

**Multi-Format Digital Products:  
How Design Attributes Interact with Usage Situations to Determine  
Choice**

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## **Multi-Format Digital Products:**

### **How Design Attributes Interact with Usage Situations to Determine Choice**

Technological advances enable companies to offer information products such as books, music and movies in electronic formats, in addition to the traditional physical formats. Although one format may appear more useful and be preferred, consumers may be enticed to consider the unique attributes of all formats if they deliver equally well on salient attributes. The authors investigate the impact of usage situations, relative attribute quality levels of the formats, and their interactions on the perception of the formats as perfect or imperfect substitutes or complements, and the purchase likelihood of the bundle of formats. The studies demonstrates that when formats have equivalent quality on a salient attribute consumers perceive the formats as more complementary, and are more likely to buy the bundle. This happens because consumers consider more usage situations for the formats and see the bundle as providing greater flexibility for future usages.

Keywords: New Product Development, Digital Products, Multi-format Products, Bundling, Design, Usage Situations, Substitutes, Complements.

Consumers often face situations in which they can choose among different product formats or buy a bundle of these formats. Music can be purchased on a CD, streamed online, or downloaded in MP3 format; books and newspapers are offered in print and electronic formats; and movies are available as DVDs or for download. For example, *The Wall Street Journal* offers the following subscription options: Print (\$119), Online (\$103), Mobile (\$78), Mobile for iPad (\$207), Print + Online (\$140), Print + Mobile (\$171), and Online + Mobile (\$155). Similarly, in addition to selling DVDs and video on demand separately, Amazon offers the Disc+On Demand option where consumers can purchase a DVD and get the same movie for immediate viewing. Do consumers regard these formats as substitutes, leading to lower likelihood of choosing the bundle of formats, or as complements, leading to higher likelihood of choice? This paper examines consumers' preferences for bundles of formats in information product categories, such as books, magazines, content publications, music, movies, and language instruction services.

In assessing the substitutability of the different formats, one might expect that the formats are substitutes since they satisfy similar needs (e.g., watching a movie or reading a book). If consumers value an attribute which is better represented in one format (e.g., searchability in a PDF format of a book), this would lead to the other format (e.g., print book) to be perceived as a poor substitute. Preference for buying both formats would then be relatively low. However, we propose that under certain conditions, consumers perceive the formats as more complementary, and are more likely to buy both formats. We suggest that product formats have usage-relevant attributes that may be common across the formats (i.e., on which the two formats have equivalent levels of quality) or unique to the formats (i.e., on which one format dominates in quality). When multiple formats deliver equally on the consumer's main usage-relevant attribute(s), consumers

can simultaneously appreciate the option value of each format's specific unique attributes<sup>1</sup>. In other words, when the print and PDF formats of a book are equivalent in terms of readability, consumers will examine the attributes on which the formats are unique or distinct (e.g., displayability for print and searchability for PDF). Because each format performs better on a distinct attribute, consumers will perceive the formats as more complementary and be more inclined to buy both. This holds true for whether the quality of the common attributes is equally high or equally low. Thus, even if the formats have equivalent low quality on a salient attribute, consumers may choose to buy both.

This counterintuitive finding adds to the existing literature on consumer preferences for rapidly emerging newer formats in information product categories (Koukova, Kannan, and Ratchford 2008) and has implications for design. Specifically, this research provides evidence that design of digital formats, in terms of their attribute qualities, can provoke consumers to rethink why they buy a multi-format product, and encourage them to value the flexibility that the bundle of formats may provide for different usage occasions consumers may encounter in the future. Thus, we contribute to the substitution-in-use literature which postulates that intended usage determines whether consumers treat products as substitutes or complements (e.g. Stefflre 1971; Day, Shocker, and Srivastava 1979) by showing that design can redirect attention from intended usage to a broader scope of potential usages that necessitate flexible formats<sup>2</sup>. In addition, our research contributes to the extensive literature on bundling by focusing on the non-price attribute determinants of perfect versus imperfect substitutes/complements and bundle choice. While previous research has studied conditions favoring bundling (e.g., Stigler 1963;

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<sup>1</sup> We thank reviewer 1 for this phraseology.

<sup>2</sup> We thank reviewer 1 for highlighting this contribution.

Schmalensee 1984; Telser 1979), and optimal composition and pricing strategies for bundles (e.g., Hanson and Martin 1990; Venkatesh and Mahajan 1993), we establish the important role of relative attribute quality levels of formats in driving complementarity and bundle choice. This is especially important in information product categories where a significant portion of content could be duplicated across formats (for example, information content could be exactly the same in print books versus e-books, in mobile and online versions of newspapers, while there could be less than full but still significant overlap in content between print and online newspapers, and between multiple formats of movies, videos and music). This duplication of content may lead to lower value perceptions for the bundle of formats, even while the lower marginal cost of producing content makes it attractive for content providers to pursue bundling strategies. Thus, examining consumer perceptions of perfect versus imperfect substitutability of the information product formats and bundle choice has important implications for the design of these formats.

In the next section, we present the theoretical model and derive the hypotheses. We then report two field studies and a lab experiment that test the predictions. Using survey (study 1) and choice data from a field experiment (study 2) with actual consumers and purchases of electronic versus print books, we show that the formats' attributes and usage situations affect consumer perceptions of the formats as imperfect substitutes or complements as well as bundle choice. We extend these findings in a lab experiment on internet versus DVD movie rentals (study 3) to show that if an attribute's quality levels are equally high or equally low for both formats (versus when one format dominates the other), consumers perceive the formats as more complementary, consider more usage situations, and buy the bundle as it provides flexibility in terms of usage.

#### *CONCEPTUAL FRAMEWORK*

The conceptual framework is presented in Figure 1. We propose that consumers may have a salient usage situation when they consider alternative formats. If the multiple formats are equivalent in the quality of attributes made salient by the usage situation (the top branch of the figure), consumers consider the unique or distinctive attributes of the formats. This leads to consideration of additional usage situations and the flexibility of the formats in satisfying those usage situations. These variables, in turn, can affect the likelihood of bundle purchase either directly or indirectly through the formats' being perceived as more complementary. In contrast, when one format dominates on a salient attribute (the lower branch of the figure), the formats will be perceived as more substitutable, leading to purchase of the dominant format.

To illustrate our predictions, we focus on a choice between the PDF or print version of a book (or both). For this choice context, relevant usage situations may include copying, searching, immediate accessibility, aesthetic use, and storage, while attributes may include image quality, browsing ability, layout, archival quality, and convenience of use. We describe the effects of usage situations and attributes on perceptions of substitutability as well as bundle choice.

< Insert Figure 1 about here >

### *Usage Situations and Salient Attributes*

Usage situations play a critical role in consumers' perceptions of products as substitutes or complements. The substitution-in-use approach (Stefflre 1971; Day, Shocker, and Srivastava 1979) assumes that products are a means of achieving usage-related goals. When two products are appropriate for the same usage situation, they are perceived as providing similar benefits and are therefore considered substitutable (Ratneshwar and Shocker 1991). When the products have

distinctive usages, however, they are viewed as less similar and are less likely to be substitutes (Ratneshwar and Shocker 1991). Based on this, Koukova, Kannan, and Ratchford (2008) showed that the perceived complementarity of two product formats increases when advertising makes each format's distinctive usage situations salient compared to when advertising makes both formats' common usage situations salient. The implication of this research is that formats that satisfy different usage situations are more likely to be perceived as imperfect substitutes or even complements.

Whereas usage situations determine the benefits that the consumer is seeking, attributes reflect the benefits provided by the product (Srivastava, Alpert, and Shocker 1984). Different usage situations may make different attributes salient. For instance, the usage context of copying articles for distribution may make attributes such as image quality and convenience of use salient. Similarly, the product formats themselves can make different attributes and usage situations salient. For instance, thinking about the PDF format may make salient the attribute of keyword searchability, which would be associated with the usage situation of searching. Further, thinking about the print format may make the ability to stack in a bookshelf salient, which would be associated with the usage situation of aesthetic use. In these examples, the salient attributes are distinctive to the format, so that the level of quality on the attributes is higher for one format than for the other. Attributes on which the level of quality is equivalent across the two formats, such as image quality, could also be salient for the consumer, increasing the accessibility of their associated usage situations (e.g., making copies for class distribution). Next, we describe how salient attributes determine whether consumers consider additional usage situations, perceive the formats as perfect substitutes, imperfect substitutes or complements, and choose the bundle.

### *The Effects of Salient Attributes on Bundle Evaluations*

According to the feature matching model of preference (Houston, Sherman, and Baker 1989; Houston and Sherman 1995), common attributes cancel out when consumers choose between two alternatives. Common attributes are those on which the alternatives have the same level of quality. Because the attribute levels are equivalent across the alternatives, the attributes are not diagnostic of choice. Instead, the attributes on which the two alternatives are distinct become the basis of choice. This model suggests that when evaluating two product formats, the attributes on which the two formats have similar levels (high or low) of quality are likely to cancel out, leaving attributes unique to each format to determine purchase likelihood.

What happens if both formats offer unique positive attributes? If one format dominates on a salient attribute while the other format is better on a different salient attribute, then consumers have to resolve the “tie.” Assuming that both attributes are desirable, the ensuing preference uncertainty makes choice difficult, leading consumers to postpone choice by picking neither alternative (Dhar 1997, Dhar and Sherman 1996). This no choice outcome may occur when consumers are faced with either choosing one of the two options or not choosing at all, as in prior research testing the feature matching model. However, prior research does not consider what would happen if consumers could choose both options. We propose that some consumers may resolve the “tie” by choosing the bundle, and that the reason underlying the bundle choice is to achieve greater flexibility rather than reduce choice difficulty.

More specifically, we argue that the unique positive attributes of each format will cue distinctive usages in which the salient attributes would be beneficial. The greater the number of usage situations associated with the attributes, the greater the perceived complementarity of the formats. Moreover, the likelihood of choosing the bundle will be higher in this situation than in

the situation in which one format dominates on a salient attribute. This outcome is, in fact, dependent on a consumer's overall marginal utility exceeding marginal disutility of price, but controlling for all other effects we argue that our prediction will prevail<sup>3</sup>. In the context of the print versus PDF illustration, if the print format makes salient the usage situation of aesthetic use (displaying the book on a shelf) and the PDF makes salient the usage situation of searching, the bundle will be perceived as an attractive option compared to either PDF or print alone. Choosing the bundle may provide consumers with the flexibility to accommodate different usage situations made accessible by thinking about the unique attributes of the formats. The flexibility of the bundle for meeting uncertain future usage situations is similar to the flexibility afforded in buying multiple flavors of yogurt or beverage to meet uncertain future tastes (Walsh 1995).

In sum, as shown in Figure 1, we propose that usage situations can make certain attributes salient. When different product formats have equivalent levels of quality on those attributes, consumers may examine the unique attributes of the formats. In the presence of unique attributes, consumers may consider the formats as complements rather than substitutes. The reason is that the unique attributes of the different formats will draw attention to new usage situations. Since these usage situations will be associated with the different formats, the consumer will see the bundle as providing greater flexibility, leading to greater preference for buying the bundle. This leads to the following hypotheses.

H1: When the quality of two product formats is equivalent on a salient attribute as compared to when one format dominates, consumers will a) perceive the formats as more complementary, and b) be more likely to choose the format bundle.

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<sup>3</sup> We formally test this prediction in study 2 using a choice model.

H2: When the quality of two product formats is equivalent on a salient attribute as compared to when one format dominates, consumers will a) consider more usage situations for the formats, and b) see the bundle as providing greater flexibility.

H3: The number of usage situations considered, the flexibility provided by the bundle, and perceived complementarity of the formats will mediate the effect of attribute quality on bundle choice.

### *STUDIES OVERVIEW AND MEASURES DEVELOPMENT*

We test the hypotheses in three studies. The first two studies, done in collaboration with a book publisher, were conducted with actual consumers. Study 1 examines the effects of usage situations and attributes on perceived complementarity (H1a), while study 2 tests the effects of usage situations and attributes on the likelihood of bundle purchase, controlling for price effects (H1b). Study 3 is a lab experiment that tests the overall conceptual model in a controlled setting.

In study 1 we surveyed the publisher's customers and measured the perception of perfect substitutability, imperfect substitutability and complementarity of the print and PDF formats, and examined how this perception was affected by usage situations and attributes of the formats. (For the sake of exposition, we will term the perception of perfect substitutability, imperfect substitutability and complementarity continuum as perception of complementarity). We captured the perception of complementarity in the absence of any information regarding pricing or bundling (past studies have shown that pricing and bundling decisions can affect this perception; Walters 1991; Stremersch and Tellis 2002). Study 2 was a field experiment that investigated the actual purchase behavior of the publisher's customers, examining the impact of relative quality

levels of attributes and usage situations in the presence of price information on the purchase probabilities of the individual formats and the bundle. In study 3 we manipulated the attribute quality levels of the formats in a lab setting, investigating their impact on bundle purchase likelihood and revealing the process driving the results.

We adopted the substitution-in-use procedure (Stefflre 1971) to identify both appropriate attributes and usage situations for the two book formats. The substitution-in-use (SIU) approach is an iterative procedure for constructing product specific usage-situational taxonomies, and works as follows (e.g., Srivastava, Alpert and Shocker, 1984). First, a sample of consumers generates a set of usage situations for the products of interest in a product category. Then, a second sample evaluates the appropriateness of each product for each usage situation. Finally, a structured questionnaire with products and usage is administered to a third group of respondents in which they judge the appropriateness of each product form for each usage situation.

We applied the above procedure to identify the most important usage situations and attributes in our product context. We first asked focus group respondents to list all relevant attributes and usage situations for the two book formats. Since our study focused on perceptions of complementarity and preference/choice among formats, we framed the attributes as beneficial rather than characteristic—those beneficial attributes that would meet the needs of the customers in various usage occasions. We mapped the identified characteristic attributes to beneficial attributes using factor analysis. For example, characteristic attributes such as *resolution*, *font size* and *pixels* were mapped on to the beneficial attribute *image quality*. Next, a group of sixteen academics rank-ordered the usage situations listed by the focus group and the corresponding beneficial attributes, and the top five were retained for the studies. Finally, another group of twenty respondents rated the appropriateness of each format—print and PDF—in each of the

usage situations to identify distinct and common usage situations. The usage situations identified were (1) use of content for searching information or references (searching), (2) use for copying part of the content (copying), (3) use for immediate accessibility of content wherever the location (immediate accessibility), (4) use for storing the content as reference material for a long period of time (permanence of content), and (5) use for stacking in the bookshelf as display (aesthetic use). Aesthetic use emerged as a distinctive usage for the print format while searching emerged as a distinctive usage for the PDF format; all other uses were characterized as common usages. The following attribute dimensions were retained for the studies: (1) image quality, (2) layout, (3) browsing, (4) convenience of use, and (5) archival quality.

### *STUDY 1*

The objective of the study was to test for the effect of attributes and usage situations on perceived complementarity of different product formats. Based on H1a, we expect that for a given usage situation, complementarity perceptions will be higher when formats are perceived as equivalent on a particular salient attribute than when one format is perceived as superior. When one format is perceived as superior on an attribute, complementarity perceptions will be lower.

#### *Method*

*Study design and procedure.* A survey was mailed to 3,500 individual customers drawn at random from the 50,000 plus customer base of the publisher. A 50%-off coupon for any book of the publisher was offered as an incentive to complete the survey. Around 1,100 customers responded to the survey (31.4% response rate). The survey included items about respondents'

usage situations for books from this publisher, perception of quality of each format on the attributes mentioned in the previous section, and perception of complementarity of the formats. Due to constraints of the survey, we did not measure control variables, such as price, download time, overall qualities of the formats, etc. (we include those in study 2). In addition, respondents were not asked about preferences for different formats. The order of presentation of the items was randomized across respondents. The order effects were later found to be insignificant.

*Measures.* Respondents evaluated each of the five attributes (image quality, layout, browsing, convenience of use, and archival quality) on a three-point comparative scale—“PDF better than print,” “Both about the same,” and “Print better than PDF” (scale development outlined in Appendix A)<sup>4</sup>. Usage situation measures focused on respondents’ need for frequent searching, copying, immediate accessibility, permanence of content, and aesthetic use, each on a five-point scale (strongly disagree to strongly agree). For instance, “I often have a need to access and read the content from wherever I am.” Perception of the two formats on the continuum of perfect substitutes to perfect complements (perceived complementarity) was measured with a nine-point scale anchored at perfect substitutes (1) and perfect complements (9). In developing this measure, we used two separate scales for substitutes and complements in the pretests following Aaker and Keller (1990). Later we combined them into one scale based on the repeatedly high correlations obtained in the pretests in the context of our application. We also treat this perception as symmetrical between the formats given our specific measurement scale.

*Model functional form and estimation.* The relative quality measures for each attribute were converted to two indicator variables for effects coding: Indicator-1 equaled 1 if the

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<sup>4</sup> The mean ratings of overall quality for print and PDF were 7.81 (sd = 1.3) and 6.11 (sd = 1.8). With print rated higher than PDF, response of “both about the same” is likely to imply that both forms are high on that dimension.

respondent indicated that “*PDF is better than print*” on the attribute dimension, 0 if “*Print is better than PDF*,” and -1 if “*Both forms are of same quality*,” Indicator-2 took on a value 1 if “*Print is better than PDF*,” 0 if “*PDF is better than print*,” and -1 if “*Both forms are of same quality*.” The dependent variable, perceived complementarity, was regressed against usage situations, interactions among usage situations, and relative attribute quality variables and their interactions with usage situation variables.

< Insert Table 1 about here >

### *Results*

Support for H1a would be shown by significant interaction effects of usage situations and attributes on perceived complementarity. For a given usage situation, we would expect that complementarity perceptions would be higher when salient attributes are perceived as equivalent across the two formats than when either format is perceived as dominant on the attribute.

The regression model estimates are provided in Table 1. The adjusted *R*-square is 0.39. Although the analysis reveals several significant main effects, we focus on the interaction effects between usage situations and attributes, since these are relevant to H1a. A detailed analysis of the other significant effects is available in Appendix B. The interactions between attributes and usage situations were tested as a block and found to be significant ( $p < .001$ ). Table 1 reports the significant interactions, plus several marginally significant interactions that are significant in study 2 (to demonstrate the consistency across the two different dependent variables).

Significant interaction effects occurred for four of the five usage situations and four of the five attributes, suggesting that the predicted effect is strong. (The exceptions were the accessibility usage situation and the browsing attribute.) Specifically, for the usage situation of

searching, the interaction with image quality was significant and the interaction with convenience of use was marginally significant. The simultaneous tests for the difference in levels indicate that respondents with high frequency of searching who view the formats to be the same on image quality and convenience of use perceive the formats more as imperfect substitutes or complements than respondents high on searching who view either PDF or print as better (Same-PDF Better:  $\beta_{IQ} = .86$  and  $\beta_{CU} = .48$ ,  $p < .10$ ; Same-Print Better:  $\beta_{IQ} = .73$  and  $\beta_{CU} = .47$ ,  $p < .10$ ). In other words, the searching usage situation makes salient the attributes of image quality and convenience of use; when consumers view the PDF and print formats to be equal on those attributes, they see the formats as complements. This is consistent with the prediction of H1a.

Similarly, the usage situation of copying moderates the effects of three attributes—image quality, layout, and archival quality—on the dependent variable. Respondents high on copying who view the two formats to be of equal quality on those attribute dimensions consider the formats less as perfect substitutes and more as imperfect substitutes or complements than those high on copying who view either PDF or Print as better (Same-PDF Better:  $\beta_{IQ} = 1.08$  and  $\beta_L = 1.19$ ; Same-Print Better:  $\beta_{IQ} = .99$ ,  $\beta_L = .98$ , and  $\beta_{AQ} = .44$ ). This is consistent with H1a.

Finally, further support for H1a comes from the significant interactions of the usage situation of content permanence with the attribute of layout as well as the usage situation of aesthetic usage with the attribute of archival quality on perceived complementarity. Respondents high on content permanence/aesthetic usage who view the two formats as having the same quality on that attribute consider the formats more as imperfect substitutes or complements than those high on content permanence/aesthetic usage who view either PDF or print as better (Same-PDF Better:  $\beta_L = .55$  and  $\beta_{AQ} = .48$ ,  $p < .10$ ; Same-Print Better:  $\beta_{AQ} = .51$ ,  $p < .10$ ).

*Discussion.* The results of study 1 support our predictions for perceived complementarity.

The findings illustrate that usage situations make various attributes salient, resulting in different perceived complementarity between the formats. For all significant interactions terms, respondents who consider the formats to be of equal quality on an attribute perceive the formats more as imperfect substitutes or complements than those who view one format as dominant. This is consistent with our conceptual model. It is to be noted, however, that the number of significant interactions is limited. This could be due to the fact that the study is a survey where some variables, such as price, are not controlled for. In addition, the absence of significant interaction effects for the usage situation of accessibility or the attribute of browsing could imply that not all attributes are considered when making judgments. Study 2 controls for the effects of variables such as price, and measures actual purchase behavior.

## *STUDY 2*

Whereas study 1 examined the effects of usage situations and attributes on perceived complementarity, study 2 investigated the effects on the likelihood of buying the format bundle. It controls for the effects of price and other covariates such as perceived overall qualities of the individual formats and overall fit of the content to the respondents' needs. Based on H1b, we predict that likelihood of bundle purchase will be higher when two formats are perceived as having equal quality on a salient attribute than when one format is superior on a salient attribute. The study was conducted online and format price was manipulated due to the client's needs.

### *Method*

*Study design and procedure.* Customers were targeted as they were browsing online

(either on the title webpage or in the free browse section) a book for which a PDF format was available. When a customer examined a title, we assumed that he or she was seriously considering it<sup>5</sup>. Potential customers were intercepted at random and presented with the details of the PDF book using a pop-up window (i.e., PDF form description, a click button for a demo, download time, price) and were prompted to make a choice between the print format, the PDF format, the bundle, and none. If a customer did not choose the PDF book at the initial price, the price was dropped one level and the offer was presented again (see Appendix B and Kannan, Pope, and Jain 2009). After participating in the choice experiment, customers were given an additional incentive to fill out a survey. The experiment included about 500 titles that the publisher was already selling in print format for at least two months prior to the study. The print prices were kept at the existing level to minimize confounds due to reference effects. The PDF versions of the 500 titles were made available for sale for the first time during the study, and the information about the PDF format was provided only to study respondents. Prices of the PDF format were varied as per the details provided in Appendix B.

*Measures.* After participating in the choice experiment, in the subsequent survey respondents completed the same measures used in study 1, except for the question about the substitutability/complementarity of the product formats. We did not include process measures to avoid potentially biased responses from making the process externally accessible (Feldman and Lynch 1988). Additional measures were collected on the perception of overall quality of print

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<sup>5</sup> While there could be an issue of oversampling of buyers, our focus is on understanding the impact of the variables and not on the predictive power of the model.

and PDF formats<sup>6</sup>, the degree of fit of content to respondents' need (all nine-point scales), connection speed, availability of printer, and purchase for personal or office use. Finally, the experiment provided us with print price, PDF price as a percentage of print price, and choice. The bundle price was the sum of the print and PDF prices.

*Model.* The dependent variable was the actual choice among the two alternative product formats, the bundle, or no choice. We assume that the utilities of each format and the bundle are functions of the attribute quality perceptions, usage situations, their interactions, the price of each format and the bundle, and other covariates. This specification has significant support. For example, Lattin and McAlister (1985) formulate the utility of alternatives as a function of their attributes in a similar manner in the context of attribute satiation. Likewise, Wendel and Dellaert (2005) model consumers' utility of media channels as a function of usage situations, attributes of the channels and their interactions, and show that the interactions are significant in explaining consumers' consideration of media channels. Finally, Ratneshwar et al. (1997) show that the salience of usages and benefits has impact on consumers' selective attention to product features, which we seek to uncover using our interaction specification. Accordingly, we modeled respondents' choice as a function of the independent variables using a mixed-effects multinomial logistic regression model (a variant of the mixed-effects logit choice model), where the no-purchase option was the baseline category. Such a model allows us to directly measure the impact of the independent variables on the probability of buying the alternate formats and the bundle relative to the no-purchase option (Jank and Kannan 2005). Specifically, for a customer  $i$

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<sup>6</sup> The bundle choice likelihood may increase when the relative quality level of the formats is high on any attribute. Such increase may be a result of an overall increase in PDF quality as compared to print, and not necessarily because of parity on any dimension. To eliminate this confound we included perceived overall quality measures of the formats.

choosing alternative  $j$ , we model the log odds-ratio as:

$$\begin{aligned} & \text{Log}(\text{Probability of Purchasing } j / \text{Probability of No Purchase})_i \\ & = f(\text{Usage Situations, Attribute Quality Perceptions, Interactions, Price, Covariates})_i \quad (1) \end{aligned}$$

As in study 1, the relative quality perception measures for each attribute were converted to two indicator variables for effects coding: Indicator-1 equaled 1 if the respondent indicated that “*PDF is better than print*” on the attribute dimension, 0 if “*Print is better than PDF*,” and -1 if “*Both forms are of same quality*;” Indicator-2 took on a value 1 if “*Print is better than PDF*,” 0 if “*PDF is better than print*,” and -1 if “*Both forms are of same quality*.” This allows us to infer the impact of relative quality of the formats on each of the alternatives – print, PDF and the bundle – separately. The functional form of the model and the estimation details are listed in Appendix B<sup>7</sup>.

*Data description.* The data consists of 1,429 choice observations from 811 respondents along with their survey responses (after eliminating 13% of the respondents due to incomplete surveys and/or weblog). In the final sample, the shares of print, PDF, and bundle choices were approximately 19%, 22%, and 6%, respectively, with 53% not purchasing any of the formats.

## Results

Table 2 provides estimation details including the main effects of usage situations, interactions of usage situations, main effects of attributes, and the significant interactions of usage situations and attributes. Although there are some significant main effects, we focus only

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<sup>7</sup> Given that in our data some respondents have only one choice observation, we employ simulated log-likelihood methods (Train 2003) to estimate the mixed-effects model where the only random effects are the price coefficients. The multiple observations per respondent vary only on the price dimensions. Since we are interested in estimating only the distribution of the price parameters, mainly as a control, and not in individual customers’ taste parameters, we can identify the model using simulated log-likelihood estimation methods (see Train 2003, chapters 6 and 11, Bhat (1998), and Brownstone and Train (1999) for estimation in the context of cross-sectional data).

on the interactions that are relevant for our hypotheses in the following discussion. In the model results, price and other covariates are significant and are controlled for in analyzing our effects of interest. Discussion of main effects of usage situations and attributes along with model fit statistics, detailed price and other covariates estimates, and overall significance tests for blocks of interactions are provided in Appendix B. The mixed-effects multinomial logistic regression model has a significantly better model fit as compared to the fixed-effects logistic model.

< Insert Table 2 about here >

*Hypothesis testing.* H1b predicts an interaction effect of usage situations and attributes on the likelihood of buying the bundle. Table 2 highlights all significant interactions between usage situations and attributes. Support for H1b was found across all five usage situations and four of the five attributes (browsing was an exception again). In fact, all the significant interaction effects between usage situation and attributes found in study 1 were replicated with likelihood of buying the bundle as the dependent variable.

Significant interactions highlight how usage situations make salient specific attributes in impacting purchase probabilities of the formats and the bundle. Specifically, the usage context of searching renders the attributes image quality and convenience of use significant in impacting the purchase probabilities. Also, the usage context of copying makes salient image quality, archival quality, and layout, while content permanence triggers archival quality and layout, and aesthetic use makes salient image quality and archival quality. Further, the differences in the effect sizes (1) between the attribute qualities being the same across formats and PDF being better (Same Quality – PDF Better) and (2) between the attribute qualities being the same and Print being better (Same Quality – Print better) are provided in table 2 for Print, PDF and the bundle, so that the impact of the interaction can be assessed for each format and the bundle.

We describe one interaction – Search and Image Quality (#1) – in detail for interpretation. Given high searching usage, if respondents judge the formats to be of equal level on image quality, they are less likely to purchase the print format and more likely to buy the bundle than those who judge the print to be better (Same Quality –Print Better is -1.04 for print and 1.23 for bundle). Similarly, consumers high on searching usage who consider the formats similar on image quality are less likely to buy the PDF format and more likely to buy the bundle than those who evaluate the PDF as better (Same Quality –PDF Better is -2.03 for PDF and .93 for bundle). Similar results are observed for convenience of use in the context of searching and immediate accessibility (#2 and #3), and for archival quality and layout in the context of copying (#5 and #6). The other interaction results have the same pattern except that some impacts are not significant for one format or the other, but the bundle purchases are always positively affected when the respondents judge the attribute quality levels to be the same across formats as compared to judging one format to be better. Consequently, our results provide support for H1b.

Finally, regarding the impact on the purchase probabilities of the individual formats, all significant results are in the expected direction. If respondents judge PDF (Print) to be better on an attribute, then they are more likely to buy PDF (Print) than those who judge the attribute levels to be the same. The interactions between layout and content permanence (#7) and between image quality and aesthetic use (#9), do not impact the bundle probabilities significantly, even though they affect the probabilities of purchase of the individual formats in the expected directions. These results provide support for the lower branch of Figure 1.

*Discussion.* The results of study 2 are consistent with those of study 1 and with our conceptual model. Usage situations make different attributes salient in impacting the dependent variables. Immediate accessibility makes the convenience of use attribute salient while copying

increases the salience of layout and archival quality. As in study 1, browsing is not affected by any of the usage situations considered. Further, when the formats are perceived as equal in quality on an attribute dimension, the bundle purchase likelihood increases. Thus, the dependence relationship between the formats is further impacted by usage situations through the specific attributes they render salient and the relative perceptions of the formats on those attributes. Next, we conduct a lab study to examine the predictions in a more controlled environment while testing the underlying process.

### *STUDY 3*

We designed this study was to test all three hypotheses together and to generalize to a different product category. According to H2, when two formats are of equal quality on a salient attribute, consumers will think about additional usage situations and about the flexibility provided by the bundle compared to when one of the formats dominates the other. In addition, H3 suggests the number of usage situations, flexibility, and perceived complementarity mediate the effect on bundle purchase likelihood.

The purchase situation involved subscription to a movie rental service; the two product formats were Internet subscription and DVD-by-Mail subscription. Three attributes of the movie rental formats were shown: one salient common attribute (easy to manage online), which was manipulated to be either equivalent or not, and one unique attribute for each format. The unique attributes were instant access to movies/TV episodes on which the internet option was always higher, and selection of movies/TV episodes, on which the DVD option was always higher.

### *Method*

*Design and procedure.* One hundred and sixteen undergraduate students enrolled in marketing classes participated in the study. They were a part of respondent pools at two universities and were randomly assigned to treatments. The study was a 2 (salient attribute quality for internet format: low, high) by 2 (salient attribute quality for DVD format: low, high) between-subjects design. We told respondents that they were considering subscribing to a movie rental service, which was offered in two formats: Internet and DVD-by-Mail. They were shown consumers' attribute ratings of the two formats. The first (therefore salient) attribute for each format was the ease of managing online, which was manipulated as either 4.7 (high) or 2.5 (low) depending on the condition. Thus, in the high internet-high DVD (low internet-low DVD) condition, both formats were rated as 4.7 (2.5) on being easy to manage online. In the two mixed conditions, one format was rated as high, and the other low. The second listed attribute of each format was instant access to movies/TV episodes, and this was dominated by the Internet option across all conditions (rated 4.8 for Internet and 3.5 for DVD). The final listed attribute was selection of movies/TV episodes, and this was dominated by the DVD format (rated 3.7 for Internet and 4.9 for DVD) across all conditions. The stimuli are presented in Appendix C.

The primary dependent variable was preference, measured by asking respondents to allocate 100 points to the subscription options – Internet (\$6.99), DVD-by-Mail (\$6.99) or both (\$9.99). After the point allocation task, respondents were asked to write down the thoughts they had when considering the three movie rental options. The open-ended protocols were coded for two process measures: the number of usage situations and thoughts about the flexibility provided by the formats. The number of usage situations variable was created by counting the usage situations the respondents listed (e.g., “often I’m sitting around and randomly want to watch a

movie,” “if I want to see a movie now when I’m in a mood,” “watch movies anywhere I want to with my iPhone,” “when I travel”). Thoughts about flexibility were measured as 1 = mentioned or 0 = not mentioned. (e.g., “I wanted the most flexibility and so I had most points for the last option,” “By getting both options I will be able to watch movies instantly and get DVDs by mail in case I want to see a new release”). Next, respondents evaluated the perceived complementarity of the formats [“The Internet and DVD-by-Mail subscription options are: 1 = substitutes (can be used interchangeably), 7 = complements (there is extra benefit in having both formats)]. They also rated the quality of the Internet and DVD subscription options (1 = low quality, 7 = high quality); these were manipulation checks for the two factors. We then asked how distinctive Internet and DVD subscriptions were on the three listed attributes (1 = not at all distinctive, 7 = very distinctive), and about the importance of these attributes (1 = not at all important, 7 = very important). Finally, we measured some control variables and potential confounds: choice difficulty (“How easy or difficult was to choose between the Internet and DVD-by-Mail subscription?” 1 = very easy, 7 = very difficult), access to DVD player and Internet (“How easy or difficult is for you to get access to a DVD player/Internet?” 1 = very easy, 7 = very difficult), whether respondents subscribed to a movie rental service at the moment, and how often they watched movies/TV shows online and on DVD.

### *Results*

*Manipulation checks.* A 2 x 2 ANOVA with salient attribute quality of formats as factors and perceived quality of the internet format as dependent variable revealed a significant main effect of salient attribute quality of Internet ( $F(1, 112) = 9.92, p < .01$ ); the other effects did not reach significance ( $p$ 's  $> .16$ ). Specifically, the Internet subscription options was perceived as

being of higher quality when the Internet option was rated high rather than low on the salient attribute, easy to manage ( $M_{highint} = 5.61$  and  $M_{lowint} = 4.91$ ). Similarly, a 2 x 2 ANOVA with salient attribute quality of formats as factors and perceived quality of the DVD-by-Mail format as dependent variable revealed a significant main effect of salient attribute quality of DVD-by-Mail ( $F(1, 112) = 5.52, p < .05$ ); the other effects were not significant ( $p$ 's  $> .74$ ). Specifically, the DVD-by-Mail subscription options was perceived as being of higher quality when the DVD-by-Mail option was high than low on being easy to manage ( $M_{highdvd} = 5.75$  and  $M_{lowdvd} = 5.05$ ). Thus, quality of the two formats on the salient attribute was manipulated as intended.

Finally, to ensure that the importance of the attributes did not differ across conditions, we ran 2x2 ANOVAs on the importance of each of the three attributes (easy to manage online, instant access and selection). There were no significant treatment effects on the importance of the three attributes.

*Bundle preference.* The primary dependent variable was bundle preference, which was expected to be higher when both formats were of equal quality than when one format dominated the other (H1b). Consistent with H1b, a 2x2 ANOVA on bundle preference revealed a significant interaction ( $F(1, 112) = 10.47, p < .01$ ). Planned contrasts revealed that respondents allocated significantly more points to the bundle when both formats were of equal quality (high-high or low-low) on the salient attribute than when one format dominated ( $M_{high-high} = 47.43$  and  $M_{lowint-highdvd} = 27.90, F(1, 112) = 6.37, p < .05$ ;  $M_{high-high} = 47.43$  and  $M_{highint-lowdvd} = 31.55, F(1, 112) = 5.45, p < .05$ ;  $M_{low-low} = 45.97$  and  $M_{lowint-highdvd} = 27.90, F(1, 112) = 5.12, p < .05$ ;  $M_{low-low} = 45.97$  and  $M_{highint-lowdvd} = 31.55, F(1, 112) = 4.14, p < .05$ ). These results support H1b.

< Insert Table 3 about here >

*Process measures.* H3 predicted that the effects on bundle preference would be mediated by the number of usage situations, perceived flexibility of the formats, and perceived complementarity. In order to show mediation, we first demonstrate that respondents thought of more usage situations (H2a), considered the flexibility provided by the formats (H2b), and perceived the bundle items as more complementary (H1a), when the two formats had equivalent quality on the salient attribute. Consistent with H2a, a 2x2 ANOVA on the number of usage situations listed in the protocols revealed a significant two-way interaction ( $F(1, 112) = 11.33, p < .01$ ) and no other significant effects. As with bundle preference, respondents listed more usage situations when both formats were of equal quality on the salient attribute than when one format dominated ( $M_{high-high} = .70$  and  $M_{lowint-highdvd} = .21, F(1, 112) = 6.41, p < .05$ ;  $M_{high-high} = .70$  and  $M_{highint-lowdvd} = .38, F(1, 112) = 3.59, p < .06$ ;  $M_{low-low} = .77$  and  $M_{lowint-highdvd} = .21, F(1, 112) = 7.89, p < .01$ ;  $M_{low-low} = .77$  and  $M_{highint-lowdvd} = .38, F(1, 112) = 4.93, p < .05$ ), supporting H2a.

Consistent with H2b, a logistic regression with the percent of respondents who mentioned flexibility as dependent variable revealed a significant two-way interaction ( $\chi(1) = 9.04, p < .01$ ). Respondents were more likely to consider the flexibility of buying the bundle when both formats were of equal quality on the salient attribute than when one format dominated ( $M_{high-high} = .49$  and  $M_{lowint-highdvd} = .21, \chi(1) = 3.78, p < .05$ ;  $M_{high-high} = .49$  and  $M_{highint-lowdvd} = .24, \chi(1) = 4.01, p < .05$ ;  $M_{low-low} = .52$  and  $M_{lowint-highdvd} = .21, \chi(1) = 4.31, p < .05$ ;  $M_{low-low} = .52$  and  $M_{highint-lowdvd} = .24, \chi(1) = 4.61, p < .05$ ). Thus, as predicted, respondents saw the bundle as providing greater flexibility when the formats were equivalent on a salient attribute.

Finally, a 2x2 ANOVA on perceived complementarity revealed a marginally significant interaction ( $F(1, 112) = 3.64, p = .059$ ). Consistent with H1a, respondents perceived the formats as more complementary when both formats were of high quality on the common attribute as

compared to when the Internet format dominated the DVD format ( $M_{high-high} = 5.57$  and  $M_{highint-lowdvd} = 4.52$ ,  $F(1, 112) = 6.37$ ,  $p < .05$ ); the other contrasts were in the expected direction but not significant ( $M_{high-high} = 5.57$  and  $M_{lowint-highdvd} = 4.84$ ,  $F(1, 112) = 1.97$ ,  $p = .16$ ;  $M_{low-low} = 5.13$  and  $M_{lowint-highdvd} = 4.84$ ,  $F(1, 112) = .29$ ,  $p = .59$ ;  $M_{low-low} = 5.15$  and  $M_{highint-lowdvd} = 4.52$ ,  $F(1, 112) = 1.67$ ,  $p = .20$ ). This pattern of results is consistent with H1a that complementarity perception is higher when both formats are of equal quality than when one format dominates.

Following the mediation procedure outlined in Baron and Kenny (1986), we ran separate 2x2 ANCOVAs with each of the proposed mediators as a covariate and bundle preference as the dependent variable. These analyses showed that each of the three variables mediated the effects on bundle preference with number of usage situations and flexibility having a slightly stronger effect than perceived complementarity<sup>8</sup>.

Figure 1 also shows that perceived complementarity mediates the effect of number of usage situations listed and flexibility on bundle choice. Following the procedure outlined above, we found that complementarity partially mediated the effects of both usage situation (Sobel  $z = 2.66$ ,  $p < .01$ ) and flexibility (Sobel  $z = 2.95$ ,  $p < .01$ ) on bundle preference. Consistent with Figure 1, the number of usage situations and the flexibility of the format had both direct and indirect effects on bundle preference.

*Control variables.* Finally, additional analyses ruled out possible alternative explanations,

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<sup>8</sup> The effect of usage situations on points allocated to the bundle was significant ( $F(1, 111) = 6.29$ ,  $p < .05$ ), while the two-way interaction was less significant ( $F(1, 111) = 5.74$ ,  $p > .05$ ). A Sobel test revealed that the number of usage situations partially and significantly mediated the effect of attribute quality of the formats on bundle choice (Sobel  $z = 2.01$ ,  $p < .05$ ). Similarly, the effect of flexibility on points allocated to the bundle was significant ( $F(1, 111) = 25.55$ ,  $p < .001$ ), while the two-way interaction was less significant ( $F(1, 111) = 4.20$ ,  $p > .05$ ). Flexibility partially and significantly mediated the effect of attribute quality on bundle choice (Sobel  $z = 5.28$ ,  $p < .01$ ). Finally, the effect of complementarity on points allocated to the bundle was significant ( $F(1, 111) = 26.08$ ,  $p < .001$ ), while the two-way interaction was less significant ( $F(1, 111) = 6.85$ ,  $p > .05$ ). A Sobel test revealed that perceived complementarity partially and marginally mediated the effect of attribute quality on bundle choice (Sobel  $z = 2.01$ ,  $p = .07$ ), supporting the findings of studies 1 and 2.

such as effects of choice difficulty or familiarity with the different formats. None of these variables affected the results.

*Discussion.* Study 3 shows that when the quality of the formats on a salient attribute is equal across formats, respondents consider more usage situations while making a choice, and are more likely to select the format bundle as compared to when one format dominates the other on this common attribute. This supports the results of both field studies, attesting to the robustness of our findings. Also, the study shows support for the predicted underlying process. When the product formats were of equal quality, consumers considered more possible usages for the formats, thought of the flexibility of using both formats in the future, and perceived them as complements, thereby increasing the likelihood of buying the bundle.

### *GENERAL DISCUSSION*

The objective of the paper was to examine consumers' evaluations of bundles of product formats in information categories. Our theoretical framework suggests that the purchase likelihood of a bundle of formats increases when the quality of salient attributes is equally high or equally low *and* the formats provide other unique benefits. In particular, we suggest that consumers may approach a purchase decision with a particular usage situation (e.g., "I want to subscribe to a movie rental service to watch movies when I'm bored"). This usage situation makes salient certain attributes (e.g., the ease with which I can manage the subscription). If the multiple formats offered (e.g., Internet vs. DVD-by-Mail subscription) are perceived as equivalent on those attributes, consumers may examine the unique attributes of each format. In this case, if both internet and DVD subscriptions are equally easy or difficult to manage,

consumers may assess the speed with which they can acquire a movie or the breadth of selection. Finding that each format is superior on a different attribute may encourage consumers to think about other usage situations in which each format is beneficial. Buying both formats will provide consumers with greater flexibility, leading them to perceive the two as fairly complementary. Therefore, consumers will be more likely to purchase the bundle than in the situation in which one format dominates on the salient attribute. This conceptual model is tested in three studies that employ a variety of methodologies: a survey, a field study, and a lab experiment. The results generalize across two product categories, suggesting that the model applies across a variety of information products.

An important contribution of this research is the counterintuitive finding that even when the formats are perceived as equally poor on a salient attribute, consumers may end up buying both formats. Because common attributes cancel out when choosing between alternatives, consumers no longer consider those and instead focus their attention on the unique positive attributes of each format. Our research highlights the unique role of design in the context of multi-format products by showing that design can redirect attention from intended usage to a broader scope of potential usages that necessitate flexible formats. The implication for designing multi-format options is clear: each format should fulfill the consumer's basic functional goals, yet highlight unique dimensions on which each excels. This encourages consumers to rethink their decision making such that they choose the bundle of formats rather than a single format.

Moreover, our studies show how variations in non-price attribute quality levels impact complementarity perceptions and bundle choice, thus complementing extant studies in bundling that focus on price (e.g., Stremersch and Tellis 2002). Our results also lend empirical support to analytical research in retail economics (e.g., Betancourt and Gautschi 1992) and theoretical

research in marketing (Shocker, Bayus, and Kim 2004) suggesting that the same items could be substitutes in the context of one usage situation and complements in the context of another. We reveal the process that drives such complementarity perceptions – that is, usage situations increasing the salience of specific attributes and the formats having similar quality levels on these attributes. Thus, while PDF and print could be substitutes for any specific use, if they are equally attractive on common attribute dimensions, then customers may consider them complementary because of the flexibility provided for future distinctive usages for the formats.

### *MANAGERIAL IMPLICATIONS*

Given that an entire class of information product formats is emerging, our findings are very important from a theoretical as well as from a practical, product/content design perspective. We discuss the implications for how managers may design and market multi-format products to increase the attractiveness of format bundles when such a strategy can boost revenues.

Our research findings provide useful answers for some of the critical questions that face marketers of digital products. Traditionally, these firms have tended to view the different formats in which they can sell content as substitutes – sometimes one format being a poor substitute for the other. This mindset has resulted in marketing decisions being more difficult to make for the firms. A specific example is pricing the individual formats given the lower price expectations for online/digital formats and the possibility of cannibalization of one format by the other. Another example is making the channel decisions for the different formats where the traditional format is sold through retailers, while the lower price online formats are sold directly, leading to channel conflicts. In other words, the “substitutes” mindset has led content providers to sub-optimal

pricing decisions such as keeping the online digital formats relatively high (Vascellaro and McBride 2006) to avoid cannibalization and channel conflicts.

Even those firms who understand the appeal of the bundle of formats (the WSJs and the Amazons) tend to view the bundling problem as just a pricing problem. Our results suggest that it is more than a pricing problem. Specifically, it is possible to *design*, in terms of the attributes, the bundle of formats to make it more appealing to customers. Design may be used by marketers as a tool to encourage a dialogue between firms and customers regarding the potential usage of the formats in usage situations customers may encounter in the future<sup>9</sup>. Thus, regardless of whether a firm decides to follow a pure bundling strategy or a mixed bundling strategy, our research provides specific guidelines on how to make the bundle offering more attractive. Using the knowledge of how usage situations make some attributes salient and differentially impact the purchase probability of the bundle, managers can refine their digital format designs and communication strategies. For example, a consumer with a searching usage may seek to purchase the PDF format. Emphasizing this usage is likely to favor the purchase of the PDF format. However, searching renders the attributes of image quality and convenience of use salient. If the print format is enhanced in its image quality and convenience of use dimensions to match those of the PDF format, then the purchase probability of the bundle will increase. Similarly, a consumer looking to buy a print format for aesthetic use may choose the bundle instead if the PDF format is equal to the print in its perceived archival quality. Working on just the image quality attribute of the PDF format will not help in this regard. Thus, publishers should communicate the equally high relative qualities of the formats on salient attribute dimensions to

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<sup>9</sup> We thank reviewer 1 for this phraseology.

enable customers to see the value of the product format bundle. A detailed understanding of the specific attributes made salient by specific usage situations can provide clear guidelines for product format design and for persuasive selling of the bundle through usage-specific advertisement strategies. A segmentation of consumers based on usage situations can help in targeting such communication messages.

Second, our results show that regardless of whether a usage situation is distinctive usage for a specific format or common usage across both formats, if the formats are equal in quality on the attribute dimensions that the usage situation highlights, the probability of purchasing the bundle clearly increases, *ceteris paribus*. Thus, emphasizing copying, which is a common usage for both formats, is likely to render the two formats as substitutes, but ensuring that the two formats are equally high on the salient dimensions of image quality, archival quality, and layout is likely to make the forms equally attractive and more complementary. This clearly implies that content providers should strive to make the quality of the formats equally high on beneficial attributes. Not only the design attributes should be objectively enhanced (by having a high quality digital offering), but also the enhanced attributes should be communicated to consumers.

Finally, our results should help content providers overcome the “substitutes” mindset and view the format bundle as a significant opportunity to increase revenues. In contrast to the current practice of making one format a poor substitute of the other to avoid cannibalization and channel conflict, firms should strive to make the formats equally high on quality attributes, thus making the formats equally attractive for customers and compel them to buy both formats. High quality for all formats may provide flexibility in use for customers, and such flexibility does not arise when one format is inferior to the other. Thus, a bundle of a hard-copy print book and a Kindle version could be as appealing as a DVD + Video on Demand for Amazon customers.

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Table 1: Regression Results for Perceived Substitutability/Complementarity

Independent Variable		Parameter Estimate	Standard Error	
Intercept		5.981 ***	1.376	
<i>Usage Situation</i>				
Searching	USr	-0.136	0.278	
Copying	UCy	0.250	0.307	
Accessibility	Uac	-0.488 *	0.234	
Content Permanence	UPr	-0.219	0.331	
Aesthetic Use	UAs	0.975 **	0.313	
<i>Usage Situation Interactions</i>				
Searching*Aesthetic Use	USr*UAs	0.108	0.058	

Independent Variable	Overall	Parameter Estimates of Levels			Difference in Levels	
	Significance (F-Test)	PDF Better	Print Better	Same	Same-PDF Better	Same-Print Better
<i>Attribute</i>						
Image Quality	0.049	-1.759	-0.413	2.172	3.931 *	2.585 *
Layout	0.543	0.049	0.458	-0.507		
Browsing	0.335	-0.472	0.072	0.400		
Convenience of Use	0.765	0.128	0.042	-0.170		
Archival Quality	0.213	0.106	-0.727	0.606		
<i>Attribute and Usage Situation Interactions</i>						
USr* Image Quality	0.023	-0.330	-0.202	0.532	0.862 *	0.734 *
USr*Convenience of Use	0.059	-0.165	-0.151	0.316	0.481	0.467
UCy*Image Quality	0.002	-0.392	-0.298	0.690	1.082 *	0.988 *
UCy*Layout	0.006	-0.470	-0.254	0.724	1.194 **	0.978 *
UCy*Archival Quality	0.014	0.020	-0.229	0.209	0.189	0.438 *
UPr*Layout	0.058	-0.385	0.218	0.167	0.552 *	-0.051
UAs*Archival Quality	0.086	-0.148	-0.180	0.328	0.476	0.508

Block Tests for Overall Interactions Significance	df	F
All Usage Situation Interactions	10, 823	1.90 *
All Usage Situation and Relative Attributes Interactions	75, 823	2.27 ***
All Usage Situation Interactions & All Usage Situation and Relative Attributes Interactions	85, 823	2.79 ***

Notes: 1) \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$   
2) N = 930

Table 2: Multinomial Logistic Regression Model Results

Independent Variable	Impact on Purchase Probability of:			
	Print	PDF	Bundle	
<i>Usage Situations</i>				
Searching	0.238	-0.830	-0.612	
Accessibility	-0.828 **	0.282	0.609	
Copying	-0.031	0.191	0.997	
Content Permanence	0.963 *	-0.449	-0.376	
Aesthetic Use	0.342	0.220	1.409	
<i>Usage Situation Interactions</i>				
USearch * UAesthetics	-0.309 *	-0.151	0.253 *	
UAccessibility * Upermanence	-0.138 *	0.125 *	0.338 *	
<i>Attributes</i>				
Image Quality	<i>Same – PDF better</i>	3.183	0.124	-2.437
	<i>Same – Print better</i>	1.257	-7.472	3.343
Layout	<i>Same – PDF better</i>	-0.139	-0.082	4.104
	<i>Same – Print better</i>	-0.530	2.377	-0.477
Browsing	<i>Same – PDF better</i>	-0.082	0.319	0.736
	<i>Same – Print better</i>	-0.140	0.605 *	0.758
Convenience of Use	<i>Same – PDF better</i>	-1.226	-0.640	3.970
	<i>Same – Print better</i>	-1.750	0.580	2.966
Archival Quality	<i>Same – PDF better</i>	-0.458	-1.635	-0.729
	<i>Same – Print better</i>	-1.705	0.438	3.189
<i>Attributes and Usage Situations Interactions</i>				
Search*Image Quality (#1)	<i>Same – PDF better</i>	-0.042	-2.033 **	0.927 *
	<i>Same – Print better</i>	-1.044 *	-0.076	1.233 *
Search*Convenience of Use (#2)	<i>Same – PDF better</i>	0.356 *	-0.119	0.763 *
	<i>Same – Print better</i>	-0.287 **	0.032	0.767 *
Accessibility*Convenience of Use (#3)	<i>Same – PDF better</i>	-0.566	-0.202	0.612 *
	<i>Same – Print better</i>	-0.808 *	0.085	1.251 *
Copying*Image Quality (#4)	<i>Same – PDF better</i>	0.801 *	-0.535 *	-0.765 *
	<i>Same – Print better</i>	-1.819 *	0.178	0.741 *
Copying*Archival Quality (#5)	<i>Same – PDF better</i>	0.456 *	-0.427 *	0.384
	<i>Same – Print better</i>	-0.399 *	0.154	0.333
Copying*Layout (#6)	<i>Same – PDF better</i>	0.205	-0.338 *	1.531 *
	<i>Same – Print better</i>	-0.637 *	0.818 *	1.028 *
Permanence*Layout (#7)	<i>Same – PDF better</i>	1.344 *	-0.729	-0.213
	<i>Same – Print better</i>	-0.024	0.300	0.330
Permanence*Archival Quality (#8)	<i>Same – PDF better</i>	0.392 **	0.070	3.327 **
	<i>Same – Print better</i>	-0.476 **	0.773 *	3.243 **
Aesthetic*Image Quality (#9)	<i>Same – PDF better</i>	-0.290	-0.380	0.395
	<i>Same – Print better</i>	-1.321 *	1.691 *	0.394
Aesthetic*Archival Quality (#10)	<i>Same – PDF better</i>	0.909 **	-0.360	0.540 *
	<i>Same – Print better</i>	0.270	-0.006	0.894 *

Notes: 1) \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ ;

2)  $N = 1,429$

3) We tested for differences in levels of each attribute (Same-PDF better, Same-Print better) only when the overall Wald test for the attribute effect (an omnibus test for the attribute) was significant.

4) Only the significant attribute by usage situation interactions are reported.

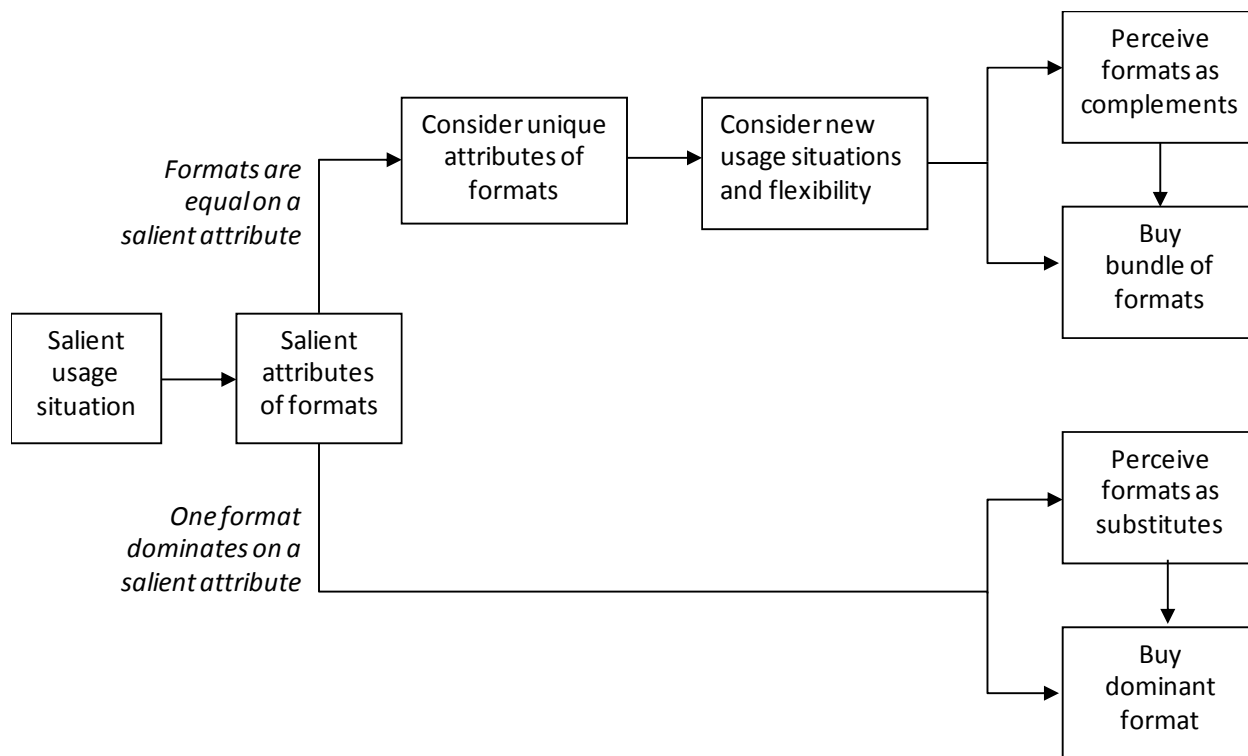
Table 3: Study 3 Cell Means

	<u>Internet low on salient attribute</u>		<u>Internet high on salient attribute</u>	
	DVD low	DVD high	DVD low	DVD high
Bundle preference*	45.97	27.90	31.55	47.43
Perceived complementarity**	5.13	4.84	4.52	5.57
Number of usage situations mentioned	0.77	0.21	0.38	0.70
Flexibility mentioned (% participants)	52%	21%	24%	49%

\* Measured on 100 point scale

\*\* Measured on 7-point scale

Figure 1: Theoretical Framework



## APPENDIX A

### Relative Attribute Qualities Scale

We examined several alternative scales for measuring the relative qualities of the two forms – print and PDF – on the five attribute dimensions. Following Wind, Denny and Cunningham (1979), we narrowed the choice to two options - a paired comparison scale, where the two forms are compared directly against each other (Print better than PDF, PDF better than Print, Both Same on the attribute dimension) and a monadic rating scale, where each form is rated on scale 1 through 5 (Poor to Excellent) on each attribute dimension. We did a pre-test of each scale with a different respondent group (group 1 with n = 60 and group 2 with n= 55). Each respondent rated the two forms on each of the attribute dimension using either the paired comparison scale or the monadic rating scale, and then made a choice among three alternatives (1) Prefer PDF, (2) Prefer Print, (3) Indifferent between Print and PDF. Each respondent was also asked a series of questions to elicit the degree of difficulty of the task, more details on their preferences, and details on the comparisons they did on each attribute. We ran a multinomial logistic regression model for each group, predicting choice as a function of the attribute dimension data. The Pseudo-R-Square values were higher for the paired comparison group as compared to the monadic rating group (52.8% versus 35.7%), indicating that the paired comparison measure performs better in predicting ultimate choice. The monadic rating scale requires respondents to provide 10 observations (rating each of the form on each of the five attribute dimensions) whereas respondents provide only 5 observations on the paired comparison scale. We conjecture that the paired comparison measure is much easier for respondents to process which could have led to this result. In a split half reliability test using 3-group discriminant analysis, the paired comparison scale outperformed the monadic rating scale marginally. Given the above results, we chose the paired comparison scale for studies 1 and 2.

We also examined the use of a four-point scale of “PDF better than Print”, “Print better than PDF”, “Print and PDF both high” and Print and PDF both low” against the three-point scale of “PDF better than Print”, “Print better than PDF”, “Print and PDF both equal.” With regard to studies 1 and 2, in initial interviews and the above pre-tests we found that customers tended to rate print generally higher than PDF in attribute quality dimensions and whenever they rated PDF to be equal to print on any dimension they usually indicated them to be “high” on that dimension, and very rarely both of them were “low” on that dimension. Thus, in deciding between a 4-point scale versus 3-point scale, we chose the three-point scale as it meant estimating less number of parameters and cutting down of a significant number of confusing contrasts in studies 1 and 2.

## APPENDIX B

### Study 1 Results – Main Effects

We highlight the important significant main effects (unless specified, all coefficients are significant at  $p < .05$  or better, please refer to Table 1 for details). Among the main effects of the usage situations, immediate accessibility has a negative impact on the complementarity perception ( $\beta = -.49$ )—respondents with high frequency of this common usage are more likely to view the forms as perfect substitutes rather than imperfect substitutes or complements. On the other hand, respondents with higher frequency of aesthetic use (a unique usage for print) view the formats less as perfect substitutes than imperfect substitutes or complements ( $\beta = .98$ ). Regarding interactions between usage situations, higher frequency of use for both searching (unique for PDF) and aesthetic use (unique for print) is associated with higher perceived complementarity between the formats ( $\beta = .11, p < .10$ ). The impact of relative attribute quality levels of the formats is discussed next. The overall significance of an attribute dimension based on the omnibus  $F$ -test is presented in column 1 of Table 1, followed by the mean estimates for each level (PDF Better, Print Better, and Same), and the difference in levels (Same – PDF Better, Same – Print Better) tested for significance using simultaneous confidence intervals. Among the attribute dimensions, only the main effect of image quality is significant ( $\beta = .05$ ). The levels' differences for image quality are also significant (Same–PDF Better = 3.93; Same–Print Better = 2.59). Respondents who indicate that the two formats are the same on image quality perceive the two formats more as imperfect substitutes or complements than those who indicate that PDF is better (by 3.93 on the dependent variable) or print is better (by 2.59 on the dependent variable). The main effect is not the final interpretation as significant interactions are present.

### Study 2 Details

#### *Setting the PDF Format Prices*

PDF prices were set at 110%, 100%, 75%, 50%, 25% and 0% of the print prices. If a customer did not choose the PDF book at the initial price, the price was dropped one level and the offer was presented again. Since the initial price that a customer sees is randomized across titles, genre & popularity, every customer has the same probability of getting a lowered PDF price offering. This assures no selection bias in the sampling procedure. The PDF prices of the 500 titles were set in such a way that, within a subject category, each the print book price level was associated with each of the six different PDF price levels. For example, the PDF versions of print titles in the education category with a print price of \$30 were priced at levels ranging from 110% to 0% of the print book price with approximately equal shares for the 100% to 25% levels (one in five), and less shares for the 110% and 0% levels (one in ten). The PDF prices were also assigned to achieve similar share balance across the number of visits for the specific titles (a measure of popularity and potential sales). Thus, among the \$40 “most popular” books, the initial PDF prices were assigned to cover all the PDF price ranges (110% to 0%). Finally, every consumer who considered a specific book in the experiment was presented with the same PDF price (price was randomized across books but not across consumers). This ensured that the results were valid

for all categories of subjects, price levels of print books, and all levels of potential sales.

### *Model Functional Form and Estimation*

$$\log\left(\frac{\pi_{ij}}{\pi_{ij^*}}\right)_{\gamma} = \alpha_j + x_i^T \beta_j + z_{ij}^T \gamma_{ij} + \sum_m (\tau_{1mj} \cdot (I_{i,m,PDF}) + \tau_{2mj} \cdot (I_{i,m,Print})) + \text{Interactions}, \quad (\text{A1})$$

where  $\pi_{ij}$  is the probability that respondent  $i$  chooses option  $j$ , and the log of the probability ratio is conditional on the random price effects  $\gamma$ . (Note that this functional form is just a variant of the well-known conditional logit model). The  $x_i$ 's are the respondent specific usage situations and other covariates (perceptions of overall print and PDF quality, degree of fit of content, etc.), and  $z_{ij}$ 's are the prices of the print and PDF forms.  $I_{i,m,PDF}$  and  $I_{i,m,Print}$  represent the effects coding on attribute  $m$  that captures respondent  $i$ 's perception of relative quality of the forms on that attribute. For example,  $I_{i,m,PDF}$  is coded as 1 if PDF is better than print on attribute  $m$ , 0 if print is better than PDF, and -1 if both are about the same on that attribute. So,  $\tau_{1mj}$  and  $\tau_{2mj}$  capture the impact of perceived attribute levels on the log-odds ratio. The last term in Equation A1 is the interactions between usage situations and attributes (this is not expanded to keep the exposition simple). In the multinomial logistic regression model, price effects were treated as random to estimate and control for their impact on purchase likelihoods as accurately as possible while studying the impact of usage situations and attribute qualities. This ensures that variations in responses to price (heterogeneity) do not bias the results. We used simulated log likelihood to estimate the model (Revelt and Train 1998; Train 2003). The log likelihood expression is:

$$l(\alpha, \beta, \tau, \gamma) = \int_{\gamma} l(\alpha, \beta, \tau | \gamma) f(\gamma) d\gamma \quad (\text{A2})$$

where  $l(\alpha, \beta, \tau | \gamma)$  is the likelihood of a standard multinomial logistic regression model conditional on  $\gamma$ , and  $f(\gamma)$  is multivariate normal with zero mean vector and covariance matrix  $\Sigma$ . We took  $r = 50$  draws from the mixing distribution  $f(\gamma)$  and approximated the integral by an average computed over these random draws to get the simulated likelihood values. As the formulation suggests, in the estimation price coefficients were allowed to covary. Most of the correlations were not significant, with the exception of the following positive ones: print price on PDF price & print price on bundle price, PDF price on PDF price & PDF price on print price, PDF price on PDF price & PDF price on bundle price ( $p < .05$ ). Although we are not directly interested in price effects and add price variables in the model only as a control, it is reassuring to note that their effects are in the expected directions. As print price increases, the purchase likelihood of the print form decreases, indicating a general tendency to buy lower-priced content. The print price's impact on PDF purchase is positive, indicating a tendency towards buying PDF when the print price is relatively high. As PDF price increases, it impacts the PDF and bundle purchases negatively ( $\beta = -.03$  and  $\beta = -.04$ ), highlighting the importance of PDF's absolute price on bundle purchases. Detailed price and other covariates estimates, model fit statistics and overall significance tests for blocks of interactions are provided below.

<b>Model Fit Statistics</b>			
<b>Multinomial Logistic Model</b>		<b>Mixed- Effects</b>	<b>Fixed- Effects</b>
Log-Likelihood		-1129.74	-1167.62
AIC		2529.48	2583.24
BIC		3240.22	3262.39

<b>Covariates</b>		<b>Print</b>	<b>PDF</b>	<b>Bundle</b>
Intercept		1.733	2.398	-9.493 *
Overall Fit of Content		0.244 *	0.039	0.180 *
Perceived PDF Quality		-0.235 ***	0.195 ***	0.123 *
Perceived Print Quality		0.166 **	-0.178 **	0.257 *
Price Variables (Random Parameters)	Print Price – Mean	-0.047 **	0.023 *	-0.015
	Print Price – Std. Dev	0.029 **	0.021 **	0.027 **
	PDF Price – Mean	0.009 *	-0.034 *	-0.043 **
	PDF Price – Std. Dev	0.031	0.047	0.068 **

<b>Overall Wald Test for Interaction Significance</b>		
All Usage Situation Interactions		p < .001
All Usage Situation and Relative Attributes Interactions		p < .001
All Usage Situation Interactions & All Usage Situation and Relative Attributes Interactions		p < .001

*Main effects and interactions between usage situations.* Although the main effects cannot be viewed in isolation when there are significant interactions, we highlight a few interesting ones (unless specified, all coefficients are significant at  $p < .05$  or better; refer to Table 2 for details). While immediate accessibility has a negative impact on print purchase ( $\beta = -.83$ ), content permanence has a positive impact on print purchase ( $\beta = .96$ ). Thus, the need to have immediate accessibility makes respondents less likely to buy the print version; in contrast, the need to store the contents for reference for a long time increased purchase of the print version. None of the usage situations has a significant direct impact on the likelihood of buying the PDF format or the bundle.

Results also indicate that respondents with higher frequency of both searching and aesthetic usages (distinctive usages for PDF and print, respectively) are more likely to purchase the bundle at the expense of the individual formats ( $\beta = .25$ ). The interaction of immediate accessibility and content permanence positively impacts the purchase probabilities of the bundle and the PDF format ( $\beta = .34$  and  $\beta = .13$ ). To measure the impact of the different levels of each attribute, we conduct an overall Wald test for each attribute effect (an omnibus test for the attribute) and identify the differences in levels (Same – PDF Better, and Same – Print Better) that contribute to the significance using simultaneous confidence bands. None of the relative attribute levels impacts any of the formats directly except for browsing. Browsing impacts the PDF purchase likelihood positively when respondents judge the formats to be of same quality as opposed to when they judge print to be better (difference = .61).

## APPENDIX C

### Study 3 Stimuli

Please imagine that you are actually considering subscribing to a movie rental service. For you it is very important to be able to easily manage your account online including signing up, browsing movies and TV shows, reading reviews, placing titles in your preferred list/queue and ordering movies and TV shows.

You decide to visit the website of the company ([www.easyrent.com](http://www.easyrent.com)) to gather information about different subscription options. You come across the following information:

#### **Subscribe Today! EasyRent.com**

With more than 10 million members in the United States, we are one of the leading subscription service for enjoying movies and TV shows. We offer the best prices and a selection of movies and TV shows comparable to other leading movie rental companies. There are no due dates or late fees - ever!

*EasyRent is offered as two subscription options:*

**Internet Subscription** – instantly watch unlimited TV episodes and movies streaming over the Internet to your TV via an Xbox 360, PS3, Wii or any other device that has streaming capability. You can also watch instantly on your PC, Mac, iPad or iPhone! *TV episodes and movies start playing in seconds, no waiting for them to download.*

**DVD-by-Mail Subscription** –get unlimited DVDs in a month by mail, up to 4 DVDs out at-a-time. Our 100 shipping points across the United States allow us to provide more than 97% of our members with delivery within about one business day following shipment. *With a DVD subscription you get thousands more new releases, TV episodes and classics in addition to those you get with an Internet subscription.*

*The Internet and DVD-by-Mail subscriptions are easy to sign up and manage online. Immediately after creating your account you'll be able to browse, preview and order movies and TV episodes.*

On the website of **EasyRent** you have access to ratings by customers who have already subscribed to the Internet and/or the DVD-by-Mail subscription options (1,290 reviews in total). Here is a summary of their ratings (*Ratings: 1 = poor, 2 = below average, 3 = average, 4 = above average, 5 = excellent*)

#### Internet Subscription

Easy to manage online: 4.7 or 2.5  
Instant access to movies/TV episodes: 4.8  
Selection of movies/TV episodes: 3.7

#### DVD-by-Mail Subscription

Easy to manage online: 4.7 or 2.5  
Instant access to movies/TV episodes: 3.5  
Selection of movies/TV episodes: 4.9