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Title	Optimal Product Information Display Formats in Online Shopping Scenarios: Implications for Management Practice and Policy Formation
Author(s)	Sharkey, Ultan; Acton, Thomas; Conboy, Kieran
Publication Date	2009
Publication Information	Sharkey, U., Acton, T. and Conboy, K. (2009) "Optimal Product Information Display Formats in Online Shopping Scenarios: Implications for Management Practice and Policy Formation", Social Science Research and Policy Making: Bridging the Divide. NUI Galway, Ireland, Irish Social Sciences Platform, December 1st - 2nd, 2009.
Item record	http://hdl.handle.net/10379/1603

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OPTIMAL PRODUCT INFORMATION DISPLAY FORMATS IN ONLINE SHOPPING SCENARIOS: IMPLICATIONS FOR MANAGEMENT PRACTICE AND POLICY FORMATION.

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ISSP Theme: Knowledge economy

Paper classification: Development paper, Postgraduate paper

ABSTRACT

The second key challenge noted by the Department of Enterprise, Trade and Employment (2004) eBusiness Strategy report is the building of confidence among Irish SME's and Micro-enterprises in the development of online trading. Its associated April 2006 progress report (Department of Enterprise 2006) further stressed the necessity of Irish business to be at the forefront of eCommerce. While Irish online shopping is performing well in comparison to OECD countries (Department of Enterprise 2004) and European Union members (CSO 2008), there is an absence of information codifying optimal methods for displaying product information in online trading. This research addresses the gap in knowledge regarding optimal information presentation formats in online trading scenarios.

Within the context of supporting the consumer decision making process lies a body of knowledge discussing decision strategies which may be utilised, the formation of consumer consideration sets and research on how best to present product data to a consumer. Somewhat lacking is research into the applicability of these domains to electronic commerce systems despite the value they hold for practitioners. The research here proposes an investigation into the product data presentation structures which exist in many free, open source webstore software systems operating for many thousands of businesses. This research identifies the shortcomings of online consumer decision supporting systems in light of the functionality and attributes expected of the decision supporting aspects of these e-commerce systems, strategies which are appropriate to support the consumer purchasing environment and methods which may be suitable to deliver some of the benefits of decision support to the online consumer. Specific management and policy implications are presented.

Keywords: ecommerce, decision systems, data visualisation, decision strategies.

1 INTRODUCTION

There is a long tradition of studying and defining the consumer decision making process and the theory surrounding those cognitive processes and steps involved is well-established (1990; Roberts and Lattin 1991; Klenosky and Perkins 1992; Kardes, Kalyanaram et al. 1993; Andrews and Srinivasan 1995; Roberts and Lattin 1997; Bearden, Hardesty et al. 2001). Information systems research, through the label of decision support systems [DSS] has sought to clarify and support, decision making processes across a wide variety of decision situations (Desanctis and Gallupe 1987; Alavi and Joachimsthaler 1992; Crossland, Wynne et al. 1995; Barr and Sharda 1997; Chen and Lee 2002; Power 2007), including not least the consumer decision making process (Guttman, Moukas et al. 1998; Häubl and Trifts 2000; van der Heijden, Verhagen et al. 2003; van der Heijden and Verhagen 2004; van der Heijden 2006).

Information systems are most useful when they remove or lessen the weaknesses of the human mind in terms of information processing capabilities, allowing for greater emphasis of human thought on more creative competencies. Information systems are best purposed to heavy computation and processing, relieving humans hindered by limitations of information processing (Todd and Benbasat 1992). Reduction of cognitive effort is seen as a valid goal of DSS development, indeed some research suggests that aiding a reduction in computational effort will incentivise decision makers not to avoid computationally intensive decision strategies (Kleinmuntz and Schkade 1993). This work seeks to elucidate the steps to a consumer purchase decision with a view to understanding how that decision can be supported by leveraging the competencies of information systems to match the methodologies or strategies employed by the decision maker.

Beach's (1993) image theory work views the selection of choice strategy as being dependent on, amongst other things, the repertoire of strategies known to the decision maker. Information systems, in this case taking the form of webstores, may be designed to support decision strategies appropriate to an online purchase decision. The value of such a support may accrue from improvement in the decision itself or by aiding a deeper analysis of the choices available through supporting strategies (Todd and Benbasat 1987). This paper discusses the antecedents of a purchase decision, the strategies which are appropriate to making that decision, current methods employed by webstores towards supporting the purchase decision and hypothesise how these methods support online consumer purchase decisions.

2 THEORETICAL BACKGROUND

2.1 The Consumer Purchase Decision Process

The consumer decision is a process of successive refinement of the set of brands evaluated (Roberts 1989) which can best be understood through "tiered levels of behaviour" (Roberts and Lattin 1997). These brands are evaluated from sets which can be structured logically to aid understanding. The super-set, that is all exisiting brands in the marketplace is referred to as the Universal Set (Kardes, Kalyanaram et al. 1993; Andrews and Srinivasan 1995). The consumer may not be aware of all of the brands in this set (Andrews and Srinivasan 1995), that sub-set of brands of which the consumer is aware is referred to as the Awareness Set (Nedungadi 1990; Roberts and Lattin 1991; Andrews and Srinivasan 1995; Roberts and Lattin 1997). As the name implies, it is a subset of the Universal set which a given consumer is aware of, though it does include those brands which the consumer becomes aware of during the purchase decision (Andrews and Srinivasan 1995). The set of brands which the consumer then proceeds to gather information on is referred to as the Evoked Set (Roberts 1989; Hauser and Wernerfelt 1990; Roberts and Lattin 1991). Roberts (1989) describes the Evoked Set as "the brands on which a consumer gathers information" and distinguishes it from the Consideration Set by describing the latter as the set of brands the consumer evaluates. The Awareness Set and Evoked Set have also been referred to collectively as the Retrieval Set (Kardes, Kalyanaram et al. 1993). The set which the consumer evaluates further from the Evoked Set is called the Consideration Set (Roberts 1989; Hauser and Wernerfelt 1990; Nedungadi 1990; Roberts and Lattin 1991; Kardes, Kalyanaram et al. 1993; Andrews and Srinivasan 1995; Guttman, Moukas et al. 1998). The Choice is made from this final Consideration Set.

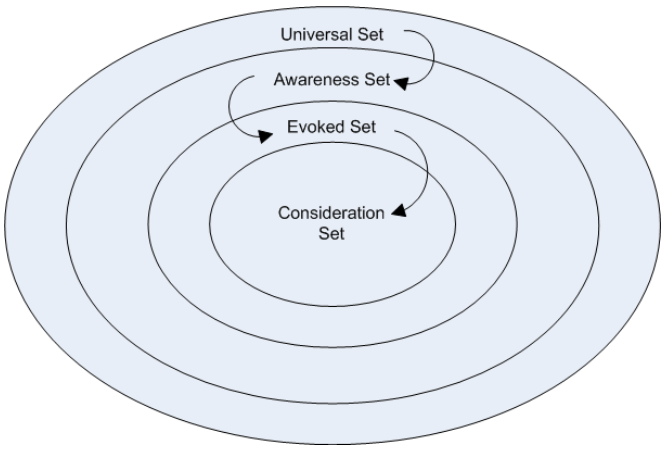

Figure 1 Diagram of decision process and set arrangement (Constructed from discussions in Roberts (1989) and Roberts & Lattin(1991))

There are a number of decisions made through the process described above. Consumers are generally unaware of the Universal Set because of cognitive limitations, complex choice tasks, evaluation and search costs (Andrews and Srinivasan 1995). Many authors support a two stage process for arriving at a consumption decision, the first being a heuristic screening decision followed by the purchase decision itself (Hauser and Wernerfelt 1990; Klenosky and Perkins 1992; Beach 1993; Kardes, Kalyanaram et al. 1993; Andrews and Srinivasan 1995). The earlier screening stage tends to employ simpler heuristic and non-compensatory strategies (Hauser and Wernerfelt 1990; Beach 1993). Considering the view of consumers as cognitive misers during the purchase decision, switching to less accurate non-compensatory strategies when faced with the larger sets makes sense (Kleinmuntz and Schkade 1993). Beach (1993) offers a definition of screening as a process governing the "admission of options to the choice set". Beach proposed a theory, referred to as Image Theory, which frames choices as being made through any number of strategies, depending on the strategies known to the decision making consumer. Whereas the choice decision based on the Consideration Set may invoke many different strategies, the screening decision invokes just one – the non-compensatory compatibility test (Beach 1993). Further, Beach (1993) found that screening and choice decisions are seen as distinctly separate from each other and that decision makers do not bring information forward from the screening decision phase [Evoked set to Consideration set] to the choice decision phase [Consideration set to Choice] leaving the possibility of sub-optimal choices. This effect echoes what is the availability judgment error described by Chen and Lee (2002), also referred to as the recency effect where more weight is given to more recent events. Zhang (2004) found that the availability to decision makers of multiple preference formats increases decision makers' satisfaction levels, implying that the support of multiple decision strategies by a system may aid in decision quality. Next follows an investigation of the decision strategies commonly employed in purchase decisions and how systems may be designed to support these strategies.

2.2 Consumer Decision Strategies

Decision strategies are employed to support decision makers in their goal of minimising cognitive effort involved in the choice while maximising the accuracy and quality of the decision (Alavi and Joachimsthaler 1992; Todd and Benbasat 1999). Todd and Benbasat (1999), citing many empirical studies assert that effort influences strategy selection more than accuracy. People generally prefer strategies that do not induce computations and numeric value trade-offs (Slovic, Fischhoff et al. 1977). Kleinmuntz and Schkade (1993) suggest that this is because feedback to the decision maker regarding the effort expended is immediate while feedback on the accuracy or quality of the decision made is not. Kleinmuntz and Schkade (1993) refer to this trade-off between effort and accuracy as the cost-benefit perspective and posited that strategy selection can be influenced by the method used to display

the information pertinent to the decision. Suggested variations on a systems information display include form [numerical, pictorial, verbal]; organisation [table, matrix, list, paragraph, hierarchical cluster]; and the sequence [random, ascending or descending on an attribute value, alphabetical, chronological] (Kleinmuntz and Schkade 1993). Thus, the reduction of decision maker effort is a valid target for researchers but supporting an increase of decision accuracy and quality is a more noble goal. Decision maker strategy selection can be influenced by the design of the information display, and the display may be designed to support decision strategies applicable to the problem domain. Indeed, Todd and Benbasat (1999) tell us that the best designs are those which make it easier for the decision maker to employ the best strategy. Zhang et al. (2004) found that exposing multiple formats to the decision makers increases the decision makers' satisfaction with the decision process. The authors further recommend that decision systems should provide a choice of functionalities to support preference formats (Zhang, Chen et al. 2004).

Early stages of decision processing involve relatively larger choice sets and tend towards comparison on one attribute and some rejection of alternatives. Latter stages involve weighing advantages and disadvantages of the reduced set (Slovic, Fischhoff et al. 1977). Roberts (1989) describes these two broad types of strategy, in his study of consideration set formulation, as conjunctive when the test is one of sufficient acceptability and compensatory when the test is one of sufficient utility, Acceptability being a threshold measure and Utility being a more processing intensive function of weighted attribute importance and attribute quantity (Todd and Benbasat 1999). Thusly, the secondary stage deals with a relatively smaller set and lends itself to the usage of strategies more onerous as regards processing, compensatory strategies, whereas the primary stage deals with a larger set and lends itself to the usage of strategies which reduce the set without onerous processing, conjunctive strategies. Research suggests that decision quality is improved when more compensatory strategies are employed (Todd and Benbasat 1992; Häubl and Trifts 2000).

In order to understand current practices in helping online consumers make purchase decisions and to understand what kind of decision strategies are commonly supported in online shopping environments, the authors examined online store software and a number of popular online stores.

2.3 Decision Quality

Decision quality is often seen as the result of the trade-off between decision accuracy and cognitive effort in that an accurate decision is seen as a quality decision (Raghunathan 1999; Speier and Morris 2003; van der Heijden 2006). It is often implemented by measuring deviation from the norm, i.e. utility or value maximisation (Todd and Benbasat 1992), indeed Barr and Sharda (1997) used value maximisation as an indicator of decision quality by measuring net earnings, return on investment,

market share and return on assets. Decision qualities' empirical measurement is typically achieved through the loading of the subject system with *dominated* and nondominated alternatives, best elucidated by Häubl and Trifts (2000), "An alternative is dominated if there is at least one other alternative that is superior on at least one attribute while not being inferior on any attribute. That is, a dominated alternative is known to be within the efficient frontier of any consumer. By contrast, an alternative is *nondominated* if no other alternative is superior on an attribute without, at the same time, being inferior on at least one other attribute." Thusly, preferences shown by the subject for nondominated alternatives indicate poor decision quality (Häubl and Trifts 2000; van der Heijden 2006).

2.4 Decision support in the wild

An examination of convenient samples of open source ecommerce supporting software was conducted to determine the support available for compensatory and conjunctive decision strategies. The decision-aiding functionality found were various implementations of sort, search, filter, and view mechanisms. The open source webshop software examined were: Magento; OpenCart; OSCommerce; OSCSS; PrestaShop; Zen-cart; VirtueMart; CubeCart; Quick Cart Lite; UberCart and Satchmo. Open source systems were chosen for convenience; their wide popularity and availability to SMEs and the ability of the researchers to modify the software to suit further experiments should the need arise. The systems were surveyed for the presence or absence of functionality to aid in decision making as in Table 1.1. Although the measures below for number of websites is a tentative one and useful mostly for comparison, undoubtedly these systems are being used on a large scale for numerous ecommerce businesses.

Software ('No. of websites')	View			Sort		Filter		Search	
	Tiled	List	Paragraph	Name	Price	Price	Brands	Keyword	Price
Magento (19,900)	Yes	Yes		Yes	Yes	Yes	Yes	Yes	
OpenCart (10,600)	Yes							Yes	
OSCommerce (8,690,000)	Yes			Yes	Yes		Yes	Yes	Yes
OSCSS (5,340)			Yes				Yes	Yes	Yes
PrestaShop (74,500)			Yes	Yes	Yes		Yes	Yes	
Zen-cart (2,490,000)		Yes		Yes	Yes		Yes	Yes	
VirtueMart (397,000)	Yes		Yes	Yes	Yes		Yes	Yes	
CubeCart (2,730,000)		Yes	Yes	Yes	Yes	Yes		Yes	
Quick Cart (472,000)	Yes		Yes				Yes	Yes	
UberCart (82,400)	Yes	Yes		Yes	Yes			Yes	
Satchmo (245)	Yes		Yes					Yes	

Table 1.1 Decision aiding abilities of common open source ecommerce software. Note: 'Popularity' represents the number of search results returned in Google.com for "'Powered by' Software name".

2.4.1 *Viewing configurations*

Figure 2 Left to right, Tile, Paragraph and List product viewing configurations

The organisation of data into structures or groups affects information acquisition (Kleinmuntz and Schkade 1993). Kleinmuntz gives examples such as tables, matrices, lists, paragraphs or hierarchical clusters as data structures. The common structures found in webstore software, as diagrammed in Figure 2 above, are lists, where the product data are structured in one row per product; tiles, where the product data is shown in one block per product usually in a three-by-many configuration [three tiles across a screen by x number as one scrolls down]; and paragraph, where product data is shown on multiple lines forming a paragraph per product, effectively a one-by-many configuration. Comparisons are enabled here only by the list structure, and then only when attributes are displayed in aligned

columns to form a matrix table. This particular type of list is similar to what Häubl and Trifts (2000) call a comparison matrix, however some do not also have attribute sorting abilities. Thusly, viewing the product catalogue via a list structure can be seen as supporting compensatory strategies more than conjunctive strategies.

2.4.2 *Searching and Filtering*

Searching reduces a set of alternatives by excluding alternatives and returning a subset. It is thusly a conjunctive strategy. Constraint-based filtering (Guttman, Moukas et al. 1998) appears to be the filtering method observed in webstore software. Searching and Filtering are distinct attributes of decision supporting systems (Holsapple and Whinston 1996). Filtering is conceptually similar to searching in that it results in a sub-set of alternatives and supports conjunctive strategies.

In the majority, the systems studied returned search results in the same configuration [i.e. Tiles, Paragraphs or Lists] as for browsing the product catalogue. Viewing a product catalogue or indeed the result of a search or filtered results as line items should support a better and/or faster purchase decision than viewing the same data in tiled or paragraphed structures because lists are more amenable to comparison.

The question follows as to whether viewing product catalogue information via a tile configuration, a paragraph configuration or a list configuration supports a consumer purchase decision. Considering that it appears to be easier to compare product data in the list configuration leads to the following proposition:

Proposition 1: Product catalogues structured in list format support better and/or faster decision making than product catalogues in tiled or paragraph formats.

2.4.3 *Sorting*

Sorting is a discrete information processing task (Häubl and Trifts 2000). It is a decision-supporting function (van der Heijden 2006). The ability to sort increases a decision makers' ability to identify, and thus avoid, sub-optimal choices. The ability to sort helps a decision maker determine the relative utility of the alternatives (Häubl and Trifts 2000). Thusly, sorting can be seen as supporting compensatory strategies more than conjunctive strategies.

As discussed above, it is proposed that viewing product catalogue information or search results or filtered results in the list configuration should support the consumer purchase decision. It also follows that, if the product catalogue, search results or filtered results are also sortable a better and/or faster decision may arise. Thus the following proposition arises:

Proposition 2: List configuration which are sortable support better and/or faster decision making than list configurations which are not sortable.

3 RESEARCH METHODOLOGY

Decision makers tend to use strategies which are enabled by the display format (Häubl and Trifts 2000). It follows that, depending on what display format the product information is presented to the decision maker in, different strategies influencing the decision process are supported and encouraged. Therefore, there are a number of different ways in which the data display format can affect the decision-making process and its outcome. These affects warrant investigation: the impact of product data display format on strategies and decision quality; the impact of search and filtering on the decision process; the impact of sorting capability; and the combinations of each of these. These overarching questions present a structure for this research through a sequence of experiments as follows:

Experiment 1: To investigate the affects of search and filter mechanisms on the quality of the derived consideration set and subsequent purchase decision when the search and filter results display format is manipulated as displaying results via tiles, paragraphs or lists.

Experiment 2: To investigate the affects of product catalogue sorting and search and filter result sorting on the quality of the derived consideration set and subsequent purchase decision.

Experiment 3: To investigate the affects of nested sorting by product attributes on the quality of the derived consideration set and subsequent purchase decision.

However, this paper concentrates on an investigation of the affect display format itself and propose a pilot study via controlled experiment to test the two hypotheses advanced above. The task shall consist of the selection and choice of an MP3 player from a webstore created specifically for the experiment. The manipulated factors proposed are Tile configuration [Yes/No]; Paragraph configuration [Yes/No]; List configuration [Yes/No]; Sortable list configuration [Yes/No]. The proposed model is diagrammed in figure 3 presented below. The webstore shall be stocked with MP3 players in such a way that the choices made by the subjects can be independently deemed to be good or bad decisions regardless of the subjects preferences. This is achieved by constructing dominated and non-dominated alternatives, as described previously.

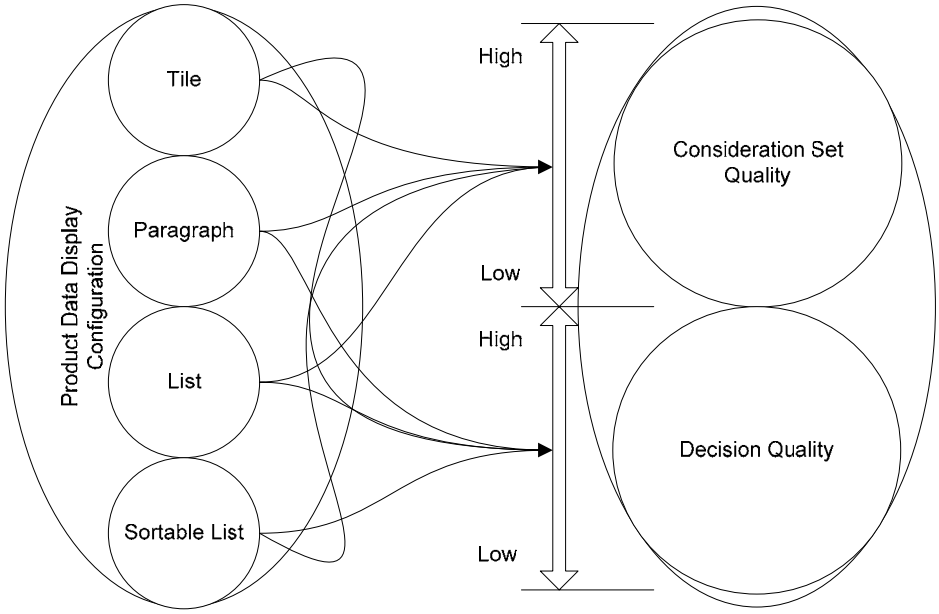

Figure 3 Product data display configurations influence on consideration set and decision quality

It is proposed that subjects be randomly assigned to each of the four conditions. Instructions include the stipulation to use the systems' shopping cart to hold their preferred products before making the final, single choice. Decision quality will be inferred from the number of dominated alternatives which appear in the subjects shopping cart. The time taken to complete the process shall also be recorded. It is proposed to draw the sample from a number of different graduate programmes in a university. Many other studies in commerce and information systems have utilised students as representative of the Internet using population (Ives, Olson et al. 1983; Ahuja, Gupta et al. 2003; Negasha, Ryan et al. 2003; van Iwaarden, Wiele et al. 2004; Lee and Kozar 2006). Aladwani and Palvia (2002) administered a 55-item instrument to 104 students between 18 and 21 years old. Palmer (2002) conducted his survey with 35 undergraduate and MBA students. Garrity et al., (2005) argued for the use of students as an appropriate sample, stating their place as present and future consumers of web technology. This suggests a sample composed of university students may be representative of the wider population of e-commerce consumers and would be appropriate for this research.

4 EXPECTATIONS

It is expected the results will indicate that product data viewed in configurations which support comparisons to produce better quality consideration sets and better quality decision making. As such, it is anticipated that the results of the experiment will support the use of the list configurations as a dominant factor in the production of higher quality consideration sets and thus higher quality product

choice. It is further expected that the sortable list configuration will support higher quality consideration sets than the standard list configuration. While it is expected that the list configurations will be the better decision-aiding product data views in their ability to support data point comparisons, it is also expected that the subjects using systems with list and sortable list display configurations will also make at least as good or better decisions as the subjects using the tile and paragraph configurations but in a shorter period of time. The model predicts that the subjects with the sortable list configuration will attain the highest quality consideration set of any of the subjects groups.

The results of this research will be applicable to many ecommerce systems, in particular to the numerous websites that are using the systems referred to in this paper. Many of those systems have built-in features or customisable code which can be used to make the product catalogue or search results return in either tile, paragraph or list configurations. It is expected that the results of this research will make it easier for practitioners to decide what display configuration is appropriate at what stages of the consumer decision process.

5 SPECIFIC MANAGEMENT & POLICY IMPLICATIONS

The layout of product information is a concern for web based ecommerce. This research seeks to address this gap and provide managers of online shopping systems with the tools to structure their product offerings in a way which will enable and encourage better decision making by consumers. Though outside the scope of this paper, there is some research investigating the effect of ecommerce systems and decision performance on behavioural intentions. These include the intention of a customer to use the ecommerce system, then intention to return a measure of loyalty and the intention to purchase. This research takes a step towards expanding the knowledge of management on these influences by focussing on the effect of product information layout on decision performance.

The product information layout predicted as the most advantageous by this research is the table approach where alternatives and attributes are presented in tabular form. Prior to Internet commerce, these formats were relegated to specific industry publications such as Consumer Reports (Todd and Benbasat 1999) and some authors argued that formats which support decision making in this way should be encouraged through policy (Bettman and Zins 1979). The development of such policy best practice scenarios for Irish SMEs involved in ecommerce may go some way to encouraging confidence among SMEs in their online trading ability.

Department of Enterprise, Trade and Employment eBusiness Strategy reports (2004; 2006) acknowledge a need for Irish business to be in the vanguard of online trading. Developing and

expanding our collective knowledge of decision processes and technologies which can be leveraged to assist the consumer in online trading scenarios and disseminating an understanding of online trading to management of SMEs involved in online trading is a well-grounded direction for research in this context.

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