

Aiding Purchase Decisions on the Internet

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ABSTRACT

Internet-mediated dialogs between sellers and buyers have disadvantages relative to speaking with human purchase advisors or sales agents. Yet the Internet also offers the advantages of enormous knowledge resources, convenience, unbiased information, search agents, and currency. Principles for creating successful conversations with buyers are presented, and a purchase aiding system under development is described.

The Internet is a new channel of communication between buyers and sellers. From the buyer's perspective, there are both reasons to use the Internet and also reasons to prefer current alternatives for making purchases [1]. Before contrasting the Internet and other purchase/sales channels, the discussion is restricted in two ways. First, the focus is only on the purchase of complex products like automobiles, personal computers (PCs), and configurable industrial products. Second, buyers who know in advance the exact product that they wish to buy are excluded. That is, the focus is on buyers who need advice, not on the best way to place an order.

The overarching question is: When is executing a complex purchase better done via the Internet alone versus some other commercial channel or combination of channels? The essence of this question, however, is revealed by the second restriction immediately above, namely focusing on advice rather than ordering. Thus, the topic of the present work is not the Internet versus alternative channels for locating and ordering a preselected product, as important as this contrast may be. Instead, the Internet is compared to other communication channels for obtaining the advice necessary to decide which product is the best one to buy.

Maybe the most obvious competitor to the Internet is a human sales agent. However, a less readily available possibility should be recognized, advice from an independent source. This advice can then be executed through any channel that accepts an order for the selected product, including the Internet. Because an independent person, a "third party", has the obvious advantage over a sales representative of no profit-induced bias, such a knowledgeable, unbiased, and cooperative person will be taken as the strongest competitor to the Internet as a source of purchase advice. Although this advice may derive either from an interaction with a human or from a non-customized resource like *Consumer Reports* magazine, human advisors offer more intelligence and customization. Further, they can access magazine reports and other non-

customized sources of information. Thus, the human software advisor is adopted as the standard to which an Internet-mediated advisor is compared.

Think of this imaginary person as a wise uncle. “Wise” means deeply knowledgeable about a product domain and about how to link the product’s features with a buyer’s needs. “Uncle” signifies someone who can be trusted to use that knowledge in the best interest of the buyer. Returning to the buyer’s perspective, how is using the Internet to make a purchase decision different from a conversation with such a wise uncle? What would it require for the Internet to mimic the conversation that would naturally occur between buyers and their own human wise uncles?

I. FIVE DESIDERATA OF AN INTERNET-DELIVERED SOFTWARE ADVISOR

The buyer’s interaction with either the human or the Internet yields a purchase conversation or dialog. What are the factors that contribute to the success of such conversations? This question’s importance is increased by the less than fully satisfactory status of most current Internet-mediated dialogs [2; 3].

A. *The Benefits of the Conversation Exceed Its Costs*

This guideline means that the expected benefits exceed the expected costs and that this expected surplus must be maintained throughout. If (expected) costs exceed (expected) benefits at any point, there is a clear risk of the buyer terminating the dialog.

As obvious as the power of the cost-benefit guideline is, it may be worth reviewing one example of its impact on buyer’s decisions. A review of programs that provided information to consumers found that new useful information to shoppers (e.g., feedback on energy

consumption) usually succeeded in influencing purchases [4]. The same was found for programs that reduced the effort to use existing information (e.g., organizing unit prices on a single ordered list to facilitate cross-brand comparisons). In contrast, those that only reminded buyers to use information that was already available (e.g., to avoid foods high in fat) usually failed to alter purchases.

As an illustration of both success and failure, consider the food comparison charts posted in supermarket aisles by [5]. When the amount of sugar added to a serving of breakfast cereal was listed for all brands, in order, on a single chart, consumers switched their purchases toward the low-sugar cereals. When the same charts were posted for vitamins and minerals, there was no effect. The sugar chart both provided new information and reduced the mental cost of comparing brands in order to find a lower-sugar brand acceptable to household tastes. In contrast, the vitamin and mineral charts organized information that buyers already had and did not value.¹ Thus, they provided no additional benefit. The conclusion is that people use information only if it is perceived as adding benefits or as reducing costs.

B. Credibility and Trust

The information and advice must be credible, and the source must be trustworthy. The need for trust applies equally to the human and the software system, but the latter has the greater challenge. An Internet-delivered software advisor cannot provide the face-to-face cues of trustworthiness that a human can. However, although a software advisor may have no initial reputation for trust (based on past experience), such an image can be built over time by personal

¹ The vitamin and mineral information was legally required to be printed on a nutrition panel on the product package. One reason why this information may have been perceived as useless was that those shoppers most concerned about these “positive” nutrients could assure an adequate intake by ingesting a multivitamin supplement rather than by altering the food they otherwise preferred to eat.

usage, word-of-mouth recommendations, or public endorsements (e.g., by consumer-oriented magazines' endorsement of the system's knowledge and disinterestedness).

C. Intelligence and Customization

One of the early lessons of AI is the difficulty of equaling the performance of humans in intellectual tasks. Customizing a product recommendation requires an advisor, either human or software, to perform two related tasks. First, the advisor must know what kinds of information people can validly provide and how to successfully extract that information from buyers. Consumers can usually say what they need or want the product to do and can articulate such personal preferences as style and color. However, they may have difficulty specifying the product features that meet those needs. For instance, automobile buyers who must drive on snow or ice may know that they need traction control, but not know whether they should buy front-wheel, 4-wheel, or all-wheel drive. Second, based on whatever can be learned from the buyer, the problem of identifying the optimal product must be solved. Thus, the advisor, human or software, must first extract the buyer's needs and then build an inferential bridge from those needs to the most suitable product.

D. Control

In a conversation between a buyer and a human advisor, both speakers have all the control customary in such interactions. For buyers this means, inter alia, that they can request that a term be defined (e.g., automobile features like GPS or 4-wheel drive) or a product feature be explained (e.g., how GPS works or the difference between 4-wheel drive and all-wheel drive). Or as the conversation proceeds, the buyer may learn something that requires returning to an

earlier point in the dialog and changing a preference stated there. Buyers who feel impatient should be able to request a recommendation at any time, even before the advisor would normally feel comfortable providing one. Finally, the buyer might even like to suspend the conversation and return later. A lack of control in any situation is discomfoting, and more so in situations where control is expected. Providing satisfactory conversational control is a special challenge to software advisors.

E. Feedback

One characteristic of human conversation is feedback. Even without the advantages of facial expressions and gestures, a software system can and should provide feedback. Specific feedback might include (a) how much progress has been made toward identifying the best product, and (b) how much longer the conversation is expected to take. Such feedback lets buyers know both that their personal needs and preferences have been registered (i.e., that they have been listened to) and, further, that providing this information is enabling the (software) advisor to home in on the best product for them.

II. ADVANTAGES AND DISADVANTAGES OF THE INTERNET-DELIVERED ADVISOR

Let it be acknowledged immediately that the technology for building a software advisor that can mimic a true wise uncle does not exist, although there is no shortage of claims to the contrary (e.g., [6]). This gap can be illustrated by two substantial disadvantages of an Internet advisor. First, no software has the ability to comprehend the buyer's natural language answers to the system's questions. Second, there is no face-to-face communication. Thus, the question is not

whether a knowledgeable and trusted human advisor, a real wise uncle, has advantages over a software purchase advisor. It is blindingly obvious that he does. Instead, the question is whether the system has its own advantages that can compensate, at least partially.

What are the advantages of an Internet-delivered software advisor? Maybe the greatest are the knowledge resources of the Internet. Thus, not only can GPS be defined, but how it works and its value to automobile drivers can be explained and illustrated. Similarly, the differences between 4-wheel drive and all-wheel drive can be shown in a tutorial. Because the cost of constructing these definitions, explanations, and tutorials is distributed over many users, their quality should exceed that offered by almost any human, even a very knowledgeable one. Furthermore, as bandwidth increases, these knowledge resources should be available in full motion (as well as color and sound) and, eventually, become highly interactive.

The Internet offers several other advantages. Its convenience is well recognized. Thus, buyers can log on and converse with their software advisor at 10:00 p.m. on Sunday evening in their own homes, something not easily asked of a human advisor. There are third-party “fact documents”, like government or specialty magazine reports on, say, automobiles’ comparative safety or computer manufacturers’ reliability. These documents provide more than information; they provide credibility. Search “bots” or agents can seek the lowest price, nearest availability, and so on. And over time, they should only increase in intelligence and usefulness [7].

In addition to the advantages of information resources, convenience, credibility, and search agents, Internet information is current. In a changing marketplace, the currency of information is a problem even for a knowledgeable human. However, as models, features, prices, or availability change, the software advisor should maintain near perfect currency. The only limitation is the software advisor’s access to sellers’ updated databases. Sellers’ incentive is to

cooperate with an Internet purchase advisor (otherwise their products cannot be recommended by the system). This should assure access to current databases.

Finally, and not least important pragmatically, how many wise uncles (or aunts) are there? Do we, as buyers, have access to wise uncles when we wish to spend thousands of dollars on an automobile, a PC, a vacation cruise, a life insurance policy, or any other complex and expensive product? Maybe the ultimate advantage of software advisors is their universal availability to anyone with an Internet connection.

The conclusion is that an Internet-delivered purchase advisor can offer substantial advantages over a human wise uncle. This is not to say that the disadvantages of the software advisor can be fully compensated by these countervailing Internet benefits. However, by building a system to mimic a conversation with a human and fully utilizing the system's own advantages, the gap between the system and a wise uncle can be narrowed. Indeed, might it even be fully closed for some segment of buyers? Going further, might some buyers actually prefer an Internet-mediated advisor over the human advisors available to them?

III. ADVISING TECHNOLOGIES

The purchase advising task is to extract sufficient knowledge from buyers and use it to infer the most suitable product. That dual task is performed today by several quite different technologies, with no one of them dominating the others.

The essence of the advising task is bridging the gap between what buyers know, namely their needs, intended uses, preferences and so forth, and what they need to know, namely the product that best fits those needs, uses, and preferences. One way to consider the advising technologies is how they solve the problem of bridging the needs-product gap.

A. Static Surveys

A survey is here defined to be a fixed set of questions to be answered by the buyer. The alternative is a dynamic or interactive survey. This is called a conversation (or dialog) and considered below. Of course, there is a continuum between the static survey and the fullest conversation enabled by technology. Thus, a static survey plays the uncomfortable role of a “straw man”. At the same time, however, (static) surveys are, by far, the most common current method of knowledge extraction from buyers. That fact alone should justify their inclusion here.

Any survey’s power as an advising technology depends on how the information obtained is used to infer the best product. The most common inference method is successive screening in which feature-based criteria are applied sequentially to narrow the product space. For instance, the survey might ask an automobile buyer to specify the model, engine size (in cylinders, liters, or horsepower), number of doors, and so on, ending with details like the sound system. If a specific screening criterion is applied directly to this information, say by setting a minimum horsepower requirement, then no advice is being provided. Alternatively, the survey might pose questions meant to identify the buyer’s need for the engine’s power, such as whether the auto will be used to tow a heavy object (like a boat or a trailer). In this latter case, an inference mechanism is needed to infer the required power.

As common as surveys are, they violate nearly every desideratum of an Internet-delivered software advisor. During the course of the survey, the benefits never exceed the costs, because the buyer experiences only costs until after all questions have been answered and the benefit of a recommended product is delivered. Surveys offer little intelligence, no control, and no feedback.

The survey itself is static and, therefore, not customized. Only the recommendation itself can be customized, but at the cost of asking more questions for increased tailoring.

B. Collaborative Filtering

Instead of matching needs and products based on survey responses, collaborative filtering uses characteristics of buyers, especially current or past purchases, to classify them into groups. Then the recommendation is based on the product(s) most frequently chosen by actual buyers in the same group. This group-chosen product substitutes for a genuine inference as to the best product for all buyers categorized into a particular group. Thus, the needs-product gap is not bridged by inference but by the past purchase decisions of similar people.

This technology works best when there are many past buyers, and they are knowledgeable enough to have made wise choices. And it is most needed when inferences are difficult, as they are for products based less on utilitarian considerations and more on subjective tastes (e.g., books and recorded music). Collaborative filtering also yields more acceptable recommendations when customization is not crucial (as it is for PCs and many other complex products), when the target buyer is a very typical member of the group (because the recommendation is the most typically purchased product), and when the product environment is stable (as it is for books and recorded music, but is not for many technology-driven products). In summary, collaborative filtering is a weak method inferentially and probably unsuitable for most complex products. This is not to say that it does not have useful applications, especially when combined with stronger, more customized methods [8].

C. Importance Weighting

The technology of importance weights defines products in terms of features. Then the bridge from the buyer's personal needs to the best product can be constructed in two smaller spans, first from needs to features, then from features to products. For instance, the need to play video games on a PC suggests a faster processor and more powerful video card. However, these are features, not products. The bridge from fast processor to a specific product depends on the availability of particular processors. These will change over time or may be limited by the buyer's preference for particular manufacturer(s). The task that confronts a buyer who uses an importance weighting purchase advisor is to understand the product's features well enough to be able to specify the relative importance of each one. For instance, the buyer may be asked to distribute 100 points over 14 features so that the number of points allocated to a feature validly reflects its relative importance.

The great disadvantage of the importance weighting technology is that the buyer must speak the language of features. This can be far, sometimes quite far, from the language of needs, uses, and preferences—which is what the buyer really knows. If the buyer can provide the required importance weights, the result is a highly customized recommendation. For less complex products, especially ones whose features are stable and can be learned over time, importance weighting may be an adequate technology. However, returning to our desiderata, it provides no control or feedback, no benefits until the end, and little intelligence (although a high degree of product customization).

D. Conversations: Dynamic Surveys

A dynamic survey can mimic a human conversation in some respects, but not others. If the survey is combined with AI technology for inference, then at least two important elements of a human conversation can be simulated. First, the next question follows intelligently from the responses to previous ones. Second, some information, in this case about a buyer's needs, does not have to be extracted by a direct question but can be inferred from other responses. This said, it should also be acknowledged that the constraints of current technology prevent a conversation from accepting natural language responses. Instead, the Internet-mediated conversation must rely on the buyer's selecting one or more of the listed responses to each question. Further, the conversation is unidirectional, with the software advisor posing the questions to the buyer and not vice versa.

The consequences of this last constraint, unidirectionality, can be mitigated in two ways. First, because the goal of the conversation is to extract information from the buyer, unidirectional questioning is natural. It would characterize a human buyer-advisor conversation as well. Thus, a conversation with an expert is one of the least objectionable situations for unidirectionality. Second, the buyer's questions can, to some extent, be anticipated. This is the goal of the assembled set of definitions, fact documents, and tutorials. Note that the success of a unidirectional dialog with the buyer's questions anticipated depends heavily on the sophistication of the advisor. The better is the software advisor, the more adequate will be the conversation, even with the constraints imposed by the combination of the Internet medium and current AI technology.

IV. BUILDING A PURCHASE ADVISOR

The construction of a purchase advisor for complex products requires domain expertise, AI technology for knowledge representation and inference, and what shall be termed interaction technology. The domain expertise, say in personal computers, must come from experts like salespeople, the information technology personnel who recommend PCs within organizations, the staff of PC magazines, and so on. This is straightforward conceptually, if not practically. The availability of such expertise is assumed in what follows.

A. AI

The available AI technologies include Bayesian networks, genetic algorithms, neural nets, and rule-based systems, complemented by fuzzification. Proprietary restrictions imposed by the commercial organization building the system described below, WiseUncle, Inc., prevent identifying the particular technologies used. However, more than one of the above is used. The inferential bridge from the buyer's needs to the best product is constructed in two stages, namely from needs to features and from features to products. This dual structure is one reason why more than one technology is used, as the two different bridges are best constructed with different technologies.

B. Interaction Technology

The interaction technology consists of two elements. The first is an understanding of the buyer's decision process that can structure the advisor's conversation. The obvious source for such a structure is the domain experts. In reality, few such experts can articulate a process framework, especially in enough detail to guide the construction of the dialog. Indeed, as their

experience grows, these underlying mental structures, which are often implicit to begin with, become more automated and even harder to articulate to a behavioral analyst trying to extract the expert's knowledge. The task is further complicated by the substantial differences in the overarching approaches developed by different experts, often ones best suited to their personal strengths and styles. For instance, some excellent automobile salespeople try to get the buyer to take a test drive as soon as possible, while others prefer to talk first (to identify the buyer's needs or to build a personal relationship with the buyer). The system built by WiseUncle, Inc. for complex products adopts a five-stage process described by [9].

Briefly, Stage 1 frames the buyer (e.g., knowledge of the product category and extent of product search to date) and the product (e.g., a desktop PC versus a laptop). Stages 2 and 3 encompass, respectively, the utilitarian and hedonic or symbolic needs. The former include the functional uses of the product, such as an automobile's gas mileage or trunk capacity. Stage 3's hedonic/symbolic needs, like the image of a car's body style and brand name, are often harder for a buyer to express. For instance, the dominant hedonic need for (many) buyers of a PC is its image as the latest or "coolest" technology. Many buyers to whom this is an important driver of preference will not admit this – sometimes even to themselves. Needless to say, extracting such knowledge is a challenge in itself. In the case of a PC's technology image, the WiseUncle system accomplishes this through pictures of PCs that differ in their image as familiar versus new ("the latest and greatest") technology. Stage 4 captures the remaining, minor product specifications, like an automobile's audio speakers or aspects of its interior. The final stage covers such external elements as a PC's warranty or the local availability of reliable repair service for an automobile. These five stages are sufficient to structure the process of a purchase decision for all complex products.

The second element of the interactive technology is its adherence to the principles described earlier, namely benefits always exceeding costs, credibility and trust, intelligence and customization, buyer control, and feedback. Of course, specifying desiderata is much easier than implementing them. The latter involves a complex tradeoff among these goals that is simultaneously artistic and technological. The elements of the current system that realize these desiderata are best conveyed by some typical screens.

C. The Wise Uncle Purchase Advisor

Shown below is the first screen that a potential buyer sees in the current WiseUncle system. Buyer control is offered, inter alia, by the “Why Ask” button, which pops up a justification for the current question. This feedback also exhibits respect for the buyer’s right to know why their time and effort are being spent answering this particular question.

Insert Screen 1 Here

Ten questions into the conversation, just as it moves to Stage 2, the following screen appears. The Progress box on the right now shows a current recommendation in the form of the

Insert Screen 2 Here

best type of computer for the particular buyer and the two most suitable alternative types. For each of the three types, a measure of fit to the buyer’s needs is displayed. This measure should increase as more needs are elicited through further questioning and the recommended product is further customized to those needs. Below the recommendation is an announcement about the number of facts known, either directly or inferred. And below that is an indicator of how far through the conversation the system expects the buyer is. The measure is not time, but the

number of questions already asked and the expected number to be asked before the conversation is finished.

After this screen the next question is “Do you have any problems with your current computer?” If the buyer answers “Yes” and identifies “Too Slow” as the only problem, then the screen shown below appears next.

Insert Screen 3 Here

Note that the fit of the Hobbyist PC to the buyer’s needs has moved from 40% to 53% and the number of known facts from 14 to 21. Both changes provide feedback and show the benefit of participating in the dialog, as it progresses toward the best recommendation.

If the conversation reaches its natural conclusion (i.e., is not terminated prematurely by the buyer), three products are recommended, in order. This is another illustration of buyer control. People prefer to make the final choice themselves from several options, although they also want to know the advisor’s ranking.

The system described above is under development. Its real test comes when a seller fields it and learns how well it meets performance criteria like (a) the extent of customer use and acceptance, (b) the magnitude of the increase in sales (i.e., in the conversion rate of site visitors to buyers), and (c) the frequency of recommending the purchase advisor to others.

V. CONCLUSION

This paper has discussed a core element of the infrastructure of Internet-mediated commerce, a software purchase advisor. Five characteristics of an ideal advisor were described and incorporated in an evaluation of the advantages and disadvantages of an Internet-delivered purchase advisor. Finally, a particular system under development was described, the WiseUncle

Purchase Advisor. Only field testing (and subsequent improvement) will determine whether this particular system succeeds. However, the technology embodied in the WiseUncle system and its goal of simulating a conversation with a knowledgeable, trusted human advisor point in the direction that must be taken if the Internet is to compete successfully with human advisors or sales agents.

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Screen 1

DESKTOP COMPUTERS: Home and Small Office

Stages of Conversation

Getting Acquainted **Needs** Preferences Extras Support

conversation space

What would you like to accomplish from our conversation today? **WHY ASK?**

- To purchase a computer as soon as I find the one that best matches my needs
- To purchase a computer, but I'm not sure when I'll actually buy it
- I would like to see what kinds of computers are available
- I would just like to learn more about computers

[back](#) [continue ▶](#) [recommend](#)

assistance

Please take a moment to think about your objective. Selecting one of the four options will let me know how I can be most useful.

Your Progress

Current PC Suggestion

Not enough is known about your needs to begin suggesting categories of desktop computers

Our Conversation

I now know 0 things about your particular desktop computer needs.

[View the things I know](#)
[View Conversation History](#)

How Much Longer?

Screen 2

DESKTOP COMPUTERS: Home and Small Office

Stages of Conversation

Getting Acquainted **Needs** Preferences Extras Support

conversation space

Do you have any problems with your current computer? **WHY ASK?**

Yes:

- It is too slow
- Not enough storage space
- Doesn't support new features (e.g. making CDs, watching DVD movies)
- Can't run certain new programs
- Limited [multimedia](#) capabilities
- Other

Nothing's wrong, I just want another computer

back **continue** **recommend**


assistance

Here's your chance to complain... tell me everything that bothers you.

[Read more about reasons for buying a new computer.](#)

Your Progress

Current PC Suggestion
Hobbyist PC



The type of PC that best fits your needs identified thus far


Top 3 Ranked	Score
1) Hobbyist PC	40%
2) Enthusiast PC	36%
3) Casual User PC	29%

Our Conversation

I now know **14 things** about your particular desktop computer needs.

[View the things I know](#)
[View Conversation History](#)

How Much Longer?



Screen 3


DESKTOP COMPUTERS: Home and Small Office

Stages of Conversation

Getting Acquainted **Needs** Preferences Extras Support

conversation space

You mentioned that your current computer is slow. When does this tend to occur? ▶ **WHY ASK?**


- It seems to run slowly when...
 - running several programs at once
 - playing games
 - I'm connected to the Internet 
 - Other:
- I'm not sure, it just seems to run very slowly.

assistance

Your computer could run slowly in some situations but not others. Select as many as you think are applicable.

Your Progress

Current PC Suggestion
Hobbyist PC



The type of PC that best fits your needs identified thus far

Top 3 Ranked	Score
1) Hobbyist PC	53%
2) Casual User PC	41%
3) Enthusiast PC	32%

Our Conversation

I now know **21** things about your particular desktop computer needs.

[View the things I know.](#)
[View Conversation History](#)

How Much Longer?