

FEATURE SELECTION FOR EVOLUTIONARY COMMERCIAL-OFF-THE-SHELF
SOFTWARE: STUDIES FOCUSING ON TIME-TO-MARKET, INNOVATION
AND HEDONIC-UTILITARIAN TRADE-OFFS

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ABSTRACT

Feature selection is one of the most important decisions made by product managers. This three article study investigates the concepts, tools and techniques for making trade-off decisions of introducing new features in evolving Commercial-Off-The-Shelf (COTS) software products. The first article investigates the efficacy of various feature selection techniques when the trade-off is between comprehensiveness and time-to-market. The second article investigates the impact of current level of product performance when the trade-off is between providing different types of innovative features to the users. The third article investigates the impact on the ability of the COTS product to attract new users and retain existing users when the trade-off is between providing utilitarian and hedonic value through new product features.

To meet these research goals an extensive multidisciplinary study of Information Systems (IS) and Product Development literatures was conducted followed by experimental research. The experiments were conducted among youth between 19-24 years who were users of Gmail software and produced some key findings.

In the first study the Kano survey method was found to be effective in identifying those features which added value to the product and those that did not. This finding will facilitate product managers in using appropriate techniques for identifying the critical product features to be built into the COTS product thereby reducing time-to-market without sacrificing product quality. In the second study, current COTS product performance was found to significantly impact the type of innovation to be introduced into the COTS product. Basic or Core product

innovations were found to have value for the users when performance is low but not when the performance is high. On the other hand, Expected or product Performance innovations and Augmented or user Excitement innovations were found to have value when the performance is high but not when the performance is low. In the third study, Hedonic value and Utilitarian value of product features were found to have distinctive impact on users. While Hedonic value impacted Word-of-Mouth, a measure of the products' capacity to attract new customers, Utilitarian value impacted User Loyalty, a measure of the products' capacity to retain existing customers.

DEDICATION

This thesis is dedicated to everyone who has helped me and guided me through the trials and tribulations of creating this manuscript, particularly my mother, wife and children who stood by me through thick and thin.

LIST OF ABBREVIATIONS AND SYMBOLS

ANOVA	Analysis Of Variance
COTS	Commercial-Off-The-Shelf
ECT	Expectation-Confirmation theory
HRA	Hierarchical Regression Analysis
HV	Hedonic Value
IEC	International Electrotechnical Commission
IEEE	The Institute of Electrical and Electronics Engineers
IS	Information Systems
ISO	International Organization for Standardization
VIF	Variance Inflation Factor
UV	Utilitarian Value
WOM	Word-Of-Mouth

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INTRODUCTION

“The hardest single part of building a software system is deciding precisely what to build... No other part of the work so cripples the resulting system if done wrong. No other part is more difficult to rectify later.” -- Fred Brooks (1987)

Commercial-off-the-shelf (COTS) Information Systems (IS) products are those that are offered for sale, lease or license to the general public (Oberndorf, 1998). The use of COTS products has the potential to lead to faster development, reduced cost and higher quality compared to developing software from scratch (Torchiano, Jaccheri, Sorensen and Wang, 2002). The demand for COTS product has thus been consistently growing compared to custom development. Today, more systems are developed for the market than for single customers (Berander, 2007).

In COTS systems, requirements are extremely volatile mainly because of rapid changes in the marketplace (Alves and Finkelstein, 2003). Competitive pressures in the market force vendors to innovate and differentiate products features rather than standardize them resulting in complex decision-making. Thus deciding which features to include in a COTS product is one of the most important and challenging decisions in product management (Berander, 2007), making it a germane topic of inquiry.

COTS products evolve over time because most software in regular use in businesses and organizations cannot be completely specified (Lehman and Ramil, 2002). The software products must be incessantly adapted to match any changes in the real world that affect its ability to satisfy its users' needs. But although these adaptations are an economic necessity for the

producer, they increase software complexity and reduce performance and reliability over time. The negative influence of this situation is rapidly increasing due to technological and business innovations, changes in legislation and continuing internationalization (Mens, Wermelinger, Ducasse, Hirschfeld, 2005).

Yet, while the need for mechanisms to support decisions regarding the content of software products is increasing (Bearnder, 2007), research in the area is sparse and scattered (Van De Weerd, Brinkkemper, Nieuwenhuis, Versendaal and Bijlsma, 2006). It is only recently, that software product management has emerged as ways of developing software as a product (Cushman and Selby, 1995; Ebert and De Man, 2002, Van De Weerd, Brinkkemper, Nieuwenhuis, Versendaal and Bijlsma, 2006) even though the domain of product management has been established with physical products since the industrial revolution in the 19th century (Kilpi, 1997).

This study therefore references relevant multidisciplinary research literature to identify concepts and practices for selection of COTS product features before conducting the experimental studies with actual users of Gmail. Lehman's (1997) Law of Increasing complexity states that "As a program is evolved its complexity increases unless work is done to maintain or reduce it." If user requirements are indiscriminately selected by adopting say a "full coverage" approach then the software product will soon become unnecessarily complex and unreliable. The aim should be parsimonious selection of features without sacrificing product quality which would not only reduce complexity of the product, but also reduce time-to-market and production costs. All the three studies investigate how this parsimony can be achieved by selecting only those features for upgrade of COTS products that meet user and producer goals.

In Study 1, given the goal of providing the maximum value of extending COTS features when there is a set amount of available resources (time and budget) methods of feature selection were first identified through an extensive review of requirements engineering, product management and quality literatures. Then the efficacy of the methods in selecting only those critical features that add value to the user of the COTS product were investigated. The results of the study showed that overall the Kano survey method was superior in identifying those features that would impact user satisfaction positively when implemented into the COTS product and those that would not significantly impact user satisfaction.

In Study 2, the value of innovation in COTS products at various levels of product performance was investigated. The three factor theory (Kano et al., 1984) and Levitt's (1980) total product concept were used to identify the various types of innovation and then examine their impacts on user satisfaction at various levels of product performance (overall user satisfaction with the current version of COTS product). The results of the study showed that implementing Core or Basic innovations did not offer significant value to the user at high level of product performance. On the other hand, Expected or product Performance innovations and Augmented or user Excitement innovations did not offer significant value to the user at low level of product performance.

In Study 3, the Hedonic and Utilitarian dimensions of product features to determine their value in retaining existing users and attracting new users were investigated. Existing IS and marketing literatures were scanned for theoretical insights and understanding of Hedonic-Utilitarian characteristics of product features. The results of the study showed that providing Hedonic value significantly impacted positive Word-Of-Mouth of existing users, thereby increasing the capacity to attract new users, while providing Utilitarian Value significantly and

positively impacted User Loyalty, thereby increasing the capacity to retain existing users. Thus if the goal of the producer of the COTS product is to attract new users then she should focus on providing Hedonic value during COTS product evolution while if the goal is to retain existing users then she should focus on enhancing Utilitarian value of the COTS product.

Thus depending on the product goal each study suggests a way of parsimoniously selecting COTS product features:

1. Study 1 explored methods of selecting software features when time and other budgetary resources are considered constrained.
2. Study 2 explored selecting software features in a trade-off between the different types of innovation.
3. Study 3 explored selecting software features in a trade-off between the Hedonic dimension and the Utilitarian dimension.

These studies will assist:

1. future research in software product feature selection by providing new theoretical perspectives of software product evolution
2. practitioners in software product development by providing them with a strategic approach to feature selection
3. software product development educators by providing them with new and useful ways of characterizing software requirements beyond the traditional functional and non-functional classification.

TIME-TO-MARKET CONSIDERATIONS FOR FEATURE SELECTION DURING COMMERICAL-OFF-THE-SHELF SOFTWARE PRODUCT EVOLUTION WITH CONSTRAINED RESOURCES

INTRODUCTION

“Functional content of a program must be continually increased to maintain user satisfaction over its lifetime” – Lehman et al. (1996)

“As a program is evolved its complexity increases unless work is done to maintain or reduce it” – Lehman et al. (1996)

Time-to-market is critical for product success (Vessey, 1992; Aoyama, 1998; Cooper and Kleinschmidt, 2003). Information Systems (IS) product managers must quickly determine which features should be included into an IS product to satisfy evolving user needs. Adding features that do not add value to the product has adverse implications for both the user and producer of the IS product as shown in Table 1.

Table 1. Implications of Implementing Non-Valued Product Features

User	Producer
Users have to expend resources in terms of memory and computing power for running additional features that add no value to their work (Basili and Boehm, 2001)	Producers have to utilize their scarce resources in building features that have no positive business outcomes as customers do not fund upgrades of market-driven products (Karlsson, Dahlstedt, Regnell, Natt Och Dag and Persson, 2007)
Overloading the product with features causes “feature fatigue” i.e. the more features a product boasts, the harder it is to use (Thompson, Hamilton and Rust, 2005)	Building new features makes the product complex and more difficult to maintain (Mens, Wermelinger, Ducasse, Hirschfeld, 2005)
May degrade quality and make products unreliable (Mens, Wermelinger, Ducasse, Hirschfeld, 2005)	Increases time-to-market as even providing features that do not add value to the user requires additional time to implement

Soon after the first release of a Commercial-off-the-shelf product there is a steady stream of new requirements – improvements, suggestions, and complaints from existing and potential consumers of the product (Karlsson, Dahlstedt, Regnell, Natt Och Dag and Persson, 2007). Producers use these inputs to continually enhance the features of their products to make them more attractive and valuable for the customers and to retain or gain market share.

COTS products are developed to meet the needs of a marketplace instead of satisfying the requirements of a particular organization (Alves, 2003). As compared with in-house software evolution, the challenges posed in the context of market-driven products, such as (Karlsson, Dahlstedt, Regnell, Natt Och Dag and Persson, 2007):

- the lack of day-to-day interactions with the user base,
- inter-organizational negotiations and
- inter-organizational conflict resolution

make the task of capturing and selecting the critical features to be built into the product more daunting.

Producers of COTS products have therefore evolved various mechanisms to communicate with the users. Of these the use of websites for gathering and prioritizing customer requirements is becoming increasingly prevalent (Laurent and Cleland-Huang, 2009). Web-based methods have been found to be particularly useful for engaging a large number of existing and potential customers in a two-way communication (Laurent and Cleland-Huang, 2009). The websites include both forums and collaborative tools, and are designed to allow large numbers of stakeholders to participate in the requirements gathering process. The forums' postings or discussions are often displayed in a threaded format which allows everyone to see the discussion unfold enabling the project team, product managers and users to closely communicate and

actively collaborate. However, the diverse needs of a large number of anonymous users pose challenges for quickly analyzing feature requests and selecting a critical subset for product upgrade.

By actively engaging the users, more feature requests are often elicited than are needed to build into the system (Karlsson et al., 2007; Regnell and Eklundh, 1998). While excluding a high-value feature may result in a lost sale, including a feature that provides minimal (or no) customer value creates unneeded development costs, delays in time-to-market, and increased complexity, maintenance and operational costs of the product. Moreover in the short-term COTS development organizations have limited staff and other resources and cannot add an unlimited number of features.

Given the premise that COTS are developed with the goal of satisfying user needs (Alves, 2003), the challenge for the product managers is to distinguish between which product features add value to the user and which features do not (Karlsson and Ryan, 1996).

To accomplish this goal, the requirements engineering literature (as presented in the next section) suggests that the ranking techniques may be unsuited for COTS products. Ranking method has advantages such as enabling managers to choose between any two features based on their ranking order. However, more features requests from users are generated for COTS products than for in-house development (Bebensee, van de Weerd and Brinkkemper, 2010; Alves, 2003) and ranking methods do not scale well for large number of requirements (Lehtola and Kaupinnen, 2006).

Thus the objective of this study is to explore if there are methods better suited for feature selection of evolving COTS products and to empirically assess their performance with ranking

methods. The goal is to select only those critical user requirements that add value to the user, thus reducing time-to-market while meeting user requirements.

The remainder of this article is devoted to:

1. reviewing the status of IS product requirements prioritization through ranking methods
2. introducing requirements prioritization through classification methods used in other domains
3. deciding which among the ranking methods and classification methods should be chosen for evaluation
4. improving requirements prioritization through the development of a Hybrid treatment that combines Dual Questioning and Kano techniques
5. detailing an empirical study evaluating the efficacy of the ranking, classification and extended hybrid requirements techniques
6. providing a theoretical explanation for the observed results
7. discussing the impact of using the empirical study results to drive practice and research to prioritize COTS feature requirements to satisfy user needs.

LITERATURE REVIEW

USER SATISFACTION

User satisfaction is an established construct and an important area in IS research because it is one of the most prevalent measures of software success and use (Ives, Olson, and Baroudi, 1983; Torkzadeh and Doll, 1991; Delone and McLean, 1992; Seddon, 1997; Zviran and Erlich, 2003).

The concept of IS user satisfaction can be traced to the work of Cyert and March (1963) who proposed that an information system which met the needs of its users would reinforce satisfaction with the system. In the early 1970s, Powers and Dickson (1973) studied factors affecting IS success, and identified user satisfaction as one of the key factors affecting it. They assumed that if users are satisfied with an IS, they use it. Therefore, satisfaction is a good measure of IS success. If the users do not perceive a system as satisfactory, they are unlikely to use it. Thus, in order to improve a system, it is important to know how its users perceive it, and where its weak points lie.

The reason for the popularity of user satisfaction as a measure of software success is the difficulty of operationalizing economics-based constructs, thus accelerating the search for constructs for which variables could be identified and more easily measured (e.g., Powers and Dickson, 1973; Nolan and Seward, 1974; Treacy, 1985; Elam, Henderson and Thomas, 1984). Gelderman (1998) found that user satisfaction was significantly related to system performance factors “providing empirical evidence for the popular assumption that user satisfaction is the most appropriate measure for IS success available”.

As “the set of requirements selected for implementation is a primary determinant of customer satisfaction” (Karlsson and Ryan, 1996) user satisfaction was chosen as a dependent variable in this study. User satisfaction is a measure of value provided by the COTS product (Calisir and Calisir, 2004). The efficacy of feature selection methods in this study will thus be determined by which method provides more value to the user by selecting a subset of features, from a given set of feature requests, which delivers maximum satisfaction to the user.

EXPLORATION OF TECHNIQUES FOR FEATURE SELECTION

Within the context of user satisfaction for COTS product feature selection this section continues by providing reviews of the status of ranking and classification requirements engineering techniques. In addition this study reviews non-IS product development and product quality literatures to explore some of the classification techniques for selection of IS features for market-driven COTS products. The identified classification techniques of feature selection were then compared for their efficacy with the ranking requirement engineering techniques.

Requirements Ranking Techniques

Several *ranking* techniques have been applied to pools of IS requirements, which then generate a rank-ordered list of requirements. Table 2 provides often cited examples of requirement ranking techniques including the Planning Game, 100 points method, Theory W method, AHP method, Binary Search Tree method and Value-Oriented Prioritization method.

Requirements Classification Techniques

The basis for Requirements Classification techniques can be traced to the Motivation-Hygiene (Herzberg, 1966) theory, which itself is expressed as an alternative to Maslow's (1954) hierarchy of needs for studying job satisfaction.

According to the Motivation-Hygiene theory (Herzberg, 1966) job satisfaction and dissatisfaction are determined by two different sets of factors.

Motivation factors affect job satisfaction (i.e., recognition, achievement, work itself, advancement, and responsibility) (Brenner, Cormack and Weinstein, 1971) that potentially excite if present, but do not dissatisfy if absent.

Hygiene factors affect job dissatisfaction (i.e., salary, company policies, interpersonal relations and working conditions) (Brenner, Cormack and Weinstein, 1971) that have no excitement potential, but potentially causes dissatisfaction if absent.

Marketing researchers have recast the 2 Factor model from the job satisfaction domain to customer requirements with the

Hygeine factors referred to as *Basic* Factors (Kano et al., 1984). The other names used for Basic factors are Dissatisfiers (Johnston, 1995), Minimum Requirements (Brandt, 1988), Must-be requirements (Kano et al., 1984), Implied requirements (ISO/IEC 9126-1, 2001).

Motivation factors referred to as Excitement factors (Kano et al., 1984). The other names for Excitement factors are Satisfiers (Johnston, 1995), Attractive requirements (Kano et al., 1984), Value enhancing requirements (Brandt, 1988).

Initial empirical studies (Swan and Combs, 1976; Maddox 1981; Cadotte and Turgeon, 1988; Johnston and Selvestro, 1990) of customer requirements found support for Herzberg's two factors classification. However, later studies (Brandt, 1987; Brandt and Reffet, 1989; Stauss and Hentschel, 1992; Johnston, 1995; Anderson and Mittal, 2000) found empirical support for the three-factor theory, the third factor identified as:

Performance factor that potentially satisfy (but not excite) if present and potentially dissatisfies if absent. The other names for Performance factors are One-dimensional requirements (Kano et al., 1984), stated requirements (ISO/IEC 9126-1, 2001).

Based on the three factor theory, classification techniques cluster requirements into categories that can be assigned priority based on the group characteristics. Wiegers (1999) describes the Priority Groups Method as applied to IS requirement. In addition to the Priority

Group Method to classify product requirements into categories Table 3 identifies often used classification techniques from the physical product development and quality literatures—these include The Direct Classification Method, Importance Grid Method, Penalty Reward Contrast Analysis Method and Kano Survey Method which classify features into three categories: Basic, Performance and Excitement.

Table 2. Requirements Ranking Techniques (adapted from Berander and Andrews, 2006)

Method	Description
AHP (Saaty, 1980)	Ranks requirements to address multi-criteria decision-making situations, AHP conducts a comprehensive comparison of the value and cost of each requirement pair.
Theory W (Boehm and Ross, 1989)	Ranks requirements to ensure that every stakeholder wins. In this method each stakeholder ranks the requirements and notes which are most important and which they would be willing to remove. The stakeholder groups then negotiates the prioritized list.
Planning Game (Beck, 2001)	Ranks requirements after the development team sorts the requirements by value, risk, and effort. Based on the relative assessments, the scope of the next release is set.
100 Points (Leffingwell and Widrig, 2003)	Ranks requirements by giving each stakeholder a total of 100 points that can be allocated (or “spent”) on the requirements. Requirement priority is then determined by sorting the requirements by total points spent by all subjects.
Binary Search Tree (Heger, 2004)	Ranks requirements by using an algorithm for arriving at the priority list of requirements from a given candidate set of requirements. The algorithm economizes on the number of comparisons.
Value-Oriented Prioritization (Azar, Smith, Cordes, 2007)	Ranks requirements by identifying the core business value categories. Company executives then rank each value on a relative scale. Thereafter all requirements are identified a weight in each value category and a ranked list of requirements is generated.

Table 3. Classification Requirements Techniques

Method	Description
Priority Groups (Wieggers, 1999)	Classifies requirements into a small number (often 3) of priority categories, such as High (critical), Medium (regular), and Low (nice to have). Individual results may be aggregated by majority, plurality, or consensus.
Penalty-Reward Contrast Analysis (Brandt, 1987)	Classifies each product feature requirement into Basic, Performance and Excitement categories by analyzing the impact of high and low feature level satisfaction on overall product satisfaction using regression analysis with two set of binary dummy variables for each product feature.
Importance Grid (Vavra, 1997)	Classifies each product feature requirement in Basic, Performance and Excitement categories. Users explicitly express preferences using 5 point Likert-like scale) and implicitly (using partial beta coefficients)
Direct Classification Method (Emery, Tian, 2002)	Classifies each product feature requirement directly into Basic, Performance and Excitement after the theory underlying this categorization is explained to the respondent
Kano Survey Method (Kano et al., 1984)	Classifies each product feature requirement into Basic, Performance, and Excitement categories based on two questions 1. the functional question “How do you feel if this feature is present?” and 2. the dysfunctional question “How do you feel if this feature is NOT present?”. Users’ response to these questions on a five point Likert-like scale

The classification methods (with the exception of Priority groups method) are all based on a three factor model with the following definitions for the factors:

Basic factors: are prerequisites and must be satisfied first, at least at threshold levels, for the product to be accepted. The fulfillment of basic requirements is a necessary but not a sufficient condition for satisfaction. The customer takes Basic requirements for granted, and therefore does not explicitly ask for them. Basic factors are critical when they are not met, but users remain

Indifferent if they are provided for in the product (Matzler, Bailon, Hinterhuber, Renzl, Pichler, 2004; Fuller, Matzler, Faullant, 2006).

Performance factors: are requirements that the customer deliberately seeks to fulfill. They are uppermost in her consciousness. Fulfilling these requirements leads to customer satisfaction and not fulfilling those leads to dissatisfaction.

Excitement factors: are those that the customer did not expect. They surprise the consumer by adding unexpected value to the product thereby delighting her. The Excitement factors are comparable to Herzberg's *Motivation factors* and *Satisfiers*. Not fulfilling excitement requirements do not lead to consumer dissatisfaction.

Dual Questioning Technique

As opposed to in-house developed and software products developed for single customers, which often have restricted product choices, COTS product evolution exists in an open environment, in which marketplace alternatives exist. As shown in Table 4, Myers and Alpert (1968) present a means to incorporate marketplace issues such as alternative products into the Dual Questioning Technique.

Table 4. Dual Questioning Technique

Method	Description
Dual Questioning Method (Myers and Alpert, 1968)	Classifies each product feature based on users explicit expression of Importance to Not Important on a 5 point scale with 5 being Extremely Important and 1 being Not Important) and Difference among compared products (5 – Very Different, 1- Very Similar)

METHOD

An Experimental method was adopted in the study. Experimental research is a useful method for examining cause and effect. It offers a methodical way of comparing differences in the effect of treatments (features selected using various feature selection techniques) on the dependent variable (user satisfaction). The extraneous variable i.e. “user segment” of Gmail users was controlled through sample. The “sequence effect” of manipulating different treatments and “individual differences” among subjects in the sample was controlled through experimental design.

STUDY APPROACH

As has been developed, time-to-market is critical for successful COTS evolution. Product managers must have requirement prioritization techniques that satisfy evolving user needs, excluding high-value features may result in lost sales, including requirements that provide minimal customer value creates unneeded development costs, and increased complexity, maintenance and operational costs of the product and increase time-to market. Thus this investigation provides support for product managers who must distinguish between which requirements add value to the users and which requirements do not.

Consequently, product managers will benefit from evaluating requirements ranking and classification prioritization techniques. To accomplish this goal an empirical study was conducted. Based on the review of previous studies, as presented in the Literature Review section, the study created experimental requirements technique treatments based on:

1. Ranking (Previously used for software products): Binary Search Tree Method
2. Classifying (Previously used for software products): Priority Grouping Method

3. Classifying (Translated from product quality literature): Kano Survey Method
4. Market Place Information: Dual Questioning Technique
5. Hybrid: Incorporating Dual Questioning technique in the Kano Survey Method

The rationale for considering these five techniques for evaluation is described in the following section.

SELECTION OF TECHNIQUES FOR EVALUATION

1. Binary Search Tree

Racheva, Daneva and Buglione (2008) reviewed a number requirements prioritization techniques and classified them into two main categories: techniques used to prioritize small amounts of requirements (small-scale) and techniques that scale up very well (medium-scale or large-scale). As COTS products are developed for the market rather than a single customer, one can expect a larger number of feature requests from users (Bebensee, van de Weerd, Brinkkemper, 2010). Hence techniques that scale up well are most appropriate for COTS IS products.

Bodensee, van de Weerd, Brinkkemper (2010) found that the Binary Search tree method scales up well compared to another well known prioritization technique the Wieggers matrix method for IS products with medium-scale requirements. Another study by Ahl (2005) investigating the accuracy, ease of use and scalability of five ranking techniques of requirements prioritization - AHP, Binary Search Tree, Planning Game and 100 Points Method and PGcAHP (Planning Game combined with AHP) - found that Binary search tree was superior to all other methods. Binary search tree was therefore chosen from among the ranking techniques as the first technique to be assessed in the study.

2. Priority Groups Method

Medium-scale or large-scale prioritization techniques might be based on relatively complex algorithms or at least due to the large amount of requirements need tool support (Racheva, Daneva and Buglione, 2008). However, sophisticated prioritization techniques are found to have limited ability to support requirements prioritization in market-driven product development with professionals in industry preferring simple tools instead (e.g. Lehtola and Kauppinen, 2006; Berander and Andrews, 2006). The Priority groups method is one such simple classification technique which ranks requirements into three priority categories, High, Medium and Low (Wigers, 1999). It is an IEEE recommended method (Sillitti and Succi, 2006) and among the most traditional and best known (Lehtola and Kauppinen, 2006). Priority Groups technique was therefore chosen as the second technique for comparison.

3. Kano Survey Method

A review of the advantages and disadvantages of classification techniques for feature selection such as the Direct Classification method, Importance Grid method, Penalty-Reward contrast Analysis method and Kano survey method suggests that the Kano method would be the most suitable. Research (Mikulic and Prebez, 2011) has shown that among the various techniques used for categorizing requirements only the Kano method using the Functional and Dysfunctional survey was both a valid and a reliable method for categorizing feature requests according to the three factor theory. For this study the Kano survey method was therefore chosen from among the classification techniques based on the three factor theory as the third technique for evaluation.

4. Dual Questioning Method

One of the limitations of the techniques listed above is that they do not take in consideration market factors such as the availability of the features being assessed in competitive products. As this study is exploring a suitable technique for market-driven COTS products, it will also investigate the potential of the determinant attribute approach (Myers and Alpert, 1968) using the dual questioning technique as the fourth technique for evaluation. This technique has been used to determine features of products and services as different as construction materials (Sinclair and Stalling, 1990) to health care systems (Lim and Zallocco, 1988).

5. Hybrid Method

In addition a fifth technique which is a combination of Dual questioning method and the Kano survey method is suggested for comparing its efficacy in feature selection. Although the three factor theory allows producers to make a strategic choice through classifying product feature requests into the three categories, it does not take in consideration market factors such as the availability of these features in competitive products of the same product category. To overcome this gap this study will investigate the potential of a hybrid of the dual questioning technique and the Kano survey method. The Dual questioning technique does not recognize the three types of feature of the three factor theory, each with its own distinctive characteristics and strategic impact; and the Kano survey method does not rank features within the three categories making choice between them impossible.

By implementing only those features that are common to the Basic, Performance and Excitement feature set derived from the Kano survey method and those derived from the Dual questioning technique will lead to a lean set of requirements that have its own characteristic strategic impact on the user as well as those that take in account competition. The features that are important and differ from competitive products but are not classified in one of the three

categories – Basic, Expected or Excitement - by the Kano survey method will be excluded from the set of selected features. Also those features which belong to the three categories - Basic, Performance and Excitement - but do not much differ from competitive offerings will be excluded. The Dual questioning approach is thus expected to complement the techniques using the three factor theory by providing a method for ranking the features within each category, keeping competition in view, after they have been categorized using the Kano method. This will help producers with additional information to select a lean set of features that give maximum impact for the resources invested while simultaneously keeping the strategic options open for the management.

RESEARCH QUESTIONS:

The research questions which this empirical study strives to answer are:

1. Which of the identified selection techniques (the Priority groups method, the Binary Search tree, the Kano survey method, the Dual Questioning method and the Hybrid method) result in highest observed perceived user satisfaction based on the selected feature set?
2. Is there a theoretical basis for the superior performing method?

EXPERIMENTAL SETTING

Gmail is an exemplar of evolving COTS product from Google. Since it was first introduced in April 2004, Gmail has today evolved to become the number one web based email platform by introducing innovative features. The Gmail Labs feature allows users to test new or experimental features of Gmail. Ten randomly selected user feature requests were chosen in late October 2012 as the test instrument for this study. The pilot study used 15 feature requests in the test instrument. But based on the subject feedback of cognitive overload, during the debriefing

session, it was decided to include only 10 feature requests in the actual study. A sample set of feature requests is shown in Table 5. The full set of ten feature requests is shown in Appendix B.

Table 5. Sample of Feature Description in Test Instrument

No	Feature description
1	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
2	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
3	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
4	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
5	Threaded conversations should be made optional to users. Presently it is a mandatory feature

SUBJECTS

Young adult (ages 19-24) cohort was used as subjects because users in this age group are recognized as innovators and early adopters of the latest technologies (Ehrenberg, Juckes, White, and Walsh, 2008). Table 6 provides the demographics of the subjects. The subjects' age ranged between 19 and 24 years and female students outnumbered males. The average age of the subjects was 21.28 years with the female subjects averaging 21.34 years and the male subjects averaging 21.22 years.

The subjects were recruited from a state university as all subjects were required to use the university Gmail account and Gmail was the COTS IS product under investigation in this study. The subjects were experienced users of Gmail who regularly used the mail system on a daily basis. Actual users of Gmail were involved in the experiment because features should be important from the users' perspective not the developer's (Fellows and Hooks, 1998). All subjects were trained on the methods of feature selection used in the experiments and their

consent taken before conducting the study. The 10 Gmail feature requests were read out aloud and subject response taken on whether they have understood the user requirements.

Table 6. Demographics of Subjects

Age in Years	Number	Number of Females	Number of Males
19-20	53	29	24
21-22	30	19	11
23-24	39	21	18
Total	122	69	53

EXPERIMENTAL DESIGN

A repeated measure design was used in the experiment. Each subject provided their requirement prioritization through a paper-based instrument that included questions related to the Binary Search Tree Method, Priority Grouping Method, Kano Survey Method and Dual Questioning Technique to select features that add value to the IS product and those that do not. Analysis for the Hybrid method is based on the integration of results from the Kano Survey Method and Dual Questioning technique. The data on user satisfaction with the current version of Gmail was captured in the first round from the subjects. The data on user satisfaction with the version of Gmail after implementing the feature subsets determined by the various treatments was captured in the second round. Previous research demonstrates that the temporal separation between measures reduces potential effects due to Common Method Variance (Sharma et al., 2009). The feature subsets used for collecting data on user satisfaction in the second round was determined specifically for each subject based on the analysis of data collected in the first round.

The use of repeated measure design offers two advantages. Variation in response due to individual subject differences is mitigated. The design is therefore extremely sensitive to finding statistically significant differences between the five conditions. In addition fewer subjects are needed for the experiment.

EXPERIMENTAL TREATMENTS

The requirement prioritization methods used by the subjects in arriving at the critical feature subset from the set of 10 Gmail user feature requests are described below.

Binary search tree method treatment

The Binary Search Tree Method has been used previously for software product feature prioritization. It provides a ranked list of requirements according to user preference. Prioritizing software requirements using this technique involves subjects constructing a binary search tree consisting of nodes equal to the number of candidate requirements. The first thing to be done is create a single node holding one requirement. Then the next requirement is compared to this node. If it is of lower priority than this node then it is assigned to the left of this node else it is assigned to the right of this node. This process continues until all requirements have been inserted into the binary search tree. The node at the extreme left of the binary search tree is of the lowest priority while the node at the extreme right is of the highest priority. If the nodes in a binary search tree are traversed in *in order*, then the requirements are listed in a ranked order of priority.

Thus using the binary search tree approach involved subjects selecting the requirements one at a time and creating a binary search tree and then traversing the binary search tree in order to generate a ranked list.

Priority groups method treatment

The Priority Groups Method has been used previously for software product feature prioritization. It is based on grouping requirements into different (highest to lowest) priority groups, with clear and consistent definitions of each group. Although the number of priority groups may vary the use of three groups (High, Medium and Low) is the most common (Leffingwell and Widrig, 2003). The description for these groups is as follows (Wiegers, 1999):

Definition: High priority requirements are mission critical requirements; required for next release

Definition: Medium priority requirements support necessary system operations; required eventually but could wait until a later release

Definition: Low priority requirements are a function or quality enhancement; would be nice to have someday if resources permit

Subjects used this description to categorize each Gmail feature request into one of the three groups.

Kano survey method treatment

The Kano Survey Method involved subjects responding to two questions for the every product feature request: the functional question "How do you feel if this feature is present?" and dysfunctional question "How do you feel if this feature is NOT present?" The first question concerns the reaction of the user if the product includes that feature, the second concerns his reaction if the product does not include that feature. The user has to choose one of the five possible options for the answers for both the functional and dysfunctional question:

1. I like it this way
2. I expect it this way
3. I am neutral

4. I can live with it this way
5. I dislike it this way

Asking both functional and dysfunctional questions helps product managers assess user priorities. If the user expects some feature to be present, but can live without the feature, it is not a mandatory feature.

Based on the user responses to the questions in both functional and dysfunctional form for each of the user's requirements, the quickest way to assess the questionnaires is to map each response in Table 7 and determine the requirement category to which it belongs.

Table 7. Matrix for assessing Kano categories

		Dysfunctional question				
		Like	Expect	Neutral	Live	Dislike
Functional question	Like	Q	E	E	E	P
	Expect	R	I	I	I	B
	Neutral	R	I	I	I	B
	Live	R	I	I	I	B
	Dislike	R	R	R	R	Q

B-Must have or Basic requirements

P-Expected or Performance requirements

E-Excitement requirements

R-Reverse, i.e. wrong features, that would make the consumer experience worse

Q-Questionable, i.e. the consumer answers is inconsistent

I-Indifferent, i.e. the consumer does not care about this feature

Dual questioning technique treatment

In the Dual Questioning Technique consumers are:

1. asked which features they consider important and then
2. asked how they perceive this feature as differing among the competitor products

Features ranked high in rated importance (5- Extremely Important 1 – Not Important) but not thought to differ much (5 – Very Different, 1- Very Similar) among the various products may not be the most determinant factor. The product of attribute importance and difference among products determines the ranking of feature requests. Attributes that are ranked high in importance and difference ratings among products in the same product category are considered more determinant than attributes that are ranked low in importance and difference ratings among products.

EXPERIMENTAL PROCEDURE

Data acquisition from the subjects was conducted in two phases.

1. During the initial data collection each subject responded to a questionnaire which had questions pertaining to selection of feature sub-set from the list of 10 Gmail feature requests in the test instrument, using the four feature selection methods - Kano survey method, Binary search tree method, Priority groups method and Dual Questioning method – described in section above.
2. The second collection occurred the following week. Based on the responses from the earlier survey, the survey was tailored specifically for each subject to reflect the feature subset selected by each method in step 1 above.

Control procedures were used to eliminate extraneous variables. The feature requests in the survey instrument were randomly selected from actual pending feature requests of users of Gmail. They were re-worded in a simple and standard style to avoid bias (see Table 3). Shifts in structure, content and format may introduce unwanted sources of variability that may confound subject response. To address the order or sequencing effect a counterbalancing design using

Latin squares (see Sheehe and Bross, 1961) were used (see Table 8) to get subject responses for different methods of feature selection. Every fifth subject got the same sequence.

Table 8. Sequencing of methods for selection of product features

Round 1: Feature Selection Method				
Subject 1	Priority group	Kano	Binary Tree	Dual
Subject 2	Kano	Dual	Priority group	Binary tree
Subject 3	Dual	Binary Tree	Kano	Priority Group
Subject 4	Binary Tree	Priority Group	Dual	Kano

EXPERIMENTAL VARIABLES

The independent variable are the experimental treatments or the feature selection technique - Kano group method, Priority group method, Binary search tree method and Dual method - used in the study to determine the feature subsets that add value to the user and those that do not. The dependent variable was perceived user satisfaction with these feature subsets. Perceived user satisfaction was used as a dependent variable because the producer would want to know the impact of implementing the feature set before rather than after implementing the features. Subjects rated their satisfaction with feature subsets on a 7 point scale with a neutral midpoint of 4, terrible at one end of the scale (1) and delighted at the other end of the scale (7) (Andrews and Withey, 1976) :

1 - Terrible 2 – Unhappy 3 – Mostly Dissatisfied 4 – Neither Satisfied nor Dissatisfied

5 – Mostly Satisfied 6 – Pleased 7 – Delighted

Single-item measures offer advantages of being short, flexible and easy to administer (Pomeroy, Clark and Philip, 2001). They are also less time consuming and not monotonous to complete (Gardner et al, 1998), thus reducing response biases (Drolet and Morrison, 2001).

Hence they are appropriate for use in large scale studies (Robins, Hendin and Trzesniewski, 2001).

SAMPLE SIZE

The sample size for the experiment was determined based on the effect size found during the pilot study. The pilot study was conducted with 49 subjects who were users of Astrid Task Manager a mobile app. Assuming a power of 0.8, $\alpha=0.05$ (one tail) and a medium effect size obtained in the pilot, a look up of Cohen's power primer (Cohen, 1992) gave the sample size. To account for mortality rate, as two rounds of experiments with a gap of one week between them were conducted in the study, and the possibility of invalid responses from the subjects, the sample size obtained from Cohen's table was inflated by 20 % to get the required sample size of 54 subjects.

As it was difficult to find subjects who were users of Astrid Task Manager, Gmail was chosen as a COTS product for investigation in the actual study. Although data was obtained from 138 subjects the analysis was restricted to 122 valid responses.

METHOD OF ANALYSES

Comparison of feature selection techniques that are structurally different from each other requires care be taken during the analysis. For example, the Kano survey method and the Priority groups method group requirement into different categories. But each of these methods has different categories and has a different basis for categorization. Kano survey method results in requirements grouped in five categories (including Reverse and Indifferent category in addition to the three categories of the three factor theory) while the Priority group method has three categories and there is no equivalence between any two categories across these two methods. To compound the problem the binary search tree method and the dual questioning method do not

group requirements into categories but produce a ranked order list of requirements with no clear direction on the cut-off point for selection of requirements to be built into the product.

Of the various methods only the Kano survey method identifies list of requirements that add value to the product (Basic, Performance and Excitement features) and a list of requirements that do not add (or provide negative) value to the product (Indifferent and Reverse features). Kano survey method was therefore used as the baseline. For instance, if the Kano survey method identifies 6 requirements that add value to the product and 4 requirements that do not add value to the product, then the top 6 requirements identified by the Priority groups method, Binary Search tree method and Dual method were taken for comparison of efficacy.

Repeated measure ANOVA was used to test the difference in user satisfaction as the same subjects take part in all conditions of the experiment. Feature selection technique is the independent variable and user satisfaction is the dependent variable. In this study the measurement of dependent variable user satisfaction was repeated as subjects rated their responses on “user satisfaction” for each of the five methods of prioritization i.e. Priority Group, Kano survey method, Binary Search tree, Dual method and Hybrid method.

Using a standard ANOVA in this case is not appropriate because it fails to model the correlation between the repeated measures as the data violate the ANOVA assumption of independence. IBM[®] SPSS[®] Statistics Version 19 was used to run repeated measures ANOVA. ANOVA is robust against violations of normality but requires that the variances for each set of different scores and their covariances are equal. Violations of this assumption of sphericity can invalidate the analysis. The Mauchly's (1940) sphericity test was therefore conducted to evaluate sphericity.

RESULTS AND ANALYSIS

The descriptive statistics of the mean user satisfaction under different experimental treatments is shown in Table 9.

Table 9. Results of Experiments – Descriptive Statistics (n=122)

EXPERIMENTAL CONDITIONS	Average Number of Features	Mean User Satisfaction	Standard Deviation
Current version as the baseline	-	4.54	1.293
After adding Indifferent features	5.65	4.61	1.457
After adding features using Kano Survey Method	4.35	4.98	1.308
After adding features using Priority Groups Method	4.35	4.68	1.300
After adding features using Dual method	4.35	4.95	1.298
After adding features using Binary search tree method	4.35	4.66	1.365
After adding features using Hybrid method (Kano + Dual feature set)	3.41	4.77	1.813

To determine if there is a significant difference between satisfaction with the various feature subsets a repeated measure ANOVA was performed. ANOVA is robust against violations of normality but requires that the variances for each set of different scores and their covariances are equal. Violations of this assumption of sphericity can invalidate the analysis. Therefore the Mauchly's (1940) sphericity test was conducted to evaluate sphericity. The data violated the assumption of sphericity as the probability of Mauchly's test statistic ($p=0.000$) was less than 0.05. Applying the Greenhouse-Geisser (1959) correction it was found that the difference in mean scores under the six different treatments of COTS product are statistically significant

($p=0.001$). However, although an overall significant difference in means was observed one does not know where those differences occurred. The Bonferroni post-hoc test results summarized in Table 10 were therefore examined (row - column) to discover which specific means differed significantly.

Table 10. Difference in Mean User Satisfaction and their Significance

EXPERIMENTAL CONDITIONS	Current	Indifferent	Kano	Priority Group	Dual	Binary Tree	Hybrid
Current	0						
Indifferent	.074	0					
Kano	.434***	.361***	0				
Priority group	.139	.066	-.295**	0			
Dual	.410**	.335**	-.025	-.270*	0		
Binary tree	.115	.041	-.320*	-.025	-.295*	0	
Hybrid	.230	.156	-.205**	.090	-.180	.163	0

* $p < .05$ ** $P < .01$ *** $p < .001$

The analysis of results in Table 9 and 10 show that

1. The mean user satisfaction ratings for the feature set selected by Kano survey method (see column titled Kano in Table 10 above) was found to be higher than the mean user satisfaction for all other methods. The difference in mean user satisfaction between Kano survey method and the other methods was found to be significant except for Dual method.
2. Further examination of the results in Table 10 show that there is no significant difference in user satisfaction ratings between the user satisfaction with current version of the COTS product and the user satisfaction after adding features classified as Indifferent by Kano survey method. This finding provides greater confidence in the superiority of the Kano survey method. The Kano survey method by accurately

identifying features that do not add value to the evolving COTS product by classifying them in the Indifferent category had indeed identified a parsimonious set of features that provide value to the user

3. Dual questioning method outperformed the Priority group method, Binary search tree method and Hybrid method. The difference in mean satisfaction ratings for the feature set selected by Dual method was found to be significant when the Dual method was compared with Priority group method and Binary search tree method.
4. No significant difference in mean user satisfaction was found between feature sets selected by the Hybrid, Binary search tree search and Priority groups methods.

INTERPRETATION AND DISCUSSION OF RESULTS

In this section the second research question is addressed - Is there a theoretical basis for the superior performing method? An analysis of the various methods show that the primary difference between the Kano survey method and methods such as Priority groups, Binary Search tree and Dual Questioning is that it takes in account both the penalty and the reward perspectives of the users for deciding which feature or feature set should be implemented into the COTS product. The other methods take only the reward perspective. A reward perspective gets the user response only for implementing a feature or a feature set into the COTS product. A penalty perspective gets the user response for not implementing a feature or feature set into the IS product.

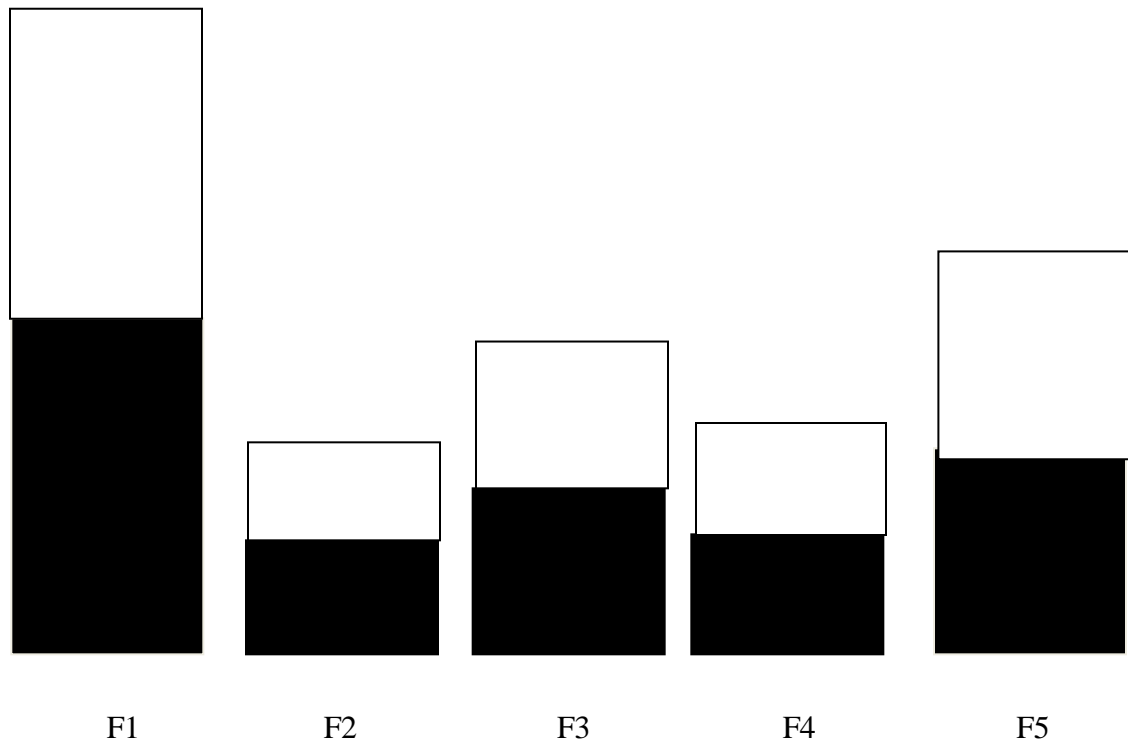


Figure 1. Equivalent Penalty and Reward User Response for Features F1..F5

Let us consider 5 user feature requests F1 to F5. The top un-shaded portion of each feature represents the quantum of reward i.e. the positive contribution of a feature to overall user satisfaction for implementing the feature into the COTS product and the top shaded portion represents the penalty i.e. the negative contribution to overall user satisfaction for not implementing the feature into the COTS product. If the user reward (white block in Figure 1) for implementing a feature or feature set is equal to the user penalty (in black in Figure 1) for not implementing the system then getting both the penalty and reward response of the user does not add any business value as the penalty for not implementing a feature or feature set can be estimated from the reward perspective. However if the reward for implementing a feature or feature set, i.e. its positive contribution to overall user satisfaction with the COTS product, is not

equal to the penalty for not implementing the feature or feature set (see Figure 2), i.e. its negative contribution to overall user satisfaction with the COTS product, then taking both the penalty and reward perspectives has merit in accurately evaluating its overall impact on user satisfaction.

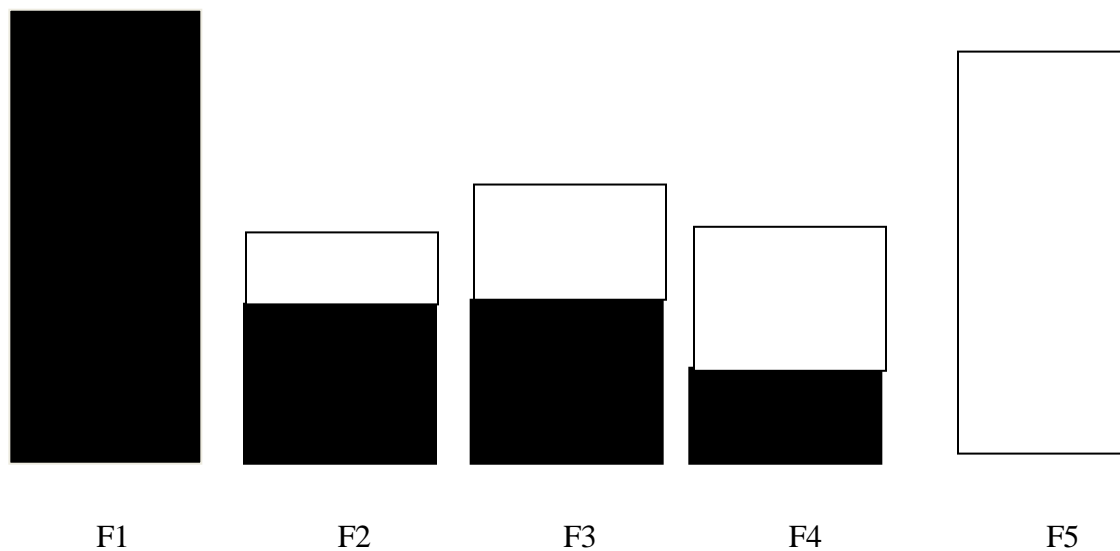


Figure 2. Different Penalty Reward User Responses for Features F1..F5

Viewing this situation from another perspective a symmetric user response (Performance features) occurs:

- if a user likes a requirement to be implemented into the system then he would dislike if the requirement is not implemented into the system; or
- if the user is indifferent if the requirement is not implemented into the system, then he would be indifferent if the requirement is implemented into the system; or
- if the user would dislike a requirement to be implemented into the system then he would like if the requirement is not implemented into the system.

An asymmetric user response occurs:

- a. if the user gives a seemingly irrational response by saying that he expects to have a particular feature implemented into a product but is indifferent if the feature is not implemented into the system (Excitement features).
- b. if the user is Indifferent if the feature is implemented into the system but would dislike if the feature is not implemented into the system (Basic features).

If the user response to the Penalty-Reward perspective is always symmetric, that is the customer penalty for not implementing a feature into the product is the inverse of customer reward for implementing a feature into the product, then no additional business information is captured by techniques based on the three factor theory.

However, if the user response to the Penalty-Reward perspective is asymmetric then the techniques based on the three factor theory, by providing additional insights into user preferences, would outperform other techniques in selecting features that reflect the needs of the user.

To empirically examine whether users exhibit only symmetric response or both symmetric and asymmetric response the subject response to the functional (reward perspective) survey and the dysfunctional (penalty perspective) survey of the Kano survey method were analyzed.

The results of the experiment presented in Table 11 show that out of a total of 1220 pairs of responses (122 subjects x 10 Gmail features) to the Functional and Dysfunctional surveys of the Kano method all the subjects together classified a total of 274 features as Basic, 248 as Performance, 289 as Excitement requirements, 390 as Indifferent, 19 as Reverse and 0 in Questionable category. 417 pairs of user responses were symmetric for 803 pairs of responses were asymmetric.

Table 11. Overall Results of Kano survey

		Dysfunctional question				
		Like	Expect	Neutra	Live	Dislike
Functional question	Like	0	36	142	111	248
	Expect	0	42	26	62	20
	Neutral	1	46	64	40	131
	Live	6	31	57	22	123
	Dislike	12	0	0	0	0

To verify that symmetric and asymmetric responses were not due to random user choices a chi-square difference test was conducted. The result shows a chi-square value of 1791.181. The chi-square table for 24 degrees of freedom at $p=0.05$ showed the chi-square value of 36.42. As $1791.181 > 36.42$ it can be inferred that the symmetric and asymmetric user responses are not due to random user choices.

The results demonstrate that user responses are both asymmetric and symmetric. Methods which use only reward perspective, extract only the symmetric user response, and are thus likely to lose some business information perhaps explaining the superiority of techniques such as the Kano survey method.

CONTRIBUTION

The primary objective of this research is to identify a method that demonstrates greatest efficacy in identifying COTS product features that add value to the user. The results of this empirical study corroborate observations made in IS research that requirements engineering techniques such as ranking methods for selection of product features may not be suitable for market-driven products such as COTS IS products.

The results of this study show that the Kano survey, a classification method based on the three factor theory demonstrated superior performance in identifying COTS product features that resonated more closely with user needs and requirements. The Kano survey method alone could identify with efficacy both features that add value to the product and the features that do not add value to the product. This is especially beneficial for COTS products because, unlike in-house development, the customer of market-driven IS products do not fund the product upgrade. Given that development resources are constrained, the findings of this study may be useful for product managers in parsimonious selection of features without sacrificing product quality while reducing time-to-market and production costs.

The main contribution of this study is that in the context of COTS IS products it has explored techniques not common in the field of requirements engineering and compared them with some of the commonly used techniques for software products. The results demonstrate the relevance of going beyond ranking methods and exploring other methods for market-driven IS products. In addition, the study expounds the theoretical underpinnings of superior performance of Kano survey technique based on the penalty-reward perspective.

The study suggests that taking the penalty-response perspective of the user, an approach adopted by the Kano survey method, has merit in identifying both a subset of features from a given set of feature requests that adds value as well as a subset of features that do not add value. Feature selection techniques which take only a reward perspective increases the risk of ignoring features which can asymmetrically impact user satisfaction. In addition they demonstrate lower efficacy in identifying features that users are Indifferent to and which do not add value to the COTS product.

Thus capturing user penalty-reward perspective can be utilized by producers in developing lean products, thereby providing salutary benefits to both producer and consumer. Although there are other approaches for reducing time-to market such as investing more resources for implementing the features into the COTS product, the approach of identifying only those critical user requirements that add value to the consumer approach frees the producer from pursuing maximum requirements coverage to being empowered with information allowing it to meet customer expectations while at the same optimally utilizing its resources. Moreover users have the satisfaction of seeing their critical product upgrade requests quickly implemented into the product.

LIMITATIONS

The subjects chosen for the empirical study are youth between 19-24 years of age. The rationale was to get as homogenous a group of sample as possible as the objective of the study was to control extraneous variables such as segmental difference in user preferences and mitigate alternative explanations for the results obtained. In addition, the study investigated user feature choices for only one COTS product. These design choices may limit the generalizability of the results.

Only 10 user feature requests were used in the test instrument. This was done to mitigate the cognitive overload of the subjects used in the study based on subject feedback during the debriefing session of the pilot study. However, by limiting the number of feature requests it is possible that the incremental impacts of the feature subsets on user satisfaction with Gmail in certain experimental conditions may have gone undetected.

FUTURE RESEARCH

This study considered a mature and established COTS product such as Gmail. Future studies may replicate this study for COTS products in various stages of their life cycle, such as Introductory, Growth and Decline stages. Also to assess generalizability of the results obtained in this study, the study may be replicated for other user segments and if feasible with a larger number of user feature requests.

The proposed Hybrid technique using the intersection of feature sets derived from Kano survey method and Dual method showed positive as well as negative results. On the negative side, in spite of having to ask four questions to the user for each feature, the hybrid method demonstrated lower efficacy in identifying a feature set that provides maximum value to the user compared to the Kano survey method. On the positive side the Hybrid method on an average identified a significantly ($p=0.000$) lower number of features (3.41) to be implemented into the COTS product compared to all the other methods (4.35) and yet there was no significant difference in the mean satisfaction feature set identified by the Hybrid method compared to the feature sets identified by the Dual the Priority groups and the Binary search tree methods. Future researchers may further investigate the potential of the Hybrid technique in identifying critical requirements under severe resource constraint conditions.

This study investigated selecting features from a given set of feature requests based on user preferences. It does not evaluate feature requests suggested by the employees, management and other stakeholders. However the techniques assessed in the study are equally applicable under these contexts. Future research may investigate the benefits of selecting even feature requests from other stakeholders to user scrutiny by using the methods suggested in this study as introducing new features can be risky (Perrin, 2002) and features should be useful in the users'

frame of mind not the developers' (Fellows and Hooks, 1998). Features that do not resonate with the users result in wasted development effort.

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FEATURE SELECTION TRADE-OFFS DURING EVOLUTIONARY COTS PRODUCT INNOVATION

INTRODUCTION

“...and this was much like talking about pets in general without distinguishing between dogs and cats and piranha fish and turtles” – Steven Alter (1983)

The needs and expectations of users are becoming and response to the continuously changing customer wants and needs. Innovation management increasingly sophisticated as customers experience new ideas in the world around them every day (Plsek, 1997). An innovative product evolution process therefore requires an understanding is not just about introducing radically and totally new products. Innovation management is also about applying innovative features within an existing stream of products and platforms (Beaume, Maniack, Midler, 2009).

Today, more COTS products are in the evolutionary phase than are newly developed (Krasner, 2008) and introduction of new product features is one of the most common methods of product innovation (Nowlis and Simonson, 1996). Producers are launching more innovative features more often (Beaume, Maniack, Midler, 2009). There is thus a need to study and develop procedures that can help a company or project team gain a profound knowledge of user requirements to develop products with innovative features (Shen, Tan and Xie, 2000a).

Innovation during product evolution can lead to significant value creation for both producer and user. Innovative offerings can lead to first mover advantages (Varadarajan, Yadav and Shankar, 2008), where the developer reaps outsized benefits due to increasing barriers to entry (Abernathy, and Clark, 1995). The producer is rewarded with increased brand equity for having offered the product feature or benefit before competitors (Sriram, Balachander and Kalwani, 2007). Later offerings are perceived as undifferentiated from the first mover. Innovations benefit users by providing them better quality, enhanced performance and new uses of existing products.

However, innovation during product evolution can be challenging. During an evolution phase whether a product is able to successfully innovate or not depends on the choices about features made during feature selection. Although the goal is to evolve a successful IS product, yet it is at the feature level that the manager must make decisions. Innovation can be risky (Perrin, 2002). The product evolution should be innovative in the users' frame of mind not the developers' (Fellows and Hooks, 1998). Innovations that do not resonate with the user create wasted development effort, delay in time-to-market, and increased complexity, maintenance and operational costs of the product.

Therefore, to design an effective innovation strategy, companies need to connect to their users. Collectively users constitute a source of massive amounts of product innovation (Vonn Hippel, Ogawa and de Jong, 2012). When users are viewed as passive recipients of innovation, the firm has a limited understanding of user knowledge developed within their specific contexts of experience, and there is little emphasis on iterative dialogue to refine and enhance ideas (Sawhney, Verona and Prandelli, 2005).

This study investigates how feature innovations can be introduced into an evolving COTS product through the active involvement of the users by:

1. First integrating concepts from Levitt's (1980) Total Product Concept model and the three factor theory (Kano, Seraku, Takahashi and Tsuji, 1984) to identify three types of innovation for evolving IS products.
2. Hypothesizing the distinct characteristics of each of the three types of innovation
3. Testing the hypotheses empirically through experiments with actual users of a COTS IS product.
4. Evaluating the impact of the findings of this study on practice and future research.

LITERATURE REVIEW

LEVITT'S (1980) MODEL

Levitt's (1980) total product concept is rated by the marketing guru Kotler (2003) as amongst the top 80 concepts that every manager should know about. It has been applied in areas as varied as business strategy (Slater and Olson, 2001) and product branding (Mudambi, 2002). In this study the Levitt's model is used to explain how software products evolve and how the three elements of the product can be utilized to take strategic product innovation decisions through feature selection.

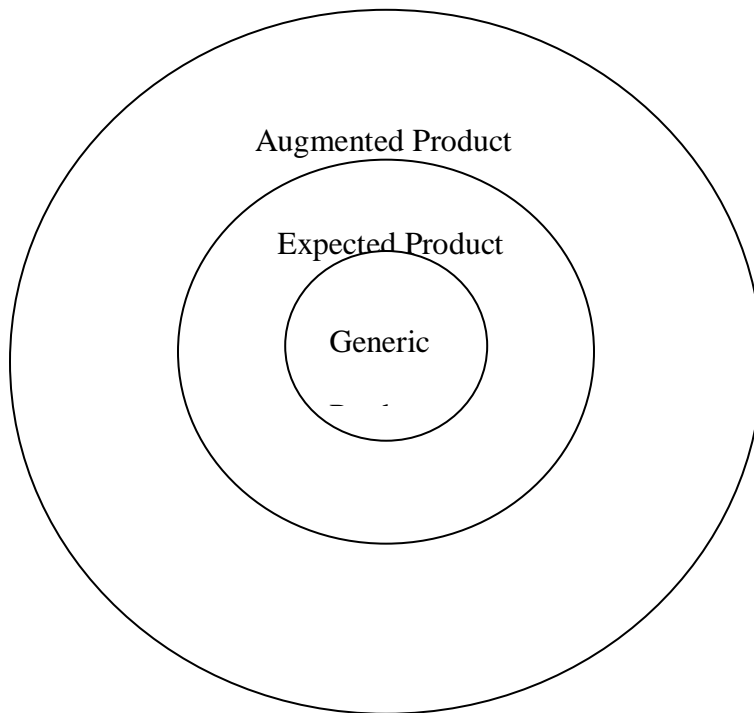


Figure 1. Levitt's (1980) Model

Levitt's (1980) Total Product Concept model (Figure 1) suggests that all elements of a product fall into three value categories: generic, expected and augmented. Generic elements are features which every product or service would offer. It is a requirement to enter the market. Expected elements are those features beyond the generic but still expected from a quality provider. It is what the users expect when they use or purchase the service or product. These features make a product competitive in the market. Augmented elements are what surprises the consumers and which they did not expect from the product. They differentiate the product from its competition.

THE THREE FACTOR THEORY

The three factor theory is popular in product quality literature as the “theory of attractive quality” (Kano, 1984). In the three factor theory product features are grouped into three categories each with its own characteristics:

Basic factors: They are prerequisites and must be satisfied first, at least at threshold levels, for the product to be accepted. The fulfillment of basic requirements is a necessary but not a sufficient condition for satisfaction. The user takes Basic requirements for granted, and therefore does not explicitly ask for them. Users are Indifferent if these requirements are met as they are entirely expected but experience dissatisfaction if they are not met. The other names used for Basic factors are Minimum Requirements (Brandt, 1988), Must-be requirements (Kano et al., 1984), Implied requirements (ISO/IEC 9126-1, 2001).

Performance factors: Performance factors typically are directly connected to customers' explicit needs and desires (Matzler, Bailom, Hinterhuber, Renzl and Pichler, 2002). Therefore, a company should be competitive with regard to performance factors. Fulfilling these requirements leads to user satisfaction and not fulfilling those leads to dissatisfaction. The other names for Performance factors are One-dimensional requirements (Kano et al., 1984), Stated requirements (ISO/IEC 9126-1, 2001).

Excitement factors: Excitement requirements are those that the user did not expect. They surprise the consumer by adding unexpected value to the product thereby delighting her. Not fulfilling excitement requirements do not lead to consumer dissatisfaction. The other names for Excitement requirements are Attractive requirements (Kano et al., 1984), Value enhancing requirements (Brandt, 1988).

TYPOLOGICAL SCHEME AND HYOTHESES DEVELOPMENT

Although various typologies of innovation have been advanced in literature, three of the most common are: administrative and technical, product and process, and radical and incremental (Damanpour, 1991). Analyzing the three typologies one finds that the first is based on source of innovation – technological or administrative, the second is based on target of

innovation – product or process and the third reflects degree of innovation – radical or incremental. These typologies are not mutually exclusive. For example there could be an incremental product innovation based on technology. The typology that is proposed in the following paragraphs is based on distinctive attributes or characteristics that predict unique outcomes for evolving products.

Although they have different origins, one in marketing and the other in job satisfaction literature, the concept in Levitt's (1980) model of the Total Product Concept and those elaborated in the three factor theory (Kano et al., 1984) are remarkably similar. While the total product concept talks about 3 layers of product, the generic, expected and the augmented, the three factor theory talks about 3 types of product features Basic, Performance and Excitement. There is a close association between the generic product and basic features. While the generic product represents the core product, the basic features represent the core minimum features. Users do not explicitly specify them as they are prerequisites. Similarly there is a correspondence between the expected product and the performance factors. The user explicitly specifies them and knows when they are made available and when they are not made available. The augmented product consists of excitement features which the users did not expect but is surprised and thrilled to have them in the product.

Based on the concepts from Levitt's (1980) model of Total Product Concept and the three factor theory (Kano et al., 1984) user feature requests during COTS product evolution can be categorized into three types of innovation:

1. Basic Product Innovation
2. Expected Product Innovation

3. Augmented Product Innovation

It is proposed that the perceived user satisfaction with product innovation will be moderated by the characteristic of the innovation itself and the characteristic of the COTS product in which the innovation is planned to be introduced.

According to the three factor theory Basic factors do not increase user satisfaction if fulfilled but causes dissatisfaction when unfulfilled. However in this study it is proposed that this depends on the current performance level of the COTS product. The basic or core product features establish a market entry threshold for the product. User would place higher value on the Basic features if in his assessment the product does not meet its core functionality.

From another perspective Basic features represent the lower level needs in the Maslow's (1970) hierarchy of needs: it is no good thinking about self esteem needs unless survival needs are catered for (Shahin and Zairi, 2009). However, they are decisive when the performance with the current version of IS product is low. If you do not get the basics right, all else may fail. However once the lower level needs are met it is by fulfilling the higher level needs that the user gets motivated. Thus it is hypothesized:

Hypothesis 2-1: A Basic innovation when introduced in a COTS IS product will not significantly impact user satisfaction when current performance (user satisfaction) is high

Hypothesis 2-2: A Basic innovation when introduced in a COTS IS product will significantly and positively impact user satisfaction when current performance (user satisfaction) is low

Expected features are requirements that the user deliberately seeks to fulfill. They are uppermost in her consciousness. They will thus positively impact user satisfaction if implemented in the product irrespective of whether the current performance is high or low. Similarly they will negatively impact user satisfaction if not implemented into the product irrespective of whether the current performance is high or low. Expected product innovations make the product competitive. Thus it is hypothesized:

Hypothesis 2-3: An Expected innovation when introduced in a COTS IS product will significantly and positively impact user satisfaction when current performance (user satisfaction) is high

Hypothesis 2-4: An Expected innovation when introduced in a COTS IS product will significantly impact user satisfaction when current performance (user satisfaction) is low

Augmented features are not expected by the user. These voluntary or unprompted "augmentations" to the expected product (Levitt, 1980) impact the user satisfaction positively by surprising users with features that add value to the product. They differentiate the product from competition as differentiation is not limited to giving the customer what he expects (Levitt, 1980). But providing augmented features will not satisfy the user if the current performance of the product is low, that is if the core or the expected functionality of the product is not met. From another perspective, Augmented features represent higher level needs of the user in the Maslow's hierarchy of needs. Thus fulfilling higher level needs by providing Augmented features alone will not impact user satisfaction. The core and expected functionality of the product have to be satisfied first before augmented features can differentiate the product from competition. However

if the lower level needs are satisfied the user will be delighted only by fulfilling her higher level needs. Thus it is hypothesized:

Hypothesis 2-5: An Augmented innovation when introduced in a COTS IS product will significantly and positively impact user satisfaction when current performance (user satisfaction) is high

Hypothesis 2-6: An Augmented innovation when introduced in a COTS IS product will not significantly impact user satisfaction when current performance (user satisfaction) is low

METHOD

An Experimental method was adopted in the study. Experimental research is a useful method for examining cause and effect. It offers a methodical way of comparing differences in the effect of treatments (type of innovative feature) on the dependent variable (user satisfaction). The extraneous variable i.e. “user segment” of Gmail users was controlled through sample. The “sequence effect” of manipulating different treatments and “individual differences” among subjects in the sample was controlled through experimental design.

EXPERIMENTAL SETTING

Gmail is an exemplar of evolving COTS product from Google. Since it was first introduced in April 2004, Gmail has today evolved to become the number one web based email platform by introducing innovative features. The Gmail Labs feature allows users to test new or experimental features of Gmail. Ten randomly selected user feature requests were chosen in late October 2012 as the test instrument for this study. The pilot study used 15 feature requests in the test instrument. But based on the subject feedback of cognitive overload, during the debriefing

session, it was decided to include only 10 feature requests in the actual study. A sample set of feature requests is shown in Table 1. The full set of ten feature requests is shown in Appendix B.

Table 1. Sample of Feature Description in Test Instrument

No	Feature description
1	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
2	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
3	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
4	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
5	Threaded conversations should be made optional to users. Presently it is a mandatory feature

SUBJECTS

A young adult (ages 19-24) cohort was chosen as subjects because users in this age group are recognized as innovators and early adopters of the latest technologies (Ehrenberg, Juckes, White. and Walsh, 2008). Table 2 provides the demographics of the subjects. The subjects' age ranged between 19 and 24 years and female students outnumbered males. The average age of the subjects was 21.28 years with the female subjects averaging 21.34 years and the male subjects averaging 21.22 years.

The subjects were recruited from a state university as all subjects were required to use the university Gmail account and Gmail was the COTS IS product under investigation in this study. The subjects were experienced users of Gmail who regularly used the mail system on a daily basis. Actual users of Gmail were involved in the experiment because features should be important from the users' perspective not the developer's (Fellows and Hooks, 1998). Before

conducting the study subject consent was taken. The 10 Gmail feature requests were read out aloud and subject response taken on whether they have understood the user requirements.

Table2. Demographics of Subjects

Age in Years	Number	Number of Females	Number of Males
19-20	53	29	24
21-22	30	19	11
23-24	39	21	18
Total	122	69	53

EXPERIMENTAL VARIABLES

The independent variable was the type of feature innovation. The categorization was done using the Kano (Kano, Seraku, Takahashi and Tsuji, 1984) survey method developed by Dr. Noriaki Kano of Tokyo Riko University. The Kano survey included two questions for the every product feature: a functional question "How do you feel if this feature is present?" and a dysfunctional question "How do you feel if this feature is NOT present?" The first question reflects the consumer reward for including the feature into the product and the second question reflects his penalty for not including the feature into the product. The user had to choose one of the five possible options for the answers for both the functional and dysfunctional question:

1. I like it this way
2. I expect it this way
3. I am neutral
4. I can live with it this way
5. I dislike it this way

Based on the consumer responses to the questions in both functional and dysfunctional form for each of his requirements, the quickest way to assess the questionnaires was to map each response in Table 3 and determine the category.

Table 3. Matrix for assessing Kano categories

		Dysfunctional question				
		Like	Expect	Neutra	Live	Dislike
Functional question	Like	Q	E	E	E	P
	Expect	R	I	I	I	B
	Neutral	R	I	I	I	B
	Live with	R	I	I	I	B
	Dislike	R	R	R	R	Q

B-Must have or Basic requirements

P-Linear or Performance requirements

E-Excitement requirements

R-Reverse, i.e. wrong features, that would make the consumer experience worse

Q-Questionable, i.e. the consumer answers is inconsistent

I-Indifferent, i.e. the consumer does not care about this feature

The dependent variable was user satisfaction with the three treatments, that is when a Basic, an Expected or an Augmented feature is added to the current version of COTS product. Karlsson and Ryan (1996) came to the conclusion that “the set of requirement selected for implementation is a primary determinant of customer satisfaction.” Also, user Satisfaction is one of the most prevalent measures of software success and use (Ives, Olson, and Baroudi, 1983; Torkzadeh and Doll, 1991; Delone and Mc Lean, 1992; Seddon, 1997; Zviran and Erlich, 2003). Subjects therefore rated their satisfaction with feature subsets on a 7 point scale which had terrible at one end of the scale and delighted at the other end of the scale (Andrews and Withey, 1976):

1 – Terrible

2 – Unhappy

3 – Mostly Dissatisfied

4 – Neither Satisfied nor Dissatisfied (Threshold level)

5 – Mostly Satisfied

6 – Pleased

7 - Delighted

EXPERIMENTAL DESIGN

The data on user satisfaction with the current version of Gmail was captured in the first round from the subjects. The data on user satisfaction with the version of Gmail after implementing the innovation type determined by the Kano survey method was captured a week later in the second round. The survey in the second round was tailored specifically for each subject based on his specific responses to the Kano survey in the first round. Previous research demonstrates that the temporal separation between measures reduces potential effects due to Common Method Variance (Sharma et al., 2009). One feature from each of the three categories determined by analyzing subject responses to Kano survey in the first round was selected randomly and used for collecting data on user satisfaction from the subject in the second round.

The use of repeated measure design offers two advantages. Variation in response due to individual variation is mitigated. The design is therefore extremely sensitive to finding statistically significant differences between experimental treatments. In addition fewer subjects are needed for the experiment.

CONTROL PROCEDURES

A number of control procedures were used to eliminate extraneous variables. The subjects were a homogeneous group of 19-24 year olds. The feature requests in the survey instrument were randomly selected from actual pending feature requests of users of Gmail. They were re-worded in a simple and standard style to avoid bias (see Table 3). Shifts in structure, content and format may introduce unwanted sources of variability that may confound subject response. To address the order or sequencing effect a counterbalancing design using Latin squares (see Sheeche and Bross, 1961) was used (see Table 4) to get subject responses for different methods of feature selection. Every fourth subject got the same sequence.

Table 4. Sequencing of treatments for selection of product features

	Round 2: Adding features to current version of COTS product		
Subject 1	Basic	Expected	Augmented
Subject 2	Expected	Augmented	Basic
Subject 3	Augmented	Basic	Expected

SAMPLE SIZE

The sample size for the experiment was determined based on the effect size found during the pilot study. The pilot study was conducted with subjects who were users of Astrid Task Manager a mobile app. Assuming a power of 0.8, $\alpha=0.05$ (one tail) and a medium effect size obtained in the pilot, a look up of Cohen's power primer (Cohen, 1992) gave the sample size. To account for mortality rate, as two rounds of experiments with a gap of one week between them were conducted in the study and there was a possibility of invalid responses from the subjects, the sample size obtained from Cohen's table was inflated by 20 % to get the required sample size of 54 subjects.

As it was difficult to find subjects who were users of Astrid Task Manager, Gmail was chosen as a COTS product for investigation in the actual study. Although data from 138 subjects was obtained, the analysis was restricted to 122 valid responses.

METHOD OF ANALYSES

Repeated measure ANOVA was used to test the difference in user satisfaction overall, at high levels of performance (satisfaction), and at low levels of performance for all three experimental treatments, that is when a Basic feature is added to a subset, when a Performance feature is added to a subset and when a Augmented feature is added to a subset. The category of feature is the independent variable and user satisfaction is the dependent variable. In this study the measurement of dependent variable user satisfaction was repeated as subjects rate their

responses on “user satisfaction” for each of the three experimental treatments. Using a standard ANOVA in this case is not appropriate because it fails to model the correlation between the repeated measures as the data violate the ANOVA assumption of independence. IBM® SPSS® Statistics Version 19 was used to run repeated measures ANOVA. ANOVA is robust against violations of normality but requires that the variances for each set of different scores and their covariances are equal. Violations of this assumption of sphericity can invalidate the analysis. The Mauchly’s (1940) sphericity test was therefore conducted to evaluate sphericity.

RESULTS AND ANALYSES

The descriptive statistics for the user satisfaction for the current version of Gmail software and when 1 Basic, 1 Expected or 1 Augmented feature listed above were added to it is shown in Table 5 below:

Table 5. Descriptive Statistics - Overall

Experimental Condition	Mean	Standard Deviation	N
1 - Current Version (baseline)	4.54	1.293	122
2 - Adding 1 Basic feature	4.60	1.251	122
3 - Adding 1 Expected feature	4.66	1.383	122
4 - Adding 1 Augmented feature	4.67	1.369	122

However the data violated the assumption of sphericity as the probability of Mauchly's test statistic was less than 0.05 as shown in the Table 6 below:

Table 6. Mauchly's Test of Sphericity - Overall

Mauchly's W	Approx. Chi-Square	df	Sig.
.610	59.261	5	.000

Applying the Greenhouse-Geisser (1959) correction reveals that the difference in the mean scores of four experimental conditions of IS product are statistically significant ($p=0.005$).

Although an overall significant difference in means was observed it is not known where those differences occurred. The post-hoc test result in the pair-wise comparison Table 7 below (row - column) was therefore examined for all the 4 experimental conditions to discover which specific means differed. Post hoc tests using the Bonferroni correction revealed that adding a Basic, Expected or Augmented features significantly increased the satisfaction level of users. It can be therefore infer that all the three types of innovation do affect user satisfaction levels. However the satisfaction level increase due to adding an Expected or Augmented features was significantly higher than adding a Basic feature in the IS product.

Table 7. Difference in Mean User Satisfaction - Overall

EXPERIMENTAL CONDITIONS	Current Version	After adding 1 Basic feature	After adding 1 Expected feature	After adding 1 Augmented feature
Current Version	0			
After adding 1 Basic feature	.057*	0		
After adding 1 Expected feature	.115*	0.57*	0	
After adding 1 Augmented feature	.131*	0.74*	0.016	0

* $p < .05$ ** $P < .01$ *** $p < .001$

The effect of these features at various performance levels was next examined. Repeated measure ANOVA was used for users below the threshold (neither satisfied nor dissatisfied) level of satisfaction that is below level 4 of the terrible-delighted scale, which implies the user is neither satisfied nor dissatisfied. The descriptive statistics for the various experimental conditions is shown in Table 8.

Table 8. Descriptive Statistics – at Below Threshold (BT) performance

Experimental Conditions	Mean	Standard Deviation	N
1 - Current Version	2.76	.435	29
2 - Adding 1 Basic feature	2.93	.371	29
3 - Adding 1 Expected feature	2.76	.435	29
4 - Adding 1 Augmented feature	2.86	.441	29

Table 9. Mauchly's Test of Sphericity -BT

Mauchly's W	Approx. Chi-Square	df	Sig.
.691	9.884	5	.079

The Mauchly's Sphericity test (Table 9) was found to be not significant ($P > 0.05$). Assuming Sphericity it was found that the mean scores of the four different experimental conditions of IS product are statistically significant ($p = 0.026$). To further assess the specific differences the post-hoc test (Table 10) result was examined in the pair-wise comparison table below to discover which specific means differed. Looking at column titled current version of the post hoc tests (Table 10) it can be seen that only Basic feature adds significantly ($p < .05$) to the satisfaction levels. Adding an Expected or Augmented feature below threshold level of product performance did not add significantly to user satisfaction.

Table 10. Difference in Mean User Satisfaction - BT

SCENARIOS	Current Version	After adding 1 Basic feature	After adding 1 Expected feature	After adding 1 Augmented feature
Current Version	0			
After adding 1 Basic feature	.172*	0		
After adding 1 Expected feature	.000	-.172*	0	
After adding 1 Augmented feature	.103	-.069	.103	0

* $p < .05$ ** $P < .01$ *** $p < .001$

Finally, the effect of adding a feature at high level of performance that is performance above level 4 or the threshold level (see Descriptive statistics in Table 11 below) was examined.

Table 11. Descriptive Statistics - Above Threshold (AT) performance

Experimental Conditions	Mean	Standard Deviation	N
1 - Current Version	5.55	.435	66
2 - Adding 1 Basic feature	5.56	.371	66
3 - Adding 1 Expected feature	5.70	.435	66
4 - Adding 1 Augmented feature	5.73	.441	66

The Mauchly's test for sphericity as can be seen from Table 12 below failed ($p=0.000$).

Table12. Mauchly's test of Sphericity -AT

Mauchly's W	Approx. Chi-Square	df	Sig.
.425	54.596	5	.000

After applying the Greenhouse-Geisser correction it was found that overall there is a significant ($p=.001$) change in mean by adding different features to the current version of Gmail.

The post-hoc test result was therefore examined in the pair-wise comparison (Table 13) below to

discover which specific means differed. Looking at column titled current version of the post hoc tests (Table 13) it can be seen that adding a Basic feature did not significantly increase the level of user satisfaction. However, adding Expected or Augmented features significantly increased the satisfaction level of users. No significant difference was found between adding an Expected or Performance feature to the current version of Gmail.

Table 13. Difference in Mean User Satisfaction - AT

SCENARIOS	Current Version	After adding 1 Basic feature	After adding 1 Expected feature	After adding 1 Augmented feature
Current Version	0			
After adding 1 Basic feature	.015	0		
After adding 1 Expected feature	.152*	.136*	0	
After adding 1 Augmented feature	.182*	.167*	.030	0

* $p < .05$ ** $P < .01$ *** $p < .001$

The results of the experiments are summarized in the Table 14 below:

Table14. Summary of Results of Experiments

Current Level of User Satisfaction	Change in User Satisfaction after a Basic innovation	Change in User Satisfaction after an Expected innovation	Change in User Satisfaction after an Augmented innovation
Below Threshold	Positive (Hypothesis 2-2 supported)	Not Significant <u>(Hypothesis 2-4 not supported)</u>	Not Significant (Hypotheses 2-6 supported)
Above Threshold	Not Significant (Hypothesis 2-1 supported)	Positive (Hypothesis 2-3 supported)	Positive (Hypothesis 2-5 supported)

INTERPRETATION AND DISCUSSION OF RESULTS

The results of the analysis thus show that only Hypothesis 2-4 was not supported. Thus the characteristic impacts of the three types of innovations on user satisfaction were not fully supported. While the Basic and Augmented innovations displayed characteristics as hypothesized, the Expected feature did not display the expected behavior at low level of performance. Perhaps at performance below threshold level of satisfaction the user remains focused on the product fulfilling the Basic requirements. Even though Expected innovations are uppermost in his consciousness it is only after the Basic requirements are fulfilled that the users start giving credit for the fulfilling their expectations. This could be a possible reason for the positive impact of Expected innovations only above threshold levels of product performance.

Thus the empirical results of the study show that innovations can be categorized into two buckets instead of three based on their distinctive characteristics - Basic innovation in one bucket and Expected and Augmented Innovations together in the second bucket. These two bucket categories can be explained by viewing the innovations in the second bucket as “motivators” in line with Herzberg’s (1966) Motivation-Hygiene theory. These innovations will impact user outcomes only when the “Hygiene” (Basic) requirements of the users in the first bucket are first met. Until the Hygiene requirements are met the users remain firmly at below the threshold level of satisfaction. Only by fulfilling the Hygiene or Basic requirements do the users reach the threshold level of satisfaction for the “Motivators” (expected and augmented innovations) to take effect.

CONTRIBUTION

While collaboration with users can span several business processes, one of the most important is collaborating to create value through product innovation. Although not all users may be creative or have innovative suggestions, collectively they can be a powerful source for innovation. The business risk of implementing innovation using this approach is less, as innovation suggestions come directly from the users and is categorized based on user response. The producer is also neither constrained for new ideas by the geographical boundaries nor those of the served markets.

However, innovative products cannot be designed and developed by accident. A need has been felt to develop a new typology to advance our knowledge of innovation - “Researchers have identified various innovation types on an ad hoc basis, and this has resulted in research myopia” (Garcia and Calantone, 2002). This study through the use of a new typology of product innovation offers an approach for engendering innovation of evolving COTS products. The typological scheme suggested in this study offers useful insights into the different types of product innovation and empirically validates their predicted impact on product outcomes at different levels of product performance. The effectiveness of this approach was tested on an actual COTS product with actual users of the product as subjects.

The findings of this study offer managers guidance for making trade-off decisions between different types of COTS product features. Investing in Basic innovation is not remunerative at high level of COTS product performance. They have maximum impact if the business goal for the COTS product is market entry when the product performance is typically low. On the other hand investing in Expected and Augmented innovations is not remunerative at low level of product performance. They have maximum impact if business goal for the COTS

product is differentiation and when the product performance is typical above the minimum threshold.

The typological scheme proposed in this study has advantage over other product typologies such as incremental and breakthrough innovation which represent the *degree of “newness”* (Garcia, and Calantone, 2001). “Newness” is a subjective measure and can vary from person to person and from product to product. Also it is not clear this “newness” is from whose perspective, the user, the firm or the industry (Garcia, and Calantone, 2001). .

By contrast, the typological scheme suggested in this article is from the user perspective, can be operationalized easily, the types of innovation can be systematically determined for new product features and their outcomes predicted. Depending on the product goals and the current level of IS product performance decision can then be made regarding which type of innovation should be implemented into the evolving IS product.

LIMITATIONS

The subjects chosen for the empirical study are youth between 19-24 years of age. The rationale was to get as homogenous a group of sample as possible as the objective of the study was to control extraneous variables such as segmental difference in user preferences and mitigate alternative explanations for the results obtained. In addition, the study investigated user feature choices for only one COTS product. These design choices may limit the generalizability of the results.

Only 1 user feature request belonging to each of the three innovation categories: Basic, Expected and Augmented were used in the test instrument. This was done because the same number of features in each category was required to be used for subject evaluation and not all

subject choices using the Kano survey would result in 2 or more features for further evaluation in the experiment. In addition using only 1 feature would mitigate the interaction effects due to presenting the subjects with multiple feature requests in each category for their evaluation. However, by limiting the number of feature requests in each innovation category to 1, it is possible that the incremental impact of the feature on user satisfaction with Gmail may have gone undetected in certain experimental conditions.

FUTURE RESEARCH

This study considered a mature and established COTS product such as Gmail. Future studies may replicate this study for innovations in COTS products in various stages of their life cycle, such as Introductory, Growth and Decline stages. Also for generalizability of the results obtained in this study, the study may be replicated for other user segments.

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HEDONIC-UTILITARIAN FEATURE SELECTION TRADE-OFFS DURING COTS PRODUCT EVOLUTION

INTRODUCTION

“Customers want products that dazzle their senses, touch their hearts and stimulate their minds” -

(Schmitt, 1999)

Until the first quarter of the twentieth century, more than two hundred years after the industrial revolution, the design of commodities and mass production artifacts were quite devoid of hedonic considerations (Tractinsky, Katz and Ikar, 2000). Later the pioneering work in industrial design such as Loewy and Dreyfuss (Petroski, 1993) saw the introduction of hedonic considerations to mass production. Likewise, the relatively young software engineering discipline has so far focused largely on utilitarian aspects of IS products rather than the hedonic.

The reason may lie in the computing disciplines’ origins in disciplines that emphasize hard science, efficiency, and utility (Tractinsky, 2006). The present set of engineering techniques take a narrow view of users’ experience by considering only user requirements for work related activities (Stelmaszewska, Fields, and Blanford, 2004). However, users strive for a more complete experience with software products, an experience that not only achieves well-defined goals, but also involves the senses and generates affective response (Bly, Cook, Bickmore, Churchill and Sullivan (1998). To evoke affective responses Hedonic features should be provided in the IS product (Ajzen, 2001).

There is mounting evidence in support of the importance of hedonic attributes in IS products. For example, Apple's iMac was heralded as the "aesthetic revolution in computing," and an indication that the visual appearance of IS has become a major factor in buyers' purchase decisions (Postrel, 2001). The growing demand for personalized user interface seems to spring from a quest for richer and more affective experiences (Blom and Monk, 2003). Product aesthetics is often the only differentiating factor in crowded or mature markets (Artacho-Ramirez, Diego-Mas, and Alcaide-Marzal, 2008; Postrel, 2001; Tractinsky and Zmiri, 2006); and customers expect attractive things to work better regardless of their real performance (Norman, 2002). Fogg et al. (2002) found that users use the design look of a site as the most promising cue in evaluating the site's credibility.

IS products today, including those designed for business use, have increasing potential for offering hedonic possibilities such as aesthetically pleasing and multisensory user interfaces, entertainment and fun (Van and Vos, 2001; Thorlacius, 2004). It has been suggested that people who have fun at work should experience less stress (McGhee, 2000; Miller, 1996), demonstrate lower turnover and absenteeism (Mariotti, 1999). Zbar, 1999), and are more energized and motivated (Stern and Borcia, 1999). People who have enjoyment at work get along with others better (Meyer, 1999) and provide better customer service (Berg, 2001).

However, this does not imply overemphasizing frivolity and glitz in lieu of substance and usefulness (Tractinsky, 2004). Unlike the arts where beauty may be the sole or chief end or computer games which are designed primarily for entertainment and fun, in industrial products hedonics can only be part of their total meaning. A good design is one that keeps the form, function and the aesthetic quality in balance. To produce an elegant IS product for business use, it might not only be important to identify those features that serve the basic product function and

those that make the product attractive, but also understand the set of rules to strike a right balance between the utilitarian and the hedonic.

Keeping this context in view this study endeavors to answer the following research questions:

1. How do Utilitarian and Hedonic value of building features in a COTS IS product impact user outcomes such as the size of user base?
2. What is the trade-off between providing Utilitarian and Hedonic value during COTS product evolution?

To answer these questions:

1. A review of literature is first conducted to understand the characteristics of Hedonic and Utilitarian dimensions of COTS product and the value they provide to the user.
2. The review then investigates the importance of User loyalty and WOM to the producer of COTS products
3. Thereafter the relationship between Hedonic value and Utilitarian value provided by the COTS product and User loyalty and WOM is hypothesized and tested using a pencil-and-paper based cross sectional survey
4. The unexpected results obtained in the cross sectional study are confirmed through a longitudinal study
5. Finally the possible explanations for the results obtained are discussed along with their implications for future research and practice

LITERATURE REVIEW

UTILITARIAN AND HEDONIC FEATURES

Products are multifaceted and can provide value in many ways. While theoretically, one could probably break down value into many very specific types, a very useful value typology can be developed using only two types – the utilitarian value and hedonic value (Hirschman and Holbrook, 2002). Utilitarian product attributes are “useful, practical, functional, something that helps you achieve a goal” (Strahilevitz and Myers, 1998), while Hedonic product attributes are “Pleasant and fun, something that is enjoyable and appeals to your senses” (Holbrook and Hirschman, 1982). Product development literature has provided empirical support for the notion that both “utilitarian”/ “functional” and “hedonic”/“aesthetic” dimensions capture distinct and critical aspects of product differences (e.g., Batra and Ahtola, 1990; Block 1995; Dhar and Wertenbroch, 2000; Mano and Oliver, 1993; Schmitt and Simonson, 1997; Strahilevitz and Myers, 1998; Veryzer, 1995). A synthesis of literature shows the following characteristic differences between Utilitarian and Hedonic features (Table 1).

HEDONIC-UTILITARIAN VALUE AND MOTIVATION THEORY

The motivational theory by Deci (1975) can be useful in understanding the role played by Hedonic and Utilitarian motivations of using IS. The motivation theory distinguishes between different types of motivation based on the different reasons or goals that give rise to an action. As Edward Deci (1975) noted “The most basic distinction is between intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation, which refers to doing something because it leads to a separable outcome.” Research

has shown that intrinsic and extrinsic motivations can lead to very different quality of experience and performance.

Intrinsic motivation is the drive to perform an activity for its inherent satisfaction rather than for some external consequence. When intrinsically motivated a person acts for the fun or challenge rather than for external rewards. Extrinsic motivation thus contrasts with intrinsic motivation and refers to the instrumental value of performing the activity rather than doing it for the enjoyment of the activity itself.

From motivational perspective of consumption, hedonic benefits entail intrinsic value as they are an end in themselves, whereas utilitarian entail extrinsic values as they are a means to an end. As many of the tasks that employees perform using IS are not inherently interesting or enjoyable, introducing hedonic elements may promote voluntary forms of extrinsic motivation. As Van der Heijden (2004) suggested Hedonic features can be provided into Utilitarian systems to make them enjoyable and easy to use, much like a parent persuading a child to swallow bitter pill by administering it with a sweetener to make it go down more easily. Employees can then perform extrinsically motivated actions with less resentment, resistance, and disinterest.

CONSUMER LOYALTY AND WOM

User loyalty and positive WOM (Word-Of-Mouth) are key business outcomes for the producer of products and services. User loyalty is defined as a deeply held commitment to repurchase or re-patronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behavior (Oliver, 1999). WOM communication

refers to “person-to-person communication between a receiver and a communicator whom the receiver perceives as noncommercial, regarding a brand, a product or a service” (Arndt, 1967).

It makes business sense to have loyal customers as it costs more to attract new customers than to retain current customers (Zhang and von Dran, 2001). Acquiring new customers may cost as much as five times more than retaining existing ones, given the costs of searching for new customers, setting up new accounts, and initiating new customers to the product (Parthasarathy and Bhattacharjee, 1998). Word-of-mouth (WOM) is more effective advertiser than all the paid advertisements placed in the media (Kotler, 1994). It is far and away the most powerful force in the marketplace (Silverman, 1997).

Thus, together User loyalty and Word-of Mouth impact the size of the user base and were therefore used as dependent variables in the study. While User Loyalty provided a measure of the ability of the COTS product to retain existing users, WOM provided a measure of the ability of the COTS product to attract new users.

SELF EFFICACY

Self-efficacy (Bandura, 1986) represents an individual’s perception of his or her ability to successfully execute some specific task, in this case, using the software. It has been used to measure computer skill (e.g., Harrison and Rainer 1992, Rainer and Harrison 1993). It is expected that users with higher self-efficacy will be able to extract greater utilitarian value from the product than users with lower self-efficacy. Therefore self-efficacy was used as a control variable in measuring the effects of utilitarian and hedonic value on user loyalty and WOM.

Table 1. Comparison of Hedonic and Utilitarian features

UTILITARIAN PRODUCT FEATURES	HEDONIC PRODUCT FEATURES
They represent “shoulds” (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)	They represent “wants” (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)
They are functional and practical Stelmaszewska, (Fields, and Blanford, 2004)	Represent novelty, aesthetics, unexpectedness, fun (Stelmaszewska, Fields, and Blanford, 2004)
Limited (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)	Unlimited (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)
Are means to an end (Babin and Harris, 2011)	Are ends in themselves (Babin and Harris, 2011)
Represent cognitive or reasoned preferences of the user (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)	Represent emotional or affective preferences of the user (Bazerman Tenbrunsel, and Wade-Benzoni, 1998)
Generates cognitive satisfaction response when fulfilled (Berman, 2005; Chitturi, Raghunathan and Mahajan, 2008).	Generates affective delight response when fulfilled (Berman, 2005; Chitturi, Raghunathan and Mahajan, 2008).
Elicitation requires understanding of customer needs	Elicitation requires innovation and creativity
Can be objectively appraised (Chitturi, 2009)	Are Subjective, Experiential (Chitturi, 2009)
Represent Maslow’s Lower level needs (Vlašić, Janković and Kramo-Ćaluk, 2011)	Represent Maslow’s Higher Level needs (Vlašić, Janković and Kramo-Ćaluk, 2011)
Represent Herzberg’s Hygiene factors (Zhang and von Dran, 2000)	Represent Herzberg’s Motivators (Zhang and von Dran, 2000)
Pain avoidance (Higgins, (1997, 2001); Chernev ,2004)	Pleasure seeking (Higgins, (1997, 2001), Chernev ,2004)
Fulfills Preventive goals (Higgins, 1997, 2001).	Fulfills Promotional goals (Higgins, 1997, 2001).
Results in Disgust/ Anger when unfulfilled (Chitturi, Raghunathan and Mahajan 2008)	Results in Dissatisfaction when unfulfilled (Chitturi, Raghunathan and Mahajan 2008)

CROSS SECTIONAL STUDY

HYPOTHESES DEVELOPMENT

Loyalty is the result of the individual's belief that the value received from consuming a product or service is greater than the value of non-consuming (Hallowell, 1996). In response to this greater value obtained, the individual is motivated to remain loyal to the product and to promote it by, for instance, positive WOM behaviors (Luis, Carlos and Migue, 2008). The extent of utilitarian value that the consumer receives from the utilitarian features in a product is the degree to which it helps her achieve functional and practical goals. The extent of hedonic value the consumer receives from hedonic features in a product is the degree to which it gives her pleasure, enjoyment or fun. Hence both Utilitarian benefits and Hedonic benefits will directly and positively impact consumer loyalty and positive WOM.

Hypothesis 3-1: Controlling for user Self Efficacy, Utilitarian value of an IS product will directly and positive impact user loyalty

Hypothesis 3-2: Controlling for user Self Efficacy, Utilitarian Value of an IS product will directly and positively impact user WOM

Hypothesis 3-3: Controlling for user Self Efficacy Hedonic value of an IS product will directly and positively impact user loyalty

Hypothesis 3-4: Controlling for user Self Efficacy Hedonic value of an IS product will directly and positively impact user WOM

METHOD

A questionnaire based survey using a paper-and-pencil instrument was used for the cross-sectional study.

STUDY SETTING

Gmail is an exemplar of evolving COTS product from Google. Since it was first introduced in April 2004, Gmail has today evolved to become the number one web based email platform by introducing innovative features. The Gmail Labs feature allows users to test new or experimental features of Gmail. Ten randomly selected user feature requests were chosen in late October 2012 as the test instrument for this study. The pilot study used 15 feature requests in the test instrument. But based on the subject feedback of cognitive overload, during the debriefing session, it was decided to include only 10 feature requests in the actual study. A sample set of feature requests is shown in Table 3. The full set of ten feature requests is shown in Appendix B.

SUBJECTS

A young adult (ages 19-24) cohort was used as subjects because users in this age group are recognized as innovators and early adopters of the latest technologies (Ehrenberg, Juckes, White, and Walsh, 2008). Table 2 provides the demographics of the subjects. The subjects' age ranged between 19 and 24 years and female students outnumbered males. The average age of the subjects was 21.28 years with the female subjects averaging 21.34 years and the male subjects averaging 21.22 years.

The subjects were recruited from a state university as all subjects were required to use the university Gmail account and Gmail was the COTS IS product under investigation in this study. The subjects were experienced users of Gmail who regularly used the mail system on a daily basis. Actual users of Gmail were involved in the study because features should be important from the users' perspective not the developer's (Fellows and Hooks, 1998). Before conducting the study subject consent was taken. The 10 Gmail feature requests were read out aloud and subject response taken on whether they have understood the user requirements.

Table 2. Demographics of Subjects

Age in Years	Number	Number of Females	Number of Males
19-20	53	29	24
21-22	30	19	11
23-24	39	21	18
Total	122	69	53

VARIABLES USED IN THE STUDY

The independent variables are the Utilitarian Value and Hedonic Value of Gmail and dependent variables are user Loyalty and WOM. To control for other source of variation in results obtained, user efficacy in using Gmail was statistically controlled.

Utilitarian Value

The Venkatesh and Davis (2000) scale was used for measuring Utilitarian value of Gmail. A sample item from this scale is: “Using Gmail increases my productivity”.

Hedonic Value

The Babin, Darden and Griffin (1994) scale was used for measuring the Hedonic value of Gmail. A sample item from this scale is: “While using Gmail I feel happy”.

Loyalty

The Casaló, Flavián and Guinalíu (2008) scale was used for measuring Loyalty of Gmail users. A sample item from this scale is: “I have intention to continue to use Gmail”.

Word-Of-Mouth

The Casaló, Flavián and Guinalíu (2008) scale was used for measuring WOM of Gmail users. A sample item from this scale is: “I will recommend Gmail to other potential users”.

Efficacy

The Marcolin, Compeau, Munro and. Huff (2001) scale was used for measuring the user efficacy with Gmail. A sample item from this scale is: “I can use Gmail and its advanced feature if someone showed me how to use it first”.

All the above measures (see APPENDIX A for complete list of items) used a 9-point Likert scale with anchors of 1 (strongly disagree) and 9 (strongly agree). A review of the literature indicates that expanding the number of choice-points beyond 5- or 7-points does not systematically damage scale reliability, yet such an increase does increase scale sensitivity (Cummins and Gullone, 2000). Scale items were averaged to create an overall value for each construct. Responses were coded such that high levels of the constructs are represented by high values.

STUDY DESIGN

Subjects answered a paper-and pencil based survey that captures data on the independent, dependent and control variables using tested measures from prior research. A repeated measure design was used. The data on dependent variables, User loyalty and WOM, independent variables, HV and UV, and control variable, user efficacy in using Gmail, were captured from each subject for the current version of Gmail used by her. The repeated measure design is extremely sensitive to finding statistically significant differences between conditions. Variation

in results due to individual subject differences is mitigated. In addition fewer subjects are needed for the survey.

CONTROL PROCEDURES

A number of control procedures were used to eliminate extraneous variables. The subjects were a homogeneous group of 19-24 year olds. The feature requests in the survey instrument were randomly selected from actual pending feature requests of users of Gmail. They were re-worded in a simple and standard style to avoid bias (see Table 3). Shifts in structure, content and format may introduce unwanted sources of variability that may confound subject response.

Table 3. Sample of Feature Description in Test Instrument

No	Feature description
1	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
2	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
3	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
4	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
5	Threaded conversations should be made optional to users. Presently it is a mandatory feature

SAMPLE SIZE

The sample size for the survey was determined based on the effect size found during the pilot study. The pilot study was conducted with 49 subjects who were users of Astrid Task Manager a mobile app. Assuming a power of 0.8, alpha=0.05 (one tail) and a medium effect size obtained in the pilot, a look up of Cohen's power primer (Cohen, 1992) gave the sample size. To

account for mortality rate, as two rounds of surveys with a gap of one week between them were conducted in the longitudinal study (described in the next section), and the possibility of invalid responses from the subjects, the sample size obtained from Cohen's table was inflated by 20 % to get the required sample size of 54 subjects.

As it was difficult to find subjects who were users of Astrid Task Manager, Gmail was chosen as a COTS product for investigation in the actual study. Although data from 138 subjects was obtained, the analysis was restricted to 122 valid responses.

METHOD OF ANALYSES

To establish reliability and validity of the measures used in the study factor analysis was performed and internal reliabilities and correlation matrix of the measures were examined.

Hierarchical Linear Regression (HRA) was used for analyzing the data obtained. Hierarchical Linear Regression reveals how well each independent variable predicts the dependent variable, after extracting variance due to other independent and control variables in the regression equation. It is also useful for assessing interaction effects after extracting variance due to independent and control variables.

Hierarchical Regression Analysis (HRA) was conducted, first to test the direct effects and interaction between Hedonic and Utilitarian value of Gmail on User Loyalty, controlling for user self efficacy and WOM, and then to test the direct effects and interaction between Hedonic and Utilitarian value of Gmail on WOM controlling for self efficacy and user loyalty.

In the first step of the first HRA analysis self efficacy and WOM were included, followed by Hedonic value and Utilitarian value of Gmail in the second step and the Hedonic-Utilitarian cross product term was included in the third step. In the first step of the second HRA analysis

self-efficacy and user loyalty were included, followed Hedonic value and Utilitarian value of Gmail in the second step and the Hedonic-Utilitarian value cross product terms was included in the third step. In the study HRA tests for the significance of the increment in criterion variance explained by the main effects after extracting the variance due to control variables and then increment in criterion variance explained by interaction terms beyond that attributed to the main effects.

RESULTS AND ANALYSES OF CROSS SECTIONAL STUDY

The factor analysis procedure was done using IBM[®] SPSS[®] Statistics Version 19. Dimension reduction was performed on the data pertaining to all the 5 measurement scales. The results of Varimax rotation (Table 4) show that the 5 factors extracted represented each of the five scales. All items of a scale loaded on the respective factors (E1 to E8 represented the items in the self efficacy scale, U1 to U5 represented items in the Utilitarian value scale, H1 to H5 represented items in the Hedonic value scale, L1 to L3 represented items in the user loyalty scale and W1 to W5 represented items in the user WOM scale). Convergent and discriminant validity between scales are evident by the high loadings within factors, and no cross loadings between factors.

The internal reliabilities of the scales used in the study: self efficacy, hedonic value, utilitarian value, hedonic value, user loyalty and WOM were then examined. As can be seen from the Table 5 the alpha reliabilities are all greater than .70.

Table 4. Factor Analysis using Varimax Rotation

	Factor				
	1	2	3	4	5
E1	.942	.019	-.044	-.052	.010
E2	.906	.023	.014	.040	-.010
E3	.910	.016	-.052	-.030	.004
E4	.799	-.025	.045	.094	-.143
E5	.857	-.001	.015	-.137	.086
E6	.840	-.026	.075	-.040	-.017
E7	.868	.019	.028	.063	-.003
E8	.879	.104	-.002	.046	.025
U1	.041	.896	.123	.133	.100
U2	.064	.840	.132	.010	.260
U3	.015	.867	.129	.087	.078
H1	-.079	.000	.635	.264	.097
U4	.008	.882	.103	.045	.166
H2	.074	.087	.889	.003	.067
U5	-.020	.899	.165	.068	.069
H3	.018	.122	.862	.088	.067
H4	.029	.200	.835	.108	-.012
H5	.035	.217	.851	.021	-.009
L1	-.089	.148	.165	.125	.800
L2	.044	.217	-.057	.199	.871
L3	.010	.229	.073	.217	.840
W1	-.019	.115	.458	.733	-.002
W2	.029	.146	.105	.870	.091
W3	.002	.067	.135	.858	.185
W4	-.017	.016	-.036	.829	.295

Table 5. Internal Reliability of Scales

Name of the scale	Cronbach's alpha	N of Items
Self Efficacy	.956	8
Utilitarian Value	.941	5
Hedonic Value	.889	5
User Loyalty	.862	3
WOM	.884	4

Table 6 provides the means, standard deviations, and correlation matrix for the variables in this study. From Table 6 it is clear that none of the correlations are too high (> 0.65) demonstrating that each scale is adding something new. Interestingly, Table 5 shows that the Hedonic value of Gmail is quite high even slightly higher than Utilitarian value. This could be due to social cues inherent in Gmail leading to increased pleasure and arousal (Wang, Baker, Wagner and Wakefield 2007).

Table 6. Means, Standard Deviations, and Correlations

Variable	Mean	Std Dev	1	2	3	4	5
1. Self Efficacy	4.451	2.549	1				
2. Utilitarian Value	4.962	2.049	0.023	1			
3. Hedonic Value	5.072	1.939	0.009	0.305**	1		
4. User Loyalty	5.735	1.927	0.025	0.382**	0.163	1	
5. User WOM	5.133	2.039	0.030	0.220	0.311**	0.389**	1
* $p < .05$ ** $P < .01$ *** $p < .001$, N=122							

Results from HRA in Table 7a show that in the first step Self Efficacy and User loyalty explained 15.2 % of the variance in WOM, Utilitarian Value did not significantly explain any variance in WOM, Hedonic Value explained an additional 5.7 % variance while the interaction term of Hedonic Value and Utilitarian value did not have any significant impact on WOM.

Table 7a: HRA Results for WOM with current version of Gmail

Step	Variables added in each step	Adjusted R-Square	Change in R-Square	F Change
1	control: Self Efficacy and User Loyalty	0.138	0.152	10.656 ***
2	main effect: Utilitarian Value	0.137	0.006	0.859
3	main effect: Hedonic Value	0.188	0.057	8.532**
4	Interaction: Hedonic * Utilitarian Value	0.184	0.002	0.318
* $p < .05$ ** $P < .01$ *** $p < .001$				

Results from HRA in Table 7b show that in the first step Self Efficacy and WOM explained 15.2 % of the variance in User loyalty, Utilitarian Value explained a further 9.3 % variance in User Loyalty but both Hedonic value and the interaction term of Hedonic Value and Utilitarian value did not have any significant impact on User loyalty.

Table 7b: HRA Results for User Loyalty with current version of Gmail

Step	Variables added in each step	Adjusted R Square	Change in R-Square	F Change
1	control: Self Efficacy and WOM	0.137	0.152	10.639***
2	main effect: Utilitarian Value	0.225	0.093	14.486***
3	main effect: Hedonic Value	0.220	0.001	0.181
4	Interaction: Hedonic * Utilitarian Value	0.215	0.002	0.227
* p < .05 ** P < .01 ***p<.001, N=122				

The normal probability plot was examined to ascertain normal distribution of residuals. The Variance Inflation Factor (VIF) option was included in regression analyses to explore the extent of multicollinearity in the results. VIF is the degree to which the standard error has been increased because of multicollinearity. The higher the score, the more difficult it is to show that the coefficient is significantly different from zero. All of the VIF values were less than 1.5 indicating a lack of multicollinearity in results (Hair et al., 2006).

To summarize the results, of the cross sectional study are intriguing. Only Hypothesis 1 and 4 were supported. Utilitarian Value impacts User Loyalty but not WOM while Hedonic Value impacts WOM but not User Loyalty and the interaction term had no impact on either User Loyalty or WOM. In addition, although the relationship between HV and WOM and UV and User Loyalty were significant, little of the variation in the user loyalty (9.3%) and WOM (5.7%) was explained by UV and HV respectively. To affirm the results of the cross-sectional study a longitudinal study was conducted.

LONGITUDINAL STUDY

HYPOTHESES DEVELOPMENT

In line with the hypotheses developed for the cross sectional study, it is hypothesized that the HV and UV value provided by implementing the feature set into the current version of Gmail would change (increase) the HV and UV of the current version of Gmail. This in turn would lead to increased User Loyalty and WOM for Gmail.

But does a change in Utilitarian and Hedonic benefits have only a direct impact on change in Loyalty? The work of Higgins (1997, 2001), Chernev (2004), and Chitturi, Raghunathan and Mahajan (2008), indicate that the goals served by Utilitarian benefits are primarily to avoid pain, whereas the goals served by Hedonic benefits are primarily to seek pleasure. As Keiningham and Vavra (2001, p. 176) state, “Creating delight for your customers first requires knowing and eliminating their points of pain, and then listening to their desires.” For example, Chitturi et al. (2007) document that consumers attach greater importance to the Hedonic (versus Utilitarian) dimension, but only after a “necessary” level of functionality is satisfied.

In a sense, Hedonic features such as aesthetics may be viewed as a motivator, as opposed to the Utilitarian which may be viewed as a hygienic factor, to use Herzberg’s (Herzberg, 1966) terminology (Zhang, and von Dran, 2000). From another perspective, functional criteria involve evaluation of concrete attributes that meet utilitarian or practical needs, not unlike Maslow’s (1970) lower-level needs (Sack, Singh and Paolo, 2009). Hedonic needs represent higher level needs of the user in the Maslow’s hierarchy of needs (Vlašić, Janković and Kramo-Ćaluk, 2011). Maslow (1970) suggests that the basic needs must be met before an individual is motivated to

pursue higher level needs. If the lower level functional needs are not met the individual remains focused on its fulfillment first before desiring to move up the needs hierarchy. Thus fulfilling Hedonic needs alone will not impact user delight. The user will remain dissatisfied if his practical and functional needs utilitarian needs remain unfilled (Chitturi et al., 2007).

This is consistent with Kivetz and Simonson (2002), who state that, Utilitarian and Hedonic dimensions are conceptually related to necessities and luxuries respectively. Social scientists generally agree that, compared to necessities, luxuries hold a lower status in terms of importance (e.g., Berry 1994; Maslow 1970; Weber 1998). A predilection towards a hedonic alternative at the cost of functional performance is likely to raise concerns that one is being extravagant or frivolous, resulting in feelings of guilt (Kivetz and Simonson 2002). Although Hedonic features generate pleasure and joy, Kivetz and Simonson (2002a) note that consumers attach greater weight to the Utilitarian (versus Hedonic) dimension, unless they believe that they have “earned the right to indulge.”

Berry (1994) proposes a “principle of precedence” to argue that there is a moral obligation to fulfill needs first, before looking to fulfill luxuries. Until the user is satisfied that the required level of functionality is provided for in the product, she will prefer Utilitarian features over Hedonic. It allows her to avoid feeling guilty and puts her on a “safer ground” in justifying her decision. Customers thus pay little attention to hedonic characteristics before functional requirements are met. But, once functional requirements are met, consumers become interested in maximizing hedonic quality (Chitturi, 2003). This leads us to the following hypothesis:

Hypothesis 3-5: Controlling for user Self Efficacy an increase in Hedonic Value of an evolving

COTS IS product will significantly and positively impact a change in User Loyalty and

User WOM when the Utilitarian value of the current version of the IS product is high but will have no significant impact on customer loyalty and WOM when the Utilitarian value of the current version of IS product is low

Hypothesis 3-6: Controlling for user Self Efficacy a change in Utilitarian Value of an evolving COTS IS product will significantly and positively impact User Loyalty and User WOM when the Utilitarian Value of the current version of the IS product is low but will have no significant impact on customer loyalty and WOM when the Utilitarian value of the current version of IS product is high.

METHOD

An Experimental method was adopted in the longitudinal study. Experimental research is a useful method for examining cause and effect. It offers a methodical way of comparing differences in the effect of treatments (hedonic value and utilitarian value of the feature set) on the dependent variable (user loyalty and WOM). The extraneous variables “user efficacy” in using Gmail was controlled using statistics and “user segment” of Gmail users was controlled through sample. The “sequence effect” of manipulating different treatments and “individual differences” among subjects in the sample was controlled through experimental design.

STUDY SETTING

The study setting is similar to that described in the cross sectional study.

SUBJECTS

The same subjects whose responses were analyzed for the cross sectional study participated in the longitudinal study.

EXPERIMENTAL VARIABLES

The independent variables are the change in Utilitarian Value and change in Hedonic Value of Gmail due to implementing a set of feature request made by the users of Gmail. The dependent variables are the change in Loyalty and change in WOM of Gmail users due to implementing the requested feature set in Gmail. Only HV and UV of Gmail were manipulated and other conditions of the experiment were kept constant. The scales used for measuring HV, UV, WOM and user loyalty were same as those used in the cross sectional study.

STUDY DESIGN

A repeated measure design was used. The data on dependent variables, i.e. change in User loyalty and WOM, and independent variables i.e. change in HV and UV are captured from each subject for the current version of Gmail used by her. The repeated measure design is extremely sensitive to finding statistically significant differences between conditions. Variation in results due to individual subject differences is mitigated. In addition fewer subjects are needed for the experiment. The data on UV HV, User Loyalty and WOM of Gmail before implementing the feature set was captured from the subjects a week before the data on UV, HV, User Loyalty and WOM of Gmail after implementing the feature set. Previous research demonstrates that the temporal separation between measures reduces potential effects due to Common Method Variance (Sharma et al., 2009).

CONTROL PROCEDURES

A number of control procedures were used to eliminate extraneous variables. The subjects were a homogeneous group of 19-24 year olds. The feature requests in the survey instrument were randomly selected from actual pending feature requests of users of Gmail. They were re-worded in a simple and standard style to avoid bias (see Table 2). Shifts in structure,

content and format may introduce unwanted sources of variability that may confound subject response.

TEST INSTRUMENT

The same test instrument was used as was used for the cross sectional study (see Table 3)

METHOD OF ANALYSES

Hierarchical Moderated Regression Analysis (HRA) was conducted, first to test the direct effects of change in HV and UV on change in WOM and User Loyalty and then the moderation effect of UV of the current version of Gmail on the direct impacts of change in UV and HV on change in WOM and User Loyalty.

In the first step of the first HRA self efficacy and change in WOM were included, followed by change in HV and UV of Gmail in the second step and the Hedonic-Utilitarian cross product terms was included in the third step. In the first step of the second HRA self-efficacy and user loyalty were included, followed change in HV and UV of Gmail in the second step and the Hedonic-Utilitarian value cross product terms was included in the third step. In the study HRA tests for the significance of the increment in criterion variance explained by the main effects after extracting the variance due to control variables and then increment in criterion variance explained by interaction terms beyond that attributed to the main effects.

RESULTS AND ANALYSIS

The results of HRA in Table 8a shows that a change in HV and change in UV after implementing the feature set requested by users explained 5.5% of variance in WOM. On further analyses of the results (Table 8b) it was found that only change in HV resulted in a significant change in user WOM. The effect of change in UV was not found significant. The moderating

effect of Utilitarian value of the current version of Gmail on the impact of change in HV on change in WOM was not detected.

Table 8a: HRA Results for change in User WOM after feature enhancements

Step	Variables added in each step	Adjusted R-Square	Change in R-Square	F Change
1	control: Self Efficacy and User Loyalty	-0.011	0.006	0.358
2	main effect: Utilitarian Value, Hedonic Value of current version	-0.020	0.008	0.448
3	main effect: Change in Hedonic Value, Change in Utilitarian Value	0.021	0.056	3.479 *
4	Interaction: Hedonic Value * Change in Utilitarian Value, Hedonic Value * Change in hedonic Value, Utilitarian Value* Change in Hedonic Value, Utilitarian Value * Change in Utilitarian Value	0.035	0.045	1.422
* p < .05 ** P < .01 ***p<.001, N=122				

Table 8b: HRA Results for change in User WOM after feature enhancements

Step	Variables added in each step	Adj R-Square	Change in R-Square	F Change
1	control: Self Efficacy and User Loyalty	-0.011	0.006	0.358
2	main effect: Utilitarian Value, Hedonic Value of current version	-0.020	0.008	0.448
3	main effect: Change in Utilitarian Value	-0.027	0.002	0.201
4	main effect: Change in Hedonic Value	0.021	0.055	6.748*
5	Interaction: Hedonic Value * Change in Utilitarian Value, Hedonic Value * Change in Hedonic Value, Utilitarian Value* Change in Hedonic Value, Utilitarian Value * Change in Utilitarian Value	0.035	0.100	1.422
* p < .05 ** P < .01 ***p<.001, N=122				

Table 9a. HRA Results for change in User Loyalty after feature enhancements

Step	Variables added in each step	Adjusted R Square	Change in R- Square	F Change
1	control: Self Efficacy and WOM	-0.013	0.004	0.794
2	main effect: Utilitarian Value, Hedonic Value of current version	-0.024	0.010	0.711
3	main effect: Change in Hedonic Value, Change in Utilitarian Value	0.507	0.522	0.000***
4	Interaction: Hedonic * Utilitarian Value, Hedonic Value * Change in Utilitarian Value, Hedonic Value * Change in hedonic Value, Utilitarian Value* Change in Hedonic Value, Utilitarian Value * Change in Utilitarian Value	0.507	0.020	0.422
* p < .05 ** P < .01 ***p<.001, N=122				

The results of HRA in Table 9a shows that controlling for Self Efficacy and change in WOM a change in HV and change in UV explained 50.7 % of variance in change in user loyalty. On further analyses of the results (Table 9b) it was found that only change in UV resulted in a significant change in user loyalty. The effect of change in HV was not found significant. The moderating effect of Utilitarian value of the current version of Gmail on the impact of change in UV on User Loyalty was not detected. The normal probability plot was examined to ascertain normal distribution of residuals. All the VIF values were less than 1.5 indicating a lack of multicollinearity in the results (Hair et al., 2006).

Table 9b: HRA Results for change in User WOM after feature enhancements

Step	Variables added in each step	Adjusted R-Square	Change in R-Square	F Change
1	control: Self Efficacy and User Loyalty	-0.013	0.004	0.231
2	main effect: Utilitarian Value, Hedonic Value of current version	-0.024	0.006	0.342
3	main effect: Change in Utilitarian Value	0.509	0.519	127.864 ***
4	main effect: Change in Hedonic Value	0.507	0.003	0.629
5	Interaction: Hedonic Value * Change in Utilitarian Value, Hedonic Value * Change in hedonic Value, Utilitarian Value* Change in Hedonic Value, Utilitarian Value * Change in Utilitarian Value	0.507	0.017	1.015
* p < .05 ** P < .01 ***p<.001, N=122				

Thus the results of Hypotheses 5 and 6 were only partially supported. Only direct effect of change in UV and HV on change in User Loyalty and WOM respectively were observed corroborating the results observed in the cross-sectional study.

INTERPRETATION AND DISCUSSION OF RESULTS

Contrary to expectations, the results of both the cross sectional and the longitudinal study indicate that UV and HV have independent and characteristic impacts on critical business outcomes. While Utilitarian value of the product impacts User Loyalty, the Hedonic value of the product impacts WOM. It has been observed in past research that objects which carry instrumental characteristics evoke more cognitive responses, whereas those that carry less instrumental characteristics evoke more affective responses (Ajzen, 2001). Do the results of the study indicate that user loyalty is primarily the result of reasoned responses from the user caused by the utilitarian value derived from the product while WOM is the outcome of emotive responses of the user caused by the hedonic value derived from the product?

It is well established that affective responses of either valence (positive and negative) stimulate consumer WOM transmissions (Westbrook, 1987). An affective response of anger and regret lead to retaliatory responses such as negative WOM. The affective response of pleasure and fun lead to promotion responses such as positive WOM (Bonifield and Cole, 2007). Therefore the findings of a significant and positive effect of Hedonic value on user WOM is in line with this expectation as hedonic value provided by the product generates positive affective responses when fulfilled (Berman, 2005; Chitturi, Raghunathan and Mahajan, 2008).

However, why did Hedonic value not impact user loyalty? Could it be because an IS product such as Gmail was evaluated where user expectations are primarily instrumental? Thus while a higher Utilitarian value provided by the product resulted in higher user loyalty, Hedonic value in and by itself did not impact user loyalty, Yet discovering Hedonic value in a utilitarian product did go beyond user expectation and provided the thrill and motivation for talking about the product to others.

Perhaps a predominantly Hedonic IS product such as Facebook or computer games might provide different results, as the user expectations for these products would be Hedonic (Hart, Ridley, Taher, Sas, and Dix, 2008). In such products higher Hedonic value may result in increased loyalty, while the unexpected Utilitarian value derived from the product, such as educational value from a computer game, might provide the motivation for positive WOM. This might be an interesting area for future research to explore.

CONTRIBUTION

Features are building blocks of IS products. IS developers have to now contend with increasingly demanding users who strive for a more complete experience with IS, an experience

that not only achieves well-defined goals, but also involves the senses and generates affective response (Bly, Cook, Bickmore, Churchill and Sullivan, 1998; Venkatesh and Brown, 2001).

Today, the functional benefits are taken for granted. Customers want products “that dazzle their senses, touch their hearts and stimulate their minds” (Schmitt, 1999).

Keeping this context in view this study examines the impacts and interplay between hedonic value (novelty, aesthetics, unexpectedness, pleasure and fun) provided by the IS product and the utilitarian (functional) value provided by the IS product on critical business outcomes for the producer such as user loyalty and WOM. Based on the literature review the expectation was that both Utilitarian and Hedonic features will impact user Loyalty and WOM and that Utilitarian features will moderate the impact of hedonic features on both User Loyalty and WOM such that at high Utilitarian levels the impact of hedonic features on User loyalty and WOM would be significant and positive while at low Utilitarian levels the impact will not be significant.

However, the results of both the cross sectional and the longitudinal study indicate that UV and HV have independent and characteristic impacts on User Loyalty and WOM. Thus different goals are served by providing Hedonic value and Utilitarian value to the evolving product. This has implications for producers of COTS product. If the goal is to influence user loyalty producers of COTS products should focus on providing utilitarian benefits. If the goal is to influence WOM then producers of COTS products should focus on providing hedonic benefits. WOM occurs beyond organizational control; hence this finding is especially useful in providing producers of COTS products with a mechanism to influence user WOM.

The results of this study indicates that looking at IS requirements from the Hedonic and Utilitarian perspectives, rather than the traditional functional and non-functional perspectives, offers interesting insights especially in the context of market-driven IS products. The findings opens up new and interesting avenues for future research such as those highlighted in the previous section.

LIMITATIONS

The subjects chosen for the empirical study are youth between 19-24 years of age. The rationale was to get as homogenous a group of sample as possible as the objective of the study was to control extraneous variables such as segmental difference in user preferences and mitigate alternative explanations for the results obtained. In addition, the study investigated user feature choices for only one COTS product. These design choices may limit the generalizability of the results.

Only 10 user feature requests were used in the test instrument. This was done to mitigate the cognitive overload of the subjects used in the study based on subject feedback during the debriefing session of the pilot study. However, by limiting the number of feature requests it is possible that the incremental impacts of the feature subsets on user satisfaction with Gmail in certain experimental conditions may have gone undetected.

FUTURE RESEARCH

This study considered a predominantly utilitarian COTS product such as Gmail. Future studies may replicate this study for hedonic COTS products such as Facebook or Computer games to determine whether the same results of HV impacts WOM and UV impacting User Loyalty are obtained or whether the results are reversed as speculated in the discussion section. Also for generalizability of the results obtained in this study, the study may be replicated for other user segments.

In addition, the results of this study show that while an increase in UV resulted in a noteworthy 52 % increase in user loyalty, an increase in HV accounted for a mere 5.5 % change in WOM of the user of Gmail.. Keeping in view the value of WOM in attracting new users, studies may be conducted to understand the other product and non-product factors that could impact user WOM of COTS products for business use.

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OVERALL CONCLUSION

The quality of a software product is determined by its ability to satisfy the needs of the customers and users (Brooks, 1987). Consequently, by finding, selecting and developing products with suitable functionality, the chance of a successful project or product increases. It does not matter how well other parts of software development are conducted if the wrong functionality is implemented and users resist buying and using the product (Brooks, 1987).

Yet, although feature selection is a critical process that impacts development costs and IS products' market potential, it is a vexing issue for a IS development organization. Choosing the appropriate set of features from a larger set of candidate user feature requests has consequences for the customer and the development organization. For the customer or user of a IS product, the appropriate set of selected requirements must deliver the expected functionality of the application domain. For the development organization, the appropriate set of requirements must not only meet the customer's desired expectations, but also minimize the resource outlay and differentiate the product meaningfully from its competitors.

This three article study brings to attention the complexities of feature selection of COTS software products. By managing to tease out some of the finer relationships the findings of the study has potential to provide decision support to product managers and create new avenues for future research in the area of parsimonious selection of features that meet producer goals without sacrificing product quality. To summarize:

The first conclusion that can be drawn from the study is that taking penalty-reward perspective of users of a software product has value. It is important not only to take in consideration the user response to implementing a feature but also to take in consideration her response to not implementing the feature as the user penalty-reward perspective is not always symmetric as one would “rationally” expect. Hence additional business information can be extracted by taking both the penalty as well as the reward perspective. The study empirically demonstrates that techniques which use both the penalty and reward perspective, such as the Kano survey method, outperform techniques which use only the reward perspective such as Priority groups method and Binary search tree by identifying product features that resonate with the users.

The second conclusion that can be drawn from the study is the importance of the type of innovation that a feature provides to the user as well as the current level of COTS product performance in selecting features that will provide value to the user. High performing software products do not become better in the eyes of the users by providing additional Core or Basic type of innovation which are critical for software products at low level of performance. It can only increase the product complexity and perhaps “user fatigue”. At the high performance stage of software product evolution users have value for those features that meet their explicit needs and those unanticipated but exciting features that “thrill” them. Therefore classification techniques by identifying the various types of innovation have potential value in facilitating product managers take a “right” decision in selectively investing in only those features that meet the producer goals without sacrificing product quality.

The third conclusion is the intriguing role played by Utilitarian value and Hedonic value provided by software product features. Providing Hedonic value to software users did not

increase user loyalty to the software product. Similarly providing Utilitarian value to the software product did not impact the user motivation to promote the software product to other users. But an increase in Hedonic value of software product did encourage the user to endorse the product to other users and an increase in Utilitarian value boosted their intention to continue using the product. Thus it is important to assess the hedonic and utilitarian value of features. It will assist product managers in parsimoniously selecting only those features for implementation in evolutionary COTS products based on whether the goal is to retain existing users or attract new users or both.

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APPENDIX A. Measures Used in the Study

Measures and Items	Reference Source
Utilitarian Value	Venkatesh and Davis (2000)
Using Gmail improves my performance in my job.	
Using Gmail in my job increases my productivity.	
Using Gmail enhances my effectiveness in my job.	
I find Gmail to be useful in my job.	
I find Gmail to be helpful in my job.	
Hedonic Value	Babin, Darden and Griffin (1994)
While using Gmail, I feel happy.	
Compared to other similar things I could have done, the time spent using Gmail was truly enjoyable.	
When using Gmail, I feel excited.	
I had a very nice time while using Gmail.	
While using Gmail, I am able to forget my problems.	
Loyalty	Casaló, Flavián and Guinalíu (2008)
I have the intention to continue to use Gmail.	
Based on my experience, I am very likely continue my relationship with Gmail in future	
I am not likely to be persuaded to use other products in the web based email category	
Positive WOM	Casaló, Flavián and Guinalíu (2008)
I will recommend Gmail to other customers/ users	
I will point out the positive aspects of Gmail if anybody criticizes it	
I am likely to say positive things about Gmail to other people	
I am likely to recommend Gmail to someone who seeks my advice	
Self Efficacy	Marcolin, Compeau, Munro and Huff (2001)

I can use Gmail if someone showed me how to use it first	
I can use Gmail by using the built-in help facility for assistance	
I can use Gmail if I had a lot of time at my disposal to do it	
I can use Gmail if someone else helped me get started	
I can use Gmail if I could call someone to help me if I get stuck	
I can use Gmail if I had seen someone else using it before trying it myself	
I can use Gmail if I had a manual for reference	
I can use Gmail if there was no one around to tell me what to do as I go	

APPENDIX B. The 10 User Feature Requests Used in the Study

No	Feature description
1	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
2	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
3	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
4	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
5	Threaded conversations should be made optional to users. Presently it is a mandatory feature
6	Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future.
7	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
8	Allow change in account name without losing contents. Currently the user password can be changed but not the account name
9	Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
10	Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her.

APPENDIX C. IRB Approval

Symbols



INSTITUTIONAL REVIEW BOARD

To: Adarsh Kumar Satindaral Kakar
From: Dr. Steven Chesbro
Institutional Review Board Committee Member
Date: December 5, 2012
Re: Request for Approval of Proposal entitled "*Feature Selection for Evolutionary Commercial-Off-The-Shelf Software: Studies Focusing on Time-to-Market, Innovation and Hedonic-Utilitarian Trade-Offs.*"

In accordance with the Department of Human Services' Code of Regulations, Title 45 Part 46 -Protection of Human Subjects, I have considered your request for review of the research protocol entitled "*Feature Selection for Evolutionary Commercial-Off-The-Shelf Software: Studies Focusing on Time-to-Market, Innovation and Hedonic-Utilitarian Trade-Offs.*" Upon examination of your proposed protocol, I have determined that it should be *Exempt from Full Board Review* according to the categories identified in the Code of Federal Regulations Title 45 Public Welfare, Part 46. This approval is based upon the following criteria:

"Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods."

Your IRB approval number is **2012COBA002A**. This approval is good for one calendar year from the date of this memorandum. Please submit *Appendix D* to renew your approval if your study has not been completed by **December 5, 2013**. If your study has been complete, please submit *Appendix E*, the Final Report, to close your proposal. Please email irb@alasu.edu if you have any further questions or concerns. This document gives permission from the Alabama State University Institutional Review Board for you to conduct the study.

ALABAMA
STATE
UNIVERSITY

APPENDIX D. Consent Form for Student Participants in the Study

Thank you for agreeing to participate in this research study regarding the impact of user feature requests on software products. More specifically, we are looking to explore how the user feature requests are evaluated before implementing them in the product.

You have been asked to participate in this study as a student to provide you with the opportunity to learn about the process of real research. If you are at least 19 years of age, and you agree to participate in the study, we will ask you a series of questions in two sessions. The first session will take approximately 45 minutes and the second session about 20 minutes.

All of the information collected in this survey will be held confidentially and securely and used only by the researcher for educational purposes. Furthermore, the information obtained will not be linked to the subject. The only place where your name appears in connection with this study is on this informed consent. The consent forms will be kept in a file drawer in the researcher's office, which is locked when he is not there. We are not using a name-number list so there is no way to link a consent form to your responses.

Participation in this study is completely voluntary and does not present any foreseeable risks to you. If you decide to participate, you may withdraw at any time without affecting your relationship with the researcher or the instructor of your class, or Alabama State University. If you have any questions about this research, please contact Adarsh Kumar Kakar at akakar@alasu.ua.edu or at 334-229-6804.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATED THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Participant's Signature

Date

Witness

APPENDIX E. TEST INSTRUMENT ROUND 1 (COMMON FOR ALL SUBJECTS)

I. Background Information

- a) Name:
- b) Gender: Male/ Female
- c) Race: African American/ Asian/ Hispanic/ White/ Other
- d) Age:
- e) Major:
- f) Class: Freshman/ Sophomore/ Junior/ Senior
- g) Are you a user of Gmail? : Yes/ No

II. Efficacy in using Gmail

How confident are you about using Gmail and its advanced features such sending emails from specific sources directly to trash, sending appointment invitations, using priority inbox etc.

- a) I can use Gmail and its advanced features if someone showed me how to use it first

**Not at all
Confident**

☐
☐
☐
☐
☐
☐
☐
☐

**Totally
Confident**

☐

- b) I can use Gmail and its advanced features by using the built-in help facility for assistance

**Not at all
Confident**

☐
☐
☐
☐
☐
☐
☐
☐

**Totally
Confident**

☐

- c) I can use Gmail and its advanced features if I had a lot of time at my disposal to do it

**Not at all
Confident**

☐
☐
☐
☐
☐
☐
☐
☐

**Totally
Confident**

☐

- d) I can use Gmail and its advanced features if someone else helped me get started

**Not at all
Confident**

☐
☐
☐
☐
☐
☐
☐
☐

**Totally
Confident**

☐

- e) I can use Gmail and its advanced features if I could call someone to help me if I get stuck

**Not at all
Confident**

☐
☐
☐
☐
☐
☐
☐
☐

**Totally
Confident**

☐

- f) I can use Gmail and its advanced features if I had seen someone else using it before trying it myself

**Not at all
Confident**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Totally
Confident**

- g) I can use Gmail and its advanced features if I had a manual for reference

**Not at all
Confident**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Totally
Confident**

- h) I can use Gmail and its advanced features if there was no one around to tell me what to do as I go

**Not at all
Confident**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Totally
Confident**

III. Assessing current version of Gmail

- a) Using the current version of Gmail improves my performance in my job

**Strongly
Disagree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Strongly
Agree**

- b) Using the current version of Gmail increases my productivity

**Strongly
Disagree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Strongly
Agree**

- c) Using the current version of Gmail enhances my effectiveness in my job

**Strongly
Disagree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Strongly
Agree**

- d) While using the current version of Gmail, I feel happy

**Strongly
Disagree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Strongly
Agree**

- e) I find the current version of Gmail to be useful in my job

**Strongly
Disagree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

**Strongly
Agree**

- f) Compared to other similar things I could have done, the time spent using the current version of Gmail was truly enjoyable

**Strongly
Disagree**

**Strongly
Agree**



g) I find the current version of Gmail to be helpful in my job

**Strongly
Disagree**

**Strongly
Agree**



h) When using the current version of Gmail, I feel excited

**Strongly
Disagree**

**Strongly
Agree**



i) While using the current version of Gmail, I am able to forget my problems

**Strongly
Disagree**

**Strongly
Agree**



j) I have a very nice time while using the current version of Gmail

**Strongly
Disagree**

**Strongly
Agree**



k) I have intention to continue to use this current version of Gmail

**Strongly
Disagree**

**Strongly
Agree**



l) Based on my experience, I am very likely continue my relationship with the current version of Gmail

**Strongly
Disagree**

**Strongly
Agree**



m) With the current version of Gmail I am not likely to be persuaded to use other email products

**Strongly
Disagree**

**Strongly
Agree**



n) I will recommend the current Gmail to other customers/ users

**Strongly
Disagree**

**Strongly
Agree**





- o) I will point out the positive aspects of the current version of Gmail if anybody criticizes it

**Strongly
Disagree**

**Strongly
Agree**



- p) I am likely to say positive things about the current version of Gmail to other people

**Strongly
Disagree**

**Strongly
Agree**



- q) I am likely to recommend the current version of Gmail to someone who seeks my advice

**Strongly
Disagree**

**Strongly
Agree**



IV. How would you feel if Gmail *did* have the following features?

1. Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

2. Allow change in account name without losing contents. Currently the user password can be changed but not the account name

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

3. Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

4. Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

5. Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

6. Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

7. Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

8. Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus on those emails that are important to her

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

9. Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

10. Threaded conversations should be made optional to users. Presently it is a mandatory feature

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

V. How would you feel if Gmail *did not* have the following features?

1. Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

2. Allow change in account name without losing contents. Currently the user password can be changed but not the account name

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

3. Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

4. Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

5. Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

6. Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

7. Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

8. Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus on those emails that are important to her

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

9. Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

10. Threaded conversations should be made optional to users. Presently it is a mandatory feature

☐ I like it this way ☐ I expect it this way ☐ I am neutral ☐ I can live with it this way ☐ I dislike it this way

VI. Please rate your priority for providing these features in the next release

1. Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

2. Allow change in account name without losing contents. Currently the user password can be changed but not the account name

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

3. Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

4. Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

5. Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends

- ☐ High Priority- A mission critical requirement, required for the next release

- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

6. Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

7. Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

8. Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus on those emails that are important to her

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

9. Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

10. Threaded conversations should be made optional to users. Presently it is a mandatory feature

- ☐ High Priority- A mission critical requirement, required for the next release
- ☐ Medium Priority – Supports necessary system operations, required eventually but could wait until a later release
- ☐ Low Priority – A functional or quality enhancement, would be nice to have someday if resources permit

VII. How important is this feature in determining your product choice

1. Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

- ☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

2. Allow change in account name without losing contents. Currently the user password can be changed but not the account name

- ☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

3. Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

4. Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

5. Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

6. Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

7. Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

8. Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus on those emails that are important to her

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

9. Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

10. Threaded conversations should be made optional to users. Presently it is a mandatory feature

☐ Extremely Important ☐ Very Important ☐ Fairly Important ☐ Slightly Important ☐ Not Important

VIII. How much difference do you perceive among competing products (such as Gmail, Hotmail, Yahoo mail) with respect to this feature?

1. Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

Very Similar

Very Different

☐ ☐ ☐ ☐

2. Allow change in account name without losing contents. Currently the user password can be changed but not the account name

Very Similar

Very Different

☐ ☐ ☐ ☐

3. Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

Very Similar

Very Different



4. Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing

Very Similar

Very Different



5. Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends

Very Similar

Very Different



6. Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

Very Similar

Very Different



7. Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

Very Similar

Very Different



8. Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus on those emails that are important to her

Very Similar

Very Different



9. Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

Very Similar

Very Different



10. Threaded conversations should be made optional to users. Presently it is a mandatory feature

Very Similar

Very Different



IX. Rank the Feature Requests list below in your order of their decreasing Importance to you using the Binary Tree Search technique

Rank	Feature description
	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
	Threaded conversations should be made optional to users. Presently it is a mandatory feature
	Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future.
	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
	Allow change in account name without losing contents. Currently the user password can be changed but not the account name
	Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
	Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her.

APPENDIX F. EXAMPLE TEST INSTRUMENT ROUND 2
(TAILORED FOR EACH SUBJECT – A SPECIFIC EXAMPLE)

USER FEATURE REQUESTS

No	Feature description
1	Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives.
2	Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
3	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
4	Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
5	Threaded conversations should be made optional to users. Presently it is a mandatory feature
6	Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future.
7	Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
8	Allow change in account name without losing contents. Currently the user password can be changed but not the account name
9	Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
10	Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her.

I. Assessing upgraded version of Gmail with the 10 features requested by the user

- a) By implementing the suggested feature requests by users, the upgraded version of Gmail will improve my performance in my job

**Strongly
Disagree**

**Strongly
Agree**



- b) By implementing the suggested feature requests by users, the upgraded version of Gmail will improve my productivity in my job

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

c) By implementing the suggested feature requests by users, the upgraded version of Gmail will enhances my effectiveness in my job

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

d) By implementing the suggested feature requests by users, the upgraded version of Gmail will enhance my happiness

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

e) The upgraded version of Gmail will be helpful in my job

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

f) Compared to other similar things I could have done, the time that will be spent using the upgraded version of Gmail with the user feature requests will be truly enjoyable

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

g) I will find the upgraded version of Gmail to be helpful in my job

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

h) When using the upgraded version of Gmail, I will feel excited

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

i) While using the upgraded version of Gmail, I will be able to forget my problems

**Strongly
Disagree**

**Strongly
Agree**

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

j) I will have a very nice time while using the upgraded version of Gmail

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

k) I have intention to continue to use this upgraded version of Gmail

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

l) Based on my experience, I am very likely continue my relationship with the upgraded version of Gmail

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

m) With the upgraded version of Gmail I am not likely to be persuaded to use other email products

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

n) I will recommend the upgraded Gmail to other customers/ users

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

o) I will point out the positive aspects of the upgraded version of Gmail if anybody criticizes it

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

p) I am likely to say positive things about the upgraded version of Gmail to other people

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

q) I am likely to recommend the upgraded Gmail to someone who seeks my advice

**Strongly
Disagree**

**Strongly
Agree**

☐
☐
☐
☐
☐
☐
☐
☐
☐

II. How do you feel about the current version of Gmail?

☐ Terrible
 ☐ Unhappy
 ☐ Mostly Dissatisfied
 ☐ Neither Satisfied nor Dissatisfied
 ☐ Mostly Satisfied
 ☐ Pleased
 ☐ Delighted

II -B. How would you feel if Gmail is upgraded by implementing this feature request?

Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-P. How would you feel if Gmail is upgraded by implementing this feature request?

Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II- E. How would you feel if Gmail is upgraded by implementing this feature request?

Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-I. How would you feel if Gmail is upgraded by implementing this feature set?

Allow change in account name without losing contents. Currently the user password can be changed but not the account name

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-BPE. How would you feel if Gmail is upgraded by implementing this feature set?

- a) Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives
- b) Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
- c) Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
- d) Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
- e) Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
- f) Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her
- g) Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-HML. How would you feel if Gmail is upgraded by implementing this feature set?

- a) Allow sending emails/ replies to emails at a later time or date. Presently if the user has to send an email or a reply to email at a later date she can only save the draft and remember to send it when the date arrives
- b) Allow change in account name without losing contents. Currently the user password can be changed but not the account name
- c) Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
- d) Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
- e) Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
- f) Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself

- g) Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-BT. How would you feel if Gmail is upgraded by implementing this feature set?

- a) Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
- b) Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
- c) Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
- d) Send an email to the user's inbox when she marks Bcc (Blind carbon copy) to herself. Currently there is no email sent to the user if she Bcc's herself
- e) Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her
- f) Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future
- g) Threaded conversations should be made optional to users. Presently it is a mandatory feature

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-D. How would you feel if Gmail is upgraded by implementing this feature set?

- a) Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
- b) Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
- c) Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
- d) Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
- e) Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her
- f) Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future
- g) Threaded conversations should be made optional to users. Presently it is a mandatory feature

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted

II-DBPE. How would you feel if Gmail is upgraded by implementing this feature set?

- a) Open more than one Gmail account at the same time. Presently the user can only open one Gmail account at a time
- b) Allow user to have another view of their inbox below the message they are composing. This will allow users to reference information from one or more emails, if required, while composing
- c) Provide preview of media stored on other sites within an incoming Gmail message when the sender includes only a link. Users get tired of clicking on links to get to the videos and photos of friends
- d) Allow sub-string, partial word and wildcard search to provide a powerful mechanism for searching relevant emails
- e) Allow use of specific colors for emails received from sources specified by the user. This will allow the user to quickly focus clearly on those emails that are important to her
- f) Gmail should allow users to report spams to the appropriate authority automatically. This will discourage spammers from spamming in future

☐ Terrible ☐ Unhappy ☐ Mostly Dissatisfied ☐ Neither Satisfied nor Dissatisfied ☐ Mostly Satisfied ☐ Pleased ☐ Delighted