

**INFLUENCE OF ELECTRONIC DECISION AIDS
ON CONSUMER SHOPPING IN ONLINE STORES**

Girish Punj
University of Connecticut, Storrs

and

Adam Rapp
University of Connecticut, Storrs

Please address all correspondence to Girish N. Punj, Department of Marketing, School of Business, University of Connecticut, 2100 Hillside Road, Storrs, CT 06269-1041. Phone: (860)-486-3835; e-mail: Girish.Punj@business.uconn.edu

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Due to the rapid growth of e-commerce, consumer purchase decisions are increasingly being made in computer-mediated environments. Online or Web-based stores offer consumers immense choice and great convenience. Yet, finding products that meet consumer needs is not an easy task in these online stores. This is because most Web-based store environments are characterized by the availability of many alternatives, multiple decision criteria and a dynamic “flow” of information (e. g., real-time updates) that can overwhelm consumers. Therefore, most Web-based decision environments now make an electronic decision aid available to facilitate information processing. These electronic decision aids are variously referred to as recommendation agents, “smart” agents, “intelligent” agents or shopping assistants and have become an intrinsic feature of online environments.

The purpose of this paper is to develop a taxonomy of electronic decision aids in terms of their characteristics, describe the functions performed by them, and then relate both the characteristics and the functions to likely changes in consumer decision-making in a Web-based decision environment. A series of theoretical propositions that predict the likely impact of electronic decision aids on how consumers make purchase decisions in online settings is presented. The paper concludes with an agenda for future research for understanding consumer decision making in Web-based decision environments.

Consumer decisions that are made using electronic decision aids are based on a complex interaction of consumer, electronic decision aid, and information environment factors. As online shopping environments continue to evolve technologically, there is a need to understand how these various elements come together in influencing consumer decision-making. Some researchers have suggested that in spite of the changed information environment and the availability of electronic decision aids, the consumer decision process remains more or less the same in a Web environment

(Hoffman and Novak 1996). Other researchers claim that the capability of the electronic decision aid to iteratively screen alternatives based on desired attribute levels (Alba et al. 1997) and to match attribute preferences with available alternatives fundamentally alters the decision strategies that are employed (Peterson et al. 1997).

In the interactive context, electronic decision aids are mechanisms that have been developed to improve communication between consumers and e-retailers that help consumers make purchase decisions. In the age of technology many consumers are finding themselves having to deal with information overload. In order to handle this information overload electronic decision aids help the consumer with information retrieval, information filtering, and collaborative filtering. Consumers may delegate some decisions or portions of decisions to these aids (Ariely 1999).

A TAXONOMY OF ELECTRONIC DECISION AIDS

Types of Electronic decision aids in Web Environments

Electronic decision aids exist in both traditional and Web-based decision environments. They may be classified as being human (e.g., a super sales associate), physical (e.g., Consumer Reports, Zagat's restaurant guides, Mobil travel guides) or electronic (e.g., Jango). Electronic decision aids are often closely related to the environments in which they are used because they are frequently "designed" for those environments. Thus, an electronic decision aid may be viewed as being an integral part of the environment. As a point of clarification, there are several different types of electronic decision aids. The individual types typically fall under one of two primary categories, individual agents or collaborative filtering agents.

Individual agents simply use the attributes and specifications entered by the user as the search criteria. Collaborative agents use this information to search other consumers' evaluations of similar products and generate a list of alternatives (Ariely 2002). Based on this, agents can be defined as performing two primary tasks. Electronic decision aids 1) collect information from the

user and 2) they use that information to create a smaller consideration set of objects for the user to view based on the inputted preferences.

One type of electronic decision aid is the query-based electronic decision aid (QBDA). A QBDA is used to refer to one set of tools available for search and decision-making on the Internet. A QBDA searches other category sites and provides the user with a refined consideration set based on their preferences (Pereira 2001).

There are two primary types of QBDAs; the passive QBDA, which applies equal weights to the preferences that are entered, and the interactive (user-inputted attribute importance weights) linear aid. It is expected that the interactive linear aid would perform better than the equal weights model in providing decision quality; however, this is not always the case. Equal weight format often performs well or better than interactive linear models (Olson 2002).

Another type of electronic decision aid is the comparison matrix (CM). The comparison matrix enables the consumer to make detailed comparisons of products among selected alternatives. The CM allows the user to view information about several alternatives and then sort that information based on specified attributes (Haubl 2000).

Notification agents will notify a user when a product that matches their profile becomes available. A notification agent will not only notify the user, but it will also encourage the user to come to the store and purchase that product. Profiles are developed by the information entered by the user and by reviewing the price the consumer is willing to pay for the product (Maes 1999).

Negotiation agents can negotiate much of the purchasing phase of the buying process. If a user has certain criteria for a buying a product (i.e., price) and a seller is willing to adjust the terms of the product, a negotiation agent can be a very useful tool. Ideally the user's agent and vendor's agent will adjust offers and specifications incrementally until common ground is achieved (Maes 1999).

Autonomous agents are currently being developed from the artificial intelligence field where users and electronic decision aids act complementary to one another. The user and aid initiate communication, monitor events, and perform selected tasks. Similarities have been made that this agent is a “personal assistant” that both takes direction and acts independently of the user (Maes 1994).

Maxims are aids that assist users with sorting and maintaining email; however, these have begun to appear as shopping aids for consumers. Maxims are based on memory-based reasoning. The aid “remembers” previous decisions and actions that were taken in similar situations and tries to mimic the behavior. It then measures confidence in each prediction and gains competence with repeated use (Maes 1994).

Multi-agent collaborators act in a similar manner. These aids will “ask” or search other agents when the aid in use does not have enough confidence in its level of prediction accuracy. The aid will make a prediction based on returned suggestions and will also increase competence with the level of accuracy of predictions (Maes 1994). These multi-agent collaborators are being used primarily in work-groups and with email, but can easily make a transition to web-based shopping electronic decision aids.

Vendor-based agents: Two separate models have been identified as the primary agents that a consumer may experience, the user-centered model and the vendor-based model. User-centered models have not shown much success due to the amount of personal information that must be input and the fact that consumers do not believe the information provided by a price comparison site is worth paying for. Based on this, many electronic decision aids have made a switch to a vendor-based model where the vendor provides the support for the aid (Menczer 2002). Many retailers employ this electronic decision aid and will configure their electronic decision aids so they pull alternative selections from their respective electronic store and make it difficult for comparison shopping with stores in the same channel (Ariely 2000).

Electronic decision aid Functionalities

Capabilities: Electronic decision aids are capable of screening a large number of alternatives using information on the consumer's utility function, such as attribute importance weights and threshold attribute levels. Thus, an electronic decision aid can help screen alternatives to rapidly identify the most attractive alternatives. But it may also "over-screen" alternatives, requiring consumers to be adept in its use. The effectiveness of the electronic decision aid is directly related to the information provided to it by the consumer. In other words, an electronic decision aid has a "cost" attached to its use. The cost of initially calibrating an electronic decision aid may be viewed as being excessive if too many consumer inputs are required and/or when consumer preferences are poorly formed. However, the cost of re-calibrating the electronic decision aid can be expected to decline as the consumer acquires greater familiarity with its continued use (Johnson 1999). The consumer may also be concerned about the privacy of the information needed to calibrate the aid (Ariely 1999).

Knowledge Sharing: One of the key assets of the electronic decision aid is knowledge sharing. Knowledge sharing involves incorporating the knowledge of expert decision makers into an electronic decision aid and applying the aid to lower levels such as the consumer. This knowledge sharing permits relatively unknowledgeable individuals with little experience with a product to make expert quality or level decisions (Glover 1997).

Roles in Buying Behavior: In general, electronic decision aids have been shown to be useful in needs identification, product brokering, merchant brokering, and negotiation. These four roles have also been referred to as an electronic decision aid acting as a tutor, clerk, advisor, and banker (Ariely 1999). Electronic decision aids can assist consumers in keeping track of their needs (after identified) and notifying them when products become available. The product selected is identified by the user specifications. Once a list of products is generated, the aid will direct the user to

available sites to purchase or view the product. Lastly, some aids can actually negotiate purchase details based on buyer and seller preferences and rules (Maes 1999).

Calibration Issues: Calibration typically refers to the level or cutoff that an electronic decision aid will use in returning product alternatives. Consumers will face time costs if the aid returns too many products, but alternatively will face limitation costs if only a few selected alternatives are generated (Ariely 2000). An interesting issue a consumer must face in an on-line shopping environment is whether or not the aid they are currently using is multifaceted, in that it is capable of searching for several products in several categories, across several stores.

Coverage / Evaluation and Authority: Electronic decision aids have a range of coverage that includes the number of websites, product categories, and geographical areas searched. The better the coverage of the aid, the larger the number of product options provided to the user. Ideally, electronic decision aids will be enabled to check the credibility or reliability of an e-tailer. A sense of “trust” needs to be established with an e-tailer with respect to shipping, confidentiality, and accurate product descriptions, which some electronic decision aids can assist in verifying (Rowley 2000).

HOW ELECTRONIC DECISION AIDS INFLUENCE CONSUMER DECISIONS

The nature of the task is different in a Web-based environment because not all product attributes may be converted into “digital” attributes. If search costs are lowered for “digital” attributes to a greater extent than for “non-digital” attributes it is more likely that consumers will use those attributes to a great extent in their alternative screening strategies (Haubl 2000). Thus, alternative screening strategies that are based on the sorting/filtering of “digital” attribute information are more likely to be observed in Web-based decision environments. Consumers are likely to increase their use of “digital” attribute information since that type of information is likely to dominate in a Web-based information environment.

Research has shown that electronic decision aids can improve the quality of the decision made by a consumer and reduce the effort placed into making the decision; however, there are four areas of concern that must be realized when evaluating the adequacy of an electronic decision aid. 1.) Information is often incomplete due to ineffective search routines. The information that is produced is sometimes irrelevant or duplicated. 2.) Electronic decision aids cannot model actual human behavior. Electronic decision aids follow rules or guidelines, whereas consumers will sometimes act irrationally or change goals in the middle of a shopping excursion. 3.) Consumers will simplify the importance of attributes and tend to weight quantifiable attributes heavier than non-quantifiable ones. (i.e., price vs. style) 4.) Products will be viewed as standardized. Differentiation and brand loyalty may be sacrificed at the expense of product information being standardized (Redmond 2002).

Effort versus Quality: There is a debate on whether consumers use electronic decision aids to make better and more accurate decisions or to simply conserve time and effort. Again, the evidence on this issue is mixed. Some researchers have found that electronic decision aids are mainly used to conserve user effort instead of supplement it (Benbasat 1996). In other words, users simply “shift” effort from themselves on to the electronic decision aid. Previous research has shown that electronic decision aids may have favorable effects on the both the quality and efficiency of purchase decisions while expending considerably less effort (Haubl 2000).

Decision effort and quality must be viewed jointly when considering specific decision strategies. Decision makers may actually expend more effort when using an electronic decision aid. The use of an aid may increase cognitive capacity helping remove cognitive limitations. Consistent with the theory of bounded rationality, as limitations are removed, increased effort will lead to better decisions. Also, an aid may cause a user to switch strategies in turn helping them to arrive at a higher quality decision (Chu 2000).

Credibility/Trust/Competence Issues: One of the greatest limitations of comparison shopping is the issue of trust. Consumers have little to no information about the reputations of e-tailers. Policies such as returns/refunds, shipping/handling, additional support and so on, are hazy at best. A user also has no way of knowing if a product is in stock and when it will arrive. This leaves price-comparison shopping as a primary avenue to select goods (Maes 1999). Another way to circumvent this issue is that many consumers will rely on the retailer's brand name as a proxy for credibility in non-contractual aspects of the purchase such as shipping reliability. Heavily branded retailers have been found to hold price advantages over generic retailers in direct price comparisons (Brynjolfsson 2001).

Along with trust, competence issues may constitute a problem for the user. Many aids require vast amounts of data and information to be entered by the user. Much of this information that needs to be entered is very user and product specific. This leads to separate issues. First, the user may not gain an understanding of how the aid works based on simply entering information and may feel that they are losing control in the decision process. Second, once the information is entered, the search is often times set or fixed. Future searches will require additional or different information to be entered (Maes 1994).

Calibration: Research indicates that electronic decision aids suitable for a particular environment may be ineffective in other environments (Widing and Talarzyk 1993). Electronic decision aids that can filter/sort through a large number of alternatives while using minimum cut-off levels on an attribute are best suited for use in a Web-based environment. Improper or incomplete calibration could also lead to the elimination of preferred alternatives (Widing and Talarzyk 1993). As a counter-measure, consumers may adopt "safe" calibration strategies by setting wider or lower attribute cut-off levels, thereby diminishing the effectiveness of the electronic decision aid. Also, the electronic decision aid might perform poorly if there were few alternatives, potentially requiring frequent re-calibration to avoid recommending a "null" consideration set.

Search Attributes: In general, search costs are lower in an online market versus an offline (brick and mortar) market. In previous research, attributes have been broken into four primary categories.(1) Brand Name (2) Price (3) Non-Sensory (4) Sensory (Degeratu 2000). Search costs should be lower for the first three categories, in that they can be acquired through an electronic decision aid and then sorted with minimal effort. However, it is expected that sensory attributes will have a higher cost associated with them in an online market. In offline markets a consumer can actually touch or smell a product with much greater ease than in an online market (Degeratu 2000).

Cognitive Costs: Cognitive cost is a key factor in understanding decision behavior. Electronic decision aids can influence the selection of a particular strategy through their influence on the “cognitive cost” of using that strategy. Electronic decision aids reduce the cognitive cost of employing various strategies for the user. Hence more accurate/normative strategies can potentially be encouraged through the availability of electronic decision aids. However, research indicates that the consumer’s focus on effort reduction is so paramount that a more accurate/normative strategy will not be used unless it matches a less accurate strategy in terms of the cognitive cost required to implement it. Thus, an electronic decision aid can counter the consumer’s natural tendency toward a particular strategy but to a rather limited degree.

Price Information: Consumers often use electronic decision aids to customize their shopping environments, thus making online shopping more convenient. However, these customized searches may reduce the availability of price information relative to non-price information (Degeratu 2000). An important consequence of this is that a consumer may shift from a price search strategy to an attribute-based search strategy. Even with this price information and the conscience switch to an electronic decision aid that will compare price information, recent research has shown that online consumers may not be as price sensitive as the general population (Degeratu 2000). This may be due to the fact that consumers are willing to pay a higher price on-line for a branded e-tailer product rather than buy a product at a lower price from a generic e-tailer.

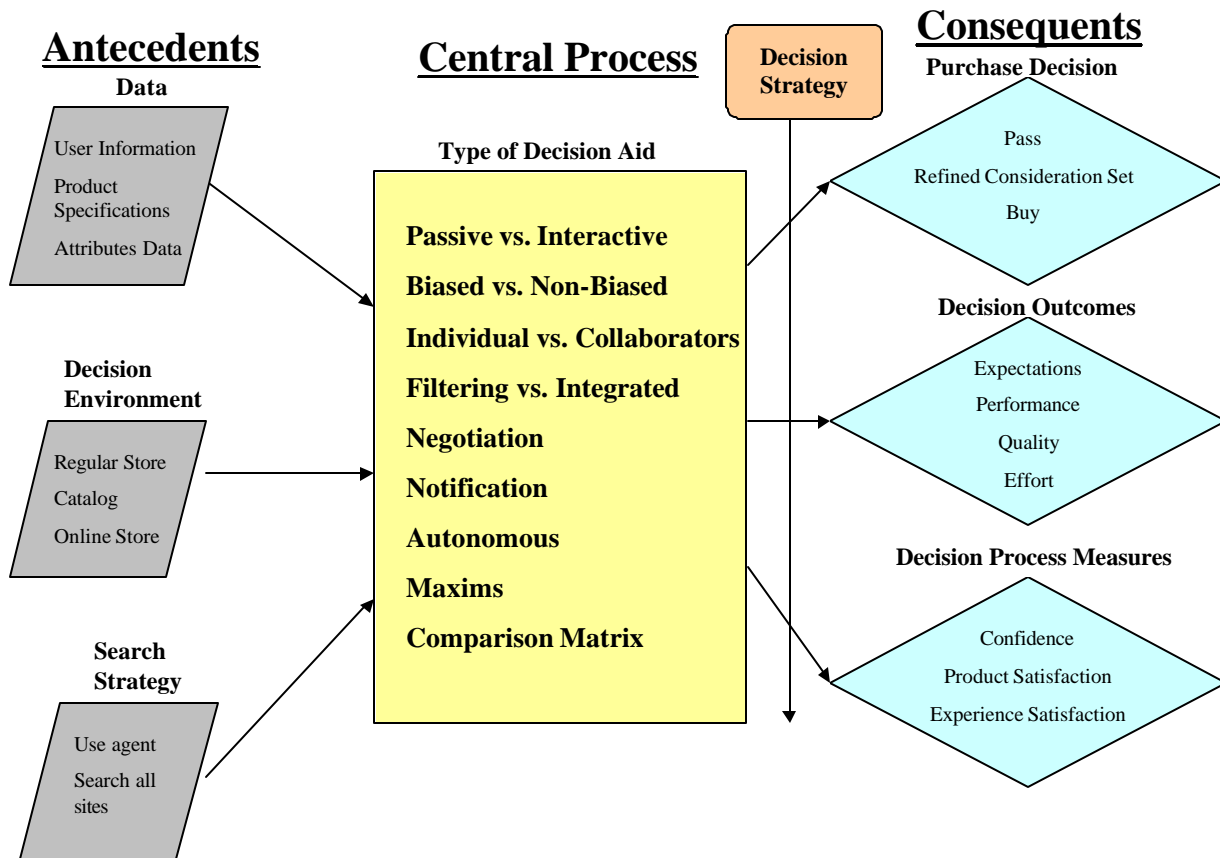


Fig. 1. A conceptual framework of decision making in a web environment.

Overall, electronic decision aids are expected to help consumers improve their performance in decision-making situations. They can either help the individual work harder, thereby achieving a better execution of a chosen strategy or they can work smarter towards a decision strategy. Past research has shown that these consumers will typically adapt their strategy selection to the capabilities of the electronic decision aid in a way that maintains a low level of effort expenditure (Benbasat 1999).

The paper concludes with an agenda for future research. A list of propositions is provided that reflect some speculations regarding electronic decision aids and decision making in a web-based environment. Several areas of future research are also mentioned that demonstrate different areas that need additional research for clarification.

AN AGENDA FOR FUTURE RESEARCH ON ELECTRONIC DECISION AIDS

Research Propositions:

- P1.** Complex electronic decision aids will cause “safe” calibration strategies; therefore they will be inefficient for the user.
- P2.** Simple electronic decision aids will work best because they will cause “optimal” calibration.
- P3.** Electronic decision aids will cause consumers to use digital attributes. Hence irrelevant digital information will be used.
- P4.** Simple electronic decision aids will cause premature elimination of preferred alternatives due to sorting and filtering of alternatives.
- P5.** Electronic decision aids will not work well when a product category has negatively correlated attributes or trade-offs are required.
- P6.** Complex electronic decision aids will lead to good decisions objectively but poor decisions subjectively.
- P7.** Electronic decision aids that provide subjective satisfaction are more likely to be used.

Future Research:

1.) Who is going to be accessing and using the aid? Electronic decision aids must effectively identify how to attract users. These users will have different needs and will have adopted different levels of technology. A user-friendly aid will obviously retain more consumers and become a more frequent search tool.

2.) Why will they be using the electronic decision aid? The two major reasons that a consumer will visit an electronic decision aid are to either purchase a product or in an on-going information search. Designers need to consider these information issues and determine if only functional information is made readily available or if there is hedonic (enjoyment) information.

3.) When will they be using it? There is the potential for the electronic decision aid to be used at every step of the decision process. As consumers begin their information search to the point of evaluations and final decisions, the electronic decision aid can be used. The intensity of information search depends on risk, involvement, and personal characteristics.

4.) What is it that they will be exactly using? What refers to what kind of information. Information can be multifaceted or hierarchical. Information can be searched for by products and by attributes.

5.) How will they be using it? How is directly related to the why of usage. Whether the aid is being used as an exploratory tool to collect functional information or if it is being used as a hedonic tool for enjoyment and pleasure, depends on the consumer.

The designer of the electronic decision aid can address these five questions by asking three primary questions. For whom is the electronic decision aid being designed? What information are we trying to present and how are we going to present it?

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