The Participatory Electronic Product Catalog: Supporting Customer Collaboration in E-Commerce Applications

PETRA SCHUBERT

Abstract

As increasing numbers of consumers use the Internet as a geographically and temporally distributed interactive, multimedia platform to conduct business, new strategic considerations dictate that e-commerce applications afford coordination and collaboration mechanisms. These coordination mechanisms are vital to leverage subgroup preferences and exploit the intelligence embedded in prior transaction histories and experiences. To provide such vital pathways, systems must support the notion of virtual communities of buyers as they cultivate the process of a collective awareness. Virtual communities of buyers and seller offerings can be merged in a single locus, the electronic product catalog (EPC). To coordinate the buyers, the EPC can usefully be extended as a Participatory Product Catalog (PEP) – which combines aspects of product information and community building into a common approach for a modern business medium. This paper will show how the PEP can provide personalization strategies on the basis of customer profiles and afford collaborative mechanisms for the support of the buying process. The paper concludes by recapitulating the importance of e-commerce strategies which meet the twin goals of personalization and community building.

Keywords: e-commerce, virtual community, e-business, electronic product catalog

Author

Dr Petra Schubert is lecturer and research director for e-business at the University of Applied Sciences in Basel (FHBB), Switzerland. Previously, she worked for the Institute for Media and Communications Management and received a doctorate in Information Systems from the University of St. Gallen. In 1998, she received an SNF scholarship and spent one year as a visiting scholar at the Haas School of Business in Berkeley. She is a member of the E-Business Competence Network of the Swiss Universities of Applied Sciences and the 'WIF Fachgruppe E-Commerce'.

INTRODUCTION

Currently, electronic commerce stores on the world-wide web look very much like their brick-and-mortar counterparts with product catalogs which follow the traditional guidelines of the paper-based world. Little use is made of the interactive potential of the electronic medium nor are there many attempts made to exploit synergies between consumer subgroups in this real-time environment.

One author states: 'Figure out not what your customers can do online, but what they can do only online' (Mougayar 1998). It follows that successful e-commerce systems should provide support for the unique online features. Many of these special features have been discussed in recent literature (Kierzowski *et al.* 1996, Selz and Schubert 1997, Palmer and Griffith 1998) but none of these discussions goes into detail on how to implement adequate mechanisms into electronic commerce platforms.

This paper will present the participatory electronic product catalog (PEP) as its core component. Consider that daily, a great number of customers shop on the Internet – yet they are artificially segmented in a virtual environment that prevents them from becoming aware of another. When we enter a physical store we form immediate impressions about its milieu (high-end or discount? Attentive service staff or do-it-yourself, etc.). On the other hand, in a virtual shopping environment there are no immediate clues to distinguish big stores from small, trustworthy from untrustworthy, well-funded infrastructure from garage-based Mom and Pop operations and so on. The invisibility of the other customers exacerbates the feeling of aloneness that many shoppers although there might be dozens of other clients shopping at the same time.

With these thoughts in mind the PEP architecture presents a solution for making the virtual environment more apt to human needs. The PEP is a collaborative system which stimulates the emergence of a community of transaction (Schubert and Ginsburg 1999) visualizing the presence of other customers.

The paper is structured as follows. First, we briefly discuss different kinds of community knowledge which are a powerful ingredient for good electronic shopping environments. We then introduce the architecture of the participatory electronic product catalog (PEP), which extends a 'classical' product information base with community-building mechanisms. Figure 1 shows an overview of the PEP profile collection mechanisms and its benefits.

As shown in Figure 1, we concentrate our analysis on two key strengths which we see in the application of

Volume 10 (4): 1–8. www.electronicmarkets.org

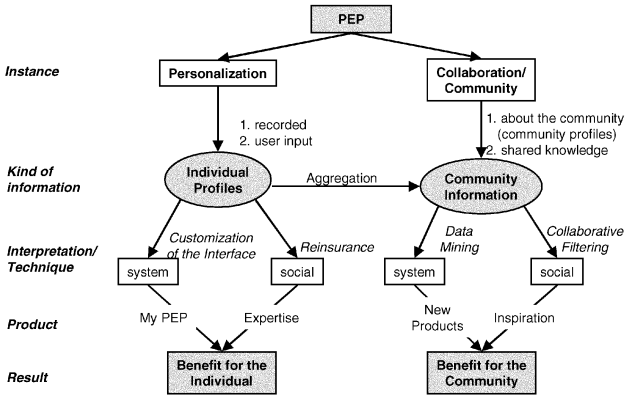

Figure 1. Paper overview

electronic media for shopping applications. On the left half of Figure 1 the personalization of interface and product selection is shown. This allows the interface to be customized to the individual consumer and his or her preferences and transaction histories collected in a 'My PEP' data store. The right half of Figure 1 shows the collaboration between customers on the basis of recorded as well as contributed information. In the final section, the advantages of personalization and coordination are reiterated and challenges for future work are indicated.

COMMUNITY KNOWLEDGE

In brick-and-mortar business customers are generally not aware of one another. The same applies today, for the most part, in Electronic Shopping environments. Consider, though, that clients are carriers of information that could be shared with others for the benefit of all interested parties. Uniting buyers in a virtual community of buyers and harnessing the potentials of the underlying IT-infrastructure, can help to exploit community knowledge. The technical challenge is to declare a strong semantic infrastructure for the product lines and map the semantics to the buying community, in order to achieve:

- Accurate trapping of historical buying activity, by individual and by (implied) buying group (demographics).
- Accurate predictive models of future buying behavior, again by individual or by the implied group.
- Iterative mechanisms to correct semantic weaknesses within and across product lines.

There are two different kinds of community knowledge that we need to distinguish:

1. Knowledge that is shared among the members.
2. Knowledge about the community.

Shared knowledge comprises all kinds of contributions such as problem solutions, experience reports as well as ratings, indices, and the vocabulary of the common language. Knowledge about the community comes in the form of customer profiles which are generally recorded or tracked by the party which hosts the EC-platform (e.g. the online merchant). As mentioned before, profiles contain various information such as transaction logs, preferences and general information on the community members.

Peppers and Rogers only focus on the knowledge *about* the community when stating: 'Community knowledge comes from the accumulation of information about a whole community of customer tastes and preferences. It is the body of knowledge that a 1:1 enterprise acquires with respect to customers who have similar tastes and needs, enabling the firm actually to anticipate what an individual customer needs, even before the customer knows he needs it' (Peppers and Rogers 1997: 231).

If applied effectively, both kinds of community knowledge can be used for the profit of all participating parties. Today, online merchants collect information about their customers partly without the explicit consent of their clients. However, there have been legal efforts to prevent the unauthorized collection of personal data (e.g. by the European Directive 95/46/EG). The deliberate disclosure of information might be the only valid future path into the collection of marketing information and is only likely if the customer is motivated by any kind of incentive.

THE PEP ARCHITECTURE

The PEP picks up the discussion about electronic product catalogs (EPC) as the core component of every e-commerce application. We look at these product catalogs from two different perspectives:

1. The vendors' view where we examine integration mechanisms which allow to compose compound catalogs featuring products from different online stores (multi-vendor catalogs).
2. The customers' view which calls for the effective use of profiles and the application of one-to-one concepts.

We further argue that e-commerce encompasses a broader set of potentials revolving around the concept of 'community'. Community is a well-known cyberspace metaphor for building social relationships over electronic networks. Besides the operation of their core business, vendors in the electronic medium should make use of the advantages of a closer relationship to their customers by means of virtual communities. As stated in a recent industry report,

> even more important[ly], the successful Web players are not simply replicating existing businesses in the new online medium but are taking full advantage of the unique, interactive nature of the Net. For example, the hottest stores on the Web don't just provide convenience and low prices – although those are essential ingredients, too. Across the board, successful Web merchants have created virtual 'communities.' At their sites, like-minded cybernauts congregate, swap information, buy something, and come back week after week. (Rebello *et al.* 1996)

The e-commerce platform which hosts the resulting 'enhanced product catalog' is called the Participatory Electronic Product Catalog (PEP). Customers are contributing to the community knowledge base and are thus participating in the development of the business medium (Schmid and Zimmermann 1998). We argue that this new medium offers a viable tool for the support of future electronic commerce platforms.

The following graphic illustrates the architecture of a PEP. It is a generic model composed of different basic components which can be operational dependent on the applied business model. The components will be presented in the following sections.

The PEP platform facilitates interaction processes between customers (private as well as businesses) and online merchants. The integration of product information (merchant view) is realized with the help of the mediation mechanism of a mediating electronic product catalog (MEPC) as discussed by Lincke and Schmid (1997). Mediating catalogs are integrated with the help of meta-mechanisms. The concept is based on a broker architecture which allows for distributed federated product catalogs which, at the same time, preserve the autonomy of the vendor. The integration/intermediation can be realized without the consent of the original merchant. Lincke and Schmid define the MEPC as 'a product catalog that semantically integrates several individual EPCs or other MEPCs into a federated system'.

The customer view represents the community of buyers. Users are identified my means of customer profiles with the possibility of treating every customer individually (in terms of user interface, automatic product selection and fulfilment of special product needs). All kind of community knowledge is stored in a special database and can be linked to specific product information. Newsletter, BBS and chat rooms are generic communication modules which stimulate the communication between the members. The recommendation service is a typical by-product of communities and can be a special incentive for the individual customer to actively participate in the community medium.

The PEP is integrated into an e-commerce platform. Additional services such as billing, payment and delivery from third parties are also hosted by the business medium.

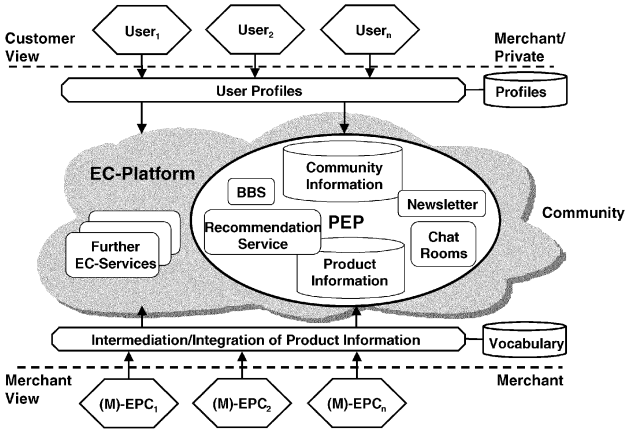

Figure 2. The PEP architecture

CUSTOMERS

When customers shop on the Internet they leave trails in the form of recorded transaction profiles or as contributions to discussion forums. The part of this information which is systematically aggregated and used can be described as the collective 'community knowledge'. The study of community knowledge requires a brief discussion of the terms 'data', 'information', and knowledge. One reasonable approach is to place these terms in a spectrum (Davenport and Prusak 1998): data is 'a set of discrete, objective facts about events' and information is a message with a sender and a recipient, or 'data endowed with relevance and purpose'. Knowledge acquisition is a subjective update of the recipient's value system which requires information flow. Schmid (1999) states that knowledge bases are 'alive' in a sense that they span linguistic and sensual spheres within human brains where they are constantly being changed. The term knowledge plays an important role in the sense of shared collective knowledge of communities. Community knowledge serves as the basis for the collaborative use of information (e.g. collaborative filtering) and the resulting retention of the bond within Virtual Communities (e.g. by building trust).

Profiles can be used for the individualization of the user interface and the product selection for the single customer. Different types of profiles (see Schubert and Ginsburg 1999 for further discussion) include:

- Identification profile (user name, role, contact information, personal browser settings, address, payment information, IP-address, etc.).
- System profile (user-id, rights and system activities (login times, file access, resources), etc.).
- Session profile (session related info (click stream, status, etc.)).
- Socio-economic profile (self-categorization in predefined classes (age, gender, hobbies, etc.)).
- Preference profile (self-revealed preferences (science fiction, politics, etc.)).
- Interaction profile (recorded interests (business, stocks, computers, etc.)).
- Transaction profile (transaction log (purchases, inquiries, payment, etc.)).
- Community profile (template-based categorization (parent, teen, hard rock fan, etc.)).

There are different ways to collect customer information. Some profiles require manual input by the customer while others are automatically recorded.

1. *User input:* The customer enters personal information about himself (socio-economic profile, preference profile). Examples for existing personalization services which focus on this class of profiles are Cybergold and Doubleclick. Both credit their members for giving away this information and performing additional actions, such as clicking on an advert, etc.
2. *Logging:* Shopping transactions have been logged by POS terminals in retail stores for years. Companies such as Safeway, Migros and Co-op have introduced membership card programs to be able to identify and track the shopping behavior of their clientele. This helps them to better promote and place their good in the physical stores. In the online medium, automatically recorded interaction and transaction profiles can play this role.
3. *Aggregation:* The aggregation of transaction data and preference profiles (community profiles) can help to compile recommendations. Amazon's 'Customers who bought this book also bought' is a famous example.
4. *Shared knowledge:* Customers are carriers of knowledge about the products they use. Under certain conditions – usually when help from others is needed – they are willing to share this knowledge. The great amount of online forums on the Internet where software developers and users meet are a good example of such mutual support groups.

The right way of collecting information is crucial for the acceptance of the shopping application. The less the customer has to actually type in to build up a usable profile the greater will be his willingness to interact with the platform.

Vendors

Electronic product catalogs are the core component of many e-commerce applications. Essentially a database, the EPC contains a dynamic representation of the vendors' offerings, including data and metadata visible to the consumer and data and metadata only visible to the seller(s). The following section examines current designs of EPC and the possibility for the creation of multi-vendor catalogs.

In the Business-to-Business sector we often encounter a situation where – due to intensive competition and increasing international trade – buyers have a certain power over their suppliers. Recently developed desktop procurement systems such as the ones offered by Ariba and CommerceOne are specifically tailored for this market (Gebauer *et al.* 1998). However, there are different rules which apply to Business-to-Private sales. A single customer does not have enough market power and clients are often forced to embark on an unpleasant journey on their web search for product information, prices and conditions. Besides, private end consumers do not get the benefit of extensive after-sales-services and are thus often dependent on mutual support.

In order to build a community of buyers, an online vendor or infomediary (Hagel and Rayport 1997) can tie such an interest group to an electronic product catalog (Schubert and Lincke 2000). This platform constitutes a business medium for the bundling of product information and community knowledge. The collection of community knowledge creates a number of advantages for the members:

1. Communication modules (BBS, chat rooms, Newsletter) support the community building process and extend the functionality of a mere catalog. Know-how is stored in databases within the common business medium and is made available for all members.
2. The product catalogs and the contained information 'from customers to customers' becomes more objective (by collecting 'neutral' customer opinions) and thus more trustworthy for the potential customer.

This process is dependent on the revenue model (source of profits) as well as on the host (single EC-vendor, intermediary or open market). Besides, some businesses (e.g. the travel business) are better suited than others (e.g. engineering). The participatory electronic product catalog unites all the mechanisms and databases which are necessary to store customer information as well as product information. The system accumulates information about the needs and requirements of the customers as well as their knowledge and forms the basis for a personalized interaction with the platform. The following paragraphs discuss the potential benefits which can be generated by the platform.

BENEFITS FROM THE PEP

The PEP exploits knowledge about the community, which often comes in the form of customer profiles tracked by the party which hosts the EC-platform (e.g. the online merchant), and knowledge that is shared between community members. PEPs can improve the EC-platform by using personalization and collaboration services:

1. Personalization on the basis of individual user profiles can help customize the interface of the product catalog, or in other words 'the product selection' which is automatically offered to a specific customer based on his history of interests or actual transactions (cf. Figure 3). This functionality can be supplied by the system. Besides that, the customer can search for reassurance from contributions of other customers. He or she can browse through discussion threads, write emails to people who seem to have experience with products or post questions in special forums. The result is a human interaction – the information cannot be processed by a

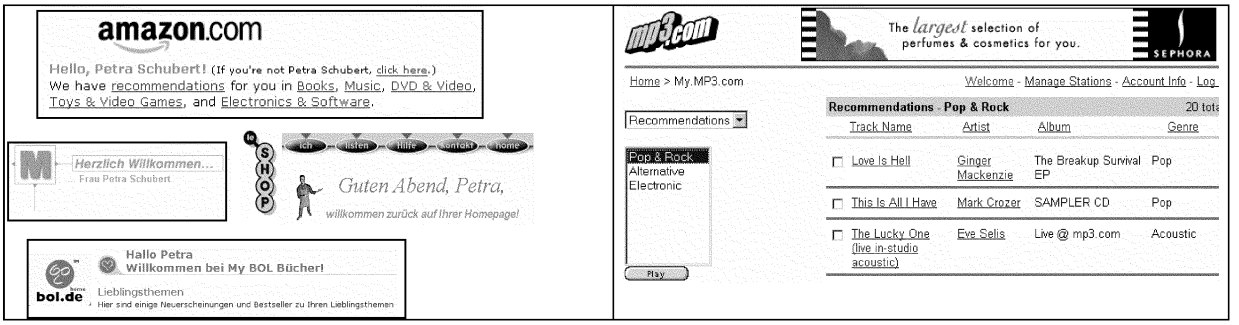

Figure 3. Personalization of the interface

computer system. Nevertheless, this social information can give assurance in a virtual shopping environment.

2. Collaboration or Community services are based on the aggregation of customers. If users reveal their preferences about products they want to buy, the product or service itself can be specifically created for an affinity group within the community of transaction (cf. Figure 4). This service can be supplied with the help of data mining the collected customer profiles. Another way of using these profiles is by means of collaborative filtering which will be discussed a following section. This technique provides a social mechanism to build affinity groups and to get recommendations and even inspirations for products which the customer might not even have heard of.

Usually, customers like to be treated as individuals. Nevertheless, in physical businesses, 1:1 products are usually not economically feasible because they require manual compilation of customer needs and are thus labor intensive. In many businesses the use of economies of scale is essential to make profits. Bringing together a large amount of potential buyers in the electronic medium may be a way to at least realize products tailored for a group of buyers with similar or identical needs who could never have met in real life (e.g. due to restrictions of time and distance).

The following paragraphs present two mechanisms which can be used with the help of collected customer profiles: personalization (on an individual level) and collaboration (on the community level).

Personalization

As shown on the left half of Figure 1, personalization is the first mechanism for use with customer profiles for individual purposes. Personalization can be applied to the interface as well as for the selection of products.

Customization of the Interface

Schubert and Ginsburg (1999) identify two different levels of customization for EC-systems.

1. *Personalization by Categorization:* The personalization of websites can be realized in two different ways: menu-driven (manual user input) or tracking-based (system logs). A first approach towards personalization

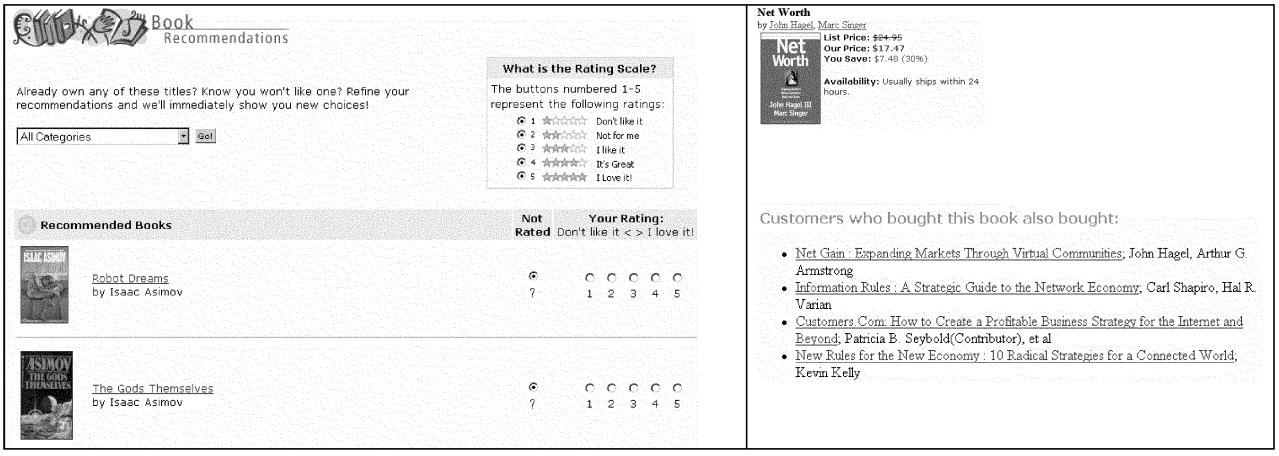

Figure 4. Collaboration and community services

of Web applications is the categorization and classification of customers in different groups of interest. This mechanisms leads to a mere personalization which is tailored to groups and not to individuals. While assigning people to certain categories, profiles emerge which contain socio-economic, preference or community related information. These profiles serve as the basis for offers tailored to the needs of the respective interest group. Examples for this kind of information are residence, gender, age, interests, and so on. A web system which is known for this kind of profiling is Firefly.

2. *Individualization:* Individualization goes even one step further. In the beginning, users state their preferences either through a direct input (menu-driven) or indirectly by monitoring their click stream (tracking-based). A personal customer profile stores the information and serves as a basis for the presentation of dynamic web pages which are specifically tailored to the interest of one single client. Over time, websites can gather more information about a customer and become increasingly powerful in the choice of the presentation of websites or products/services. A customer who visits an information websites always looking at exchange rates at first will find this information on the entry page after a while. The compound customer profile can be composed of socio-economic, community or interaction profiles.

Push and Pull Techniques

Push and pull techniques help to initiate an automated, interactive dialog with the customer. On the Internet, customers are empowered to look for product information performing price comparisons between the different vendors. This means that the web as such is a pull medium. Customers choose the time and place to select the offer which best suits them or which seems most attractive to them (Choi *et al.* 1997). Classical marketing strategies aim at the support of pull media using advertisements, discounts, club cards, prominent placement in store shelves, or similar measures. On the Internet, however, it is feasible to use push mechanisms based on stored customer profiles on a mass basis. These profiles can be used to automatically inform the customer about potentially desired products, e.g. in email messages. According to an industry study, such marketing messages are quite successful. Whereas paper-based direct marketing only succeeded into a feedback quota of 1–2 %, email messages on the Internet achieved 7–10 % (Harris and Hoff 1998).

Besides the 'pure' push and pull systems, interactive applications additionally support hybrid systems which allow for a combination of the two techniques. Malhotra *et al.* (1997) present a framework for push/pull systems stating that the degree of control over personal information on the part of the customer represents an important aspect for the acceptance of the system. According to them, an ideal system should be a hybrid system which guarantees a high level of perceived control for the customer at the same time optimally tailoring the offer to his individual needs.

Community profiles may facilitate additional possibilities for personalization without even requiring an extensive transaction history. Due to the self-selection of characterizing attributes and the assignment to the matching affinity group, a system which has already 'learned' from like-minded members can instantaneously offer its expertise to a new customer.

Advice and Reassurance: The community information database contains the contributions of the members (and thus their questions, their answers, and their general know-how). The product information in the EPC serves as the basis for discussions about specific products. Apart from the general discussion among the community members, customers have the possibility to comment on products or ask for help, make ratings, discuss problems and solutions. This information is directly linked with the product information. Amazon.com, for example, collects customer reviews and ratings for books and offers these contents to the community of book readers on their website. The PEP thus helps the host to increase his level of 'agent objectivity'. The community information database stores all the community's contributed knowledge which forms – together with the profiles of the users – the true heart of the community platform.

Collaboration/Community

As shown on the right half of Figure 1, collaboration is the second mechanism for use with customer profiles for community purposes. A whole set of customer profiles from the community members is required to perform an analysis of their needs and to compile possible recommendations.

1. *Data Mining:* PEP-enabled EC-systems go beyond interface customization and present the possibility for new products which target groups of potential buyers with common requirements. Elofson and Robinson (1998) present examples for the group-customization of products from the insurance industry where many community members might ask for a similar insurance for health services (e.g. members of high risk groups). The aggregation of their demand makes the product attractive for the insurance company. In their example intermediation takes place in the form of a broker service which uses collaborative filtering mechanisms for the identification of customers with similar needs. Such a principle could be applied to a general 'exchange platform for community products' in which a special product is being offered as it is lucrative for the

seller. Such alliances of interest groups can today be found in the form of unions, cooperatives and other member-based organizations which aim at the generation of economies of scale.

2. *Collaborative Filtering:* As discussed above, the concept of community knowledge in e-commerce applications goes one step further than simply customizing product or interface. Electronic merchants can even use information provided by other customers to improve the offer for an individual customer. This procedure, as shown in Figure 2, is 'collaborative filtering' (Goldberg *et al.* 1992, Resnick and Varian 1997).

Recommendations, with the use of customer profiles, can be mapped to are personalized suggestions offered to an individual customer. In a typical recommender system people provide recommendations as inputs, which the system then aggregates and directs to appropriate recipients (Resnick and Varian 1997). In some cases the primary transformation is in the aggregation; in others the system's value lies in its ability to make good matches between the recommenders and those seeking recommendations.

Peppers and Rogers (1997) call sub-communities of customers with similar taste 'affinity groups'. By linking affinity groups with recorded purchase transactions of a big number of customers, a knowledge base emerges which can be used for the prognosis of future buying behavior of individuals. The shoe chain 'The Custom Foot' uses a similar mechanism for their shoe sales: customers rate shoes on a scale from one to five. This information is being stored in large databases where customers with similar patterns are combined into affinity groups. Based on the buying behavior of the respective peer group, customers receive recommendations for future shoe purchases without even the need to look at a broad range of shoes.

Preference and transaction profiles can also support buyers regarding recurrent purchases. Once individual settings (such as preferred airplane seat, choice of menu, kind of rental car, etc.) have been stored any future transaction can consist of only one 'confirmation click' of the compiled product. Amazon's '1-Click-Ordering' or Barnes and Noble's 'Express Lane' are examples for such services.

Community profiles may facilitate additional possibilities for personalization without even requiring an extensive transaction history. Due to the self-selection of characterizing attributes and the assignment to the matching affinity group, a system which has already 'learned' from like-minded members can instantaneously offer its expertise to a new customer.

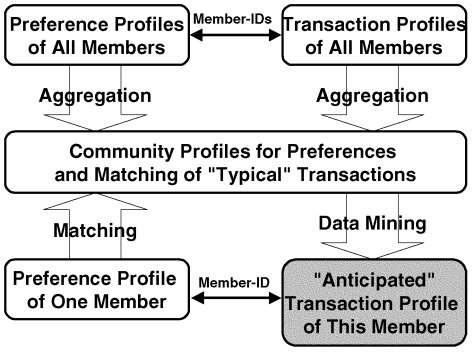

Figure 5. Collaborative filtering

AQ should this be Figure 5, Figure 3 on manuscript.

CONCLUSIONS

The paper presents a modular framework for collaborative product information systems at the core of e-commerce applications. As increasing numbers of people use the Internet as a new medium for interactive, multimedia communication spanning time and distance, new business potentials emerge which need to be harnessed to remain strategically competitive. World-wide, there is an increasing battle for customer information and market success dictates a basic knowledge of the requirements of the clientele.

These considerations have motivated our discussion of the effective use of electronic media for electronic shopping environments. The proposed architecture for the participatory product catalog (PEP) combines personalization and collaboration aspects into a common approach for a modern business medium which effectively supports the building of communities and the support of e-commerce transactions.

In summary, we believe that the perspective of forming virtual communities of buyers and gaining advantage from customer profiles is vital to virtual shopping environments. As electronic markets continue to evolve, along with their infrastructure and communication models, so will the complexity and importance of customer information which are stored on the market platforms. The understanding of the effective use of electronic business media will be key to designing a socially and technically efficient virtual market to best suit the needs of buyers and sellers alike.

Further research in this area is indicated to explore the socio-technical ramifications of real-life implementations of individual and community profiles in e-commerce systems.

References

Choi, Soon-Yong; Stahl, Dale; Whinston, Andrew (1997) *The Economics of Electronic Commerce – The Essential Economics of Doing Business in the Electronic Marketplace*, Indianapolis, Indiana: Macmillan Technical Publishing.

Davenport, Thomas and Prusak, Laurence (1998) *Working Knowledge: How Organizations Manage What They Know*, Boston, MA: Harvard Business School Press.

Elofson, Greg and Robinson, William (1998) 'Creating a custom mass-production channel on the Internet',

Communications of the Association for Computing Machinery (CACM) 41(3): 56–62.
Europäische Gemeinschaft (1995) Richtlinie 95/46/EG des Europäischen Parlaments und des Rates vom 24. Oktober 1995 zum Schutz natürlicher Personen bei der Verarbeitung personenbezogener Daten und zum freien Datenverkehr, [http://www2.echo.lu/legal/de/datenschutz/datensch.html] accessed 24 August 1998.
Goldberg, David, Nichols, David, Oki, Brian and Terry, Douglas (1992) 'Using Collaborative Filtering to Weave an Information Tapestry', *Communications of the Association for Computing Machinery (CACM)* 35(12): 61–70.
Hagel, John and Rayport, Jeffrey (1997) 'The Coming Battle for Customer Information', *The McKinsey Quarterly* 3 AQ.
Harris, Nicole and Hoff, Rob (1998) 'Spam that you might not delete', *Business Week* 15 Juni: 115–117.
Kierzkowski, Alexa, McQuade, Shayne, Waitman, Robert and Zeisser, Michael (1996) 'Marketing to the Digital Consumer', *The McKinsey Quarterly* 3 AQ.
Lincke, David-Michael and Schmid, Beat (1997) 'Architecture and Business Potential of Mediating Electronic Product Catalogs', *Proceedings of the 3th Conference of the Association for Information Systems* (AIS '97), Indianapolis, August.
Malhotra, Arvind, Gosain, Sanjay and Lee, Zoonky (1997) 'Push–Pull: The Information Tug of War – A Framework for Information Delivery and Acquisition Systems Design', *Proceedings of the 3th Conference of the Association for Information Systems* (AIS '97), Indianapolis, August.
Mougayar, Walid (1998) 'Turning the Unthinkable into the Irresistible', *Business* 2.0 November: 116.
Palmer, Jonathan and Griffith, David (1998) 'An Emerging Model of Web Site Design for Marketing', *Communications of the ACM* 41 March: 45–51.
Peppers, Don and Rogers, Martha (1997) *Enterprise One to One: Tools for Competing in the Interactive Age*, New York: Bantam Doubleday Dell.
Rebello, Kathy, Armstrong, Larry and Cortese, Amy (1996) 'Making Money on the Net', *Business Week* 23 September: 44–52.
Resnick, Paul and Varian, Hal (1997) 'Recommender systems', *Communications of the Association for Computing Machinery (CACM)* 40(3) March: 56–58.
Schmid, Beat (1999) 'Elektronische Märkte – Merkmale, Organisation und Potentiale', in Arnold Hermanns and Michael Sauter (eds.), *Management-Handbuch Electronic Commerce*, München: Franz Vahlen Verlag, p. 31–48.
Schmid, Beat and Zimmermann, Hans-Dieter (1998) 'Business Media: A new Perspective on Creating Value in the Information Age', in *Proceedings of ITS 1998 – 12th biennial conference of the International Telecommunications Society* 21–24 June, Stockholm, Sweden.
Schubert, Petra and Ginsburg, Mark (1999) 'Virtual Communities of Transaction: The Role of Personalization in Electronic Commerce', in *Proceedings of the 12th International Bled Electronic Commerce Conference* 9–11 June, Bled, Slovenia.
Schubert, Petra and Lincke, David-Michael (2000) 'Product Knowledge Medium: Integration einer Virtuellen Transaktionsgemeinschaft in den Elektronischen Produktkatalog', in Beat Schmid (ed.), *Wissensmedien*, Gabler, (in print).
Selz, Dorian and Schubert, Petra (1997) 'Web Assessment – A Model for the Evaluation and the Assessment of Successful Electronic Commerce Applications', *International Journal of Electronic Markets* 9: 46–48.