), we expect (i) an increase in the gap between damaged and used iPad 2's after the introduction of iPad 3, and (ii) a decrease in the gap between damaged and used iPad 2's after the introduction of iPad 4.

Results

We conducted the same analysis as that for the white iPhone 4, now using 2012 iPad 2 listing data on 111,481 iPads: 104,323 used and 7,158 damaged. We also repeated the analysis for the announcement and launch of the iPad 4, using both iPad 2 and iPad 3, and using only the iPad 3 as our unit of analysis, with no significant change in results.

The regression results that appear in Table 5 support our theory and conceptually replicate the iPhone findings. We see β_3 is positive (1.27, $p < .01$) after the launch of the iPad 3. Thus, we again find that when justifying the replacement of the owned product with the new one is difficult, the gap between the damaged and used products offered for sale increases. Interestingly, β_3 is not significant after the introduction. This pattern is consistent with that observed for the iPhone, where we found damaged phones take time to be listed for sale. Recall that we interpret

the delay as an indication that owners do not intentionally damage their product but, rather, may endanger it or take less care of it, in which case damage is unlikely to be immediate.

By contrast, following the announcement of iPad 4, which is technologically superior to the earlier models, we find a decrease in the gap between damaged and used iPads; that is, the coefficient of the interaction variable, β_3, is negative (-.51, p < .01). Notice that in this case, the coefficient is not significant after the launch. This pattern is similar to what we observed after the introduction of the iPhone 4S. Specifically, when the purchase of a new device is easy to justify, more used than damaged devices are offered for sale.

The results support our hypotheses and are consistent with the findings from Study 1a. Specifically, more damaged devices were offered for sale after the introduction of a device whose purchase was relatively hard to justify, and more used devices were offered for sale after the introduction of a device whose purchase was relatively easy to justify. In summary, product endangering is not unique to the iPhone.

Table 5: The effect of introducing the iPad 3 and the iPad 4 on used and damaged iPad 2 models using a 28-day window

	iPad 3		***iPad 4***	
Event	**Announced**	**Launch**	**Announced**	**Launch**
Intercept	1.06 (.24) **	2.24 (.23) **	-.38 (.10) **	.08 (.12)
Damaged Dummy	-1.84 (.34) **	-2.76 (.32) **	1.46 (.14) **	1.22 (.18) **
Event Dummy	1.01 (.31) **	-1.31 (.29) **	1.18 (.13) **	.63 (.16) **
Damaged x Event Dummy (β_3)	-.64 (.43)	1.27 (.42) **	-.51 (.18) **	.04 (.23)
Weekend Dummy	-.40 (.34)	-.45 (.33)	-.27 (.14) ·	-.28 (.18)
Weekend x Damaged Dummy	.15 (.48)	.17 (.46)	-.83 (.20) **	-.85 (.25) **
Adjusted R^2	48.4%	51.2%	71.6%	57.3%

N=112; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

In summary, the findings from the field data (iPhone, iPad, and Samsung Galaxy II reported in Appendix A) indicate consumers endanger their products and that justification concerns drive this behavior. We use the term "indicate" because the field data provide a consequence of product endangering—damaged products—and not the behavior itself. In studies 2 and 3, we directly test for product-endangering behavior. In study 2, we demonstrate product endangering using a hypothetical decision, and in study 3, we use a setting in which iPhone owners pay real money to endanger their product.

Study 2: Evidence for product endangering

The aim of Study 2 was to corroborate the field data and provide further evidence that product endangering is moderated by the new version's characteristics that influence justification concerns. To this end, in Study 2, we measured whether iPhone owners would be more willing to risk damage to their iPhone when made aware of a new version of iPhone offering mainly design improvements than when made aware of a new iPhone offering mainly technological improvements.

In this study, we used an online article to manipulate iPhone owners' perceptions regarding the new iPhone 7 that had been launched two months prior to the running of the study on September 16, 2016 (O'Boyle, 2016). Some owners were exposed to an article in which the iPhone 7 was framed as offering mainly design improvements over existing iPhones, whereas others were exposed to an article in which the iPhone 7 was framed as offering mainly technological improvements (see Appendix D). We then asked them to evaluate the iPhone 7, to report on their usage of their iPhone, to report how they would use their iPhone in two future situations (the order of the two questions was randomly determined across participants), and

finally to report whether their iPhone was under warranty. Our interest was in iPhone owners without a warranty, because damaging an iPhone that is not under warranty "frees" the consumer to purchase a new iPhone. By contrast, damaging an iPhone that is under warranty does not "free" the consumer to purchase a new phone (i.e., the phone can be fixed at no cost).

To examine product endangering, we asked participants to choose between a risky and safe option: (a) take their iPhone on a scenic outdoor trek full of water crossings where it could get damaged (risky option) or (b) keep their phone safe at home without being able to take great pictures on the trek (safe option). We predicted that among iPhone owners without a warranty, those exposed to a new iPhone offering mainly a design improvement would be more likely to place their iPhone in harm's way than those exposed to a new iPhone offering mainly a technological improvement. We did not expect consumers with a warranty to behave differently in the technological- versus design-upgrade conditions. Formally:

H3: Participants will be more likely to take their iPhone with them on a trek (thereby endangering it) after being exposed to a new iPhone that offers design versus technological improvements. This effect will manifest only for owners without a warranty on their iPhone.

To establish the pivotal role of potential damage resulting from keeping one's iPhone with them on the trek, we also asked all participants to make a second decision regarding future iPhone use that was not linked with potential damage to their iPhone. In this decision, the conflicting factor was convenience. Specifically, iPhone owners were asked whether, on an airline flight where WIFI was not available, they would prefer to (a) keep their iPhone with them and suffer some inconvenience or (b) stow it in the overhead compartment. Because this decision is not associated with potential damage, we did not expect owners without a warranty to behave differently in the technological- versus design-upgrade conditions. Formally:

H4: We expect participants to be equally likely to keep their iPhone with them on a flight without WIFI after being exposed to a new iPhone that offers design versus technological improvements regardless of warranty status.

In summary, the only case in which we expected the type of upgrade (tech vs. design) to influence owners' hypothetical behavior was when (a) the decision involved potential risk to their phone and (b) they did not have a warranty. When the decision involved convenience (rather than risk) behavior and/or when the owner's iPhone was under warranty, we did not expect the type of upgrade to have an effect.

We recruited iPhone owners from prolific.com to participate in return for 1 euro. We filtered for relevant iPhone owners by asking potential participants to choose the model of the phone they owned and used. We did not inform participants in advance that we were interested only in iPhone owners. Potential participants were shown a list of 12 leading cellphone models that also included one option comprising the iPhone 5, 5s, 6, 6s, and plus versions, and another option that included only the iPhone 7. Participants also had an open-field response option for indicating a cellphone not provided in our list. We kept in our sample the 152 iPhone owners (mean age = 33; 55.2% female) who reported owning either the iPhone 5, 5s, 6, or 6s (and plus) versions and who had either purchased their iPhone or had received it as a gift (a second filtering question). We excluded the five consumers who owned an iPhone 7 or had received their iPhone from their workplace. We also asked participants how long they had owned their iPhone (< 6 months, 6 <> 12 months, 12 <> 18 months, 18 <> 24 months, >24 months)?

First, we asked participants who passed the filters and entered the study to read an article that had purportedly appeared in a popular online tech forum about the new iPhone 7. Approximately half the participants read an article that emphasized the iPhone 7's design

features. The verdict of this article was “The iPhone 7 looks great!” The remaining participants read an article that emphasized the iPhone 7’s technological features. The verdict of this article was “The iPhone 7 improves on its predecessors in multiple areas!”

Next, to verify that our framing manipulation worked, we asked participants to indicate the extent to which they felt the new iPhone was superior in design and in technology to their iPhone and to what extent they would want to have a new iPhone 7 (all three responses ranging from 1 = *Not at all* to 7 = *Very much so*). Then, participants answered questions regarding their uses of their iPhone. We asked them to report the extent to which they used their iPhone for making calls over the internet, taking pictures, taking selfies, wake-ups, listening to music, playing games, and making online purchases (1 = *Never* to 7 = *A lot*). At this point, participants reported what they would do in two scenarios that were randomly ordered within participants. In the risk-related scenario, participants read the following and answered on an 8-point scale (1 = *Definitely take my iPhone with me*, 8 = *Definitely leave my iPhone at home*):

> Imagine you were going on an outdoor trek to a beautiful nature area full of lakes and rivers with a group of people. The guide organizing the trip mentioned there will be amazing photo opportunities, but at the same time you will be crossing areas with water and there is a risk your cellphone will get wet/damaged. So, you are faced with a dilemma, taking your iPhone so you can take great pictures but possibly having your iPhone get damaged, or not taking your iPhone, not being able to take great pictures, but keeping your iPhone safe at home. What would you do?

In the convenience-related scenario, participants read the following and answered on an 8-point scale (1 = *Definitely keep my iPhone with me*, 8 = *Definitely put iPhone in overhead compartment*):

> Imagine you are on an international flight that does not have WIFI on it. What a bummer. You are contemplating whether to keep your iPhone with you in your hand or pocket or put it in your backpack that you are stowing in the overhead compartment. On the one hand you might want to entertain yourself with your iPhone (looking at pictures, playing games, reading something) but you are also thinking about the inconvenience of having your iPhone in your hand or pocket all the time. So, you are faced with a dilemma, keeping iPhone with you = potential entertainment but some inconvenience, or stowing your iPhone in the overhead compartment = no entertainment but no need to hold your iPhone. What would you do?

Next, participants indicated whether their iPhone was still under warranty (Yes, No). Finally, they indicated their age, education, gender, and income.

Results

In all analyses, we entered the new iPhone 7's upgrade frame (design improvement vs. technological improvement) and warranty status (under warranty vs. not under warranty) as independent variables, and past usage as a covariate. We entered owners' past usage as a covariate, because owners who use their iPhone more may be more likely to keep their iPhone with them in each of our scenarios.

Of the 75 participants in the technological-upgrade framing condition, 48 did not have a warranty on their iPhone (64%), and of the 77 participants in the design-upgrade framing condition, 53 did not have a warranty on their iPhone (68.8%). Thus, the majority of iPhone owners in our sample were without warranty.

Participants with and without a warranty did not differ on age, education, or income (all F's < 1). Men were more likely (29 out of 68; 42.6%) than women (22 out of 86; 25.5%) to have a warranty ($X^2 = 4.56$, $p < .05$). Finally, those with and without a warranty did not differ in their self-reported usage of their iPhone ($F < 1$), whereas those without a warranty reported having owned their iPhones for longer than those with a warranty ($M_{\text{without}} = 3.3$, $M_{\text{with}} = 1.94$; $F(1, 150) = 55.03$, $p < .001$). Recall that our main interest is in owners without a warranty who could benefit from fortuitous damage to their iPhone if they took it with them on a river trek.

Our framing manipulation worked. Participants viewed the new version as offering better technology and wanted it more when it was framed as a technological improvement than when it was framed as a design improvement (see Web Appendix D).

Next, we test our main hypothesis that iPhone owners without a warranty will be more willing to endanger their iPhone after being made aware of a new iPhone that offers primarily design improvements than after being made aware of an iPhone that offers primarily technological improvements (**H3**).

Trek (Endangering) decision. We reverse scored participant responses so that higher values represent a greater tendency of owners to take their iPhone with them on the river trek. The effect of past usage, the covariate, was not significant ($b = .13$, $p = .10$). We found no main effects for upgrade frame ($F(1, 147) = .00$, $p = .99$, partial $\eta^2 = .00$) or for warranty status ($F(1, 147) = .42$, $p = .525$, partial $\eta^2 = .00$). Crucially, however, and as predicted in **H3**, the upgrade

framing x warranty interaction was significant ($F(1, 147) = 5.90$, $p < .05$, partial $\eta^2 = .04$).[4] Consistent with our hypothesis, iPhone owners without a warranty were more likely to risk their iPhone after being made aware of a new iPhone 7 that offered a design improvement ($M = 5.83$) than after being made aware of a new iPhone 7 that offered a technological improvement ($M = 4.86$; $F(1, 147) = 4.38$, $p < .05$). By contrast, for iPhone owners with a warranty, the effect of upgrade framing on their tendency to keep their iPhone with them was not significant ($M_{\text{design upgrade}} = 4.59$, $M_{\text{technological upgrade}} = 5.58$; $F(1, 147) = 2.24$, $p = .14$).

Recall that we also asked owners to make a second decision regarding iPhone use in which the conflicting factor was convenience. Because this decision is not associated with potential damage, we did not expect consumers without a warranty to behave differently in the technological- versus design-upgrade conditions (**H4**).

Flight (Convenience) decision. We reverse scored participant responses so that higher values represent a greater tendency of owners to keep their iPhone with them on the flight. The effect of past usage, the covariate, was significant ($b = .19$, $p < .05$). We found no main effect for upgrade frame ($F(1, 147) = .00$, $p = .98$, partial $\eta^2 = .00$), whereas the effect of warranty status was significant ($M_{\text{without warranty}} = 6.30$, $M_{\text{with warranty}} = 7.04$; $F(1, 147) = 4.25$, $p < .05$, partial $\eta^2 = .03$). More importantly, and as predicted in **H4**, the upgrade framing x warranty interaction was not significant ($F(1, 147) = .06$, $p = .80$, partial $\eta^2 = .00$). Upgrade framing did not affect owners' decision to keep their iPhone with them whether they did not have a warranty on their iPhone ($F < 1$; $M_{\text{technological upgrade}} = 6.33$, $M_{\text{design upgrade}} = 6.27$) or did have a warranty ($F < 1$; $M_{\text{technological upgrade}} = 6.97$, $M_{\text{design upgrade}} = 7.10$).

[4] We also ran this analysis with both length of ownership and past usage as covariates. Neither covariate was significant (length: $b = .09$, $p = .35$; past usage: $b = -.12$, $p = .11$) and the interaction remained significant ($F(1, 146) = 5.62$, $p < .05$, partial $\eta^2 = .04$).

In summary, iPhone owners without a warranty were more willing to endanger their iPhone after being made aware of a new iPhone offering primarily a design improvement than after being made aware of a new iPhone offering primarily a technological improvement. By contrast, these two groups of iPhone owners treated their iPhones similarly when the decision of keeping their phone with them was associated with a convenience consideration.

These results provide converging support for the notion that product owners are more likely to engage in product endangering when faced with an upgrade that offers mainly design improvements. We contend that product endangering happens because product owners have difficulty justifying product replacement. Importantly, in Study 2, we tested for hypothetical product endangering. Next, we examine consumers' willingness to pay real money to endanger their iPhone, and we test the moderating role of justification.

Study 3: Product endangering and justification

This section consists of two studies that aim to provide direct evidence for the role of justification in product endangering. The studies use a purportedly real product-endangering decision. In Study 3a, consumers faced a new iPhone mainly superior in design to existing products, and in Study 3b, a new iPhone mainly superior in technology to existing products. The experimental materials appear in Appendix E and Appendix F.

We contend product endangering arises when product replacement is hard to justify (i.e., when consumers are faced with a new version offering superior design). Thus, one can expect an external increase in justification concerns to be associated with increased product endangering. Put differently, if justification concerns cause product endangering, consumers with salient

justification concerns should endanger their product even more when faced with a new product offering design improvements. By contrast, justification concerns should not influence product endangering for consumers faced with a new product offering technological improvements, because justifying product replacement in this case is easy.

To establish the role of consumers' justification concerns in product endangering, we made this concern salient for some participants and not others. More specifically, in both studies 3a and 3b, we asked participants in the hard-to-justify condition to read the following text: "Think about a (recent) purchasing decision you made that was *hard to justify*. In other words, you felt it was hard to justify why you bought the product or service." We then asked participants to vividly imagine the purchase occasion and to describe it and their feelings in two or three sentences. We asked participants in the control group to think about a (recent) general purchasing decision they had made, to vividly imagine it, and to describe it and their feelings in two or three sentences.

The studies were conducted before the introduction of the iPhone 8 and before Apple had released any information about its characteristics. The participants in these studies were owners of the iPhone 6 and iPhone 7 (including "S" and "plus" versions). After answering the above questions, participants were made aware of the new iPhone 8 and its expected characteristics. In Study 3a, the upgraded iPhone was described as offering mainly design improvements, and in 3b, mainly technological improvements.

To assess product endangering, we devised a new measure. We offered all participants the opportunity to purchase up to 10 raffle tickets (at 1 US cent per ticket from their $1 participation fee) to increase the likelihood they would be chosen to participate in a pre-launch event that involved tossing their iPhone at a balloon floating at a height of about 10 feet. If they were to hit

the balloon, they would receive a significant discount on the new iPhone 8. To ensure participants were aware of the risk to their iPhone, we pointed out that if it were damaged, they would be able to sell it at the going market price for damaged iPhones (see "Lottery" section in Appendix E). Next, we asked participants whether their phone was under a warranty agreement whereby it would be replaced if it were broken or damaged. Finally, they indicated their age, gender, income, and how long they had owned their phone (12 monthly values up to a year and then a single value representing ownership of more than one year).

We recruited iPhone owners from MTurk to participate in the study in return for $1, filtering for relevant iPhone owners by asking potential participants to choose the model of the phone they owned and used. We did not inform participants in advance that we were interested only in particular iPhone owners. Potential participants were shown a list of 12 leading cellphone models that also included one option comprising the iPhone 6, 7, and their "S" or "plus" versions. Participants also had an open-field response option for indicating a cellphone not provided in our list.

Study 3a: A design upgrade

As discussed above, the relevant hypothesis follows:

H5: When the upgrade offers mainly design improvements, we expect participants who received a task that heightens justification concerns to purchase more raffle tickets than participants for whom such concerns were not heightened. This effect will manifest only for owners without a warranty on their iPhone.

Participants read an online article describing the new iPhone and experts' opinions about its various attributes. The title of the article was "Verdict: The iPhone 8 looks great!" and the last

paragraph read: “In summary, our experts think the iPhone 8 looks great (an average design score of 7.5) yet it offers only minor technological advancements (an average technology score of 3)” (see Appendix E; primarily design improvement and related measures).

Next, participants indicated the extent to which they felt the new iPhone 8 was better than, and superior to, their iPhone (both responses ranging from 1 = *Not at all* to 7 = *Very much so*). We averaged the two items to form an "improvement" score ($r = .89$, $p < .0001$). We then asked participants to report on their past usage of their iPhone: take selfies; wake up; take pictures; make online purchases; make calls over the internet like WhatsApp/Facebook messenger; play games; listen to music (all responses ranging from 1 = *Never* to 7 = *A lot*). Next, we asked participants how many raffle tickets they would like to purchase, and finally, we asked them whether their iPhone was under a warranty agreement (Yes/No).

Our sample includes 166 iPhone owners (mean age = 32.61; 75 female) who reported owning either the iPhone 6 or 7 (and the “S” or “plus”) versions and who had either purchased their iPhone or received it as a gift (a second filtering question). Of the 79 participants in the hard-to-justify purchase condition, 39 did not have a warranty on their iPhone (49%), and of the 87 participants in the control condition, 49 did not have a warranty on their iPhone (56%). In total, 88 out of the 166 participants (53%) did not have a warranty on their iPhone.

Participants with and without a warranty did not differ on their age, gender, income, or self-reported usage of their iPhone (all F’s < 1.5). Those without a warranty reported having owned their iPhones for longer than did those with a warranty ($M_{\text{without}} = 9.79$, $M_{\text{with}} = 8.11$; $F(1, 164) = 8.08$, $p < .01$). Note that in both Studies 3a and 3b, including past usage and length of ownership as covariates does not change the results, and thus we report the results without them.

Results

Participants in the hard-to-justify and control conditions did not differ in their self-reported usage of their iPhone ($M_{\text{hard to justify}} = 5.16$, $M_{\text{control}} = 5.12$, $F(1, 164) = .056$, *ns*) or in their assessment regarding the extent to which the new iPhone was an improvement over their current iPhone ($M_{\text{hard to justify}} = 4.42$, $M_{\text{control}} = 4.52$, $F(1, 164) = .136$, *ns*).

We analyzed participants' willingness to purchase lottery tickets as a function of the justification condition. Confirming **H5**, participants purchased more lottery tickets after describing a hard-to-justify purchase than after describing a regular purchase ($M_{\text{hard to justify}} = 3.13$, $M_{\text{control}} = 1.63$; $F(1, 164) = 6.72$, $p < .01$, partial $\eta^2 = .039$). To test the final element of **H5** (i.e., "This effect will manifest only for owners without warranty on their iPhone."), we analyzed participants' willingness to purchase lottery tickets as a function of condition for those with and those without a warranty on their iPhone. Further supporting **H5**, we find that participants without a warranty purchased more lottery tickets after describing a hard-to-justify purchase than after describing a regular purchase ($M_{\text{hard to justify}} = 3.41$, $M_{\text{control}} = 1.10$; $F(1, 86) = 9.62$, $p < .003$, partial $\eta^2 = .10$). By contrast, for participants with a warranty, we found no difference in the willingness to purchase lottery tickets between the two groups ($M_{\text{hard to justify}} = 2.85$, $M_{\text{control}} = 2.32$; $F(1, 76) = .35$, *ns*).

In summary, willingness to endanger one's product was highest for participants whose concerns about justifying a purchase were intensified and were without a warranty. The results indicate justification concerns underlie product endangering.

Study 3b: A technological upgrade

Study 3a results indicate justification concerns play a role in product endangering, by showing that when such concerns are made salient (and the upgrade offers mainly design improvements), participants are more likely to endanger their phone when they do not have a warranty on it. To provide further evidence for the role of justification, we reproduce the setting of Study 3a with one important change—the new phone offered mainly technological improvements (see Appendix F for the article participants read in Study 3b). We argue consumers should not have difficulty justifying the purchase of a technological upgrade. Therefore, making justification concerns salient should not impact product endangering. Accordingly:

H6: When the upgrade offers mainly technological improvements, we expect participants who received a task that intensifies hard-to-justify concerns to purchase the same number of raffle tickets as participants for whom such concerns were not intensified, regardless of warranty status.

We used the same recruitment and payment specifications as in Study 3a. We filtered for MTurkers who owned the iPhone 6 or iPhone 7 (including "S" and "plus" versions), and we offered participants $1 for completing the study. We collected data for 166 iPhone owners (mean age = 35.84; 93 female). Of the 80 participants in the hard-to-justify purchase condition, 29 did not have a warranty on their iPhone (36%), and of the 86 participants in the regular purchase description condition, 42 did not have a warranty on their iPhone (48%). In total, 71 out of the 166 participants (42%) did not have a warranty on their iPhone.

Participants with and without a warranty did not differ on their age, gender, or income (all F's < 1). We found two marginally significant effects. Those without a warranty reported owning their iPhone for longer than those with warranty ($M_{\text{without}} = 9.25$, $M_{\text{with}} = 8.12$; $F(1, 163) = 3.25$, $p = .073$), and those with a warranty reported using their iPhone more than did those without a warranty ($M_{\text{without}} = 4.87$, $M_{\text{with}} = 5.2$; $F(1, 164) = 3.61$, $p = .059$).

Results

As in Study 3a, we averaged the two items to form an "improvement" score (r = .78, p< .0001). Participants in the hard-to-justify and control conditions did not differ in their assessment of the new iPhone offering improvement over their current iPhone ($M_{\text{hard to justify}}$ = 5.01, M_{control} = 5.17, $F(1, 165)$ =.55, *ns*).

We analyzed participants' willingness to purchase lottery tickets as a function of condition. As predicted in **H6**, we found no difference between the two groups in the willingness to purchase lottery tickets ($M_{\text{hard to justify}}$ = 1.75, M_{control} = 1.31; $F(1, 165)$ =.80, *ns*). Furthermore, we again analyzed participants' willingness to purchase lottery tickets as a function of condition for those with and without a warranty on their iPhone. As expected, we found no difference between the two groups in the willingness to purchase lottery tickets, whether participants had a warranty ($M_{\text{hard to justify}}$ = 1.88, M_{control}= 1.73; $F(1, 94)$ =.05, *ns*) or did not have a warranty ($M_{\text{hard to justify}}$ = 1.52, M_{control}=.88; $F(1, 70)$ =.90, *ns*) on their iPhone.

The results of Studies 3a and 3b demonstrate the role of justification in product endangering. The results of Study 3a show that making justification concerns salient increases product endangering when the new version offers design improvements and owners are without a warranty on their iPhone, whereas the results of Study 3b show that making justification concerns salient does not increase product endangering when the new version offers technological improvements (where justification is not an issue).

Discussion

We demonstrate that owners of a technological product may endanger it when faced with the launch of a new version. Product endangering is more likely when the new version improves mainly on design aspects than when it improves mainly on technological aspects, and it occurs only for owners without a warranty on their product. Our findings suggest owners endanger their product to justify upgrading to the new version.

First, we provide suggestive evidence for product endangering in an analysis of online listings of over 400,000 second-hand iPhones. We find the introduction of the white iPhone 4, which differed only in its color from its predecessor, the black iPhone 4, was associated with an increase in the number of damaged relative to used iPhone 4's offered for sale (relative to the period before the introduction). By contrast, following the introduction of the iPhone 4S, which offered clear technological improvements over its predecessors, the number of used relative to damaged iPhone 4's offered for sale increased (relative to the period before the introduction). Further analysis showed the increase in the listings of the damaged iPhones took time to develop (about 2 weeks), suggesting owners endangered their product but did not break it. Last, we provide analyses that rule out an alternative explanation whereby the timing of the white iPhone 4 launch (e.g., seasonality) led to an increase in online listings of damaged iPhones.

Next, results of a survey confirmed the assumptions used in the analysis of the field data (Study 1b). Specifically, consumers perceived the iPhone 4S as offering more functional improvements than the white iPhone 4, whereas they perceived the white iPhone 4 as offering more aesthetic improvements than the iPhone 4S. Also, consumers were willing to pay more to upgrade to the iPhone 4S than to the white iPhone 4, and they perceived upgrading to the iPhone 4S as less wasteful and more justified.

To demonstrate generalizability of the product-endangering finding, we conducted three studies. First, using a survey almost identical to that used in Study 1b, in Study 1c, we find that consumers' tendency to perceive an upgrade offering technological improvements as less wasteful and easier to justify than an upgrade offering design improvements is not specific to Apple products. Second, in Study 1d, we examined the launches of the iPad 3 and iPad 4, conducting an analysis similar to that done on the launches of the white iPhone 4 and iPhone 4S. The result pattern was similar to that for the iPhone. After the launch of the iPad 3 that offered modest improvements over the iPad 2, a slow-to-develop increase occurred in the number of damaged relative to used iPad 2's offered for sale after its launch (relative to the period before the introduction). By contrast, following the launch of the iPad 4, which offered substantial improvements over the iPad 3, the number of used relative to damaged iPad 2's sold increased. Finally, in Appendix A, we report the results of an analysis showing that after Samsung introduced the Galaxy S III which differed from its predecessor the S II mainly in its design there was an increase in the number of damaged relative to used consumer sales listings of the S II. These findings suggest product endangering is not specific to Apple products.

Next, we conducted experiments to provide converging evidence for product endangering and to further demonstrate it is moderated by the characteristics of new versions that influence justification concerns. To this end, in Study 2, we used hypothetical scenarios in which we measured whether iPhone owners would be more willing to risk damage to their iPhone when made aware of a new version that offered mainly design improvements than when it offered mainly technological improvements. We found that iPhone owners indicated a higher willingness to take their iPhone with them on a scenic outdoor trek full of water crossings where it could get damaged (as opposed to keeping it safe at home without being able to take great pictures on the

trek) after being exposed to a new version that was superior in design to existing iPhones relative to when it was technologically superior. Importantly, this effect arose only for participants who did not have a warranty on their iPhone and therefore could benefit from its damage.

Then, in Study 3a, we found that iPhone owners were willing to pay actual money for an opportunity to throw their iPhone at a balloon floating at a height of about 10 feet after they were exposed to a new iPhone that primarily offered design improvements. Furthermore, they were even more willing to pay for such an opportunity after having described a hard-to-justify purchase than after having described a regular purchase. This evidence demonstrates the role of justification in the endangering behavior we observe. Again, we found the product-endangering effect only for iPhone owners without a warranty on their iPhone. By contrast, in Study 3b, justification had no effect when participants were exposed to a new iPhone that offered mainly technological benefits.

In summary, we provide evidence for the role of justification in product endangering in two ways. First, we compare product endangering when the new version offers improved design as opposed to improved technology. As shown in Studies 1b and 1c, justifying product replacement when the new version offers improved technology is easier than justifying it when the new version offers an improved design. As expected, in each of our studies, we find increased product endangering when the new product offers design as opposed to technological improvements. Second, in Study 3, we heightened consumers' purchase-justification concerns and find increased product endangering. This finding suggests owners endanger their product to justify product replacement.

The growing importance of product design improvements

Previous research has highlighted differences in how consumers think about, talk about, evaluate, and behave toward hedonic and utilitarian consumption (Khan, Dhar, and Wertenbroch, 2005; Kronrod and Danziger, 2013; Mishra and Mishra, 2011; Sela, Berger, and Liu, 2009). To date, less attention has been dedicated to consumer behavior regarding new product versions that offer design or technological improvements.

Importantly, the distinction between design and technological upgrades is relevant in mature markets. Although technology is constantly advancing and many products offer technological improvements, in mature categories, such improvements often become small, and sometimes, negligible (O'Cass, Heirati, and Ngo, 2014; Orbach and Fruchter, 2014). For example, even in the rapidly evolving cellphone market, experts often proclaim a new cellphone is offering "more of the same" (Kelly, 2016; Sin, 2017; Smith, 2015). At the same time, design improvements have become an important fixture of new product introductions (Frommer, 2017; Guinness, 2017).

Our research shows consumers react differently to new versions that offer design improvements and technological improvements. Our results suggest that although consumers may want a new product that offers mainly design improvements, they may have difficulty justifying its purchase. Our findings indicate firms' promotions of such new versions should provide the consumer with "justification ammunition." For example, a firm may advertise the functional benefits of design characteristics such as enhanced usability, or that it will allocate a certain fraction of the sales revenues to charity. Such announcements may provide consumers with sufficient justification for purchase.

The launch of the white iPhone studied here is unique in that it offered only an aesthetic design improvement. In practice, new versions often offer a mix of design and technological

improvements. Accordingly, in Studies 2, 3a, and 3b, we compared consumers' product endangering when they faced a new version that offered mainly design or technological improvements. Future research could more systematically manipulate the extent of technological and design improvement to identify the band within which consumers want a new version but find product replacement difficult to justify, so they engage in product endangering.

Self-signaling and self-deception

Why do consumers engage in product endangering and not overt product damaging? In the introduction, we called upon a literature documenting peoples' negative evaluation of wastefulness (Arkes, 1996). Shani and Shachar (2011) raise the issue of self-signaling and self-deception as a potential source of such concerns. Following Bem (1972), who claims individuals often come to know their own dispositions and character by inferring them from observing their own behavior, and Bodner and Prelec (2002), who show people alter their actions to signal to themselves their desired character, Shani and Shachar (2011) interpret their findings of product endangering as suggesting consumers may use the "accidental" damage to their owned product as a way to protect and defend their positive self-perception. Future research could explore the role of self-signaling in product endangering, and could extend the setting of the studies presented here in several ways. For example, participants could be asked to describe their identity before being exposed to the new version, which would likely increase their sensitivity to self-signaling issues and would increase their tendency to engage in product endangering. In addition, researchers could threaten participants' projected identity before exposing them to the new version. Such a treatment is likely to have an effect similar to the first one.

<u>Appendix A</u>: Careless behavior in the field – Samsung S III

We also tried to test for careless behavior with other popular phone models in our dataset. Note, however, that our dataset contained far more listings of damaged iPhone 4 devices (N=30,366) than any other leading smartphone model. Because the iPhone is so popular and has a small number of high-priced models, salvaging its damaged parts may be economically more worthwhile than doing so for the multitude of models, shapes, and sizes offered by Android manufacturers. Compared to the 30,366 damaged iPhone 4's listed on the site, the top five Android brands were Samsung Galaxy S II (N=11,256); HTC EVO (N=10,494), T-Mobile MyTouch (N=5,702), HTC Droid Incredible (N=3,885), and the Motorola Droid X (N=3,555). The HTC EVO and the T-Mobile MyTouch are a series of models with a wide range of variants that are difficult to uniquely identify. From 2009 until 2012, the HTC EVO line had seven model (3D, 4G, 4G LTE, Design 4G, 3D CDMA, Shift 4G, and 4G+) and the MyTouch line had 10 models (4G, 4G Slide, 3G, 3G Slide, MyTouch, Q 2, Q, 3G Fender Edition, 2, and 3G 1.2). This may explain why relatively many of these devices are listed. The other top models had even fewer listings, about 10% of the listings of the iPhone, and about 10 phones per day on average.

We performed our exercise on the Samsung Galaxy S II (SII) because of its relatively large number of damaged phones listed for sale. Samsung positioned the Galaxy S as a direct competitor to Apple's successful iPhone (Kain 2011). In May 2012, Samsung launched the Samsung Galaxy S III (SIII) to succeed the SII. The SIII offered a new design, four processors (compared to two for the SII), and a bright new high-resolution screen (GSMArena 2012), yet many pundits reviewed it as functionally similar to the SII, mentioning that upgrading to the SIII would reflect more of a desire than a real need (GSMArena, 2012; Hill, 2012; Manimaran, 2012). For this reason, we tentatively classify the upgrade to the SIII as relatively difficult to justify.

Though it is not as good an example as the white iPhone 4 of a relatively difficult-to-justify upgrade, it was the best option available to us.

The SIII was announced on May 3, 2012, and T-Mobile launched it in the US on June 21, with other providers launching it later. Because consumers could become aware of the SIII when it was announced, we examined the effect of the announcement on potentially careless behavior. Note the 49-day gap between announcement and launch is much larger than the 1-day gap for the white iPhone 4. According to H1, the announcement of the SIII should have prompted some consumers to become careless with their SII, and therefore we expected a steady increase in the number of damaged SII listings. We conducted the same analysis as that reported in Study 1, using 2012 SII listings of 113,109 SII phones: 101,853 used and 11,256 damaged.

Results

Table A1 shows the regression results for a 28-day window. We see β_3 is positive (.19, p = .056) after the announcement of the SIII and negative (-.24, p = .055) after the US launch. This pattern suggests the model announcement prompted SII owners to think about upgrading to the SIII, rather than the launch that took place 49 days later. Thus, we performed a finer-grained analysis of the effect of the announcement using a 14-day window. As was the case for the white iPhone 4, we find evidence of a gradually developing carelessness effect (Table A2). In the first 14-day window after the announcement, the difference between the listings of damaged and used SII was not significant (.19, p = .148), but it was significant in the 15-28 window (.31, p = .025) and it approached significance in the 29-42 window (.25, p = .063). These data provide converging evidence that when an upgrade to a new desirable model is relatively hard to justify, consumers become careless with their model, thereby increasing the likelihood of its damage.

Table A1: The effect of introducing the Samsung Galaxy SIII on used and damaged Samsung Galaxy SII models using a 28-day window.

	Samsung Galaxy S III	
Event	**Announced**	**Launch**
Intercept	-.29 (.06) **	-.18 (.07) **
Damaged Dummy	-.23 (.08) **	-.00 (.10)
Event Dummy	-.08 (.07)	.62 (.09) **
Damaged x Event Dummy (β_3)	.19 (.10) ·	-.24 (.12) ·
Weekend Dummy	-.52 (.08) **	-.54 (.10) **
Weekend x Damaged Dummy	.15 (.11)	-.01 (.14)
Adjusted R^2	37.2%	54.6%

N=112; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

Table A2: DiD regression results for three successive 14-day windows compared to 14 days before the announcement of the Samsung Galaxy S III.

Event	*Samsung Galaxy S III announcement*		
Compared to:	***1-14 days after***	***15-28 days after***	***29-42 days after***
Intercept	-.08 (.07)	-.11 (.07)	-.10 (.07)
Damaged Dummy	-.28 (.10) **	-.29 (.11) **	-.28 (.10) **
Event Dummy	-.14 (.09)	-.37 (.10) **	-.06 (.09)
Damaged x Event Dummy (β_3)	.19 (.13)	.31 (.14) *	.25 (.13) ·
Weekend Dummy	-.65 (.10) **	-.55 (.11) **	-.57 (.10) **
Weekend x Damaged Dummy	.14 (.14)	.20 (.15)	.13 (.14)
Adjusted R^2	56.4%	47.0%	48.9%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; standard errors in parentheses

Appendix B: Image comparison of the iPhone 4 and 4S versions and colors

Figure A1. iPhone 4 versions offered in black and white

Figure 1B. iPhone 4 (left) versus iPhone 4S (right)

<u>Appendix C:</u> The information participants read about the launch of the white iPhone 4 (design) and the launch of the iPhone 4S (technology) conditions

White iPhone 4 (design) condition:

The black iPhone 4 was launched on June 24, 2010.
The white iPhone 4 was launched on April 28, 2011. **The white iPhone 4 was virtually identical to the black iPhone 4, except it was offered in white.**

Figure 1. The black iPhone 4 (launched in June, 2010) and the white iPhone 4 (launched in April 2011)

Assume that you own the original black iPhone 4. You purchased it for $499.

iPhone 4S (technology) condition:

The black iPhone 4 was launched on June 24, 2010.
The white iPhone 4 was launched on April 28, 2011. The white iPhone 4 was virtually identical to the black iPhone 4, except it was offered in white.

The iPhone 4S was launched on October 14, 2011. **The iPhone 4S (offered in either white or black) was identical in its appearance to the black and white iPhone 4's respectively, but it was a faster device with new and innovative features (e.g., the introduction of the digital personal assistant Siri, a superior camera and more memory).**

Figure 1. The black iPhone 4 (launched in June, 2010) and the black and white iPhone 4S (launched in October 2011)

Assume that you own the original iPhone 4 in color BLACK. You purchased it for $499.

Appendix D: The information participants read in the design and technology condition

Design condition:

Now we would like you to read an article that appeared in a popular online tech forum. We have shortened the article a bit but captured its main points. Please read the article and answer the questions that follow it:

Verdict: The iPhone 7 looks great!

The iPhone 7 removes the cumbersome headphone jack and antenna bands for a more seamless design, while it also adds two new unique and gorgeous colors to the mix, the silky Black and the shiny Jet Black (pictured above). The change in the iPhone 7 isn't as dramatic as it was when the iPhone 6 launched a couple of years ago, but there are some good additions to the new device that will see a few wanting to upgrade, especially those with the iPhone 6.

Details:
Apple announced the next generation of its iPhones on September 7th. The Apple iPhone 7 features several changes compared to the iPhone 6: The antenna strips on the rear have seen a move to the top for **a leaner, cleaner look**, while the 3.5mm headphone jack has been finally removed altogether in favor of **a sleek Lightning port and stereo speakers**. **It's the first time an iPhone is being offered in two black colors: matte black and jet black, both colors look gorgeous**. It will also come in Silver, Gold and Rose Gold, as before. **The home button has also been redesigned and the camera bump on the rear is a little larger and more refined**. The

iPhone 7 sticks with a Retina HD display and the 4.7-inch size. That means a resolution of 1334 x 750 pixels for a pixel density of 326ppi. Apple claims the new display is 25 per cent brighter however, and it also has a P3 color gamut, meaning colors should be richer.

Technology condition:

Now we would like you to read an article that appeared in a popular online tech forum. We have shortened the article a bit but captured its main points. Please read the article and answer the questions that follow it:

Verdict: The iPhone 7 improves on its predecessors in multiple areas!

Although it looks just the same, the iPhone 7 hardware sees a substantive improvement over the iPhone 6 and there have been enhancements in the camera and battery departments too. The iPhone 7 removes the headphone jack and antenna bands for a more seamless design, and it also adds waterproofing to the mix.

Details:
Apple announced the next generation of its iPhones on September 7th. The Apple iPhone 7 features a **similar design to the iPhone 6S and iPhone 6**, though there are a couple of changes to note. The antenna strips on the rear have seen a move to the top for a cleaner look, while the 3.5mm headphone jack has been removed altogether in favor of a Lightning port only and stereo speakers. **The iPhone 7 also offers IP67 waterproofing** and **3D Touch**, while the iPhone 6

doesn't, so **more features** are available on the later model. The iPhone 7 arrives with a new **12-megapixel sensor** (compared to 8-megapixel in the iPhone 6) and **a new six-element lens**, **optical image stabilization and a Quad-LED True Tone flash**, body detection and wide color capture. **The front camera has also upped its resolution to 7 megapixels**, while also offering body detection, wide color capture and auto image stabilization. The Retina Flash is onboard and the front-facing camera will record in 1080p, while the rear is capable of 4K. The iPhone 6 did not offer optical image stabilization and had a dual-LED True Tone flash rather than Quad-LED. The Apple iPhone 7 arrives with a **new processor - the A10 Fusion**. It has an embedded M10 motion coprocessor and it is said to two-times faster than the iPhone 6 A8 Processor. The GPU in the new iPhone 7 is claimed to add to the performance enhancement, with Apple saying it is three times better than the A8. The battery life of the iPhone 7 is also said to be two hours longer than the iPhone 6.

Appendix E: Study stimuli, related measures taken, and the information participants read regarding the iPhone 8 offering primarily non-functional improvements in design.

This survey is for participants with specific characteristics. To determine whether you can participate in this study, please fill in the following:

Please choose the model of the phone that you own and use.

- ❑ Moto Z
- ❑ Google Pixel
- ❑ Motorola Moto G4 or X Play
- ❑ Nexus 5, 5X or 6
- ❑ LG G4 or G5
- ❑ Huawei Mate 8, S or P9
- ❑ iPhone 5, or 5s (and their s or plus versions)
- ❑ iPhone 6, or iPhone 7 (and their s or plus versions)
- ❑ iPhone 7 (and plus version)
- ❑ HTC One M9 or HTC 10
- ❑ OnePlus 1, 2, or 3
- ❑ Samsung Galaxy S6, S7, S7 edge
- ❑ Samsung Galaxy S8
- ❑ Other (Specify) _____

In this survey we are interested in your honest impressions. To verify that you are carefully reading the instructions, please choose option number five in the following question and ignore its content.

When people buy cell phones, their primary consideration is price.

- ❍ Completely disagree 1
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ Completely agree 7

Which iPhone do you currently use (if you use more than one iPhone for your own personal use then indicate all iPhones)?

- ❍ iPhone 6
- ❍ iPhone 7s
- ❍ iPhone 6 plus
- ❍ iPhone 7
- ❍ iPhone 7 plus
- ❍ Other _____

How did you get the iPhone you own?

- ❍ I purchased it
- ❍ I got it as a gift
- ❍ Other: specify _____

How long have you had the iPhone you currently use?

- ❍ 6 months or less
- ❍ Between 6 and 12 months
- ❍ Between 12 and 18 months
- ❍ Between 18 and 24 months
- ❍ More than 24 months

In this hit, you will be doing several consumer surveys. Please pay close attention to the instructions on each page. First, we ask that you complete a purchase inventory task.

PURCHASE INVENTORY SURVEY

Instructions

Now, we would like you to think about a (recent) purchasing decision you made that was hard to justify. In other words, you felt it was hard to justify why you bought the product or service. Please imagine the purchase occasion as vividly as possible and describe it and the feelings you felt feelings in 2 to 3 sentences.

_____

_____

_____

NEW IPHONE EVALUATION TASK

In this survey, we would like you to read an article that appeared in a popular online tech forum. We have shortened the article a bit but captured its main points. Please read the article and answer the questions that follow it:

Verdict: The iPhone 8 looks great!

Apple has some iPhone redesign planned for 2017. The iPhone 8 will feature a more seamless design, with an edge-to-edge OLED display that includes an integrated Touch ID fingerprint sensor and front facing camera, and it will come in some new colors.

Details:

The Apple iPhone 8 features several changes compared to the iPhone 7: Instead of placing the TOUCH ID fingerprint under the glass, it is located at the back of the iPhone. The iPhone 8 will feature a 5.8-inch display with 5.15 inches of usable area, with the rest dedicated to virtual buttons that will replace the existing Home button. Moreover, the display is flexible plastic OLED rather than an LCD, allowing Apple to introduce a thinner device that consumes less power and offers a slightly better display with a better contrast ratio and more true-to-life colors.

Finally, we asked 9 industry experts to provide an overall ranking of the new iPhone 8 relative to recent iPhone models in regards to design and technological improvement. The experts were given a 10-point scoring system, where 0 represents no improvement and 10 indicates a major improvement. Here are their rankings.

Expert		Technology	Design
Jamie Simmons	***CNET***	**2**	**7**
Robert James	***TechCrunch***	**4**	**8**
Lulu Yan	***Digital trends***	**3**	**6**
Dan Trout	***PC Mag***	**4**	**9**
Leslie Chou	***Phone Arena***	**3**	**8**

Bob Ross ***Top Ten Reviews***	**2**	**6**
Evan Wright ***Engadget***	**4**	**7**
Ben Monja ***The Verge***	**3**	**8**
Arun Ran ***Trusted Reviews***	**2**	**9**

In summary, our experts think the iPhone 8 looks great (an average design score of 7.5) yet it offers only minor technological advancements (an average technology score of 3).

The next couple of questions are based on the article excerpt and what you know about the new iPhone 8.

	1 Not at all	2	3	4	5	6	7 A lot
To what extent do you feel the iPhone 8 is better than your iPhone?	❍	❍	❍	❍	❍	❍	❍
To what extent do you feel the iPhone 8 is superior to your iPhone?	❍	❍	❍	❍	❍	❍	❍

IPHONE USAGE SURVEY

In this survey, we want to know about what you use your iPhone for. Please read each description carefully.

	1 Never	2	3	4	5	6	7 A lot
Do you use your iPhone to take selfies?	❍	❍	❍	❍	❍	❍	❍
Do you use your iPhone to wake you up?	❍	❍	❍	❍	❍	❍	❍
Do you use your iPhone to take pictures?	❍	❍	❍	❍	❍	❍	❍
Do you use your iPhone to make online purchases?							
Do you use your iPhone to make calls over the internet (like WhatsApp/Facebook messenger)?	❍	❍	❍	❍	❍	❍	❍
Do you use your iPhone to play games	❍	❍	❍	❍	❍	❍	❍
Do you use your iPhone to listen to music?	❍	❍	❍	❍	❍	❍	❍

LOTTERY

Special offer for iPhone 6 and iPhone 7 owners (s and plus versions included)!

We have a great offer for you from a company that is organizing a promotion event during the launch week of the new iPhone 8. The event will take place at retail stores nationwide (next to Apple stores and at many retailers that sell iPhones including Costco and Walmart).

Rules of the special event game:

Each iPhone owner chosen by the company to participate in the special event game will get one shot to toss their iPhone at a balloon that will be floating at the height of about 10 feet (in a room with thin carpet flooring).

Participants that successfully hit the balloon will receive a $400 cashback rebate on the new iPhone 8!!

Participants that miss the balloon will receive $50 cashback rebate for having tossed their iPhone!

Participants whose iPhone is damaged by the toss can sell their iPhone to the company organizing the event at the value that Buybackboss.com pay for damaged iPhones ($110 for the iPhone 6, $135 for the iPhone 6plus, $155 for the iPhone 6s, $160 for the iPhone 6s plus, $235 for the iPhone 7, $240 for the iPhone 7 plus).

The company organizing the effect is conducting a lottery on the 26th of July to determine which lucky iPhone owners will play the game. Each lottery ticket costs one cent (that will be deducted from your $1 pay for completing this hit). Each iPhone owner can buy up to 10 lottery tickets (for a total of 10 cents). The company is charging for the lottery tickets so that only those wanting to play the special event game receive lottery tickets.

Do you want to participate in the lottery so you can play the game?

If so, how many lottery tickets do you want to purchase (each ticket costs 1 cent)? (scale varies from 0 to 10 tickets)

Please enter your email here so that we can contact you if you are selected to play the special event: _____

Demographics

Is your iPhone under a warranty agreement where it is replaced if it is broken or damaged?

- ❍ Yes
- ❍ No

Which iPhones (aside from your current iPhone 7 or 6) have you owned in the past for your own personal usage? (you can indicate more than one iPhone)

- ❑ iPhone SE
- ❑ iPhone 6S
- ❑ iPhone 6S plus
- ❑ iPhone 6 plus
- ❑ iPhone 6
- ❑ iPhone 5S
- ❑ iPhone 5C
- ❑ iPhone 5
- ❑ iPhone 4S
- ❑ iPhone 4
- ❑ iPhone 3GS
- ❑ iPhone 3G
- ❑ iPhone (first generation)
- ❑ I did not own an iPhone before owning my current iPhone

Now we would like to know a bit more about you: What is your age?

_____

What is your gender?

- ❍ Male
- ❍ Female

Information about income is very important to understand. Would you please give your best guess? Please indicate the answer that includes your entire household income in (2016) before taxes.

- ❍ Less than $10,000
- ❍ $10,000 to $19,999
- ❍ $20,000 to $29,999
- ❍ $30,000 to $39,999
- ❍ $40,000 to $49,999
- ❍ $50,000 to $59,999
- ❍ $60,000 to $69,999
- ❍ $70,000 to $79,999
- ❍ $80,000 to $89,999
- ❍ $90,000 to $99,999
- ❍ $100,000 to $149,999
- ❍ $150,000 or more

Appendix F: The information participants read regarding the iPhone 8 offering primarily functional improvements in technology.

In this survey, we would like you to read an article that appeared in a popular online tech forum. We have shortened the article a bit but captured its main points. Please read the article and answer the questions that follow it:

Verdict: The iPhone 8 looks improves on its predecessors in multiple areas!

Apple has some iPhone technological improvements planned for 2017. The iPhone 8 hardware sees a substantive improvement over its predecessors and there have been enhancements in the camera and battery departments too. The iPhone 8 features an IP68 water resistance rating, an improvement over the IP67 certification earned by the iPhone 7, 6 and the iPhone 6 and 7 Plus.

Details:

The Apple iPhone 8 features major changes compared to the iPhone 7: Instead of placing the TOUCH ID fingerprint under the glass, it is located at the back of the iPhone. With an edge-to-edge design, iPhone 8 offers a display the size of the 5.5-inch iPhone. It features a 5.8-inch display with 5.15 inches of usable area, with the rest dedicated to virtual buttons that will replace the existing Home button. Moreover, the display is flexible plastic OLED rather than an LCD, allowing Apple to introduce a thinner device that consumes less power and offers a much better display with a much higher contrast ratio and more true to life colors. In a glance, iPhone 8 will offer the following advanced features: 5.8 inch OLED display, Faster A11 processor, Glass body, Edge-to-edge display, Camera and Touch ID integrated in the display, No home button, wireless charging, and a new OLED model.

Finally, we asked 9 industry experts to provide an overall ranking of the new iPhone 8 relative to recent iPhone models in regards to design and technological improvement. The

experts were given a 10-point scoring system, where 0 represents no improvement and 10 indicates a major improvement. Here are their rankings.

Expert	Technology	Design
Jamie Simmons ***CNET***	7	2
Robert James ***TechCrunch***	8	4
Lulu Yan ***Digital trends***	6	3
Dan Trout ***PC Mag***	9	4
Leslie Chou ***Phone Arena***	8	3
Bob Ross ***Top Ten Reviews***	6	2
Evan Wright ***Engadget***	7	4
Ben Monja ***The Verge***	8	3
Arun Ran ***Trusted Reviews***	9	2

In summary, our experts think the iPhone 8 offers major technological improvements (an average technology score of 7.5), yet it offers only minor design advancements (an average design score of 3).

References

Arkes, H. R. (1996). The psychology of waste. *Journal of Behavioral Decision Making*, 9(3), 213-224.

Bellezza, S., Ackerman, J., Gino, F. (2017). Be careless with that! Availability of product upgrades increases cavalier behavior toward possessions. *Journal of Marketing Research*, 54(5), 768-784.

Bem, D. J. (1972). Self-Perception theory. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 6, pp.1-62). New York: Academic Press.

Bodner, R. Prelec, D. (2002). Self-signaling and diagnostic utility in everyday decision making. In I. Brocas J. Carillo (Eds.), *Psychology and Economics, Vol I*. Oxford: Oxford University Press.

Frommer, D. (2017). Samsung's Galaxy S8 shows Apple is behind the smartphone design trend. *Recode*. Retrieved from https://www.recode.net/2017/3/29/15108352/samsung-galaxy-s8-apple-iphone-8-design.

Gilbert, J. (2012). iPad 2 vs. 'iPad 3': Should You Keep Your Old iPad Or Buy A New One? *Huffington Post*. Retrieved from https://www.huffingtonpost.com/2012/03/14/ipad-2-vs-ipad-3-decision-to-buy_n_1339483.html.

GSMArena. (2011). Should I stay or should I go: iPhone 4S over iPhone 4. *gsmarena.com*. Retrieved from http://www.gsmarena.com/iphone_4s_over_iphone_4-review-664.php.

GSMArena. (2012). Samsung Galaxy S III vs. Galaxy S II: Intergalactic. *gsmarena.com*. Retrieved from https://www.gsmarena.com/galaxy_s_ii_vs_galaxy_s_iii-review-764.php.

Guinness, H. (2017). Is it worth upgrading to the iPhone 8 or iPhone X?. *How-To Geek*. Retrieved from https://www.howtogeek.com/325757/is-it-worth-upgrading-to-the-iphone-8-or-iphone-x.

Harrison, N., Kerris, N. (2011). White iPhone arrives tomorrow. *Apple*. Retrieved from https://www.apple.com/pr/library/2011/04/27White-iPhone-Arrives-Tomorrow.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford Publications.

Hill, S. (2012). Why you shouldn't fall for the upgrade trap phone makers set for you. *Digital Trends*. Retrieved from https://www.digitaltrends.com/mobile/why-you-shouldnt-fall-for-the-upgrade-trap-phone-makers-set-for-you.

Hsee, C. K. (1995). Elastic justification: How tempting but task-irrelevant factors influence decisions. *Organizational Behavioral and Human Decision Process*, 62, 330-337.

Jackson, N. (2011). Here's why people will buy Apple's new white iPhone 4. *The Atlantic*. Retrieved from http://www.theatlantic.com/technology/archive/2011/04/heres-why-people-will-buy-apples-new-white-iphone-4/237890.

Kain, E. (2011). Is Samsung's Galaxy S II an iPhone Killer? *Forbes*. Retrieved from https://www.forbes.com/sites/erikkain/2011/10/05/is-samsungs-galaxy-s-ii-an-iphone-killer.

Karcz, A. (2017). 10 Years With The iPhone: How Apple Changed Modern Society. *Forbes*. Retrieved from https://www.forbes.com/sites/anthonykarcz/2017/01/09/apple-iphone-10-year-anniversary.

Keinan, A., Kivetz, R., Netzer, O. (2016). The functional alibi. *Journal of Academy of Consumer Research*, 1(4), 479-496.

Kelly, G. (2016). iPhone 7 Vs iPhone 7 Plus Review: Should You Upgrade? *Forbes*. Retrieved from https://www.forbes.com/sites/gordonkelly/2016/09/21/apple-iphone-7-vs-iphone-7-plus-review-should-you-upgrade.

Khan, U., Dhar, R., Wertenbroch, K. (2005), Hedonic and utilitarian consumption, in Inside Consumption: Frontiers of Research on Consumer Motives, Goals, and Desire, ed. S. Ratneshwar and David Glen Mick, London: Routledge, 144–65.

Kronrod, A., Danziger, S. (2013). "Wii will rock you!" The use and effect of figurative language in consumer reviews of hedonic and utilitarian consumption. *Journal of Consumer Research*, 40(4), 726-739.

Manimaran, S. (2012). Should you Upgrade your Galaxy S2 to Galaxy S3? *TecKdiary.com*. Retrieved from http://www.teckdiary.com/samsung/should-you-upgrade-your-galaxy-s2-to-galaxy-s3.

Meyer, B. D. (1995). Natural and quasi-experiments in economics. *Journal of Business & Economic Statistics*, 13(2), 151-161.

Mishra, A., Mishra, H. (2011). The influence of price discount versus bonus pack on the preference for virtue and vice foods. *Journal of Marketing Research*, 48, 196–206.

Nations, D. (2017). The Differences Between the iPad 3 and the iPad 4. Lifewire. Retrieved from https://www.lifewire.com/differences-ipad-3-ipad-4-1994220.

O'Cass, A., Heirati, N., Ngo, L. V. (2014). Achieving new product success via the synchronization of exploration and exploitation across multiple levels and functional areas. *Industrial Marketing Management*, 43(5), 862-872.

O'Boyle, B. (2016). Apple iPhone 7 vs iPhone 6S vs iPhone 6: What's the difference? *Pocket-lint* Retrieved from https://www.pocket-lint.com/phones/buyers-guides/138283-apple-iphone-7-vs-iphone-6s-vs-iphone-6-what-s-the-difference.

Okada, E. M. (2005). Justification effects on consumer choice of hedonic and utilitarian goods. *Journal of Marketing Research*, 42(1), 43-53.

Orbach, Y., Fruchter, G. E. (2014). Predicting product life cycle patterns. *Marketing Letters*, 25(1), 37-52.

Sela, A., Berger, J., Liu, W. (2009). Variety, vice, and virtue: How assortment size influences option choice. *Journal of Consumer Research*, 35(6), 941-951.

Shafir, E., Simonson, I., Tversky, A. (1993). Reason-based choice. *Cognition*, 49(1-2), 11-36.

Shani, Y., Shachar, R. (2011). Accidentally on purpose: How consumers manage to detach from owned products. Unpublished manuscript.

Sin, B. (2017). Do Not Buy The Lazy Rehash That Is Apple's iPhone 8. *Forbes*. Retrieved from https://www.forbes.com/sites/bensin/2017/09/13/do-not-buy-the-lazy-rehash-that-is-the-iphone-8.

Smith, D. (2015). I regret upgrading from an iPhone 6 to an iPhone 6S. *Business Insider*. Retrieved from http://www.businessinsider.com/dont-upgrade-from-iphone-6-to-iphone-6s-2015-9.

Statista. (2019a). Smartphone market share of Apple and Samsung in the United States from 1st quarter 2010 to 1st quarter 2012. *Statista*. Retrieved from https://www.statista.com/statistics/242388/market-share-of-smartphone-vendors-in-the-united-states-usa/.

Statista. (2019b). Global market share held by the leading smartphone operating systems in sales to end users from 1st quarter 2009 to 2nd quarter 2018. *Statista*. Retrieved from https://www.statista.com/statistics/266136/global-market-share-held-by-smartphone-operating-systems/.

Web Appendix A – Extending the window for the timing of the damage

In Table 1, we conduct analyses for a time window of 28 days before and after the event. Herein, as a robustness test, we reran all regressions in Table 1 while using an extended time window of 42 days before and after the event. The results are similar to Table 1, and the magnitude of the effect is much stronger, $\beta_3 = 0.66$, with standard error of .17.

Table WA1: DiD regression results for a 42-day time window for the effect of introducing the white iPhone 4 and the iPhone 4S on used and damaged iPhone 4 models

	White iPhone 4	***iPhone 4S***	
Event	**Announced**	**Announced**	**Launch**
Intercept	-.47 (.09) **	-.14 (.10)	.51 (.14) **
Damaged Dummy	.29 (.13) *	.39 (.13) **	-.17 (.20)
Event Dummy	.26 (.12) *	2.28 (.12) **	1.31 (.18) **
Damaged x Event Dummy (β_3)	.66 (.17) **	-2.03 (.17) **	-1.24 (.25) **
Weekend Dummy	-.54 (.13) **	-.44 (.14) **	-.50 (.20) *
Weekend x Damaged Dummy	-.40 (.19) **	-.16 (.19)	-.07 (.28)
Adjusted R^2	53.4%	72.1%	38.1%

N=168; · p-value < .1, * p-value < .05, ** p-value < .01; Standard errors in parentheses

Web Appendix B – Varying window for the timing of the damage

In Table 2, we conduct analyses for three successive time periods of 14 days each (1-14, 15-28, and 29-42 days after the introduction). We compare the listing in these shorter windows with a 14-day window immediately prior to the introduction.

Herein, as a robustness test, we reran all regressions in Table 2 while using a window of 15-28 days prior to the introduction and also one with 29-42 days prior. The estimates were even more supportive in these regressions. In Table WB1, we compared 15-28 days before the announcement, to the three successive 14-day windows, with results similar to those in Table 2. In Table WB2, we compared 29-42 days before the announcement with the three successive 14-day windows, again, with results similar to those in Table 2.

Table WB1: DiD regression results for three successive time periods of 14 days each, compared with 15-28 days before the announcement of the white iPhone 4

Event	***White iPhone 4***		
Compared to:	***1-14 days after***	***15-28 days after***	***29-42 days after***
Intercept	-.44 (.14) **	-.45 (.13) **	-.45 (.19) *
Damaged Dummy	.33 (.19) ·	.36 (.18) *	.36 (.26)
Event Dummy	.38 (.18) *	.27 (.16)	.07 (.24)
Damaged x Event Dummy (β_3)	.08 (.25)	.81 (.23) **	.94 (.34) **
Weekend Dummy	-.57 (.20) **	-.53 (.18) **	-.52 (.27) ·
Weekend x Damaged Dummy	-.65 (.28) *	-.77 (.26) **	-.77 (.38) *
Adjusted R^2	50.5%	69.3%	49.0%

N=56; · p-value < .1, *p-value < .05, **p-value < .01; Standard errors in parentheses

Table WB2: DiD regression results for three successive time periods of 14 days each, compared with 29-42 days before the announcement of the white iPhone 4

Event	***White iPhone 4***		
Compared to:	***1-14 days after***	***15-28 days after***	***29-42 days after***

Intercept	-.47 (.15) **	-.48 (.14) **	-.49 (.20) *
Damaged Dummy	.10 (.21)	.13 (.20)	.13 (.28)
Event Dummy	.40 (.19) *	.29 (.18)	.09 (.25)
Damaged x Event Dummy (β_3)	.28 (.27)	1.02 (.26) **	1.14 (.36) **
Weekend Dummy	-.52 (.21) *	-.48 (.20) *	-.47 (.28) ·
Weekend x Damaged Dummy	-.54 (.30) ·	-.66 (.28) *	-.67 (.40) ·
Adjusted R^2	44.2%	64.5%	45.6%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; Standard errors in parentheses

Web Appendix C - Excluding water-damaged iPhones from the analysis of the white iPhone 4 announcement

Table WC1: DiD regression results for a 14-day time window before and a 14-day window X days after the event (without water-damaged iPhones)

Event	***White iPhone 4 announcement***		
Compared to:	***1-14 days after***	***15-28 days after***	***29-42 days after***
Intercept	-.47 (.15) **	-.48 (.14) **	-.48 (.20) *
Damaged Dummy	.54 (.21)	.56 (.20) **	.56 (.28) ·
Event Dummy	.42 (.19) *	.31 (.18) ·	.11 (.25)
Damaged x Event Dummy (β_3)	-.01 (.27)	.78 (.26) **	.84 (.36) *
Weekend Dummy	-.61 (.21) **	-.57 (.20) **	-.56 (.28) ·
Weekend x Damaged Dummy	-.82 (.30) **	-.88 (.28) **	-.87 (.40) *
Adjusted R^2	53.4%	69.2%	50.3%

N=56; · p-value < .1, * p-value < .05, ** p-value < .01; Standard errors in parentheses

Web Appendix D – Manipulation checks for Study 2

Perceived design improvement of iPhone 7 relative to owned iPhone. The effect of past usage on perceived design improvement was significant ($b = .22$, $p < .01$). Neither the main effect of warranty ($F(1, 147) = 2.92$, $p = .09$, partial $\eta^2 = .02$) nor the warranty x upgrade frame interaction ($F(1, 147) = .16$, $p = .68$, partial $\eta^2 = .00$) were significant. Participants rated the design improvement as higher when the upgrade was framed as primarily offering a technological improvement than when framed as primarily offering a design improvement ($F(1, 147) = 6.94$, $p < .01$, partial $\eta^2 = .05$; $M_{\text{technological upgrade}} = 5.00$, $M_{\text{design upgrade}} = 4.30$). Note the technologically improved version also offered design improvements (see Appendix C). This fact may have led to the relatively high ratings of design superiority in the technological-improvement condition.

Perceived technological superiority of iPhone 7 relative to owned iPhone. The effect of past usage on perceived technological improvement was marginally significant ($b = .14$, $p = .06$). The main effect of warranty was not significant ($F(1, 147) = 1.98$, $p = .169$, partial $\eta^2 = .01$). Participants rated technological superiority as higher when the upgrade was framed as primarily offering a technological improvement than when framed as primarily offering a design improvement ($F(1, 147) = 7.78$, $p < .01$, partial $\eta^2 = .05$; $M_{\text{technological upgrade}} = 5.68$, $M_{\text{design upgrade}} = 5.00$). We also found a significant warranty x upgrade frame interaction ($F(1, 147) = 4.30$, $p < .05$, partial $\eta^2 = .03$), such that the effect of the iPhone 7 upgrade framing on ratings was apparent for iPhone owners without a warranty ($M_{\text{technological upgrade}} = 6.10$, $M_{\text{design upgrade}} = 4.92$), but not for those with a warranty ($M_{\text{technological upgrade}} = 5.26$, $M_{\text{design upgrade}} = 5.09$).

Wanting the new iPhone 7. The effect of the covariate, past usage, was significant ($b = .32$, $p < .001$). The main effect of warranty was significant ($M_{\text{without warranty}} = 3.97$, $M_{\text{with warranty}} = 3.35$; $F(1, 147) = 5.00$, $p < .05$, partial $\eta^2 = .03$), and the warranty x upgrade frame interaction was not

significant ($F(1, 147) = .00$, $p = .98$, partial $\eta^2 = .00$). Participants wanted the new version more when it offered a technological improvement than when it offered a design improvement, yet this effect only approached statistical significance ($F(1, 147) = 2.40$, $p = .12$, partial $\eta^2 = .02$; $M_{\text{technological upgrade}} = 3.88$, $M_{\text{design upgrade}} = 3.44$).