

# **The Effects of Electronic Decision Aids on Consumers' Cue Utilization in Product Evaluations**

**Gokhan Karaatli**  
**Indiana University - Purdue University Fort Wayne**

**Robert W. Veryzer**  
**Robert Veryzer Research**

*One of the important aspects of online shopping is the availability of electronic decision aids (EDAs). The use of these increasingly pervasive shopping tools may affect key relationships underlying consumers' search and processing with respect to product related information. The primary objective of this research is to investigate the effects of electronic decision aids on consumers' product evaluations. Overall, this research demonstrates that EDAs that enable attribute-based sorting and comparison of products can significantly influence the effects extrinsic and intrinsic cues have on consumers' purchase decisions (e.g., quality judgments).*

## **INTRODUCTION**

Interactive tools such as electronic “decision aids” or recommendation agents are one of the primary tools that differentiate online shopping from other traditional mediums in assisting consumer information search and processing. Consumer researchers have studied the ways these online tools assist and affect consumer information search and purchase processes (e.g., Diehl, Kornish, and Lynch, 2003; Haubl and Trifts, 2000; Swaminathan, 2003). For example, research showed that the use of well designed decision aids (query-based) leads to increased satisfaction with the decision process and increased confidence in judgments (Pereira, 1999).

A crucial part of consumer information processing is cue utilization (Rao and Monroe, 1988; Szybillo and Jacoby, 1974; Zeithaml, 1988). This phenomenon is no less important in the Internet context; however, it is not clear how introducing electronic decision aids (EDAs) into the consumer decision making process affects cue utilization or whether it at all changes the impact of various types of cues— intrinsic and extrinsic—from what would normally be expected. Extrinsic cues are product-related attributes that are not part of the physical product, such as price, brand name, warranty, and country-of-origin. On the other hand, intrinsic cues are physical attributes of a product and involve the physical composition of the product (Szybillo and Jacoby, 1974; Zeithaml, 1988). Although intrinsic cues tend to be better indicators when it comes to quality (Szybillo and Jacoby, 1974), extrinsic cues also play an important role in consumer decision making. In the context of online shopping, it is conceivable that EDAs may affect or even shift the influence of intrinsic and extrinsic cues on consumer decision making. For example, products with dominant intrinsic and extrinsic cues might have an even more favorable

position when decision aids are present. Alternatively, perceptions of differences between products might actually be diminished due to the accessibility of relevant information.

The goal of this research is to investigate the effects of electronic decision aids on consumers' use of product information (intrinsic and extrinsic cues) in product evaluation (perceived quality). From a research perspective, this work provides a greater understanding of the role of increasingly pervasive electronic decision aids on influencing consumer information processing, in particular, intrinsic and extrinsic cue utilization.

## **THEORETICAL FRAMEWORK**

### **Information Search, Decision Aids, and Consumer Decision Making**

In many ways the Internet has decreased consumers' search costs and increased search benefits by making a large amount of information accessible to consumers. However, the volume of information and the choices presented can also overwhelm consumers, especially now since consumers have access to a tremendous amount of information via the Internet. For this reason, information agents such as search engines, decision aids, recommendation agents, ratings, and reviews have become increasingly popular as aids in consumer decision making in the on-line shopping environment.

Although the information search cost reduction aspect of the Internet is important (Alba, et. al., 1997; Diehl, Kornish and Lynch, 2003; Haubl and Trifts, 2000; Lynch and Ariely, 2000), what is also critical for consumers is whether or not this medium helps them make better purchase decisions in terms of maximizing consumer satisfaction at an acceptable cost. Among the limited research bearing on this issue are studies that highlight the complexity of achieving this goal in the online context. For example, Haubl and Trifts (2000) have found that the information and comparison capability of online decision aids dramatically reduces search costs for consumers, increases the quality of consideration sets, and improves the quality of decisions. In contrast to the Haubl and Trifts (2000) findings, Swaminathan (2003) suggested the use of recommendation agents did not result in significant impact on decision quality.

The complexity of the decision-making task also raises important issues concerning various types of product information, risk reducing strategies, and so on. For instance, when online decision aids are present: do consumers rely on intrinsic cues more than extrinsic cues?; and does the level of product category knowledge play a significant role in terms of the type of information processed and the evaluations arrived at by consumers? Some studies have investigated the impact of electronic agents on price sensitivity due to reduced search costs. There are also conflicting findings reported as concerning whether price sensitivity is decreased (Lynch and Ariely, 2000) or increased (Diehl, et. al., 2003) when cost of search is reduced for quality information.

### **Product Cue Utilization**

A number of researchers have suggested that, in general, intrinsic cues are more important for consumers in judging product quality because they provide more predictive value than extrinsic cues (Szybillo and Jacoby, 1974; Zeithaml, 1988). However, research investigating consumers' shopping behavior and decision making has shown that consumers often rely on extrinsic cues rather than intrinsic cues (Brucks, Zeithaml, and Naylor, 2000; Rao and Monroe, 1988; Richardson, Dick, and Jain, 1994; Szybillo and Jacoby, 1974; Teas and Agrawal, 2000; Zeithaml, 1988). It appears many consumers rely on extrinsic cues online as well. Tan (1999) found that overall, reference groups are the most important risk reliever in the Internet shopping context followed by retailer's reputation, brand image, and warranty. If evaluation of intrinsic cues requires more effort and time than the consumers perceive worthwhile, they will continue to depend on extrinsic attributes more than intrinsic attributes (Zeithaml, 1988). However, since intrinsic cues are better predictive indicators of product performance and quality, and electronic decision aids reduce the cost of accessing and processing intrinsic cues, consumers may be inclined to rely on intrinsic cues more in making judgments when online decision aids are present.

## Hypotheses

If electronic decision aids do reduce the search cost for the consumers, and intrinsic cues are indeed better indicators of product performance, it could be expected that consumers would rely on intrinsic cues more in evaluating product alternatives in a shopping environment when electronic decision aids are present. Hence, the differences between products with more dominant (higher value) intrinsic attributes versus lower value intrinsic attributes should be easier to detect for consumers when online decision aids are present. Since product quality is one of the most important aspects in consumers' decision making, the effect of electronic decision aids should result in a greater difference in consumers' perceptions of quality between products with high and low intrinsic cues when consumers evaluate these products using online decision aids.

*H1: Products with dominant (high) intrinsic cues will be evaluated (perceived quality) more positively when decision aids are present in the shopping environment.*

One might expect that increased reliance on intrinsic cues may result in less reliance on extrinsic cues based on the information search cost and the cue utilization theories discussed previously. Although decreased search costs might be expected to result in consumers relying more on intrinsic cues due to their higher predictive value (e.g., for determinations of product quality), extrinsic cues such as price and brand name continue to play an important role in online decision making. Lynch and Ariely (2000) have found reduced price sensitivity due to reduced search costs for quality information. However, it is been also shown that the use of "screening agents," due to lower search cost, may increase or decrease the price paid and the quality selected depending on the price-quality relationship and the relative importance of the price in the utility function (Diehl, et. al., 2003). Other extrinsic cues such as brand name and warranty continue to play an important role on the Internet when it comes to consumers' quality judgments and purchase decisions (Lwin and Williams, 2006). Since electronic decision aids reduce the information search and processing costs for extrinsic cues as well, consumers' increased ability to compare products based on the extrinsic cues (e.g., price, brand name) may yield results that favor products with dominant (high) extrinsic cues as well.

*H2: Products with dominant (high) extrinsic cues will be evaluated more positively (perceived quality) when decision aids are present in the shopping environment.*

However, decision aids may conceivably shift consumers' reliance on or weighting of intrinsic vs. extrinsic cues, and the degree of these shifts could depend on the level of product knowledge. This interaction effect might be expected due to the influence of online decision aids on the use of intrinsic/extrinsic cues differing for consumers with different levels of product knowledge. Therefore, testing the potential effect of product knowledge on the relationships under investigation here is also warranted in order to provide more valid results.

It is important to note that, in this study, we are investigating the process where consumers are utilizing product information in order to evaluate products and make purchase decisions. Therefore, those consumers who already know which product they want and use various shopping agents to compare prices are not considered here.

## METHOD

An experiment using a 2 x 2 x 2 x 2 mixed factorial design with intrinsic cues (low, high), and extrinsic cues (low, high) as within-subjects factors, and electronic decision aids (present, absent), and knowledge (low, high) as a between-subject factor was conducted to test the hypothesized relationships discussed earlier.

## **Electronic Decision Aid Manipulation**

In order to test the effect of electronic decision aids, two mock online-shopping sites were developed for this study. One treatment was a site that contained no electronic decision aids (No EDA), in which products were presented in an on-line catalog format. The second treatment condition was a site that contained an electronic decision aid (EDA) that allowed subjects to sort and re-order product alternatives based on individual product cues (e.g., by brand name, attribute such as “screen resolution”, and so on). Consistent with such tools, the site also enabled subjects to review the products in a side-by-side comparison matrix format. Other than the presence or absence of the EDA both shopping sites were identical.

## **Stimuli Development**

Through pilot studies, air purifiers and multimedia projectors were determined as suitable product categories for this research. The product stimuli were designed in such a way that intrinsic and extrinsic cues were perceived as being exhibited at either low or high levels. Product stimulus sets contained product alternatives that represented each of the following attribute formulations: Low Extrinsic-Low Intrinsic (LELI), Low Extrinsic-High Intrinsic (LEHI), High Extrinsic-Low Intrinsic (HELI), and High Extrinsic-High Intrinsic (HEHI). For the Air Purifier category, brand name, price, and warranty information were used as extrinsic cues; while air flow, filter type, and Clean Air Delivery (CAD) Rate for dust, smoke and pollen ratings were provided as intrinsic cues for the air purifier category. Brand name, price, and warranty information were the extrinsic cues for the multimedia projectors, while ANSI lumens (an industry standard for measuring how much light is emitted from the unit--which indicates the light output of the projector and relates to “Screen Brightness”), resolution, and contrast were provided as intrinsic cues.

## **Procedure and Measures**

Five-hundred-seven undergraduate students from a U.S. university participated in this study; of these all but three fully completed the experimental task ( $n=504$ ). Participants were randomly assigned to one of four conditions; each of the four between-subject cells contained 126 subjects.

The experimental task was administered in a controlled environment (a computer laboratory) using computer work stations. Subjects were randomly assigned to one of the four (2x2) between-subject conditions (Low Knowledge-No EDA, High Knowledge-No EDA, Low Knowledge- EDA, High Knowledge- EDA Present). The product subjects would start the task with (air purifier versus multi-media projector) was randomly assigned to control for possible order effect.

The dependent measure, perceived quality, was collected by using a multi-item 7-point bi-polar scale (e.g., very low- very high) for each of the dependent variables. The perceived quality scale (which includes items assessing consumers’ sense of product reliability, dependability, and durability) was adopted from Dodds, Monroe and Grewal (1991). The coefficient alpha value of the scale was .95.

## **RESULTS**

The lack of a significant difference between the responses for air purifier and multimedia projector categories with respect to the dependent variable perceived quality [ $F(1,500) = 0.18, p > .10$ ] allowed results to be interpreted across product categories. Hence, the results are reported here across product categories using the GLM repeated measures approach. Gender was also examined in order to identify any potential influence on the dependant variables. Results indicate there is no significant gender effect [ $F(1, 500) = 1.38; p > .10$ ].

Results across two product categories (AP & MP) confirm an expected significant main effect between the intrinsic cues and consumers’ product quality judgments [ $F(1, 500) = 534.73, p < .001$ ]. Results indicate a significant interaction effect between EDA and intrinsic cues [ $F(1, 500) = 17.88, p < .001$ ] and the pattern of change in subjects’ perceived quality evaluations occurred consistent with what was indicated in hypothesis 1. The difference in consumers’ product quality judgments between products

with *high extrinsic* cues and *low extrinsic* cues was greater when electronic decision aids were present (EDA HI – EDA LI = 0.91) as opposed to when online decision aids were absent (No EDA HI – No EDA LI = 0.6). Furthermore, the lack of any significant main effect of EDA on the dependent measure of perceived product quality [ $MEDA = 4.53$ ,  $MNoEDA = 4.45$ ;  $F(1, 500) = 1.45$ ,  $p > .10$ ], combined with the previous findings, suggests a moderating effect of electronic decision aids on the relationship between intrinsic cues and product quality.

Although as expected, products with higher (value) intrinsic cues (e.g., a multimedia projector with XGA resolution) are perceived to be higher quality than those with lower (value) intrinsic cues (e.g., a multimedia projector with SVGA resolution) in both shopping environments, the presence of an EDA in the shopping environment seems to further increase the difference between perceived quality of these products with high versus low intrinsic attributes. It appears that the use of EDAs influences consumer's perceived quality judgments in a way such that the effect of intrinsic cues on consumers' product evaluation (perceived quality) is greater when decision aids are present in the shopping environment.

Further analysis confirmed that those who are more knowledgeable about the product tend to rely on intrinsic attributes more than those who are less knowledgeable when judging product quality online [ $F(1, 500) = 13.97$ ,  $p < .001$ ]. Such a finding is similar to the pattern observed in more traditional shopping environments as documented in past studies mentioned earlier (e.g., Rao and Monroe 1988). In addition, there was a significant interaction between product knowledge and decision aids on the intrinsic cues-product quality judgments [ $F(1, 497) = 14.67$ ,  $p < .000$ ]. This suggests that the effect on electronic decision aids may also depend on the level of product knowledge possessed by consumers.

The results indicated a significant main effect between the extrinsic cues and consumer's product quality judgments [ $F(1, 500) = 1125.90$ ,  $p < .001$ ]. A significant interaction effect between EDA and extrinsic cues was also detected [ $F(1, 500) = 25.78$ ,  $p < .001$ ]. The difference between consumers' product quality judgments for products with *high extrinsic* cues and *low extrinsic* cues was greater when electronic decision aids were present (EDA HE – EDA LE = 1.83) as opposed to when electronic decision aids were absent (No EDA HE – No EDA LE = 1.4) and thus is consistent with the hypothesized relationship (H2). The results suggesting no significant main effect of electronic decision aids on the dependent measure of perceived product quality [ $MEDA = 4.53$ ,  $MNoEDA = 4.45$ ;  $F(1, 500) = 1.45$ ,  $p > .10$ ] also indicate a moderating influence of electronic decision aids on the relationship between extrinsic cues and product quality.

It appears that when electronic decision aids are used in the shopping environment, the difference in consumers' quality judgments between products with high extrinsic cues (e.g., Toshiba) and low intrinsic cues (e.g., Vivitek) became greater.

Further analysis confirmed that those who are less knowledgeable about the product tend to rely on extrinsic attributes more than those who are more knowledgeable when judging product quality online [ $F(1, 500) = 10.60$ ,  $p < .05$ ], which is consistent with the pattern observed in more traditional shopping environments as discussed earlier. However, the moderating role of decision aids and product knowledge on the extrinsic cues-perceived quality relationship appear to be independent from each other since results suggested no significant interaction between EDA and product knowledge [ $F(1, 500) = 0.74$ ,  $p > .05$ ].

## DISCUSSION

The results indicate that using electronic decision aids can improve the influence of intrinsic cues on consumers' product evaluations. This suggests that when electronic decision aids (which reduce search costs and increase accessibility) are used, consumers are more aware of the differences among product alternatives with respect to intrinsic cues, and have more insight about product performance and quality differences, thus resulting in better decisions with respect to the quality and performance of a product. However, it is also important for manufacturers and retailers to note that the use of electronic decision aids can potentially increase the differences in consumers' quality perceptions between products with high extrinsic values and those with low extrinsic values. This means the gap between the product alternatives that have both high intrinsic and high extrinsic cues (e.g., Sony projector with high-

resolution) and those with low intrinsic and low extrinsic cues (e.g., Vivitek projector with low-resolution) might become even greater with respect to consumers' perception of quality when decision aids are used. This also implies extrinsic cues such as brand name continue to play an important role in the electronic shopping environment. Despite the fact that unfamiliar or small brands may have better exposure in the electronic shopping environment against strong brand names compared to what they might have in traditional shopping environments (e.g., due to increased likelihood of being included in consumers' "available set" and "consideration set" with the use of search engines and decision aids), unless they provide compatible levels of intrinsic product attributes, their chances against big brands are not necessarily improved when decision aids are present in the shopping environment. Further research investigating the impact of individual extrinsic cues (e.g., brand name) versus intrinsic cues in the online context in light of the influence of EDAs is warranted.

From a consumer perspective, it is important to be able to evaluate as many product alternatives as necessary without having to worry about incurring added search and processing costs, especially if this process leads to a more effective evaluation of product performance and results in a more satisfactory purchase that is a better fit for their needs. From a marketer perspective more satisfied and better matched customers (in terms of their needs to an appropriate product solution) will lead to more successful relationships with purchasers of their products. Marketers may also benefit from how EDAs heighten customer awareness of certain aspects of product offerings. For example, products with dominant intrinsic cues might have a better competitive advantage when decision aids are in use. This makes it easier for marketers to justify the price difference in an environment where price competition seems to be even more prevalent in the era of electronic shopping.

Although the type of electronic decision aids and search activities that are discussed in this research are more relevant to complex products (e.g., electronics), the implication of this research is not limited merely to such products. Relevance is affected chiefly by the number of intrinsic and extrinsic cues involved as well as the balance between them. It is likely that electronic decision aids would be more effective in increasing the influence of intrinsic cues on consumers' quality judgments and product choice when shopping for products that have a larger set of intrinsic cues from which consumers can evaluate products. On the other hand, for those products that inherently lack a considerable number of intrinsic cues from which consumers can evaluate alternatives (e.g., experience products such as clothing items), the use of electronic decision aids might be expected to increase the influence of extrinsic cues on consumers' decision making.

While this study included two of the most popular features (product sorting/ranking based on chosen attributes and a comparison matrix of chosen product alternatives) present in existing decisions aids, studying the effects of decision aids with various features is needed to provide a more thorough investigation of their effects on consumer cue utilization and decision making in general.

The decision aids used in this study allowed all the product attributes to be included in the processing (e.g., sorting the products based on chosen attribute, comparing products side by side) of the information during product evaluation and purchase decisions. Therefore, the results of this study might be a better representation of what is referred to as cooperative decision aids rather than those non-cooperative (selective) ones (Haubl and Murray, 2003). Although fully cooperative decision aids should provide a more accurate assessment for consumers, given some decision aids available today are selective, investigating the effects of decision aids on cue utilization using this type of decision aid might shed further light into better understanding the relationships between these variables and consumers product evaluation and purchase decisions. It is important to consider the type (fully cooperative versus selective) of decision aids used in a particular study when comparing the outcomes of studies in this area.

Although currently most relevant for online shopping situations, advances in mobile technology (e.g., increased capabilities of mobile devices and wireless services) and consumers' ability to access electronic and online resources (regardless of their location) is improving to a point where EDAs are likely to become even more pervasive in affecting consumers' shopping decisions.

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