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Impacts of Software Agents in eCommerce Systems on Customer's Loyalty and on Behavior of Potential Customers

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ABSTRACT

Most of the software agents only perform simple product price comparisons; some support the purchase of products or the negotiation over multiple terms of a transaction, such as e. g. warranties, return policies, delivery times and loan options. Auctions help to find an effective pricing mechanism in electronic commerce. The active technologies enabling customers to purchase efficiently, force the merchants to offer high personalized, value-added and complementary services. The - techniques such as rule-based matching or collaborative filtering provide contents that are appropriate to the customer's preferences or analyze past purchases of other clients. The one-to-one marketing may be especially useful for sophisticated products demanding explanation or to enable cross-selling of other products. The merchants might achieve additional reduction of transaction costs (especially transport, storage and costs for safety measures) using electronic money systems.

1. INTRODUCTION

Electronic commerce on the Internet introduces a new marketspace for large numbers of relatively unknown companies often offering substitutive products and services. The merchants profit from reductions in costs, time and unsold stock. Customers browsing and ordering products over the Internet are attracted by increasing convenience and speed of procurement.

Suppliers offering substitutive products in the marketspace need to acquire new customers and sustain ongoing business relationships. Actually, most merchant's sites are passive catalogs of products and prices with mechanisms for receiving orders from buyers (Dasgupta et al., 1998). The pull strategy is also applied in auctions available over the Internet, where the offerer waits passively for bids. The new push technologies for electronic commerce including software agents, enable customers to compare a bewildering array of products efficiently and automatically. Switching costs for customers and thereby their loyalty to previous suppliers in the marketspace declines.

Using the Internet the producers profit from reduction of costs through direct sales (non-intermediation) and through staff reduction. The dimension of such costs reductions and consequently the possibility to offer price discounts is the same for all suppliers involved in e-commerce. Therefore, the key elements to successful long-term relationships between merchants and buyers will be the offering of personalized and value-added services, such as one-to-one marketing services, discounts, guaranties and savings coupons. Additional cost reductions, especially for small-value products, may be achieved by using electronic payment systems. This is especially true for merchants.

In this paper we will analyze possible consequences of new push and pull technologies in e-commerce for customer's loyalty. The active technologies enabling customers to purchase efficiently, force the merchants to offer high personalized, value-added and complementary products and services. We will provide some examples of such services and of personalization techniques sustaining one-to-one relationships with customers and other actors involved in e-commerce. Finally we will discuss the additional cost and benefits for suppliers and customers using electronic payment systems.

2. CHANGE BARRIERS FOR CUSTOMERS IN ELECTRONIC COMMERCE

The Internet-based World-wide Web provides a great opportunity to compare better products and services. Consumers as well as competitors may quickly gain detailed and up-to-date product information. Especially, suppliers of digital products (software, financial products, consulting services) over the Internet are in fear of declining customer's loyalty. Customers compare the catalogs of products of diverse merchants and producers and conduct transactions independently of their geographic localization. There are three crucial basic factors responsible for limited loyalty of consumers in e-commerce: convenience, time and cost of the procurement process. An e-commerce system should support the ability to embed intelligence to automate decisions (Dasgupta et al., 1998). A customer should not only be able to passively compare products and prices from merchants' catalogs, but also to delegate software agents, which can retrieve information, negotiate and finally purchase products. Nowadays, most e-commerce procurements still involve a substantial human element, which is from the consumers' perspective neither convenient nor timely or costly efficient. Human involvement in the procurement process should be limited to transaction specification at the beginning and to the buying or refusal decision at the end of the process. In the intermediate stages of the e-commerce-based purchase consumers should be involved as seldom as possible. On the one hand such reduction in interaction time through automation requires close coordination between buyers and suppliers. On the other hand an appropriate technology is necessary. Mobile software agents emerge as ideal mediators in electronic commerce and thereby as an appropriate technology for an automated procurement process. Consumers may specify constraints on the features of products which enable mobile agents to select products from the merchant's catalog and finally to determine the terms of the transaction. Otherwise, software agents can be used by suppliers as market surveyors to determine the current demand and an appropriate price for the product. Software agent technology also abolishes the problem of diverse technological standards as e. g. hardware platforms and operating systems of remote computers. Summarizing, geographical or technologically barriers for consumers in e-commerce are of no significant importance. The key factors are convenience, time and cost of procurement process. They may be satisfied by new mobile software agent technologies and other e-commerce systems like e. g. auctions. These automated push and pull technologies will replace the traditional long-term consumers' loyalty to the suppliers with the concept of only limited loyalty. This calls for more active and personalized interaction between consumers and merchants.

One way to save costs and running time in a distribution process and therefore to be more competitive is the concept of non-intermediation. The producers or service suppliers may sell their products directly to the customer avoiding intermediators such as whole-sale, discount or specialized dealers.

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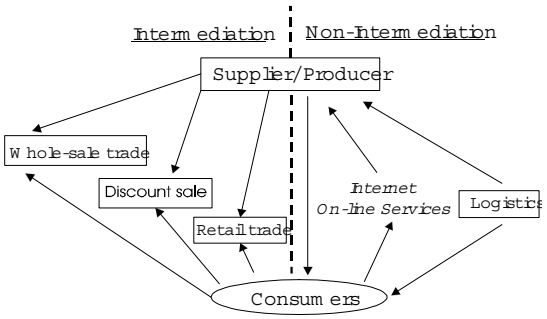
Figure 1: Non-intermediated distribution in electronic commerce (Schoder, Strauss, 1999)



3. ACTIVE E-COMMERCE SYSTEMS

There are several e-commerce systems, that support customers in the buying process. Especially, the push strategies for e-commerce are appropriate for active and automated information retrieval. After registration at a WWW content provider the customers may get automatically emails or faxes for requested topics. They may also send software agents comparing products from multiple merchants. The primary goal of customers is to maximize their benefit by reducing costs (or product's prices through comparison), running time and human involvement in the buying process. Otherwise, suppliers may use their active e-commerce systems to acquire new customers and to enhance loyalty of present clients. They may send e. g. supplier mobile agents, which query many WWW sites of possible buyers, analyze the responses and determine the optimum price for the product (Dasgupta et al., 1998). The goal is to maximize the gross returns of the supplier on the one hand and to sustain the long-term relationship to the clients on the other hand.

In the following we will analyze some strategies for e-commerce supporting both customers and merchants in the procurement process.

Figure 2: Classification of software agents (Joshi, Ramesh, 1998)

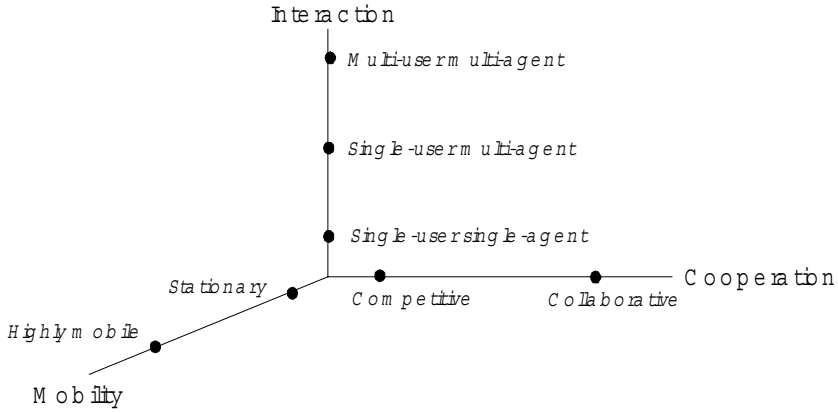
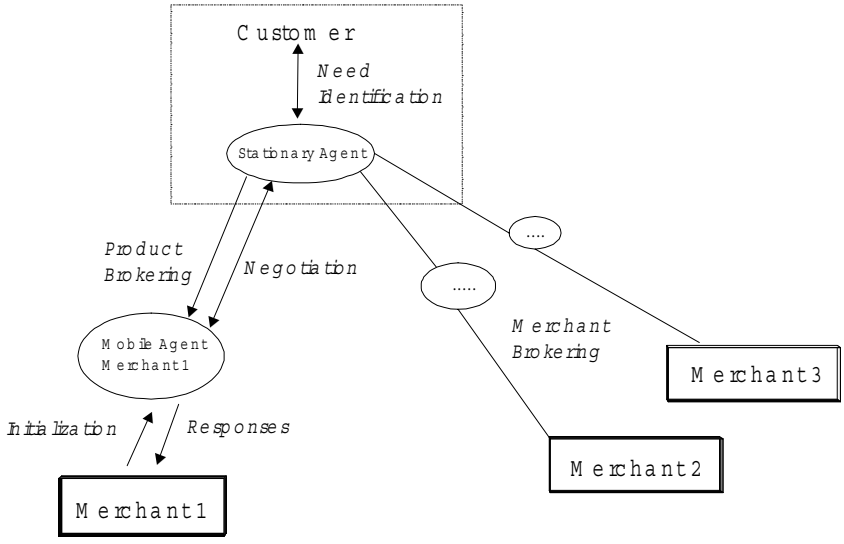


Figure 3: Agent's functions



3.1 Agent-mediated electronic commerce

Software agents are computer programs showing the following characteristics (Joshi, Ramesh, 1998):

- Reactivity (agent senses and reacts to the environmental changes)
- Autonomy (agent has its own program code, data and execution state)
- Proactivity (agent takes initiatives to change the environment)

The ability of an agent to travel enhances it to a mobile agent. Software mobile agents may be classified based on their attributes, such as mobility, type of cooperation and level of interactions (Joshi, Ramesh, 1998). For further possible classification schemes see e. g. Nwana (1996) or Sycara et al. (1996).

Competitive agents, mostly single-agents, maximize the interests of their owners. Collaborative agents on the contrary share their knowledge and try to maximize benefits of the community as a whole (Joshi, Ramesh, 1998). Mobile agents differ also in terms of the ease of an agent's mobility between two remote computers (Gilbert, 1996). A continuously traveling nomadic agent such as e. g. the mobile sales agent (containing information of the total quantity of the product to be sold, the initial price of the product and the list of buyers to visit) arrives at a buyer site and communicates with a stationary buyer agent, which determines the quantity to be purchased at a given price (Dasgupta et al., 1998). The buyer agent uses tables containing the market values and demand curves of the product. The sales agent must adjust the price dynamically during the negotiations in order to maximize the gross returns. The price for the product may not be settled too low (agent sell all of his inventory at a bargain price) or too high (a given quantity of the product may be unsold). Such supplier-driven e-commerce system enables merchants to maximize their gross return, but also to identify quickly the customers' needs and finally to cultivate the long-term relationship with them. The architecture of the supplier-driven system was presented by Dasgupta et al. (1998).

From a consumer's perspective software agents should be highly personalized, continuously-running and autonomous mediators, that have to delegate some process management tasks (Guttman, 1998). An agent should firstly identify consumer's needs, then retrieve information about the product from the merchants sites, compare the offers and finally determine the terms of the transaction. These requirements result from the Common Consumer Buying Behavior Model (CBB model), which divides the procurement process in six stages: need identification, product brokering, merchant brokering, negotiation, purchase and delivery, and product service. Nowadays, consumer agents are used mostly for product and merchant brokerage and for negotiation. In the product brokering stage of the CBB model consumers determine the product to be bought. Agents, like e. g. PersonaLogic help them to select the best product from the merchant's list that satisfies the consumer's constraints (Guttman, 1998).

While PersonaLogic filters out unwanted products, Firefly system recommends products, which are highly rated through other shoppers. In the merchant brokering stage agents compare merchant offerings, e. g. through an on-line price comparison. Jango and Andersen Consulting's BargainFinder are very appropriate for such price comparisons. BargainFinder collects price infor-

mation from merchants at a central site. The disadvantage of that method is that some merchants, who do not want to participate in the price competition only, block the requests of the agent (Guttman, 1998). Jango removes such limitations of the suppliers originating requests directly from a consumer's WWW browser. Such agents bring the consumers only a limited benefit, because the comparison is driven only by price, not by service. The agents bypass the value-added and post-purchase services from merchants. Andersen Consulting argues that the BargainFinder's implementation showed, how WWW stores with on-line merchandising (attractive graphics, clips, etc.) could increase on-line traffic, but not necessarily sales.

The price of a product may also be dynamically negotiated instead of being fixing. MIT Media Lab's Kasbah is an on-line multi-agent system allowing negotiations. A user creating a buyer agent provides it with such criteria as price, time constraints, quantity of merchandise and sends it into a centralized agent marketplace. There the agent filters, offers and begins to negotiate with a selling agent, which responds only with either "yes" or "no" (Dasgupta et al., 1998). While agents in Kasbah's system negotiate competitively over price, tête-à-tête agents (also from MIT Media Labs) cooperatively negotiate multiple terms of a transaction, such as e. g. warranties, return policies, delivery times and loan options (Guttman, 1998). The buyer agent in the tête-à-tête system negotiates towards a pareto-optimal deal with sales agent. Such a system does not maximize gross returns to the suppliers or price discounts for consumers. However, it takes into consideration the important value-added merchant's services.

Summarizing, software agents are helping consumers to compare and to purchase products in the Internet. Most of them are agents for a simple on-line product price comparison (PersonaLogic, Firefly, BargainFinder, Jango) or for competitive negotiation over price (Kasbah), without considering the value-added and post-purchase services from merchants. Such agents decrease customer's loyalty to a merchant towards zero. However, additional transaction's services such as guaranties, return policies, loans, gifts, discounts and insurance are of interest to consumers. Therefore, they should rather use agents comparing or negotiating over multiple terms of a transaction (tête-à-tête). Otherwise, merchants may also send their own sales agents to the potential buyer in order to acquire new consumers and remind the previous clients of new sales offerings (an active supplier-driven agent system).

3.2 Auctions

Auctions are an independent instrument in electronic commerce as well as a basic component of software agents. As an independent instrument a human being acts by itself. As a component of a software agent the agent acts as a deputy of a human being. The software agent needs a strategy, one or more goals and the dependencies between the goals for acting.

There are several requirements to efficient and effective coordination mechanisms of auctions in electronic commerce. Efficient allocation of resources are a criterion to get global acceptance. To implement auctions in an electronic commerce system, it is necessary that the actors don't need information about concurrent actors. The actors must not act strategic. For a local acceptance, the actors don't need to disclose their information. A minimized mean need for communication leads to low transaction costs (Gomber et al., 1996). We make the assumptions that the actors don't have preferences with regard to the actor, who gets the knocking down and that the human beings or software agents act economically rational and symmetric. Economically rational means that the actor bids with the goal to maximize his utility. Symmetric behavior means that bids are equal if the subjective values are.

In the following, we discuss four types of auctions that are possible in electronic commerce (McAfee, McMillan, 1987):

- The **English auction**: Starting with a low price, the actors make open bids. Each bid has to exceed the known highest bid. The auction is finished if nobody is ready to pay a higher price. The actor who makes the highest bid gets the knocking down and has to pay the price he bids.
- The **Dutch auction**: The auctioneer starts with a high price that will be lowered step by step. The fist actor who stops this gets the knocking down and has to pay this price.
- The **first price sealed bid auction**: Each actor makes exactly one bid that he gives to the auctioneer so that nobody will see it. All bids will be opened at the same time. The actor with the highest bid gets the knocking down to the price of his bid.
- The **second price sealed bid auction (Vickrey auction)**: The difference to the first price sealed bid auction is that the actor with the highest bid gets the knocking down to the price of the actor who makes the second highest bid (Vickrey, 1961).

All of the four types of auctions grant efficient allocation because always the actor with the highest bid gets the knocking down (McAfee, McMillan, 1987). Strategic behavior and the necessity of information about concurrent actors is only avoided by the English and the Vickrey auction. In case of the English auction the actors know the bids of each other. It is also not useful to act strategically or procure more information in the Vickrey auction, see e. g. Weinhardt, Gomber, 1996. In case of the Dutch or first price sealed bid auction the bidders will act strategically. They make assumptions about the concurrent bidders and therefore they need information. Disclosure of information is only necessary in English auctions. In case of the Dutch auction the first bid gets the knocking down, the other two types of auctions implement an invisible bidding process. The need of communication is determined by the number of interactions. In the case of sealed bid auctions each actor makes exactly one bid to the auctioneer. In Dutch auctions there is only one bid. Under the assumption of linear price cuts in constant time intervals the bidder needs only information about the starting price, the price cuts and the time interval. This means a low need of communication. The English auction has the highest need of communication because of the bidding process. Figure 4 gives an overview on the suitability of different types of auctions for electronic commerce.

Figure 4 shows that only the Vickrey auction fulfills all criteria. We don't have enough empirical information at the moment to give an overview which type of auction is preferred for auctions where human beings or software agents bid. We will do this in further research.

Figure 4: Comparison of different types of auctions

	English auction	Dutch auction	first price sealed bid auction	Vickrey auction
efficient allocation				
no need of Information/ no strategic behavior		-	-	
no disclosure of information	-			
small need of communication	-	( )		

4. INCREASING CUSTOMER'S LOYALTY THROUGH COMPLEMENTARY SERVICES

In general, software agents, auctions and others technologies helping consumers in the buying process may minimize their loyalty to the merchants. Suppliers, who do not want to compete solely on the basis of price provide their customers with highly personalized and value-added services, that will help to sustain the long-term relationship to the clients.

4.1 Personalization and privacy

Personalization is defined as the customization of the WWW site to meet the particular needs of individual users (Dean, 1998). The goal of personalization technologies is to encourage repeated visits and to enhance user loyalty. The identification of private users' needs occurs through the observation of consumer behavior or through collection of user's data (filling out a form or following a decision-tree set of questions).

There are some advanced personalization techniques helping to personalize WWW contents, such as rule-based matching or collaborative filtering. Using rule-based matching users have to answer a set of yes/no or multiple-choice questions to settle a set of user's criteria. Such filtering then provides content, that is appropriate to the customer's responses. The collaborative filtering method combines the user's personal preferences with the preferences of like-minded people (Dean, 1998). Such recommendations to each others use e. g. the already mentioned Firefly system, which is currently helping consumers to find appropriate (recommended) books and music. Amazon.com also involves the recommendation engine to analyze past purchases and post suggestions of the clients. Clients, who want to actively rate books, receive recommendations from Amazon's BookMatcher. The

collaborative filtering is also very useful for bidders and offerers at auctions. The TopDeal auction in Germany offers both suppliers and shoppers to rate the partner of the sale/purchase, that may help the users, who haven't sold/bought there before, to avoid unfair players.

In regard to personalization techniques one-to-one-marketing should be noticed. This strategy enables targeting unique offers and products to specific customers (Dean, 1998). Institutions offering such individualized services have to dispose of accurate user profiles before. Examples may be found especially under on-line brokers offering stocks and bonds, such as e. g. Etrade or ConSors (in Germany). At Etrade, the customer may have his own WWW Site ("My Etrade") containing only information desired by the user. When paying with a credit card and after achieving an appropriate turnover, the customer will be informed about the advantages of premium credit cards. If his stocks will attain a previously settled limit, the Etrade customer will be informed by telephone, fax or email. Also at ConSors, customers may create their personal "Watchlist" with information and analysis from stocks, bonds, futures and currency markets. Users trading at ConSors may also get advices from their personal advisor's team that is helping customers in technical as well as in investment affairs. A new quality for one-to-one connections between a client and his advisor offers the TeleWeb-System X-Agent developed by Brokat (Germany). X-Agent combines the services from call centers and Web-sites within an institute using video and chat simultaneously. A client connecting to an advisor is able to see him at the WWW site (the advisor is filmed by a camera) and communicate with him at the same site. The advisor is helping the customer in filling out the forms or finding an appropriate product or service, that improves customer's service in the institute. Such one-to-one marketing may be especially useful for sophisticated and tailor-made products demanding explanations or to enable cross-selling of other products.

A critical factor of personalization is the privacy issue. Filtering and customization techniques entail the collection and use of personal data, such as name, email, address, age, gender, income, internet connection, zip code, country, employment status, which must be protected from abuse (Dean, 1998). Furthermore, a lot of suppliers in the Internet deriving revenues mainly from advertising need to identify their users in order to better customize the content to the readers and to attract the advertisers being interested in specific audience. Hence, the user should be informed by suppliers, how they use the personal data, how they correct or change it and how they protect it. Nowadays, there are a few initiatives and standardization projects for the privacy of data interchange. P3P (Platform for Privacy Preferences project) developed by WWW Consortium provides an infrastructure for the privacy allowing users to tell automatically trusted sites personal information without typing it for each site. TRUSTe organization is a nonprofit initiative, that certificates WWW sites accepting the specific principles of disclosure and user's content. Such initiatives increase user trust and confidence in electronic commerce, however, no organization or institution has the power to enforce it to the wide usage of suppliers.

4.2 Value-added services

Suppliers, who do not want to compete solely on then basis on price, often offer their customers value-added or complementary services. Complementary products imply higher benefits for the customer in the case he only buys the product he looks for (Seitz, Stickel, Woda, 1999). Such products or services increase the value of the primary good to the customer. Examples for value-added services in e-commerce are sales discounts, savings coupons, additional insurance and guarantees, gifts, but also free software to test. Often CDNOW offers their customers CD bestsellers with 30 to 50 % discount. New customers at BrandsForLess.com are attracted by 10 % off for the first order. The Internet merchant Buy.com established a BuySurplus.com store, whose inventory consists of brand-name products from liquidations, overages, discontinuations where sales are made at great discounts. Content providers, as e. g. Save-Net offer saving coupons entitling users to buy cheaper at some merchants. Such sales discounts at Internet stores are possible through the reduction of branch offices and of costs. In contrast to stationary stores, on-line merchants don't pay rental charges for sales areas. They want to sell products as fast as possible to reduce costs for valuable warehouse areas.

The providers of digital products in the marketspace offer their customers software for testing or specific software tools for free. The bank's customers may often calculate their savings, credit and other budget plans at the WWW sites of the financial institute. Other suppliers as e. g. BrandsForLess or ebay provide special guaranties or insurance covering items bought there. Ebay's insurance (from Lloyd's) covers purchases for up to $ 200 at no cost for the customer. In general, value-added services enable buyers to trade at favorable terms and with confidence. They increase the attractiveness of the merchant to present customers and attract new customers.

4.3 Reduction of transaction costs through electronic payment systems

On-line merchants might achieve additional reduction of transaction costs using electronic money systems. Electronic money is defined as an electronic store of monetary values that may be widely used for making payments without involving bank accounts but acting as a prepaid bearer instrument (BIS, 1996). Current e-money products my be classified as card-based (hardware) or network-based (software). The multipurpose prepaid chip cards have a great potential to be used for small-value retail payments as well as for Internet payments (by embedding a special reader in the keyboard as e. g. for the German GeldKarte) (Deutsche Bundesbank, 1999). The network-based electronic money working with a special software is used for small-value payments to purchase products and services only in the Internet. Both systems reduce cash handling costs for merchants and improve speed and convenience for customers. Currently there are over a

Figure 5: Status of implementation of the most important electronic money systems

System (Provider)	Service Provider (Issuer)/Status
GeldKarte (ZKA, Debis AG) (Deutsche Bundesbank, 1999)	The German banking industry, Ca. 40 million chip cards issued in March 1999; share of transaction's turnovers in retail trade less than 1%
Mondex (Mondex Int.) (Mondex, 1999)	NatWest Bank, Bank of Scotland (UK) - Pilot test at the University of Edinburgh, Start October1998 Chase Manhattan, Citibank, Morgan Stanley, MasterCard, Michigan National Bank, Wells Fargo (USA) - Pilot test within Wells Fargo Institute, Start September 1998 Hong Kong Bank Bank of Canada
Visa Cash (Visa Int.) (Visa, 1999)	Projects in 15 Countries (Argentina, Australia, Brazil, Canada, Colombia, Germany, Hong Kong, Italy, Japan, Mexico, Norway, Spain, Taiwan, United Kingdom, United States) In USA provided by First Union Bank, NationsBank, Visa International Headquarters, Wachovia Bank – Pilot projects: San Francisco, California; Bronx, New York; Tampa, Florida; Celebration, Florida
eCash (DigiCash) (Deutsche Bank, 1999; eCash, 1999)	Deutsche Bank AG (Germany) - Pilot project (Start October 1997), 35 Merchants, 1500 customers), On-line shop since January 1999 Mark Twain Bank (USA) - Pilot project (Oct. 1995 – Sept. 1998), 300 Merchants, 5000 Customers Swiss NetPay AG - Pilot project (Start June 1998), 28 merchants St. George Bank (Australia) – Pilot project (since October 1996), 50 Merchants Bank Austria - Pilot project (Start May 1998), BA test shop
CyberCoin (CyberCash Inc.) (CyberCash, 1999)	11 Banks (Germany) – Pilot project (since November 1997), 27 Merchants
Minipay (IBM) (Clark, 1998)	Tested by IBM
Millicent (Digital Equipment Corp.) (Digital, 1999)	KCOM (Japan)

dozen of electronic payment systems, which are being implemented or tested in many countries (inTouch, 1998). In general, such payment systems are particularly implemented in countries, where the telecommunication costs for local calls are very high, as e. g. in Europe. Especially the smart card technology that allows off-line authorization, is a cost effective way of processing financial transactions.

The aggregated costs of each payment consist of transformation costs (e. g. the fees for conversion from assets to cash and vice versa), transport and storage costs, costs for safety measures, search and time costs (Hakenberg, 1996). The charges for withdrawal of paper-based money may be related to the costs of transformation and clearance between electronic money and cash. For software-based electronic payment systems, we may assume that search costs are equal to zero, while for smart card users charges for loading funds exist. There are three types of costs that may be reduced by using electronic payment systems: transport, storage and costs for safety measures. The transport and storage costs are very high for fiat money because of its physical characters. Transport costs for intangible electronic payment systems are generated from charges imposed by local internet access providers. Safety costs consisting of costs for technical infrastructure and software (cryptography) are currently relatively high. If it is possible to exploit economies of scale these costs might decrease and eventually be lower than in case of paper money. Nowadays, the main problem of electronic money lies in missing acceptance by a large number of merchants and institutions. The willingness of merchants to accept electronic money depends on fees imposed by the issuer and operators, hardware costs and the reduction of costs of handling money in comparison to traditional paper-based money.

5. •CONCLUSION

This work discussed consequences of electronic commerce on customer's loyalty. Electronic commerce is analyzed especially in the environment of the World-wide Web. The World-wide Web offers the possibility to create a perfect marketspace. The intermediation in distribution will be reduced. This means lower costs for both suppliers and customers.

We analyzed and classified different types of existing software agents with regard to their use on supporting electronic commerce. Most of the software agents only perform simple product price comparisons, some support the purchase of products. These agents reduce customer's loyalty because the price is the only variable. Quality and added values are not considered. Therefore, the on-line multi-agent systems allowing negotiation might be useful from a consumer's perspective. MIT Media Lab's agent systems is able to negotiate competitively over price (Kasbah) or cooperatively over multiple terms of a transaction, such as e. g. warranties, return policies, delivery times and loan options (tête-à-tête). Merchants may also send their own sales agents to the potential buyer in order to remind the previous clients of new sales offerings or to suppliers in order to maximize their gross return. Auctions help to get an efficient and effective pricing mechanism in electronic commerce.

As instruments for increasing customer loyalty we discussed the personalization and customization of World-wide Web sites, value-added services and the reduction of transaction cost through electronic payment systems. The personalization techniques such as rule-based matching or collaborative filtering provide WWW contents, that are appropriate to the customer's preferences or analyze past purchases and prior suggestions of other clients. An other personalization techniques like one-to-one marketing may be especially useful for sophisticated products demanding explanations or to enable cross-selling of other products. The registration of customers allows the merchant to build user profiles and therefore to make customer-oriented offers or build special offers including additional services. The value-added services attract the clients to trade at favorable terms. The usage of electronic money systems may result in additional reduction of transaction costs for merchants. This is especially true in Europe where telecommunication costs are high.

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