

Shopping robots and e-commerce

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Abstract: *The paper analyzes features, roles and functions of shopbots, comparing them to non-virtual intermediaries. The aim is to understand how they can support and optimize decision making processes and especially decision-making for purchasing.*

Key words: *Shopping robot, electronic commerce, decision making.*

1. Shopping robots (shopbots) and e-commerce

Shopbots or shopping robots are software agents which automatically, efficiently and efficaciously search, among innumerable Internet information, that about qualitative and quantitative peculiarities of products and services. Therefore they are considered an essential feature of electronic business. The shopbot architecture is based on the purpose of giving a complete access to sources of heterogeneous and distributed information.

Shopbot accesses to these sources by their wrappers answering to some queries. It has to decide what source of information to approach, can divide the query into different sub-queries for different sources, and has to integrate the answers. Regarding the on-line shopping, the customer interacts with the agent through the browser. To the customers' requirements for a specific good or service, a shopbot can visit various websites, comparing and selecting the available information in a few seconds.

Shopbots fulfill their tasks better than men, providing a wide range of products in a few seconds. The most patient and determined human purchaser could not obtain the same amount of information, even if facing a lot of boring and tiring hours of physical and mental work.

Category	Description	Examples
Stand-Alone (Unbiased)	Price comparison separate from product information, offers sorted by price	PriceScan
Stand-Alone (Biased)	Price comparison separate from product information offers sorted by retailer promotional spending	MySimon, Dealtime, BizRate
Contextual	Associate price comparison search with product information	CNETShopper, EdgeGain, Click-the-Button, Books.com
Personalized	Personalize prices, product search, or display of results	Frictionless.com Value Shopper, IBM Information Economies Project

Tab 1: Taxonomy of shopbot

2. Features of shopbots

Shopbots are characterized by the following features:

- **autonomy**, that is the ability of offering the best services remaining independent both buyers and sellers;
- **personalization**, that is the ability to fully understand the customer's behaviour and his preferences. The shopbot analyzes the actions carried out by customer during the

purchase, in order to draw out an identikit on the basis of the interests displayed during the previous navigations. When a customer examines the available articles in the e-commerce sites, shopbots provide useful feedbacks to deduce consumer's preferences. This information is useful for the development of additional searches, as well as to foresee if a customer might be interested to a good, and therefore provide her/him with information about it;

- **privacy**, that is shopbot must keep reserved the customer' identity and behaviour.

3. Roles and functions of shopbot

The interaction between buyers and sellers, in a business market is linked to the costs of transaction which come out from all the activities connected with the exchange of goods and services, as for instance the way to find appropriate suppliers or potential clients, to guarantee that the terms of the bargaining are satisfied, or to arrange the billing of the goods and payments.

In the real market, the costs of transaction can be not too much expensive thanks to the presence of the brokers, who coordinate the exchange of goods and services, buy from the suppliers for the resaling to the buyers, and to support negotiations. The traditional brokers provide a range of roles and functions that bring to the creations of values in market, as:

- **aggregation of buyers' demand and sellers' products** . Aggregating the buyer's request or the seller's products, a broker annuls the individual negotiation between each customer and each seller, realizing economies of scale or purpose, cutting down the costs of transaction and the asymmetry in the contractual power between customers and suppliers;

- **research and matching**. The brokers coordinate the transactions for their customers and suppliers, building the arena for the exchange (a catalog or, in general, a virtual point of sale), avoid the costs of research (of products, prices, trade), of transport, of the elaboration of information (for instance, the connected costs, the commercial partner's features: location, quality of the products, the offered prices and the terms of contract). On the basis of the wished peculiarities, the brokers reduce such costs individuating a number of commercial partners. Furthermore, in presence of M sellers and N buyers, a broker's interposition optimizes the procedures of connection: in a market without brokers it is necessary to implement the MN contacts. A broker can collect complete information about sellers with M requests and provide the information to the buyers with N added transfers of information. Therefore, brokers create a reduction of the total costs of elaboration and coordination, because the total amount of transactions that is necessary to ensure a total connection is M+N, instead of M*N transactions.

Brockers' lack can involve some problems for the commercial partners, who are consequently forced to trade and agree on the exchange terms, when an agreement has been implemented. Finally, the broker can be supported in the individuation of customers or resellers who are more appropriate to the specific situations, because he/she has a better knowledge of the market.

- **determination of the price and facilitation of the transactions**. The determination of the price and all the activities that make easier the direction of a business arrangement, given by the brokers, are useful to make clearer the market. The brokers coordinate buyers and sellers' activities, replacing them; ask for the prices replacing the buyers and present the offer as sellers; an agent can also elaborates the inventory to improve the model of purchase and sale. So the brokers can distribute goods and services, reduce the risk of the fluctuation of demand and offer, and coordinate the commercial exchanges between customers and suppliers.

4. Advantages in the use of the shopbots

For the electronic commerce Shopbots represent a great opportunity, because they allow a valid reduction of the costs of information finding and distribution.

Generally, if a free flow information profoundly influences the efficiency of the market, the financial fiction is significantly reduced. Transport costs, menu costs (what the companies support to value the updating and to launch a price), and the shopping costs (what costumers support to search quality and good prices) will be reduced because of the digital nature of the information, and of the presence of independent agents who look for, compare and spread the information at a low cost.

4.1 Comparison to non-virtual intermediaries

If compared to the human traders, artificial agents have at least three main advantages.. The first has a computational nature: they can operate quickly and deal with many transactions. In general, in various areas of distribution, the agents can optimize the procedures of purchasing, individuating the optimal mixture of goods and services. For example, with reference to a journey which includes a combination of more packages (that include the flight, the hotel room, the car rental), a single agent is able to explore the alternatives and can implement the commercial exchange, in a way that is much more efficient in comparison to an individual research.

The second advantage is that the agents do not get distracted. They can participate in complex auctions without distractions, while this could happen in the case of human beings. For instance, if we consider a bidding agent (which makes offers) on eBay website, it would be able to take part in a very long auction (an auction that lasts days), when new offers constantly come. If a "human" bidder is not connected when an auction closes and if other bidders do crucial offers in that precise moment, the first bidder, who had not the opportunity to react, gives up the opportunity to improve their own offers and to gain eventual benefits. In order to avoid this, it is possible to program an autonomous bidding agent that, for instance, increases all the new offers till a certain price: in this way it is obvious that the bidder can win the auction and its utility is maximized as long as the price is appropriate.

Thirdly, it is possible to program an agent that has not reasoning imperfections, due to human peculiarities, as for instance decision changing, irrationality, impulsiveness[1], changing of motivations about the purchase[2].

5. Shopbots and no-store sale processes

Shopbots can find interesting application spaces in digital sale processes. They are mainly studied by informatics, with specific interests in intelligent agents. They pay attention to techniques regarding agents' creation and knowledge representation, to the implementation of learning[3] and adaptative[4] agents, to the development of communication among several multi-agent systems[5]. Consequently, several researches concerned the consumer's behavior, in order to increase knowledge about shopbot [6].

Among the principal fields, there are:

- *choosing process with unsure sets*: the analysis divides individuals by using the optimal cut rule[7]; according this rule who takes a decision must decide what alternatives have to evaluate through a screening, even if he/she has inaccurate information. The shopbot does not consider that consumers will evaluate all the alternatives which are offered in the decision-making process, but will implement a procedure in which consumers will narrow their attention to little sets. In this way, the engagement regarding the advantage evaluation (that would come from the adding of another product) is reduced. Shopbot faces this problem in the place of the costumers, in order to create the elements set, on which the possible customer will concentrate the choosing process. So the shopbot has to implement the research, aiming at the privileging of the customers'

advantage, that can also be translated in the contraction of the connected research costs [8];

- *the overloaded of information and cognitive costs*: electronic contexts tend to present a large quantity of information to costumers. But these, in the evaluation of a large list of articles, face an expensive cognitive problem, and the overburdened information. This kind of information has its own origin in the research regarding the costumers' behavior. Some researchers underline how the customers are inclined to do a cognitive effort in the development of decisional process: this cognitive effort can be defined in terms of elementary information processes. The elaboration of the information can be used to optimize the planning of electronic interfaces, in which the measure of decisional cognitive costs balances the advantages of consumption;

- *decision support systems*: shopbots reduce cognitive effort and allow to the costumers to optimize decision-making, arranging and filtering choices. Some researchers[9] revealed that, sorting choices according to the weight linear average of the product features was better than having users who selected cuts which can eliminate poor choices or put article in a casual order. Other researchers suggest the use of agents (they also use the weight average of the characteristics of the product) to increase the precision and the speed of costumers' decisions. Finally, other authors[10] defend the use of support systems which use the strength of human decisions, taken trough technologies of agents which can compensate their weaknesses.

5.1. Decision-making process for purchasing, optimized by shopbots

For customers shopping process starts with the identification of the product to buy: this can happen after the visit of a digital or real selling point, or after the reception of any message of enterprise integrated communication, or after personal communications.

Once the costumer has identified the product to buy, he must choose where to buy it. If the costumer decides to use a shopbot, it consults all the selling points and sends him/her the results. Some shopbots decide through the implementation of a better procedure with respect to the classic one. It has been demonstrated that, in the case of a delay in the waiting time, a loss of interest by the user[11] arises, in fact the user turns his attention towards other peculiarities, like download times[12]. To avoid this problem, instead of visiting all the shops, as the biggest part of autonomous shopbots does, shopbots can identify shops which have the cheapest prices, the better qualitative levels, and eventual additional services.

Many of the most advanced shopbots can reduce both the average and the extremity of their distribution, limiting the number of demands, or stopping the research: in this way the shopbot is more interesting for users.

Another problem is the high number of existing choices, because these force the user to a cognitive effort; and because the additional time for cognitive activities is more difficult than a simple wait. It would be possible to compensate this aspect by the underlining of the most advantageous offers, but this solution is not the best one, because the best offer is not always the cheapest one; sometimes other characteristics, as the delivery time and/or the dispenser brand, can be a superior advantage with respect to the lower cost. Shopbots can offer less, but more targeted, possibilities of choice, removing options that are not interesting for the consumer. Few choices reduce the cognitive burden for the costumer, but risk to limit the utility of the set of offers.

Moreover, shopbot offers to the consumer the possibility to choose the place (the State and therefore the tax treatment), and the currency.

Practically, the decisional process of the shopbopt is articulated in the following phases:

- the consumer carries out the choice and begins the research;

- the shopbot explores all of the distributors contained in its set of research and classifies the information on the basis of the companies that reply in a specific time;
- the shopbot shows to the consumer prices and alternatives. Such offers are generally ordered on the basis of the price; some shopbots classify the point-sale in relation of the payment. The shopbots can filter point-sales, according to the consumer's demands, and in connection with different criterions (for example, unit prices, point-sales names, modalities of delivery).

Figure 1 shows the flow-chart about the decision-making of the shopbot:

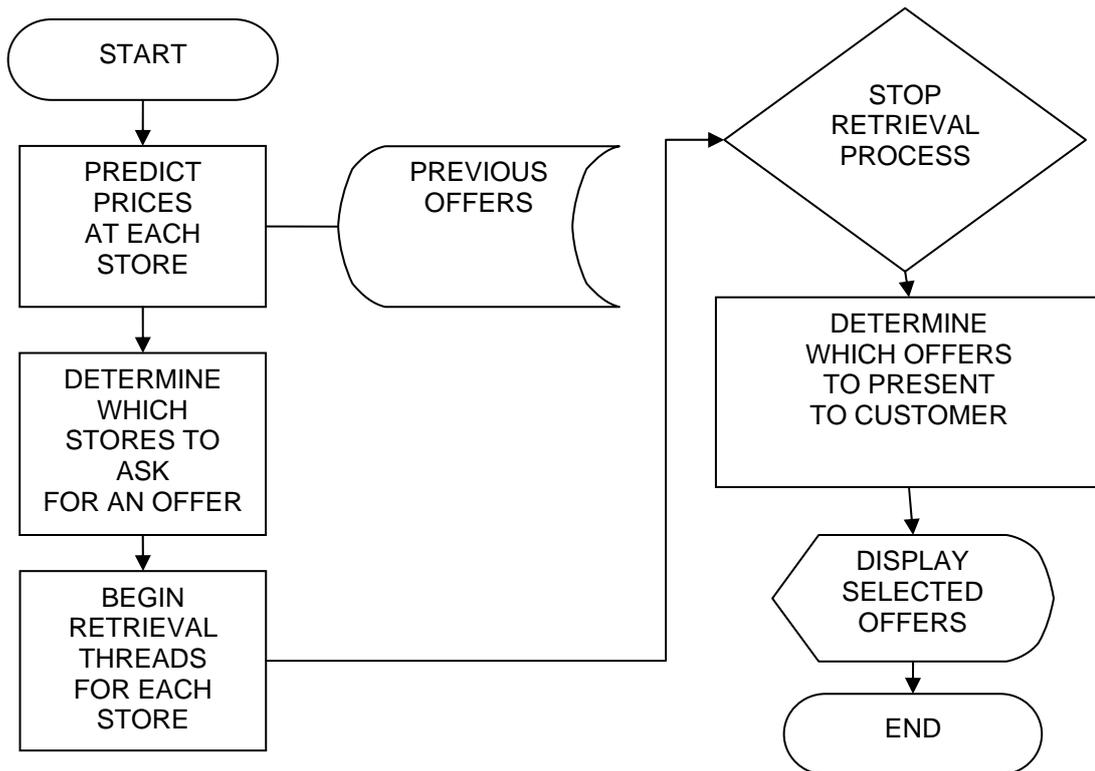


Fig 1: Flow-diagram illustrating the operational decision process for a shopbot [13]

First of all, the item to search is communicated to the shopbot. Then, it develops a prediction of the price and the reply time of each store. The previous prediction can be used to determinate which stores have to be searched and how much time it is necessary for the answer. It is assumed that only the offers obtained in the sites (for example those retrieved from a store) can be presented to the consumer. So shopbots are obliged to search actively and to not consider the previous expectations. Finally, when the process of the point-sales location begins, the shopbot has to decide if it is necessary to wait the end of the retrieval function of all the processes thread or if it is necessary to stop prematurely this process. When all of the offers are picked up, the shopbot decides what has to present to the customer.

In conclusion, the complexity and the dynamism of the systems enterprise-environment[14] generate a surplus of information[15], that is always more difficult to govern, above all if it is compared to the lack of the time. In such scenarios, the shopbots occupy an important role, because enriche the role of the consumer engaged in the implementation of the decision-making process of purchasing. In fact, they provide him/her with real time information, and very low costs; moreover, they disengage the procedures of purchasing from spatial and temporal limits, and from trade intermediation.

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