

Feature Fatigue:

When Product Capabilities Become Too Much of a Good Thing

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## **ABSTRACT**

As technology advances, it becomes more feasible to load products with a large number of features, each of which individually might be seen as useful. However, too many features can make a product overwhelming for consumers and hard to use. Three studies examine how consumers balance their desires for capability and usability when they evaluate products, and how these desires shift over time. Because consumers give more weight to capability and less weight to usability before relative to after use, consumers tend to choose overly complex products that do not maximize their satisfaction when using them, resulting in “feature fatigue.” An analytical model based on these results provides additional insights into the feature fatigue effect. Our model shows that choosing the number of features that maximizes initial choice results in the inclusion of too many features, potentially decreasing customer lifetime value. As the emphasis on future sales increases, the optimal number of features decreases. Our results suggest that firms should consider having a larger number of more specialized products, each with a limited number of features, rather than loading all possible features into one product.

A common way to enhance and differentiate a product is by increasing the number of features included (Goldenberg et al. 2003; Mukherjee and Hoyer 2001; Nowlis and Simonson 1996), providing greater functionality for consumers. This strategy has become especially popular as new developments in electronics and information technology (e.g., miniaturization and integration of electronic components) have allowed products to include more functions, yet cost less and require less time to be manufactured (Freund, König and Roth 1997).

While each additional feature provides another reason for the consumer to purchase a product (Brown and Carpenter 2000) and may add desired capabilities, too many features can make products overwhelming for consumers, leading to dissatisfaction and “feature fatigue.” Anecdotal evidence suggests that consumers do not use all of the features of the products they buy (Ammirati 2003), and even more significantly, empirical evidence suggests that consumers may experience negative emotional reactions such as anxiety or stress in response to product complexity (Mick and Fournier 1998).

Why do consumers seem to be making choices that do not maximize their long-term satisfaction? One potential reason is that consumers do not make a connection between increasing the number of product features and the difficulty of using a product. Another is that consumers understand that products with more features will be more difficult to use, but because features are bundled together, they are forced to buy features they do not want in order to get features they do want. Finally, consumers may understand that products with more features will be more difficult to use, but give ease of use too little weight in their purchase decisions.

In this research, we examine how consumers balance their competing needs for functionality and ease of use when evaluating products. First, we measure the effects of adding product features on two distinct product dimensions, the perceived capability of the product and

the perceived usability of the product. Second, we test the degree to which consumers consider usability relative to capability when evaluating products before using them. Third, we measure the relative weights of capability and usability in consumers' expected utility (before use) and experienced utility (after use) and test for significant differences in these weights before and after product use. While previous research has focused on either pre-usage evaluations such as purchase intentions (e.g., Carpenter, Glazer and Nakamoto 1994), or post-usage evaluations such as satisfaction (e.g., Bolton and Lemon 1999) and usability (e.g., McLaughlin and Skinner 2000), we integrate these perspectives by comparing evaluations of products before and after use.

Our paper is organized as follows: first, we briefly discuss the effects of adding product features on consumers' evaluations of products. Second, we report the results of three studies designed to test our hypotheses. Based on our results, we propose an analytical model to help managers balance the sales benefits of adding features against the customer equity costs of feature fatigue. We conclude with a discussion of our results, their theoretical and managerial implications, and directions for future research.

## **THE EFFECTS OF ADDING PRODUCT FEATURES ON PRODUCT EVALUATIONS**

Both economic theory and current market research techniques predict that increasing the number of features will make products more appealing. Economic theory models consumers' preferences using an additive utility function that links product attributes to consumer demand (Lancaster 1971). Each positively valued attribute increases consumers' utility. Similarly, market research techniques such as conjoint analysis or discrete choice analysis model each product as a bundle of attributes and estimate part-worths for each attribute (Srinivasan, Lovejoy and Beach 1997). Because market shares are predicted based on these part-worths, each positively valued

feature increases a product's market share relative to products without the feature.

The behavioral assumption underlying decompositional models such as these is that consumers infer functional product benefits from concrete product attributes. Because the utility of a product is based on its potential benefits to the consumer rather than product features per se, consumers translate information about concrete product attributes into functional benefits in their mental representations (Olson and Reynolds 1983). Consistent with this mapping process, research has shown that added features provide positive differentiation by giving a product perceived advantages over competitive products (Carpenter, Glazer and Nakamoto 1994). Consumers seem to use added features in an instrumental reasoning process that makes the brand with more features appear superior in a choice set (Brown and Carpenter 2000). Although these inferences have been demonstrated to occur for irrelevant as well as important attributes (Brown and Carpenter 2000), consumers must perceive a benefit from the added feature for product evaluations to increase. Non-negative features perceived to add little or no value (e.g., calculator functions only useful to biochemistry students) tend to decrease brand share because they provide reasons against choosing the enhanced product (Simonson, Carmon and O'Curry 1994).

Thus, we predict that perceived product capability, the consumer's beliefs about the product's ability to perform desired functions, will increase as more features providing perceived benefits are added to a product. While previous research has asked participants to compare products differing in a single feature (e.g., Brown and Carpenter 2000), we predict that consumers will perceive greater capability as the number of features increases, even when evaluating a single product. Moreover, while previous research has focused on consumer perceptions prior to use, we predict this relationship will hold both before and after product use.

**H1:** As the number of beneficial features included in a product increases, perceptions of the product's capability will increase.

In addition to the product's capability, consumers should consider their ability to use the product and benefit from its features. Research on usability and user-centered design suggests that adding features to products has a negative effect on consumers' ability to use them across several product categories (Wiklund 1994). Every additional feature is "one more thing to learn, one more thing to possibly misunderstand, and one more thing to search through when looking for the thing you want" (Nielsen 1993, p.155). Usability research has focused on measures that allow a consumer's usage experience to be compared across products, such as the ease of learning how to use a product, the propensity to make errors while using it, and the efficiency of using it (McLaughlin and Skinner 2000). The time taken to complete a task, the ratio of successful to unsuccessful interactions with a product, and the number of errors are typical operationalizations of usability (Nielsen 1993). However, while usability research supports the principle that less is more, this research is based on consumers' actual experiences using products rather than their perceptions about their ability to use products.

There is some evidence that consumers account for learning costs when features are added to products. For example, adding a novel feature to a Web TV or personal computer had a positive effect on product evaluations when the feature was described as fully automatic, but a negative effect on product evaluations when it was described as manually operated, presumably due to consumers' inferences about learning costs (Mukherjee and Hoyer 2001). However, while these findings are suggestive, consumer perceptions were measured in response to varying a single feature across products, and consumers did not use the products being evaluated.

Based on both usability studies and consumers' inferences about the effects of adding a feature to a product, we predict that perceived product usability, the consumer's beliefs about the difficulty of learning and using the product, will decrease as more individually beneficial

features are added to a product. This should be true even when consumers evaluate a single product, and should hold both before and after consumers use the product.

**H2:** As the number of beneficial features included in a product increases, perceptions of the product's usability will decrease.

How will consumers' expertise within a product category affect their perceptions of product capability and product usability? Experts have a better understanding of product-related information and are better able to discriminate between important and unimportant features than novices (Alba and Hutchinson 1987). As a result, experts should be better able to assess product capability than novices. However, whether experts perceive a given product's capability to be higher or lower than novices will depend on the specific features of the product and the benefits they are believed to provide. Therefore, we cannot make a general prediction about the effect of expertise on perceived product capability. In contrast, the effect of expertise on perceived usability is clear. Experts perform product-related tasks more automatically, freeing cognitive resources that can be used to learn new product features (Alba and Hutchinson 1987). For example, experts were more successful in solving tasks and were more efficient when using a mobile phone than novices (Ziefle 2002). Experts also may be better able to handle complex products because they focus their attention on a smaller, more diagnostic number of inputs (Spence and Brucks 1997). Thus, we predict that because experts are better able to learn and use each product feature than novices, usability ratings should be higher for experts than for novices.

**H3:** Expertise will have a positive effect on consumers' perceptions of product usability.

### **HOW CONSUMERS WEIGH CAPABILITY AND USABILITY IN THEIR PRODUCT EVALUATIONS**

If increasing the number of product features has positive effects on perceived capability

(H1) and negative effects on perceived usability (H2), how do consumers integrate these two product dimensions when forming their overall product evaluations? Previous research suggests that consumers consider both the benefits and costs of adding a new feature to a product (Mukherjee and Hoyer 2001). We propose that the net effect of increasing the number of product features on product utility depends on the relative weights consumers give to capability and usability in their product evaluations, and that these weights may vary across time and situations.

Experimental research has shown that when evaluating options for the distant future, individuals favor highly desirable options that are less feasible over less desirable options that are highly feasible. However, the reverse is true when evaluating options in the near future (Liberman and Trope 1998). The relative weights of desirability (i.e., the expected value of the goal or the “why” aspect of an action) and feasibility (i.e., beliefs about the difficulty of reaching the end state or the “how” aspect of an action) change because the construal of more distant future events tends to be more abstract, favoring desirability, while the construal of near future events tends to be more concrete, favoring feasibility (Liberman and Trope 1998).

Analogously, we propose that consumers will create more abstract construals of products in their evaluations before use, assigning greater weight to the desirability of the promised benefits (e.g. what can this product do for me?), relative to their evaluations after use. In contrast, after using a product, consumers will develop a more concrete construal of the product, placing more weight on feasibility (e.g., is this product easy to use?), relative to their evaluations before use.

Based on this expected shift in the importance of capability and usability, we predict that:

**H4a:** Consumers will give more weight to product capability in their expected product utilities (before use), relative to their experienced product utilities (after use).

**H4b:** Consumers will give less weight to product usability in their expected product utility, relative to their experienced product utilities.

To test our hypotheses, we ran three studies in which participants evaluated or used web-based products. Studies 1 and 2 examine consumers' intuitions about the effects of adding product features on capability (H1) and usability (H2 and H3) before use. Study 3 directly compares consumers' ratings of capability and usability and their overall product evaluations before and after using products (H4). Our goal is to demonstrate that although the effects of increasing the number of features on perceptions of product capability and usability are significant both before and after product use, there is a shift in the relative weights of these dimensions on consumers' product evaluations. Figure 1 summarizes our hypotheses.

INSERT FIGURE 1 HERE

### **STUDY 1 – CONSUMERS' INTUITIONS**

Study 1 was designed to simulate an in-store experience. Our goal was to test how consumers' intuitions about product capability and usability were related to the number of product features (H1 and H2) and whether perceived usability was related to expertise (H3).

Consumers' involvement in the evaluation task may affect their motivation to process product information (Celsi and Olson 1988). For example, highly involved consumers are more likely to elaborate on product information and form inferences (Celsi and Olson 1988). Thus, involvement with the task could potentially affect participants' judgments about product capability and usability. To control for this, we manipulated involvement across conditions.

#### **Stimuli**

To develop the stimuli for our studies, we conducted a pretest in which 40 participants (69% females,  $M_{\text{age}} = 21.8$ ) rated the importance of and their familiarity with thirty features of the following four products: a digital audio player, a digital video player, a personal digital

assistant (PDA), and an online product-rating database. Participants also rated their involvement and expertise for each product category. We selected digital audio players and digital video players because participants were involved and familiar with these product categories. Three models of each product were created, differing only in their number of features. The low level of features included the seven most important features, the medium level included the fourteen most important features and the high level included the twenty-one most important features.

### **Participants, Design and Procedures**

One hundred and thirty undergraduate students participated in this study (50.8% females,  $M_{\text{age}} = 20.5$ ) and were randomly assigned to conditions. The study had a 2 Player (video, audio) x 3 Feature (low, medium, high) x 2 Involvement (low, high) mixed design. Player and involvement were manipulated between subjects and number of features was manipulated within subjects. In the high involvement condition, we told participants that after they evaluated three models, they would choose one model to perform a series of tasks. Low involvement participants were simply told they would be evaluating three models of video (audio) players. The study was conducted using MediaLab software, and sessions were run in a computer lab with groups of three to eighteen students. Participants worked individually.

First, participants rated their expertise with digital video (audio) players. Next, they viewed the user interface and the list of features for each model. Participants rated their perceptions of each model's capability and usability, and then provided an overall evaluation of each model. The order in which participants evaluated the low, medium and high feature models was counterbalanced between subjects, according to a standard self-conjugate Latin square. After rating all three models, participants were asked to choose one of the models.

### **Measures**

Participants' expertise was measured using five items (e.g. how familiar are you with digital video [audio] players, how frequently do you watch videos [listen to music] on your computer; Mitchell and Dacin 1996). Product capability was measured using three items (extent to which the products were likely to perform poorly/well, offer few/a lot of advantages and add little/a lot of value; Mukherjee and Hoyer 2001). Product usability was measured using eight items (e.g.. learning to use this product will be easy for me, interacting with this product will not require a lot of my mental effort, it will be easy to get this product to do what I want it to do; Chin, Diehl and Norman 1988). Product expected utility was measured using six items (bad/good, unlikable/likable, not useful/useful, low/high quality, undesirable/desirable, unfavorable/favorable; Peracchio and Tybout 1996). After choosing one of the models, participants rated their decision confidence and the difficulty of the choice. All items used seven-point scales.

## Results

Reliability for expertise, capability, usability and product overall evaluations all exceeded .83. To assess the construct validity of our capability, usability and overall product evaluation scales, we ran a confirmatory factor analysis for each of the low, medium and high feature models. A three-factor model indicated an acceptable goodness of fit and significant loadings for each observed variable in their respective latent factor (all  $ps < .001$ )<sup>1</sup>. Involvement did not affect any dependent measures (all  $ps > .13$ ), and we collapsed the data across involvement conditions.

To test hypothesis 1, we ran a 2 (player) x 3 (features) repeated measures ANCOVA on product capability with expertise as a covariate. There was a main effect of number of features ( $F(2, 250) = 24.1, p < .001$ ). No other effects were significant ( $ps > .08$ ). As predicted, the

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<sup>1</sup> The comparative fit indexes (CFI) ranged from .91 to .93, capability items loadings ranged from .58 to .95, usability items loadings ranged from .70 to .96, and overall evaluation items ranged from .49 to .96. Each of the three factors had an average extracted variance larger than 62%. Capability and usability were not correlated for any of the models. Capability was correlated with overall evaluations for all three models ( $r_{low} = .76, r_{medium} = .83, r_{high} = .69$ , all  $ps < .001$ ) and usability was correlated with overall evaluations for the high feature model ( $r = .29, p < .001$ ).

within-subjects linear contrast for capability across feature levels was significant, ( $F_{linear}(1, 125) = 27.8, p < .001$ ), indicating that perceptions of product capability significantly increased as the number of product features increased ( $M_{low} = 3.4, M_{medium} = 4.9, M_{high} = 6.0$ ).

To test hypothesis 2, we ran a 2 (player) x 3 (features) repeated measures ANCOVA on product usability with expertise as a covariate. There was a significant main effect of number of features ( $F(2, 250) = 17.6, p < .001$ ). The main effect of player and the interaction between number of features and player were not significant ( $ps > .09$ ). As predicted, the within-subjects linear contrast for usability across feature levels was significant ( $F_{linear}(1, 125) = 22.7, p < .001$ ), indicating that perceptions of product usability significantly decreased as the number of features increased ( $M_{low} = 6.2, M_{medium} = 5.6, M_{high} = 4.8$ ). Controlling for the number of features, expertise had a positive effect on usability ( $F(1, 125) = 43.1, p < .001$ ). Perceived usability for both video and audio players was higher for experts than for novices, supporting hypothesis 3.

A 2 (player) x 3 (features) repeated measures ANCOVA on product expected utility with expertise as a covariate revealed only a significant main effect of features ( $F(2, 250) = 7.5, p = .01$ ). No other effects were significant ( $ps > .16$ ). The within-subjects linear contrast for product expected utility across feature levels was significant, ( $F_{linear}(1, 125) = 8.4, p < .01$ ), indicating that expected utility increased as the number of features increased ( $M_{low} = 4.1, M_{medium} = 5.1, M_{high} = 5.6$ ). Regardless of expertise, expected utility was most favorable when the product included the highest number of features. Thus, prior to use, capability appears to have a stronger effect on product expected utility than usability. Figure 2 shows the impact of increasing the number of features on ratings of capability, usability, and expected utility for the video player.

INSERT FIGURE 2 HERE

After evaluating the three models, participants chose one of them to perform a series of

tasks. Participants' choices strongly indicated a preference for products with a higher number of features and greater capability, regardless of expertise. The majority of the respondents chose the model with the highest number of features (62.3%) rather than the model with a medium number of features (28.5%) or the model with the lowest number of features (9.2%). A multinomial logistic regression of player and expertise on choice showed that neither of these factors affected choice (all  $p$ s > .55). Interestingly, despite the lack of difference in their choices, novices<sup>2</sup> rated the difficulty of choosing marginally higher than experts ( $F(1, 128) = 3.5, p = .06$ ), and experts were more confident in their choices than novices ( $F(1, 128) = 9.8, p < .01$ ).

## Discussion

The results of study 1 suggest that consumers believe increasing the number of features decreases the usability of products as it increases their capability. However, participants' expected product utility and choices still favored products with higher level of features, regardless of their expertise. Therefore, consumers' initial preferences appear to be driven more by product capability ratings than by usability ratings.

One limitation of study 1 is that varying the number of features within subjects may have increased the salience of the number of features when judging capability and usability. However, a replication of study 1 using a between-subjects design produced the same results, indicating that salience does not explain the effect.<sup>3</sup> We also address this concern by using a between-subjects design in study 2. A second limitation of study 1 is that because the three models of video and audio players were the same for all participants, they may have included features that participants did not consider important, potentially decreasing usability without adding

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<sup>2</sup> Based on a median split on the expertise variable (median = 4.0).

<sup>3</sup> In the follow-up study ( $N = 73$ ), participants were shown only one model of the video player (either low or high feature) and were asked to provide product evaluations. The results were consistent with those of study 1. Perceived capability increased with number of features ( $F(1,71) = 23.8, p < .001$ ), perceived usability decreased with number of features ( $F(1, 69) = 3.9, p = .05$ ), and expected utility increased with number of features ( $F(1, 69) = 8.2, p < .01$ ).

significant capability. While this is a realistic choice situation – companies often find it cheaper to produce feature-rich products that can satisfy the needs of heterogeneous consumers than to produce more narrowly targeted products with fewer features – we would like to disentangle supply side and demand side explanations for feature fatigue. In study 2, we allow participants to customize their products, so that the products being evaluated include only desired features.

## **STUDY 2 – CUSTOMIZING A PRODUCT**

In study 2, participants customized their own products by selecting the features they would like to add from a list of features. We predicted that consumers who chose more features would perceive their products to have more capability but less usability than consumers who chose fewer features. Support for hypothesis 2 will show that consumers predict degradation in usability as the number of features increases, even when products include only desirable features.

### **Participants, Design and Procedures**

One hundred forty one undergraduate students (55.3% females,  $M_{\text{age}} = 21.1$ ) participated in this study. Participants were asked to imagine they were about to subscribe to and download a new digital audio player and a digital video player, and that they would have the opportunity to choose the features they wanted. Product category was manipulated within subjects. The order in which they designed the two products was counterbalanced between subjects.

As in study 1, we used a digital audio player and a digital video player as our products. For each product, we presented participants with 25 different features that they could select. Participants checked off each feature they wanted to include in the product they were buying. To isolate the effects of usability constraints from the effect of financial constraints, they were informed that their budget for the purchase would allow them to select as many features as they

liked. After selecting features, participants rated the product's perceived capability and usability. Product capability, product usability, and expertise were measured using the same scales as in study 1. Participants also rated their familiarity with each feature and the importance of each feature (1= not at all important/familiar, 7 = very important/familiar).

## Results

The reliability for expertise, capability, and usability ranged from .78 to .93. A confirmatory factor analysis on the capability and usability measures for each media player supported the construct validity of these constructs. A two-factor solution yielded a reasonable goodness of fit and significant loadings of each observed variable in their respective factor (all  $ps < .001$ ).<sup>4</sup> The order in which participants customized the products was not correlated with any of our measures (all  $ps > .10$ ), except with usability for the video player ( $p = .04$ ). We included order as a covariate in all analyses related to the perceived usability of the video player.

The average number of features chosen among the 25 available was 19.6 (sd = 4.8) for the video player and 19.6 (sd = 4.3) for the audio player. Approximately half of the sample chose more than 80% of the available product features, and the median number of features chosen for both players was 20. Interestingly, while the specific features chosen by experts and novices differed, the number of features chosen by experts and novices did not differ ( $ps > .25$ ). Experts reported significantly greater familiarity with all 25 video player features and with 23 of the 25 audio player features. The features chosen more frequently by experts were among those rated least familiar by novices. For example, the three audio player features chosen significantly more frequently by experts than novices, the equalizer/bass boost, pre-amp and equalizer settings, and encoded filename control, were three of the seven features for which the difference in familiarity

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<sup>4</sup> The comparative fit indexes (CFI) ranged from .95 to .96. Capability loadings ranged from .66 to .83 (average extracted variance was larger than 54%). Usability loadings ranged from .46 to .92 (average extracted variance was larger than 64%). The correlation between the two factors was not significant.

ratings between experts and novices was largest.

Hypothesis 1 predicts that participants who choose more features will perceive their products as having greater capability than participants who choose fewer features. As expected, when we regressed ratings of product capability on the number of selected features and expertise, we found a positive and significant coefficient for both the video player ( $\beta = .50, t = 6.9, p < .001$ ) and the audio player ( $\beta = .47, t = 6.2, p < .001$ ), supporting hypothesis 1. The effect of expertise on capability was not significant for either the video or audio player ( $ps > .07$ ).

We predicted that usability would have a negative relationship with number of features (H2) and a positive relationship with expertise (H3). We found a significant negative effect of number of selected features on the perceived usability of the video player ( $\beta = -.16, t = -2.2, p = .03$ ). However, the effect was not significant for the audio player ( $\beta = .01, t = .70, p = .48$ ). Thus, the findings partially support hypothesis 2. Controlling for the number of features, expertise had a significant positive effect on perceived usability for both players (video player  $\beta = .52, t = 7.0, p < .001$ ; audio player  $\beta = .98, t = 52.9, p < .001$ ), supporting H3.

## **Discussion**

Overall, the results of study 2 support our predictions. The number of features participants selected increased perceived product capability for both products and decreased perceived product usability for one of the two products. Thus, the connection between adding product features and decreasing usability seems to hold even when the consumer individually selects each of the included features. Consistent with our expectations, expertise significantly improved ratings of product usability but did not affect ratings of product capability.

On average, participants chose a very high number of features, again suggesting that a desire for capability is driving decisions more than a desire for usability. Interestingly, the

average number of features chosen in study 2 was nearly the same as the number of features in study 1's high feature condition. Using two different types of choice tasks, participants clearly favored high feature products over low feature products. However, studies 1 and 2 test choices prior to using products. In study 3, we compare the ratings of participants who have not used the product with ratings of participants who have used the product.

### **STUDY 3 – CONTRASTING EVALUATIONS BEFORE AND AFTER PRODUCT USE**

In our third study, we compared consumers' evaluations of products with a low, medium or high number of features before use and after use. As predicted by hypothesis 4, we expected that consumers would give more weight to capability before use relative to after use, and less weight to usability before use relative to after use.

#### **Participants, Design and Procedures**

One hundred and ninety participants (52.1% males,  $M_{age}=20.5$ ) were randomly assigned to conditions using a 2 Product Use (before, after) x 2 Feature (low, high) between subjects design. The study was conducted using MediaLab software, and sessions were run in a computer lab with groups of 2 to 18 students. Participants worked individually. Each participant evaluated one model of the product, either before or after product use. Using a between-subjects design was critical because making predictions about capability or usability before use can bias participants' evaluations of the product after use (Jones 1977).

The product used in this study was the same digital video player participants evaluated in study 1. Two working models of the product were created, one with seven features (low features condition) and one with 21 features (high features condition). Participants who used the product were provided with a manual of the video player describing the features of their model and how

to use them. In the low features condition, the manual had four pages and in the high features condition, the manual had eight pages. The layout of the manual was identical across conditions.

Participants were asked to imagine that they were considering subscribing to and downloading a new digital video player. In the before use condition, participants viewed the user interfaces and a list of features for three models of players, one with a low number of features (7 features), one with a medium number of features (14 features), and one with a high number of features (21 features). The order of presentation was counterbalanced between subjects.

Participants evaluated either the low or high feature model and then chose their preferred model.

Participants in the after product use condition were told that they would use one model of a new digital video player. They were asked to perform a series of four tasks using either the low or high feature model of the player. These tasks included choosing a specific movie from a play list, watching parts of the movie, modifying the audio settings, and recording parts of another movie available in the play list. After completing these tasks, participants were free to use the player at their leisure. Next, participants evaluated the product they used. After completing their evaluations, they viewed the user interfaces and a list of features for two additional models of digital video players (e.g., models with a low and medium number of features if they had used the high features model). The order of presenting the other two models was counterbalanced between subjects. Finally, participants chose their preferred model.

## **Measures**

Expertise and product usability were measured as in studies 1 and 2. Product capability was measured using three items (this digital video player performs many functions/ has many capabilities/ has a large number of features). Expected and experienced utilities were measured separately using the six-item measure for overall product evaluation used in study 1 and one item

about product satisfaction (how satisfied would you be if you subscribed to the digital player in the before use condition, how satisfied were you with the digital player you used in the after use condition). All items were measured using seven-point scales.

After participants had either evaluated or used one of the models, we asked them to choose one of the three models. As in study 1, participants rated their confidence in their decision and the difficulty of making the decision.. We also recorded participants' clickstreams as they used the video player in the after use condition. We gathered information on how many tasks were completed, the time it took to complete the tasks, and how long they used the player.

## Results

The reliability of the multiple item scales ranged from .89 to .98. A confirmatory factor analysis on the capability, usability and overall product evaluation scales showed an acceptable goodness of fit for the three-factor solution and significant loadings for each observable variable in their respective latent factors (all  $ps < .001$ ).<sup>5</sup> Because order was not significant for any of the dependent variables (all  $ps > .06$ ), we collapsed the data across order conditions for subsequent analyses. Table 1 shows the means of the dependent variables across conditions.

INSERT TABLE 1 HERE

A 2 (product use) x 2 (features) ANCOVA on perceived capability with expertise as a covariate showed a significant main effect of number of features ( $F(1, 185) = 132.9, p < .001$ ), indicating that capability increased with the number of features ( $M_{low} = 3.2, M_{high} = 5.2$ ). Thus, hypothesis 1 is supported. In addition, we found a significant main effect of product use ( $F(1, 185) = 5.2, p = .02$ ). Perceived product capability was lower after use ( $M_{before} = 4.0$ ) than before

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<sup>5</sup> The comparative fit index (CFI) was .93. Capability loadings ranged from .94 to .97 (average extracted variance = 91%). Usability loadings ranged from .52 to .93 (average extracted variance = 64%), and overall evaluation loadings ranged from .55 to .92 (average extracted variance = 70%). The correlation between usability and capability was not significant. Overall evaluations were correlated with capability ( $r = .63, p < .001$ ) and usability ( $r = .29, p < .001$ ).

use ( $M_{\text{after}} = 4.4$ ). The interaction between number of features and product use on ratings of capability was also significant ( $F(1, 185) = 67.2, p < .001$ ), indicating that the number of features had a smaller effect on perceptions of product capability after use, relative to before use. The effect of expertise on perceived product capability was not significant ( $p > .60$ ).

A 2 (product use) x 2 (features) ANCOVA on perceived usability with expertise as a covariate showed that usability significantly decreased with the number of features ( $F(1, 185) = 33.1, p < .001$ ), supporting hypothesis 2 ( $M_{\text{low}} = 5.9, M_{\text{high}} = 4.9$ ). Consistent with hypothesis 3, participants' expertise had a positive effect on their perceptions of product usability ( $F(1, 185) = 12.7, p < .001$ ). No other effects were significant ( $ps > .17$ ).

Consistent with H4, a 2 (product use) x 2 (features) ANCOVA on overall product evaluations with expertise as a covariate revealed a main effect of features ( $M_{\text{low}} = 4.5, M_{\text{high}} = 5.1, F(1, 185) = 15.8, p < .001$ ) that was qualified by a significant interaction between features and product use ( $F(1, 185) = 31.5, p < .001$ ). Controlling for expertise, product evaluations before use significantly increased with number of features ( $M_{\text{low}} = 4.0, M_{\text{high}} = 5.6, F(1, 91) = 49.0, p < .001$ ), but product evaluations after use did not ( $M_{\text{low}} = 5.0, M_{\text{high}} = 4.7, F(1, 93) = 1.6, p = .20$ ). The effect of expertise on participants' overall product evaluations was not significant ( $p > .40$ ). A 2 x 2 ANCOVA on product satisfaction produced very similar results.

To investigate the relative weights of product capability and usability on consumers' product utilities before and after product use, we ran a multisample path analysis using maximum likelihood estimation.<sup>6</sup> Number of features, expertise, and their interaction entered the model as independent variables. We partialled out the main effects of number of features and expertise from the interaction effect, and used the regression unstandardized residuals as the

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<sup>6</sup> We also estimated the models using partial least squares (PLS), and results were consistent with those obtained using maximum likelihood estimation.

interaction term. Product capability and usability were mediator variables. We estimated the coefficients with two different dependent variables reflecting product utility: overall product evaluations and satisfaction. All goodness-of-fit indices were in an acceptable range.<sup>7</sup> The interaction between number of features and expertise was not significant ( $p > .11$ ). Table 2 shows the standardized path coefficients before and after product use.

INSERT TABLE 2 HERE

To test the difference in the relative weights of capability and usability on expected and experienced product utility (H4a and H4b), we constrained each of these two parameters in the model to be equal across conditions and assessed whether the chi-square decrease in the unconstrained model was significant. The Lagrange Multiplier test showed that the effects of product capability on product evaluations and satisfaction differed significantly in the before and after use conditions ( $\chi^2_{(1)\text{overall evaluations}} = 4.2, p < .01, \chi^2_{(1)\text{satisfaction}} = 4.9, p = .03$ ). Consistent with H4a, participants gave more weight to product capability before use relative to after use.

Hypothesis 4b predicted that consumers would give less weight to usability before use than after use. Our models comparisons partially supported this prediction. The effect of usability on overall product evaluations was invariant before and after use ( $p > .26$ ), but the effect of usability on satisfaction was significantly lower before product use than after product use ( $\chi^2_{(1)} = 4.5, p = .03$ ). This indicates that, as expected, participants gave less weight to usability in their predicted product satisfaction than in their satisfaction ratings after product use.

### **Additional Analyses**

Decomposing the direct and indirect effects in our model, we found that before product

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<sup>7</sup> The comparative fit index was .95 in the before use sample and .99 in the after use sample. All  $\chi^2$  tests  $> .07$ .

use the indirect effect<sup>8</sup> of product features on overall product evaluations mediated by product capability was strong ( $\beta = .70, p < .001$ ), and overshadowed the significant negative indirect effect of product features through usability ( $\beta = -.10, p < .01$ ), yielding a positive net effect. After product use this pattern reversed. The indirect effect of features through capability became nonsignificant ( $\beta = .09, p > .05$ ), and the indirect effect of features through usability was negative and significant ( $\beta = -.18, p = .001$ ), resulting in a negative net effect. The indirect effects of number of product features on satisfaction followed the same pattern.

Participants' choices of players before and after product use suggest a substantial decrease in the share of the high feature model. The majority of the respondents in the before use condition (66%) chose the high feature model as their preferred player. However, a significantly lower percentage of the participants who had used the high feature model (44%) chose the high feature model ( $z = 2.5, p = .01$ ) even though they had already invested time learning to use this model. Moreover, participants who used the high feature model were less confident in their choices ( $M_{\text{high}} = 4.7$ ) than participants who used the low feature model ( $M_{\text{low}} = 5.4, F(1, 94) = 5.8, p = .02$ ), and they rated the choice as more difficult ( $M_{\text{high}} = 3.1$ ) than participants who used the low feature model ( $M_{\text{low}} = 2.3, F(1, 94) = 5.7, p = .02$ ). Controlling for expertise, participants' confidence in their choices was lower after use ( $M_{\text{after}} = 5.0$ ) than before use ( $M_{\text{before}} = 5.8, F(1, 185) = 14.8, p < .001$ ), suggesting that usage does not enhance confidence in product evaluations.

Finally, we analyzed the usability data. There was no difference in the number of tasks completed in the low and high feature conditions ( $M_{\text{low}} = 3.2, M_{\text{high}} = 3.1, p = .45$ ). The number of tasks completed was positively correlated with perceived product usability ( $r = .30, p < .01$ ). Participants in the high feature condition spent marginally more time completing the four tasks than participants in the low feature condition ( $M_{\text{low}} = 6.9 \text{ min.}, M_{\text{high}} = 9.2 \text{ min.}, F(1, 94) = 3.4, p$

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<sup>8</sup> The significance level of all indirect effects was computed using the Sobel  $t$  statistic.

= .07). The amount of time required to complete the four tasks was negatively correlated with both participants' expertise ( $r = -.31, p < .01$ ) and perceived product usability ( $r = -.23, p = .05$ ).

## **Discussion**

The results of Study 3 show that using a product structurally changes consumers' preferences. Supporting our predictions, consumers gave more weight to capability and less weight to usability in their expected utilities, relative to their experienced utilities. After product use, consumers no longer evaluated the product with the highest number of features more favorably, supporting the existence of a feature fatigue effect. Our findings also suggest that consumers' expertise does not eliminate the feature fatigue effect. The shift in preferences before and after use occurred just as strongly for experts as for novices.

If adding product features improves the initial attractiveness of a product but decreases consumers' satisfaction after using the product, how should firms address this problem? How many features should managers offer to consumers? In the next section we present an analytical model, based on our empirical findings, to provide guidance for managers.

## **THE EFFECTS OF PRODUCT FEATURES ON FIRMS' PROFITS**

In this section we present an analytical model, based on findings from our three studies, to provide managerial insights about the influence of number of features on firm profitability. We assume a scenario in which adding features is essentially free (as is the case in many information-based products), implying that incremental profitability from adding features equals incremental revenue. Thus, we express incremental profit (revenue) from number of features,  $R$ , as a function of number of features,  $F$ , for a typical customer. We decompose  $R$  into a positive effect due to product capability,  $C$ , minus a negative effect due to lack of usability,  $D$ .

From studies 1-3, we know that perceived product capability increases with number of features. We also know from study 3 that adding features has a smaller effect on perceived capability after use, as compared with prior to use. For this reason, denoting capability before and after use as  $C_1$  and  $C_2$  respectively, we model capability as<sup>9</sup>:

$$(1) \quad \begin{aligned} C_1 &= dF \\ C_2 &= eF \quad c, d, e > 0 \text{ and } d > e \end{aligned}$$

From studies 1-3 we also know that usability is perceived to decline with the number of features, and based on study 1 this decline appears to accelerate. Based on this, we model lack of usability,  $D$ , as:

$$(2) \quad D = aF + bF^2 \quad a, b > 0$$

We also impose  $d, e > a$ , to ensure that the optimal feature level will be positive (otherwise the firm should not create the product at all).

Let us now construct a dynamic scenario, to help us generate insights on short-term and long-term profitability. For analytical parsimony and tractability, we adopt a two-period scenario in which profit from initial purchases is represented by the first period, and profit from all subsequent purchases are represented by the second period. We weigh the second period by a factor,  $w$ , that represents the weight with which subsequent purchases contribute to the typical customer's net present value. This weight encompasses such things as the firm's discount rate, the typical lifetime of a customer, the length of the firm's planning horizon, and the extent to which the product category is conducive to repeat sales. Denoting profits in period one and two as  $R_1$  and  $R_2$  respectively, and the net present value of the customer's profit stream as  $R_{tot}$ , we have, from equations (1) and (2):

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<sup>9</sup> For simplicity, we model this relationship as linear. Previous research, however, suggests that the effect of number of features on capability may have diminishing returns (Nowlis and Simonson 1996). This has no impact on our results. If we replace the linear formulation in equation (1) with a quadratic function all results are replicated.

$$R_1 = C_1 - D = (d-a)F - bF^2$$

$$R_2 = C_2 - D = (e-a)F - bF^2$$

$$(3) \quad R_{tot} = R_1 + wR_2 = [(d-a)+w(e-a)]F - (1+w)bF^2$$

Let us first consider a myopic profit maximization in which the firm seeks to find the number of features that maximizes initial choice (and hence initial profits). This amounts to maximizing  $R_1$  with respect to  $F$ . It is easily shown that  $R_1$  is maximized when  $F_1 = (d-a)/2b$ .

Similarly if the firm seeks to maximize repurchase (and hence second-period profits), the firm maximizes  $R_2$  with respect to  $F$ , leading to the optimal value of  $F_2 = (e-a)/2b$ . If the firm instead seeks to maximize the net present value of the customer's profit stream, as financial analysts would consider optimal, the firm maximizes  $R_{tot}$  with respect to  $F$ , leading to the optimal value:

$$(4) \quad F_{opt} = [(d-a)+w(e-a)]/[2b(1+w)]$$

Assuming that the firm wishes to maximize the net present value of the typical customer's profit stream, the following results arise from these equations:

**Result 1:** *Maximizing initial choice/sales/profits results in the inclusion of too many features.* It is easily shown that  $F_1 > F_{opt} > F_2$ , implying that the optimal number of features is less than the number that maximizes initial choice, sales, or profits. This casts into doubt the exclusive reliance on conjoint or discrete choice models to determine the appropriate product configuration, because use of such methods, which use initial choice as their criterion, will typically result in the inclusion of too many features.

**Result 2:** *Maximizing repurchase results in the inclusion of too few features.* This again results from the fact that  $F_{opt} > F_2$ .

**Result 3:** *If the number of features is sufficiently large, then additional features should*

not be added, even if they may be added at no cost. Specifically, once  $F > F_{opt}$ , adding additional features reduces the net present value of the profit stream. Again, this is in contradiction to the typical economic/conjoint utility model, which suggests that adding features can only add utility.

**Result 4:** *As the emphasis on future sales increases, the optimal number of features decreases.* This follows from  $\partial F_{opt}/\partial w = (e-d)/(2b(1+w)) < 0$ , (because the denominator is positive, and  $d > e$ ). This result is also managerially meaningful. With business becoming more relationship-focused over time, with increasing amounts of attention being paid to the lifetime value of the customer, this result implies that firms should, on average, be making their products simpler over time, to increase repurchase and future sales.

For simplicity of exposition, the preceding results have been obtained for a monopolist. It can be shown, though, that consideration of competition does not change any of the substantive conclusions.<sup>10</sup> The only change is that in the case of choice inertia (customers choosing a brand tend to stay with a brand) the optimal number of features increases. Nevertheless, all of Results 1-4 still hold.

The analytical results can be usefully summarized by Figure 3. We see from the figure that there is always an optimal number of features, but this optimal number depends upon the goals of the firm. If the firm wishes to maximize initial choice (or equivalently, profits from initial purchases), then the number of features  $F_1$  is optimal. Any greater number of features is incompatible with not just the initial purchase objective, but with any profit objective. If the firm wishes to maximize probability of repurchase (or equivalently, profits from repurchase), then  $F_2$  is the optimal number of features (and any less is also incompatible with any profit objective). If the firm seeks to maximize the net present value of the customer's profit stream, then  $F_{opt}$  is best.

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<sup>10</sup> Results for the effects of competition are available from the authors upon request.

The only range of number of features that the firm should ever consider is the range from  $F_2$  to  $F_1$ , with the optimal level of features dependent upon the nature of the firm's objective.

INSERT FIGURE 3 HERE

### **GENERAL DISCUSSION**

Our goal in this research was to examine the effects of increasing the number of product features on consumers' expected and experienced product utilities. In three studies, we showed that increasing the number of product features has a positive effect on perceived capability, but a negative effect on perceived usability. Thus, whether adding desirable, important features to a product will increase or decrease utility depends on the relative weights of capability and usability in consumers' utility functions. Study 3's results indicate that consumers assign more weight to product capabilities in their evaluations before than after use, and less weight to product usability in their satisfaction ratings before than after use. Thus, what looks attractive in prospect does not necessarily look good in practice: when using a product, consumers may become frustrated or dissatisfied with the number of features they desired and chose before using the product. In short, product capability may become too much of a good thing.

These changes in the relative weights of product capability and usability are consistent with our hypotheses based on construal level theory. Before using a product, consumers seem to be more focused on desirability issues, such as the product's capabilities, and less focused on feasibility concerns, such as usability, than they are after using a product. Because different considerations are salient in expected and experienced utility, using a product can change the structure of consumers' preferences. Such changes in preferences are significant because they suggest that consumers may not choose products that maximize their long-term satisfaction.

The impact of product usage on preferences is an understudied area. Consumer behavior

research has traditionally focused more on pre-purchase processes such as information processing and choice (Bazerman 2001). Although the services literature has long recognized the importance of relationship duration, ongoing usage levels and satisfaction (e.g., Bolton and Lemon 1999), this literature has focused on changes over time, and has not developed theoretical frameworks to explain why consumers' underlying preferences might change.

In some respects, our studies presented a conservative test of our hypotheses. First, we used college students as our sample, a demographic segment that tends to be more open to new technology and new features than other segments. A recent nationwide survey indicated that after buying a high-tech product, 56% of consumers feel overwhelmed by its complexity, and this percentage is positively correlated with age (NTRS 2004). Second, our high feature product had only 21 features, a relatively low number of features in some product categories. The dashboard alone of the BMW 745 has over 700 features. Future research should examine products with more features and test for nonlinearities in evaluations as features are added. Finally, our studies only considered features that added functionality to the product and were reasonably familiar to the participants. The negative effect of unimportant or highly complex features may be stronger.

Future research should also examine consumers' reactions to product features over a longer period of time. For example, it will be interesting to learn whether consumers attribute poor usability to the large number of features in the model they chose, or to the brand, potentially damaging a firm's sales across multiple categories. Even if consumers learn about the negative effects of too many features after a usage experience, this learning might be forgotten in future purchase situations, when product capability again becomes the key driver of evaluations. Finally, consumers use a variety of strategies to cope with technology (Mick and Fournier 1998). If consumers use confrontative strategies (e.g., mastering, partnering), the effects of product

features on usability and experienced utility may decrease over time. However, if consumers use avoidance strategies (e.g., distancing, abandonment), the effect of product features on experienced utility is likely to remain strong.

Although supply-side explanations for the proliferation of product features abound, our results demonstrate that demand-side explanations are sufficient for feature fatigue to occur. It is certainly true that companies often find it cheaper to produce feature-rich products that can satisfy the needs of heterogeneous consumers than to produce more narrowly targeted products with fewer features. However, companies often add features to products because they believe their customers want more features. Indeed, our results suggest that even conducting market research may not eliminate the problem. If companies conduct market research by asking customers to evaluate products without using them, too much weight will be given to capability relative to usability, and it is likely that too many features will be added to the products.

### **MANAGERIAL IMPLICATIONS**

Our research has several important managerial implications. First and foremost, our findings call into question the predictive power of attribute-based models for determining the optimal number of features. Firms planning new products or considering product improvements typically use market research techniques such as conjoint analysis or discrete choice analysis. The conjoint model, for example, defines the product as a bundle of attributes and estimates part-worths for each attribute. Because market shares are predicted based on these part-worths, each positively-valued feature increases a product's market share relative to products without the feature. Our results suggest traditional conjoint analysis can lead to marketing myopia, where firms maximize initial sales. This happens because usability, a global rather than an attribute-

based characteristic, is underweighted by consumers before product use, but becomes a critical element in consumers' satisfaction during use. Our results suggest that a product use experience may be required to increase the salience of usability so that its relevance in choice approaches its relevance in use. Thus, consumers' preferences may be more accurately predicted using customer-ready prototypes and product-in-use research (Srinivasan, Lovejoy and Beach 1997).

Because additional features can differentiate a product from competitors (Carpenter, Glazer and Nakamoto 1994) and add desired functionality, the benefits of adding new features to products are evident. However, managers rarely consider the full cost of adding features. The financial costs of adding new features are typically weighted more heavily than intangible customer usability costs. Thus, as the marginal cost of adding features decreases, approaching zero for information-based products (e.g., software), firms are likely to increase product capability beyond the optimal level. This is a dangerous trend: both our empirical findings and analytical model suggest that adding costless features can damage firms' profitability by decreasing the usability of products and consumers' satisfaction with them.

As firms shift their focus from one-time transactions to long-term relationships with customers, the importance of product usability – and research methods that allow managers to incorporate usability into their decision making – will only increase. Our results suggest that too many features might encourage initial purchase but damage satisfaction and reduce repurchase probabilities, leading to lower customer lifetime values. As demonstrated by our model, the optimal number of features varies depending on firms' objectives. As firms' reliance on continuing customer relationships increases, the optimal number of features decreases, implying that products should be made simpler. Conducting research with customers both before and after they use products will allow firms to measure product-specific parameters for the model,

allowing them to predict the number of features that will maximize their long-term profits.

What can firms do to minimize feature fatigue? Our findings suggest that managers should consider offering a wider assortment of simpler products, instead of all-purpose, feature-rich products. Instead of packing one model with many features to address market heterogeneity, firms might enhance consumer satisfaction by developing more tailored products with limited sets of capabilities that appeal to different segments. Consumers can now purchase a single product which functions as a cell phone, game console, calculator, text messaging device, wireless internet connection, PDA, digital camera, MP3 player, and GPS system. However, while purchasing this highly complex product may give the consumer bragging rights, each function the consumer does not actually use adds to the difficulty of learning to use the product without providing any functional benefit.

A challenge of creating and marketing more narrowly targeted products is that choosing among a wider variety of products can be more difficult for consumers (Schwartz 2004). Rather than using the heuristic of buying features they may need (but are not sure they will need), consumers will have to think carefully about which features to purchase. Moreover, our empirical results suggest that during the choice process, consumers will be tempted by products that offer greater capability. To minimize feature fatigue, decision aids such as recommendation agents that help consumers choose the right products for their needs could be designed to increase the salience of usability. Offering extended product trials also may help consumers learn which products best suit their needs by increasing the salience of product usability. For example, the companies that sell digital media players RealOne and WinAmp offer evaluation versions of their products. By decreasing the gap between consumers' preferences during choice and use, such strategies may increase both customer satisfaction and customer lifetime value.

**TABLE 1**

EFFECT OF NUMBER OF FEATURES ON DEPENDENT VARIABLES (STUDY 3)

Product Use	Number of Features	Product Capability	Product Usability	Product Evaluations	Product Satisfaction
Before	Low	2.7 <sup>a</sup> (1.2)	6.0 <sup>a</sup> (.9)	4.0 <sup>a</sup> (1.2)	3.4 <sup>a</sup> (1.6)
	High	6.2 <sup>b</sup> (.9)	5.1 <sup>b</sup> (1.1)	5.6 <sup>b</sup> (1.0)	5.6 <sup>b</sup> (1.0)
After	Low	3.7 <sup>c</sup> (1.3)	5.8 <sup>a</sup> (1.1)	5.0 <sup>c</sup> (1.0)	5.2 <sup>bc</sup> (1.1)
	High	4.3 <sup>d</sup> (1.3)	4.8 <sup>b</sup> (1.4)	4.7 <sup>c</sup> (1.3)	4.9 <sup>c</sup> (1.6)

NOTE. –  $N = 190$  participants. Standard deviations are in parentheses. Different superscripts in same column indicate difference between means is significant ( $p < .05$ ).

**TABLE 2**

## STANDARDIZED PATH COEFFICIENTS (STUDY 3)

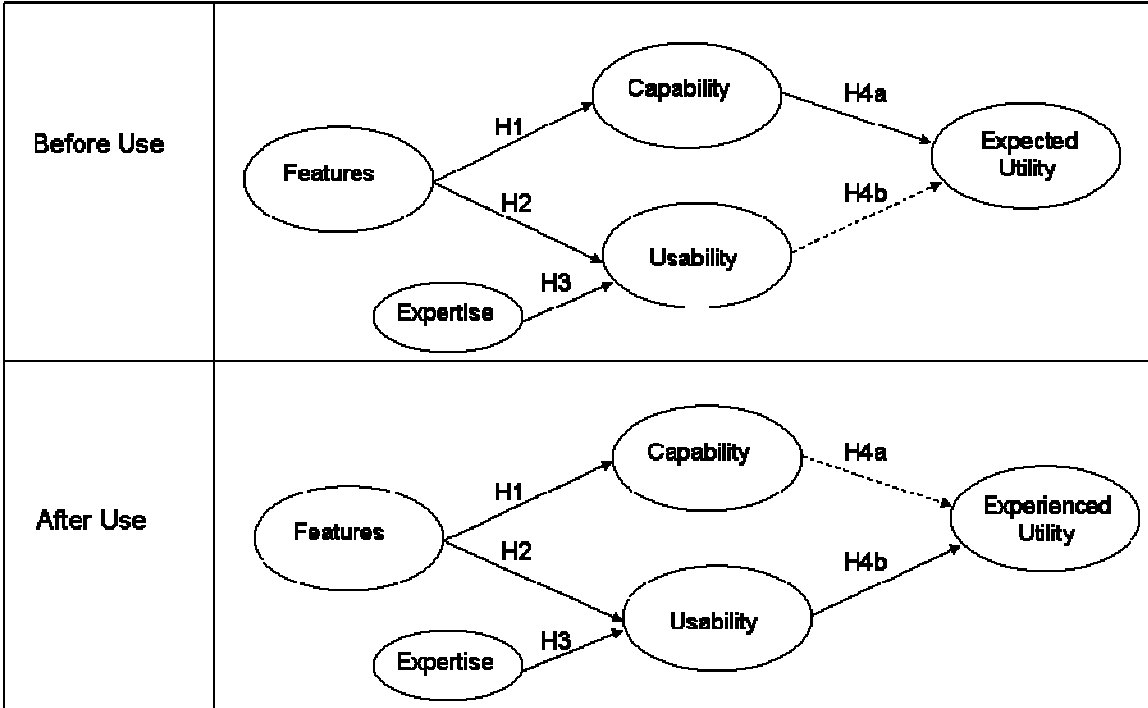
Independent Variables	Dependent Variables							
	Capability		Usability		Overall Evaluations		Satisfaction	
	Before Use	After Use	Before Use	After Use	Before Use	After Use	Before Use	After Use
Number of Features	.85**	20*	-.43**	-.36**	–	–	–	–
Expertise	ns	ns	.36**	ns	–	–	–	–
Capability	–	–	–	–	.82**	.45**	.79**	.48**
Usability	–	–	–	–	.24**	.51**	.15*	.51**

ns – nonsignificant effect

\* $p < .05$

\*\* $p < .001$

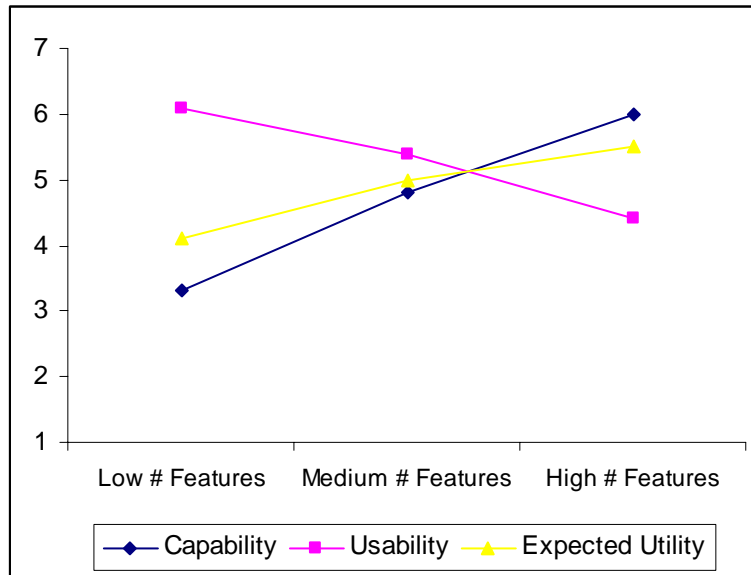
**FIGURE 1**  
**CONCEPTUAL MODEL**



**FIGURE 2**

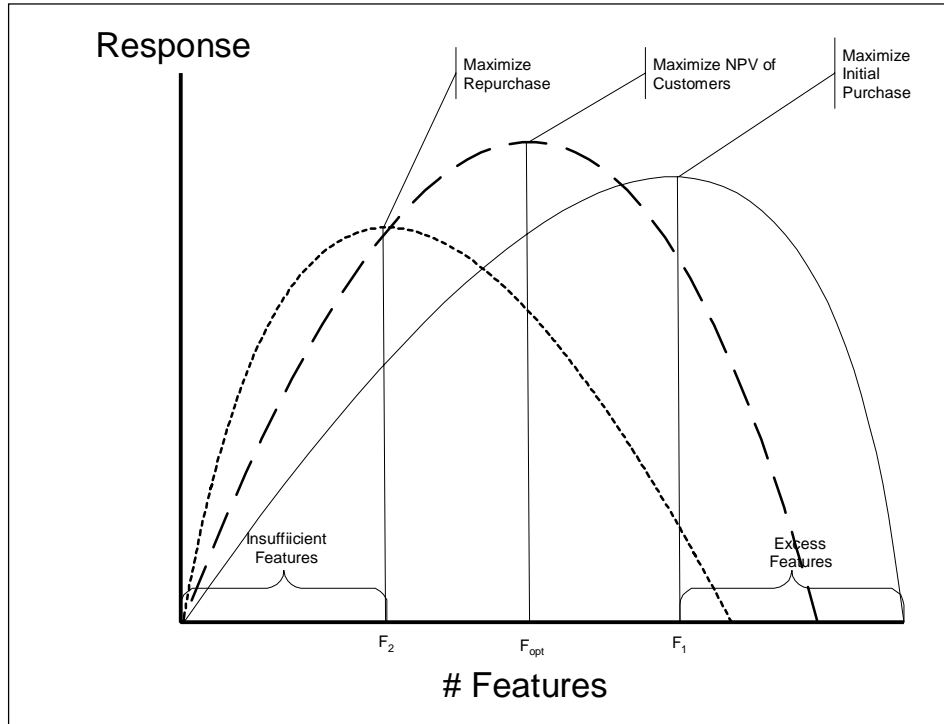
EFFECTS OF NUMBER OF FEATURES ON DEPENDENT VARIABLES

FOR THE DIGITAL VIDEO PLAYER (STUDY 1)



**FIGURE 3**

**NUMBER OF PRODUCT FEATURES AND FIRM OBJECTIVES**



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