

# eCommerce powered by Knowledge Technologies

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***Abstract.***

*B2C eCommerce Web site require excellent sales support (assistance) to attract the customers and to be successful. Ordinary database and full text queries as well as simple profiles do not provide the expected level of service. Knowledge technologies can fuel intelligent searching, personalized feedback dialogs, and sophisticated knowledge navigation giving the customer the kind of help and comfort she is looking for. The results are higher traffic, turnovers, and increased customer satisfaction.*

## 1 Introduction

B2C eCommerce Web sites are mostly online shops or auctions selling products over the Internet. Their competitive factors compared to real shops are opening hours (24x7), shopping without leaving home, larger list of products to select from, and sometimes personalized offers controlled by customer profiles.

It is state-of-the-art that product information and customer data of an online shop are stored in a database. The product information can be accessed by queries – like book title, author name, ISBN – and can provide simple information about related products – like customers who bought this book also bought book XYZ. Customer data can be divided into address/accounting information and into profile information supporting personalized offers – e.g., if you bought already two Grisham books you will be happy to be informed when the next Grisham is available.

But the customers of online shops often feel like the “lonesome cowboy” lost in the rich selection of electronic offers. If you know what you are looking for you will find it; if you do not know it, your searching will probably fail – and you will leave the shop unsatisfied and disappointed. This is true for all kinds of goods – even for products where selection process does not need a lot of explanation and help, like books, music, videos, software. But dot.com companies also want to offer and sell products which need help from an assistant – like clothes, used cars, bank services, insurance contracts. These are the eCommerce Web sites which have to provide even more sales support. Knowledge technologies can provide intelligent assistance like a human clerk – or even better.

The paper cites some analysts showing that knowledge technologies will become an essential selling point for eCommerce. Following chapters describe different knowledge technologies which can power eCommerce. The appropriate technologies can be divided into three classes: search, feedback dialog, and navigation. All are based on knowledge structures about the offered products and application domains the products are embedded in.

## 2 Some Facts About the “New Economy”

Sources: Ernst & Young , Forrester Research, Boston Consulting Group, IDC, Bank of America, Meta Group 1999,2000

**Providers :** 79% of all retailers and 28% of manufactures have eBusiness in place

**Revenue:** Revenue is about 9,3% (retailers) and 7,3% (manufactures)

**Interaction:** 50 % of communication / interaction is already purely by electronic media

**Content:** 58% of catalogs worldwide are already on electronic media

**Quantity:** eBusiness applications holds about 131.000 information entities increasing by 35% per year

**Interactions:** Company/Customer Interactions will increase from 4 Billions in 1999 to 23 Billions in 2003

**Success:** 1000 contacts turn into 18 buyers. Loss of 6 Billion \$ in last Christmas Season

**Self-confidence:** 66% of managers said their current search functionality is sufficient

**Reality:** 76% of the customers said they had difficulties with the provided search functionality of the respective sites

### 3 Intelligent Searching

The search is not only a simple SQL or full text query, it is an intelligent search which is based on AI techniques – e.g. Case-based Reasoning (CBR).

Information about the products is modeled as a classification scheme or as a thesaurus (all terms which might be used by the customers are organized with synonyms, related terms, broader terms, and narrower terms).

The classification scheme could be part of the thesaurus (broader/narrower term hierarchy) and supports searches which also look automatically for the narrower terms to make the query more intelligent.

The thesaurus information about synonyms and related terms help to find even more hits. If the hit list is too large narrower terms can be used to group the hits or to start a feedback dialog (see below). Improvements to the described solution are based on weights and negations which are added to the classification scheme and the thesaurus. The weights allow a precise ranking of the hit list showing the best fitting answer to the query in first place. Both classification as well as thesaurus could be modeled using the Topic Maps or RDF standard.

Example for intelligent searching in a online Jeans House application: You are looking for “a blue shirt for your sister for less than 30 US\$”. Intelligent searching would figure out that the shirt has to be for a girl/women and that also the colors navy blue, turquoise, or azure might be appropriate. If you are looking for a “stone-washed blue jeans” blue would not be associated with other kinds of blue, because stone-washed blue jeans have only one kind of blue.

### 4 Feedback Dialog

The feedback dialog is the reaction of the system on queries with vague parameters. The thesaurus is extended by additional information which relates terms with questions and other terms which are possible answers to the questions. This information is used by the system to automatically start a dialog with the customer fixing all vague query parameters. Furthermore the currently available products may also control the questions. Adding an avatar (e.g., a nice lady) to the dialog will make the customer feel really comfortable and well treated.

Example for feedback dialog: You asked the virtual assistant for “a blue shirt for your sister for less than 50\$”. The intelligent search mapped “sister” to “girl/women”. The feedback dialog will ask you about the uncertain parameters of your query, e.g. how old the sister is and what her size is.

### 5 Navigation

Navigation is about traversing explicitly coded knowledge structures. This could be the already mentioned classification scheme or thesaurus, but it could also be a much richer representation of the knowledge about the products and

the application area – the thesaurus is just a specific part of such a rich structure. Again, Topic Maps or RDF are the standards of choice to represent the knowledge.

Navigation helps the user to get to the product of interest by following links which represent related/associated topics. The topics model/represent the ontology – the kinds of things of the application area – and the real things/concepts of the application area. The user might start with a query getting to some topics of interest; from these topics he starts navigation the knowledge structure. The other way around – starting with navigation and continuing with a query – might also lead to the product of interest.

Example for navigation: The home page of our online Jeans House organizes the departments of the store into the categories jeans, shirts, sweats/pullovers, and accessories. Every category is represented by its own page offering further sub-categories (e.g., category jeans could be divided into original blue jeans, stone-washed jeans, colored jeans). If the customer reaches the category she is interested in – e.g. original blue jeans – she starts the query “Levis in 30/32 (female) with straight cut”.

## **6 Online Shops powered by Knowledge Technologies**

### **6.1 Shopping Mall**

*“Customers visit our site not just for leisurely window shopping but to find things fast. We offer them a search technology which is intelligent enough to find similar products as an alternative or some that match the chosen ones – so they are not left to cope with a huge product portfolio on their own. This is a unique selling proposition.”* (Andreas Feike, Managing Director, Shopping24)

shopping24, a subsidiary of German mail-order giant Otto, is one of the largest Internet shopping-malls. More than 20 different shops offer over eight million items online: Fashion, flowers, travel, books, CDs and software. Each of the product-based shops has at least 500 items in their portfolio.

Eight million products available online! To develop the search solution for this vast online mall, shopping24 used CBR technology to access the existing product data of various types of documents. The user has the option to search for a particular product by means of a virtual assistant in all shops simultaneously or in just one particular store. Only relevant results are listed, sorted according to values based on previous click-behavior. The search engine is also able to offer additional matching items. If, for example, the customer is looking for a pair of jeans, white T-shirts and belts can also be offered. The results might be ranked according to the brand the shop would like to promote at that particular time. Should none of the requested products be available, it is possible to offer related items. If Atira, the avatar cannot solve the problem by herself, she contacts the call center online – invisible to the customer.

Facts:

- [www.shopping24.de](http://www.shopping24.de)
- Product search in a mall (one stop shopping)
- Natural language queries
- Avatar “Atira”

- 8+ Mio products in 20+ virtual shops
- 3.000 concepts, 15.000 objects
- Daughter company of mail-order giant Otto
- Online since June 99

## 6.2 Last Minute Tour Packages

*“E-Commerce has become the motivating vision in our company. Not only our customers but also the staff appreciate the potential for online consultancy with our CBR-based Internet Travel Agency.”* (Roman Borch, Managing Director, check out Touristik GmbH)

At [www.reiseboerse.com](http://www.reiseboerse.com) the check out Touristik GmbH operates an award-winning last minute travel agency. With the support of CBR-technology the matches closest to the customer's requirements are found.

Customers always receive an offer or at least an alternative as a result of their query . If their request is too vague, they do not have to scroll through pages of offers. The company's expertise is stored in the CBR-system acting as an intelligent assistant. It involves geographical knowledge as well as connections and dependencies. Knowledge can therefore be made available where it is most productive, namely at the interface between company and customer. “No match found” is avoided. Consulting competence and expertise of the company is made available on the Internet.

Facts:

- [www.reiseboerse.com](http://www.reiseboerse.com)
- Award-winning (“Best of Internet World Berlin 99” and “Innovative Application of AI 1999”, Orlando USA)
- Access to last minute tour packages
- Regular feed from the host of a major German tour provider
- Up to 300.000 offers, response in less than 1 sec
- Online since 1995

## 6.3 Used Cars Market

*“The automatic search engine is multilingual, corrects typing errors and looks for similar offers. Someone who lives in the French-speaking part of Switzerland and is looking for a car in the German-speaking part has the possibility to enter the keywords in French. This is excellent added value.”* (Dirk Kleiner, Managing Director Quoka AG)

The intelligent search engine checks requests like “Looking for a car for a family with four kids, preferably in red with tow”, or ads like “1 yr old Audi, ABS, dual airbug” for typos, corrects and recognizes abbreviations. The solution for the online pre-owned car market with a portfolio of more than 500,000 cars works like this: The data of the printversion “Motormarkt” – an advertisement paper of the Quoka publishing house – is transferred to the online offer and is made available oriented towards customers. The prospective customer receives the hits sorted according to their relevance. In order to optimize this sequence, the search engine remembers the clicking behavior of

all users and adjusts its order accordingly. If there are no matches found, similar cars are displayed.

The unstructured data from the print version of ‘Motormarkt’ was structured with the help of models and rules. This approach enables an intuitive access to product data. The customer can communicate with the system in natural language and without specific expertise. Similarity values find the matching car for the respective query.

Facts:

- www.autoaktuell.de
- Search engine for used cars based on ads from print media
- 1.5 Mio entries
- Automatic conversion of textual ads
- Online Update
- Natural language query (optional)

#### **6.4 Music on Demand**

*“Score Music is not Britney Spears and as such it is not possible to find it via objective search terms like title or singer with the usual online music search engines. In order to supply individually matching score music for the respective movie project to directors, producers and editors, a complex search engine is required which takes into account the special emotional and dramatic character of the instrumental songs and also produces search results which consider similarities between search criteria. Against this background, a “fuzzy search”, which CBR offers, is the solution for the soundtrack library intervox.de. The advantage: CBR implements a structure prior to the search, already at the classification of the individual tracks. Only those tracks are found which are included in the database or in the search logic.” (Bettina Bonengel, responsible for Marketing and New Business Development)*

intervox.de offers far more than the usual search engines. With the help of the intelligent retrieval technology, registered customers are able to find, listen to, download and license appropriate music scores easily and quickly. Based on 300 different music, theme and emotional criteria, the intervox.de categorizers assess each individual piece of music. The individual emotions of the user are taken into account. The intelligent search engine connects emotional impressions of music like “mystic” with objective criteria like length of the track, kind of music or tempo. A similarity value connects various emotional criteria. If the user chooses the term “mystic”, the intelligent search engine also displays tracks which are characterized as being “mysterious” in the selection of results.

The knowledge and similarity model abstracts from individual emotional criteria, which the user expects from his ideal track, and creates mathematical relations to similar terms. Based on this determined similarity relations between the search terms, it is possible to find also tracks, which do not comply with the query one hundred per cent. Thus, relevant results are guaranteed.

Facts:

- [www.intervox.de](http://www.intervox.de)
- Music-on-demand for background music of commercials
- Member of Kirch Group
- Fuzzy search
- Content-oriented search on classified music clips
- 40.000+ music clips

## **7 Summary**

eCommerce Web site have to provide easy to use interfaces to attract the customers. The number of clicks to place the product in the shopping cart has to be as small as possible and additional information about related products has to tempt the customer to buy more. Both requirements can be somehow fulfilled by traditional database applications and search techniques, but – as this paper shows – knowledge technologies can fuel the eCommerce applications. Case studies show that eCommerce sites powered by knowledge technologies can drastically increase the traffic, customer's satisfaction, and shop's turnover.