Towards Building Loyalty in e-Commerce Applications: Addressing Issues on Personalisation, Persistence & Presentation

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ABSTRACT

In the increasing trend towards e-commerce, vendor-purchaser relations have become de-personalised. Attempts to improve relations by introducing so-called loyalty schemes, which are in fact thinly disguised discount schemes, have failed to redress the balance. On-line, on-site kiosk-based multimedia systems in conjunction with reward schemes can engage the customer's interest but do not necessarily create loyalty. The EU MAPPA Project (EP28831) seeks to add value to such systems in order create loyalty: our means of achieving this is to use Agent technology and by addressing issues on Personalisation, Persistence, and Presentation (the 3Ps).

This paper discusses the problems in creating loyalty in electronic commerce. We argue that it is necessary to address the 3Ps in-order to achieve loyalty: that is by understanding the potential value of the customer's $I^2P^2R^2$ (the value of information, interaction, personalisation, privacy, (mutual) respect and re-use). In each case, we analyse the situation in conventional retailing, give guidelines on transferring the value to electronic commerce, and then discuss how the value is realised in the MAPPA system architecture and/or its agents

Keywords

E-commerce, Loyalty, Personalisation, Persistence, Presentation-RSVP, Personal Sales Assistants, Multi-agent Systems.

1. INTRODUCTION

The explosion of e-commerce, which has resulted in both increased business opportunities and increased competition, has entailed a fundamental re-assessment of conventional retailing. Many organisations have recognised that customer loyalty is the key to creating and maintaining market share, but real loyalty in electronic environments is created by adding real value, which the plethora of card-based loyalty schemes have not fully achieved.

The MAPPA Project (EP28831) anticipates in-store, kiosk-based, internet-enabled, multimedia information systems becoming commonplace in retail premises. These systems can, we believe, be used to create customer loyalty by adding value, if they are used and presented in the appropriate ways. The way MAPPA systems are used and presented has been determined by examining existing techniques in Customer-Relationship Management (CRM). By understanding the value of information, interaction, personalisation, privacy, (mutual) respect and re-use in creating customer loyalty in conventional retailing [18], we can see how this value can be transferred to electronic commerce.

In the remainder of this section, we analyse each of the properties: information, interaction, personalisation, privacy, respect and re-use, considering what the issues involved in realising the value of the property, our recommended actions to effect the transfer, and describe how this has been, can be or will be supported by the MAPPA system.

2. CREATING LOYALTY IN ELECTRONIC COMMERCE

We refer to loyalty, here, as being the perception of loyalty by which customers are encouraged to and do return to the system and/or the store. Also, this continuous return may potentially increase sales. The MAPPA application, hence, uses Smart Card ownership, Quality of Service (QoS) adaptation to individualised criteria and requirements, visual animated Personalised Sales Assistants, adaptive interaction and presentation, loyalty points and bonus schemes to engender the proposed loyalty. We implement this perception of loyalty by addressing the 3Ps in the MAPPA project:

2.1 Personalisation

2.1.1 The Value of Information

In realising the value of information in creating loyalty, we encounter directly what we call the 'information Catch-22', whereby we observe that:

- users will only establish user profiles at sites which have already gathered their loyalty;
- loyalty can be gathered by adjusting offers in a way that is consistent with purchase history; but

- individual purchase history can only be established and maintained if associated with a user profile.

To square this particular circle, our recommended action is to capitalise on the retailer's brand name and leverage the loyalty of the existing customer base. This has to be transferred to the electronic system or site. This can be achieved by maintaining both a consistent look and feel, by which we mean that the multimedia presentation should faithfully reflect the real world image of the retailer, and a distinctive look and feel, by which we

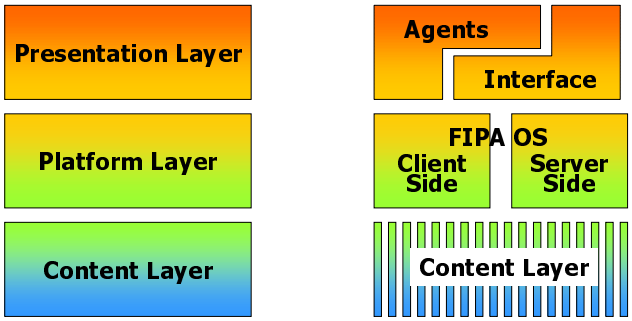

Figure 1: Logical Architecture of MAPPA System

mean the operation of the system should be oriented towards shopping in the particular store (compare the WWW pages of the search engines Google (www.google.com) and Altavista (www.altavista.com)). Therefore the multimedia system should not be perceived as just another sales and marketing tool, and the lesson learned from popular web sites should be applied: that loyalty is enhanced if the site becomes more valuable to the user at each visit, and no visit should be used as an excuse for a (probably unwanted) sales pitch.

The value of information is realised in MAPPA by a component-based architecture that allows plug-and-play of the presentation layer (see Figure 1). In most multimedia or hypermedia systems, the logical system architecture comprises essentially 3 layers: the run-time (presentation) layer, the platform layer, and the content layer, where the physical data is stored. In the MAPPA system, the presentation layer is broker into two: an agents layer and an interface layer. The agent abstraction here provides interoperability with different interfaces, so that different retail organisations can develop customised, purpose-built multi-media presentations which properly reflect the company, and use them as part of a MAPPA system.

In fact the separation of layers in the logical architecture occurs 'further down' as well. The platform layer, which is based on Nortel's FIPA compliant open source agent-oriented middleware system FIPA-OS, allows either client-side or server side processing of multimedia content, and indeed, because of the distribution that agent systems bring, content itself can be widely distributed in any number of thin 'slices'. In addition, the use of agents in the presentation layer brings additional possibilities of adding value, as we discuss the presentation sub-section.

2.1.2 The Value of Personalisation

The key issue in personalisation is: how do I (the retailer) get to know the customer? Or better, How do I (the retailer) find out how the individual wants to be treated (in order to add value by providing this treatment, and so creating loyalty). Of course, personalisation in conventional retailing comes from interaction and the familiarity that follows from that interaction over a period of time. In electronic commerce, that direct interaction is lost, but the ability to add value can be realised if the agent (as introduced above) takes care of the customer by personalisation.

The recommended action to realise the value of personalisation is to use the guideline "sense and respond, not make and sell". Retail organisations have to employ a different marketing mentality in electronic commerce, i.e. they no longer make a product and then seek to sell that product as is, or in order to satisfy any perceived or created demand. Instead, it is important, if the intention is to create loyalty, to detect what the customer wants, and then to customise a product or service so that it fits an individual need. This is what is referred to in the literature of CRM as mass customisation or accelerated 1-1.

The value of personalisation is being realised in MAPPA by using the Personal Sales Assistant agent to reduce the segment size in electronic commerce. Teerlink *et al* [17] describe a general approach to pro-active marketing which aims to satisfy customer needs even before they are really aware of it themselves. One component of their approach is a process of trying to reduce the segment size to as small as one, i.e. the individual. Teerlink et al suggest this can be achieved in a four step process (see Figure 2).

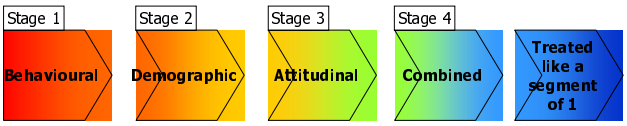

Figure 2: Creating a Segment of 1

The role of each step is as follows.

- Step 1: use existing data. In fact already fairly detailed behavioural patterns can be derived from current data;
- Step 2: add external financial, demographic or preference data. This data can provide may extra indicators of lifestyle and individual profile, but in the first instance may need some additional means of capture (possibly non-electronic but as non-invasive as possible).
- Step 3: data captured from the individual at all points of customer contact. As MAPPA is an electronic system, the various techniques for creating loyalty on the web (Nielsen, 1997) can be used, for example regular fresh content, use the smart card for security mechanisms, and gather information by logging (as unobtrusively as possible - see below).
- Step 4: combine all the above. The fourth step is to combine all this information to create "new" information, by deriving learned traits of the individual. This points to a strong learning component but different for each individual. The logical distribution of responsibility and control afforded by the agent design in MAPPA supports this requirement.

The MAPPA system currently uses existing data and deploys profile agents to acquire additional data. The system is therefore at step 2. Further work will focus on putting the learning components into the MAPPA personal agent in to support step 3 and 4 and move towards the ideal in step 5: treating the individual as a segment of one. In particular, the personalisation that comes from learning (the agent and system adapt to the user's needs and preferences over time) adds value for the user. This should create loyalty as the system fits the user's needs so well that another competitor cannot offer the same quality of service.

2.1.3 The Value of Privacy

The issue in privacy is the following: If a retailer goes in for personalisation (as described above) and providing a customised service or product, then how is privacy respected? From the customer's perspective this gives rise to two questions:

- Who do you give what information to, and how often and how long can they use it?
- Who has found out what about you, and how are they using it?

The recommended action to respect a user's (customer's) privacy is to follow the guideline: "remember for, not about" [18]. This means that for each item of information stored about the customer, the retailer should ask itself if the information is being stored for the benefit of the customer or the retailer. If the latter, then the retailer should ask itself if it is worth risking an "invasion" of privacy and so compromising the loyalty it is trying to create.

As well as this guideline, the retailer can try to engage the user by keeping this learned information on the smart card. This is a sign of trust from the retailer to the customer, which can be reinforced if the retailer offers an 'information banking' service. The retailer should ensure that it does no more than store the data, but it effectively offers to store value for the customer (i.e. the learning of the agent, any reward points accrued, and so on).

We believe information is a commodity, but, in its electronic form, to maximise its utility it has to be traded not sold, and pushed not pulled. By this we mean that in general in electronic commerce users *will not pay a cent for content*. They are happy to provide user profiles and other data, but in general will not part with “hard cash” for electronic content. The failure of Slate magazine to pay its way through subscription fees despite the quality of its journalism is indicative of this trend. In this context, the user profile is highly valuable and the customer wants to know that his/her interests are protected.

The value of privacy has not been realised in the MAPPA system at this time, but a possible route has been identified through the implementation of the privacy model developed by Adams and Sasse [2]. In their privacy model, Adams and Sasse identify three main privacy factors:

The information sensitivity: the customer's perception of the sensitivity of information is significant, not the retailer's;

The information receiver: whether what is known about the user that is potentially invasive, or who knows it;

The information usage: providing users with the mechanisms for control and feedback.

These factors will define privacy boundaries that, if breached, are likely to cause resentment among users. To avoid a breach, it may be possible to use privacy critics, as defined by Ackerman and Cranor [1], implemented in the personal agent. These critics may be used to interpret the privacy model, and make suggestions (e.g. about releasing a information of a certain level of sensitivity to a certain type on information receiver).

2.1.4 The Value of (Mutual) Respect

Reichheld [15] considers the changing face of loyalty over the last 50 years. He points out that 50 years ago, in business and commerce, there was a strong loyalty to organisations and/or other abstractions. This loyalty was often mutual: employees expected to work a lifetime for one organisation, the employer would take care of the employee in retirement. The idea of brand loyalty was also mutual: customers would persist with one product on the expectation of receiving continually consistent quality of service.

In the present day, there is no absolute loyalty in consumers (the whittling away of this loyalty has many contributory explanations that need not concern use here). Loyalty in consumers is now given to whoever provides superior service, and this is contingent upon the creation of value. Loyalty is also shown to one's peer group. Therefore a recommended action for the retailer is to create a "one of us" mindset among the customer base. With personalisation reducing the segment to a size of 1, as described above, the retailer can create a peer-peer relation with the customer. The creation of value cements such a relationship.

A peer-peer relationship can be encouraged by the idea of the situated electronic society. One aspect of this to ensure that events in the e-space have correlates in the real world [9]. In the MAPPA demonstration system, wine retailing, this could be achieved by, for example, wine tasting evenings, formation of a wine club, and so on. Such activities create social cohesion, and encourage loyalty through peer-peer relations.

An additional aspect to consider in creating peer-peer relations is feedback and empowerment. In the MAPPA system this is achieved by providing third party trust and forum agents. These agents will be used so that customers can inquire if recommendations are endorsed by other customers, or to provide feedback themselves (cf. the recommendation system supported by Amazon [3]). A final aspect to consider is the social and legal aspects of electronic interactions between agents, a subject which is being investigated in the EU ALFEBIITE project (http://www.iis.ee.ic.ac.uk/alfebiite). Ensuring that these interactions are supported by an appropriate legal framework is important aspect of creating trust in electronic commerce: trusting relations serve also to create loyalty.

2.2 Presentation

2.2.1 The Value of Interaction

The interaction that concerns us here if the business-to-consumer (b2c) interaction involved in retail. Here, loyalty is created by human-human interaction and the ‘personal touch’. The question then is how to reproduce that kind of service online in e-commerce? Everyone remembers personal service or a knowledgeable shop assistant, and such intelligence and individuality (one-to-one treatment) implies that the multimedia interface could benefit from some kind of similar personality and sensitivity.

However, this benefit will only be realised if it is predicated on good HCI (Human-Computer Interaction). This implies:

- avoid adaptive interfaces, which are unstable and increase uncertainty in the user (but configurable interfaces with optional features are required to satisfy a wide range of users)
- avoid paperclip technology, which is intrusive and takes initiative away from the user (but just as WIMP interfaces were an improvement over command-line interfaces because of the ease of recognition over recall, we want to intelligent interfaces which can remind users of functionality)
- avoid excessive anthropomorphisation, which can raise undue expectations in the user (but human elements are found to be

reassuring when dealing with un-user-friendly new digital technology).

The value of interaction can be realised if it remembered that the interaction should create value, not exchange value. In particular, a loyalty scheme is not a discount scheme. Too often, existing "loyalty" card based schemes result only in an exchange of value: some meagre "reward" points in exchange for purchase information which is used in data mining. This exchange does not engender loyalty: most people are prepared to exchange information about their shopping habits and/or preferences in return for a discount but shop elsewhere if the opportunity arises.

To create value in electronic commerce, it is necessary, we argue, to give the customer a stake in the system, and then to see that stake grow or become better in some way. In particular, we want to exploit people's attachments to objects, as identified by Reeves and Nass [14], and also the increased trend towards the software ownership model, whereby users no longer own their hardware and take out a licence to run someone else's software, but instead own their software and have a licence to run it one someone else's software (Pitt, *et al.*, [12]).

The value of interaction is realised in MAPPA by the implementation of agents with personality, which is stored on a smart card. This intention is for the user to be in control: that is the agent is highly intelligent, highly competent character that is essentially a slave. The character adds the personal touch to the interface, but more importantly (as will be seen in subsequent sections) increases in competence over time, thus increasing its intrinsic value to a single user (i.e. its owner). This also exploits the user's attachment to objects: s/he owns the smart card *and* its contents (witness to the strength of this attachment - to a gadget and an electronic entity that is 'grown' - can be seen by the crazes for Tamagotchi and Pokemon). The concept is reinforced in MAPPA by the personal agent having the visual representation of a genie: the intention is to invoke the Aladdin and Lamp metaphor with the user and the smart card, as the agent moves off the WID (the smart card) and occupies (appears as a presence) position on the screen (see Figure 3).

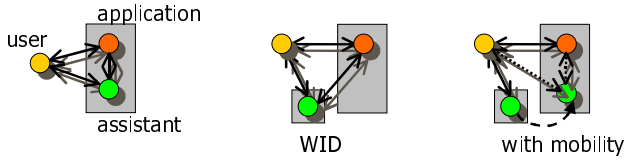

Figure 3: Interaction with an Intelligent Assistant: on a fixed platform, on a WID, and with mobility

2.3 Persistence

2.3.1 The Value of Re-use

The final aspect of creating value is to prevent "card proliferation" by ensuring that the smart card is fit for use in a variety of stores, not just one. The MAPPA system's platform layer, being built on the FIPA standards specifications (FIPA, 2000) supports interoperability between heterogeneously developed systems. Looking further into the future, there are technological developments that need to be considered, for example in display, chip and battery technology, and in network and protocols (WAP, UMTS, and Bluetooth), so that eventually a single universal access device may be anticipated. From the sales and marketing perspective, retailers should seek to capitalise on these developments by creating opportunistic alliances with other retailers, using standards for profiles and products (internet labels), and using ontologies to create plug and play databases. For example, the MAPPA demonstration system has a second interface for video hire, and can use a separate knowledge base for making recommendations. However, MAPPA will not develop this further in its demonstration system: this is really a subject for development in the new EU initiative in the domain of "the disappearing computer".

2.3.2 The Value of Persistence

Persistence of context, to provide an extension to personalised information that maintains the client's current interests and supports off-line information and service gathering and to develop the functionality to continue to work "off-line", acting proactively or attempting to complete a transaction. This persistence means that a user has an agent identified and working for them, and continuing to work for them whether or not they are actually on-line. Existing and new interface modalities can ensure that the user may make contact with, or be contacted by, their agent by voice, email, or other means.

3. THE MAPPA APPLICATION

The MAPPA system is built on the FIPA-compliant agent-oriented middleware system FIPA-OS, distributed as open source by NortelNetworks. In the demonstration system, recommender-type agents manage domain knowledge about wines and personal agents manage specific knowledge about users' wine tastes. The user profile and character (competence) of the personal agent are stored on a smart card. The combination of information, interaction and personalisation enables the multi-agent system to make pro-active suggestions, which are to the customer's taste and interest. This personalisation adds value and, over time, should increase loyalty. In this way, the retail organisation is able to leverage the existing loyalty of its current customer base and transfer it to the electronic domain, and then, by using agent technology to increase that loyalty, to maintain market share

Figure 4 delineates the overall MAPPA system architecture and the details of each component is discussed in the following section.

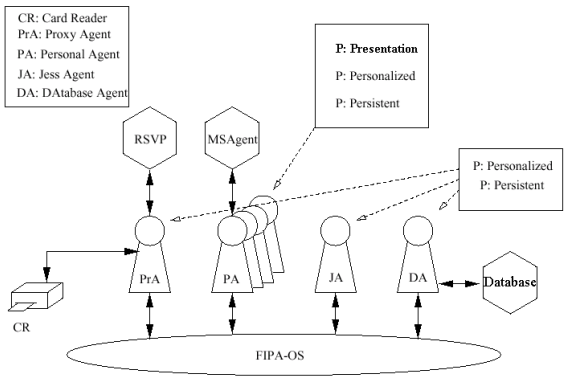

Figure 4: MAPPA Architecture

4. CLIENT-CENTERED INTERACTION

As transactions between vendors and their consumers become more digitally self-serviced and since customer services is

becoming a primary value-added function in every business, human involvement and personalisation becomes a key issue. Motivating us to look for interface paradigms which can provision for even more personalised interactions that complement current e-commerce functionality and services. A paradigm providing personalised services that reaches the individual with different information profiles and levels of expertise, and that can provide more intelligent, socially-intuitive interaction. For these reasons we use the metaphor of an Electronic Sales Assistant working on behalf of the consumer in an electronic-based marketing environment. We extend this metaphor to provide an animated human-like embodiment of the Electronic Personal Sales Assistant (e-PSA) endowed with a distinct and predefined personality adequate to each individuals cultural and social communication protocols and needs.

4.1 Electronic Personal Sales Assistant

Personal Sales Assistants (PSA) are autonomous Interface Agents that employ intelligence and adaptive reasoning methods to provide active, collaborative services and assistance to users' of a given application [11, 20]. PSA agents differ from customary interfaces in that they are expected to change behaviour and actions autonomously according to users' actions and the surrounding system environment as an interaction progresses. Because their main role is to engage in communication with users, they are often termed as Conversational Agents. The PSA metaphor aims towards providing effective highly personalised services. Personifying the PSA with a context generated affect-based character is an additional dimension to providing personalised services. The motivation for this type of personalisation is that an animated figure, eliciting quasi-human capabilities, may add an expressive dimension to the PSA's communicative features, which can add to the effectiveness and personalisation of the interface and the application on the whole. As this technology moves from the research benches to on-line service spaces into office applications, they have expected potential to breakdown the complexity of application entry-barriers as well as the information cost structure. Since there is strong evidence that Affect has major influence on learning and recall [4], reasoning and decision making [8], both collectively effecting system usability and efficiency, and in turn, effecting the overall work load. Furthermore, the MAPPA claim that such agents may influence loyalty.

Their role is to act as mediators between the human and the computer cyberspace and to be capable of personalising an interface by monitoring and sensing individuals' capabilities, interests, and preferences. As such, PSA functionality is realised on two levels: the service level and the interface level. The PSA is, hence, considered a service agent1 that must communicate and negotiate with other agents in a multi-agent system to determine which and how services are to be provided. As all software agents are distinguishably characterised by the services they provide, the PSA is principally characterised as a user-oriented agent. It is expected to facilitate and provide mechanisms that enhance an application's efficiency and usability from both interface and functionality perspectives.

The PSA is implemented as an agent, which uses an expert system to manage its internal states. The agent maps the semantic of FIPA performatives to basic JESS functions. More complicated commands are communicated in the content of an FIPA ACL and executed by the JESS engine. The agent uses profiles to dictate is basic operation style and the kind of knowledge it works on. For example in the MAPPA system a personal agent on start-up loads a Knowledge base which has domain facts and heuristics about wine. When a user logs into the MAPPA system after validation the agent loads that persons profile the agent then uses these two knowledge bases to personalise general questions from the user about wine to find the appropriate product that best fits the users request and profile. This basic functionality can also be made to act as Vendor Agent acting on behalf of the used retailer. It does this by loading the appropriate profile for a vendor and then it will behave accordingly.

[1] A specialised agent dedicated to provide a particular service.

4.2 Profiles

For the implemented components of the PSA to be fully converged and effective in a real-time MAS, the agents must have some knowledge about the surrounding environment which includes knowledge about internal and external states. The agents must have a semantic and contextual understanding of the information being exchanged. This requires a theoretical framework for representing knowledge and belief of agents interacting within an agent society. This includes frameworks for representing uncertain knowledge about the surrounding environment evolving with experience and time, awareness of the implication of time constraints, and context-based behaviour. For this purpose we use the notion of meta-level knowledge representation, which are annotations of data [10], being manipulated between the agents in a MAS. This provides an understanding of the content being handled and hence provides better awareness of the environment. The abstractions hold physical and conceptual meaning as well as affective states.

The user interface represents the sole point of contact between Agent and Customer, and a variety of techniques must be employed to extract valid personalisation information. Some considerable care must be taken if the criteria previously discussed are to be met. Our approach is to combine active, elective and passive information gathering methods.

4.2.1 Gathering Customer Preferences

Active methods include electronic form filling. We request as little personal data as possible in this way, as this can be seen as intrusive by some users (decreasing the sense of privacy) and can delay access to the main business oriented activities. Some active information gathering is inevitable, such as name and delivery addresses. In the case of both wine and video sales the customers age band must be ascertained in order to meet legal obligations, fortunately, over 18 years old the actual value is irrelevant. We also request a (self-assessment) of computer experience to tailor the amount of introductory help presented on first use.

In general, we prefer not to present the customer with an extensive "preferences" form, but rather to gather that information incrementally by elective means. Each product selection dialog presents two extra buttons, "Like" and "Dislike". Pressing either of these buttons informs the Personal Agent that the customer prefers (or not) the current selection indicated. This information then forms part of the persistent knowledge the Personal Agent holds about the customer. A particular preference (or not) may be indicated by repeated application of a button and previously held

preferences reversed using the opposite sense button. Many of the product selector panels allow the user to select a broad category (i.e. “French Wines”) with a pictorial button, or (for more knowledgeable users), to specify a detailed sub-category (such as “French-Bordeaux” or even “French-Bordeaux-St. Emilion”) from a list-box. The preference always attaches to the specific option selected. In this manner the customer may express a general dislike of a general category, such as sweet wines, but a liking for exceptions, such as the sweet Tokaji style, or even an individual product.

Finally, we may infer preferences from the actions of the customer and the various choices they make. This is at the same time more direct but carries a higher risk than the elective technique. As this profile is built over time, we consider that the investment a customer makes in informing the PSA as to his or her specific likes and dislikes contributes to the sense of loyalty between customer and Agent system. It is clear that these mechanisms must be applied judiciously, the Agent should not appear to act slavishly as a consequence of each preference. It must also allow for exceptions, such as when a customer selects a gift for someone with different tastes, and for the changing tastes of individuals.

Most recently, we have been exploring the value of allowing the customer to express an overall sense of satisfaction or dissatisfaction with the system. This is made manifest by the set of “emoticon” buttons (bottom-centre, figures 5 and 6), to indicate approval, disapproval or confusion. Initially this will be used in continuing usability trials to identify acceptable and unacceptable conditions and but eventually lead to the development of rules to adapt the Agent’s on-going behaviour to the individual customer’s outlook.

4.2.2 Customer Profiles

In the MAPPA project profiles are used by agents to take on certain aspects of the role of retailers and customers. The idea is that a customer has a buying history which can be used to form the basis of a profile of that customer’s preferences for certain products and services. The customer is encouraged to view and change this profile so that it can better reflect the customer’s likes and dislikes. An agent can then use this profile along with domain knowledge the agent has about the products available in the system. This means a customer can ask very general questions about the products and the agent will filter them according to the customer’s profile and the its domain knowledge. It can then search the product databases for specific products that match the filtered request.

This can be made more realistic if other agents in the system have profiles that enable them to work on behalf of the vendor. The vendor can have information of a particular customer’s purchasing preferences from looking at previous purchases the customer has made. The vendor agents can then make suggestions to the customer of offers and deals tailored to the its perception of what a customer wants. Naturally as the customer buys more the vendor agent will have more data to reason about a customers perceived preferences and so can tailor its offers better to meet a customer’s needs.

Given this scenario it is not hard to see that agents can then negotiate on a customer’s behalf. A customer indicates that they are interested in a type of product. A search of the system according to the personal profile returns to the customer a certain number of choices. However a vendor agent might be able to make a number of offers or deals to the customer trying to get the customer to buy products it wants to sell but are at the same time relevant to the customer. At this point the vendor and agent and the customer agent could negotiate using the customer’s preference on how much he or she are prepared to spend and the vendors preferences for increasing gross margin and selling products that need pushing. A compromise is reached and the customer is given a number of choices.

This system in the context of e-commerce where the limits of physical location are removed will be very exciting and important. A customer can search for the best deal globally and vendors have global market. However the software is needed to filter the potentially enormous number of customers on-line at any one time and the vast choice of products available.

4.3 RSVP: Rapid Serial Visual Presentation

In the RSVP Presentation System display method, many "products" are shown in a single display window This area serves as an on-screen metaphor for a shelf of products, as might be encountered in any shop or store. It is an alternative to the “catalogue pages” approach familiar to all those that shop “on-line” regularly. RSVP largely overcomes two familiar problems with the catalogue approach. First, the customer may browse a large number of products quickly in a single page. This avoids the familiar problem of navigating many pages to locate a particular item. Second, the contents of the “shelf” may be quickly configured to display particular products of interest to the customer.

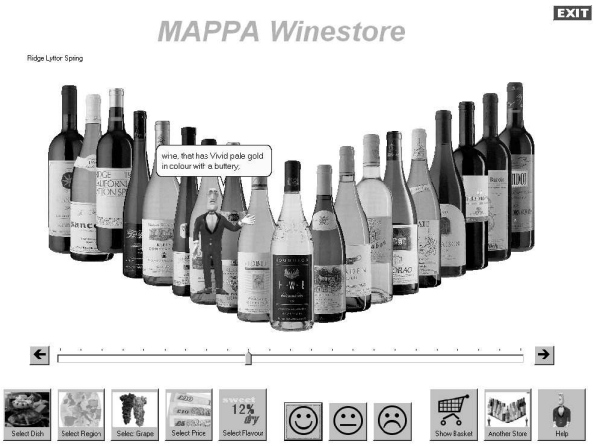

Figure 5: The RSVP display area

A customer interacts with the RSVP display in three ways. First the customer may “riffle” through items on the “shelf” using a pointing device (mouse pointer, or with the finger on a touch screen), as if picking the item from the shelf and inspecting it. As the pointer moves over the visible portion of each product image the touched product image moves away from the others. It is thus made more visible and is highlighted. The effect is both distinctive and effective. Second, the customer may move back-and-forth “along” the shelf, as if they were moving to another part of the shelf. This is accomplished by “left” and “right” buttons. Equally, the slider bar can be used to traverse the length of the “shelf” rapidly. Third, the customer may indicate particular interest in a product, or request a purchase, by selecting it (for instance, with a mouse click/double click, or by tapping a touch screen).

Figure 6 below shows one method by which the customer focuses on sub-sets of the full product range by selecting criteria from button based selection panels. In the example shown the customer may refine a selection of wines on the basis of food it might best accompany. Equally, the customer might refine their choice on the basis of region, cost or grape variety. When the RSVP display is configured to present another product type, the general screen furniture is modified for the new range and appropriate product selection panels presented on demand. For instance, a video film product range will allow the customer to select on the basis of film content (drama, comedy, action, etc.), actor, year of production or age classification. Product sub-sets may also be derived by a Personal Agent from known customer preferences or other sources of expertise.

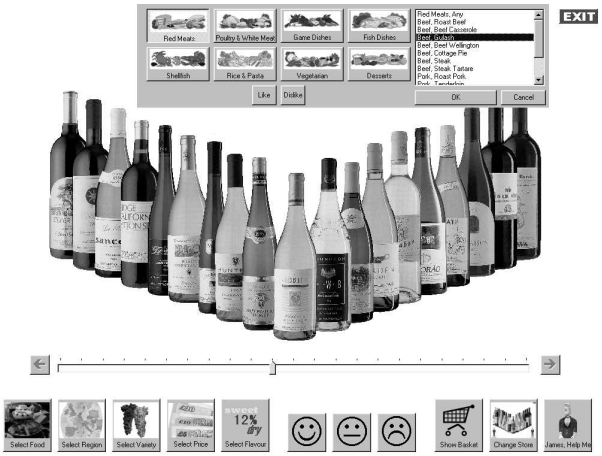

Figure 6: Customer product preference selections

The Presentation System is accessed using a series of methods, communicated using a FIPA-ACL compatible ontology. Each significant action taken by the customer is messaged to the Personal Agent, which can intervene at any point, or just observe the customer's activities. Unsolicited events, such as actions by the customer, are reported via a Proxy Agent to the Personal Agent, again using well-defined ACL compatible messages.

The Presentation System implements and exploits a version of the RSVP idea developed by Spence, and others [7, 19, 16, 5]. These researchers have been primarily interested in understanding how computer users may most rapidly and effectively identify image files within a large number of similar images. Our primary concern is to enable a customer to rapidly and effectively browse a potentially large number of (possibly rather similar) products in a single display. The customer may select a product to obtain further information, and then purchase any item(s) required. Additionally the RSVP display acts as a presentation area over which the PSA agent may roam, providing extra assistance to the customer, or make a sales pitch on behalf of a Vendor Agent.

4.4 PERSISTENCE

4.4.1 The need of persistence

It is general believed that agents will in future act on behalf of their human owner. In order to do that, they will surely need to be persistent. Persistence is necessary for many of their most important traits.

Persistence allows:

- Reliability: in fact when the owner ask them to accomplish a task, agents need to persist in doing that until it is complete.
- Personalisation: agents can be tailored to the user need.
- Added social traits: agents can remember who they are and their characteristics.
- Learning: agents can be modified by their experience.
- Mobility: which mobile agents need to persist.

MAPPA agents should persist in many senses. They have to keep record of their history, personality traits and user preferences. Moreover, they have to be able to work off line, which means that they have to survive even when the user has gone away or when the system is rebooted even after a crash. Finally MAPPA agents should allow to be safely stopped and restarted, for example when the system is overloaded.

The problem of persistence could be solved with two different approaches. The first one was to be concerned only with the MAPPA problem and to develop a system, which worked fine to solve this particular problem. The second one was to look for a more general solution that could be applied to MAPPA and also to other different systems. We chose the second approach.

4.4.2 Two sorts of persistence

When it refers to agents, the word persistence may lead to some misunderstanding. There are, in fact, at least two very different ways of conceiving it and we will be calling them: *static* and *dynamic persistence*.

4.4.2.1 Static Persistence

If a program could be divided in code + data, static persistence has to do with the data. Such data could be, for example, the agent name and characteristics, its user profile etc. This sort of storage does not present any particular difficulties to be implemented in traditional languages.

4.4.2.2 Dynamic Persistence

Dynamic persistence is much more than that and it is concerned with persistence of action more than persistence of data.

A wide range of agents' activities could be defined as *slow action*, meaning those actions that last for a prolonged period of time. For example a task for an agent could be to deliver a message to all employees of a supermarket asking them to vote in favour or against something. It may then wait for all the replies to come, evaluate the result and inform all the employees.

The interesting thing in slow actions is that they have an intrinsic increased probability of being interrupted. This in fact may occur in very common situations such as rebooting, crashes, overload of computer resources etc. and the only fact that they may last for days or weeks makes them vulnerable to these problems.

When it comes to actions, traditional Object Oriented Languages, which are very useful at managing Objects, don't give much advantage to the programmer. Java, for example, which is an object oriented language, allows the programmer to save the state of an objects throw a mechanism called *Serialisation*. But Serialisation only saves the set of the object's variables and their values at the moment of saving. It does not save state of its running method, making it impossible for methods to recover.

5. Summary and Conclusions

We have addressed the issue of adding value to electronic commerce (enabled by kiosk-based, internet-accessible multimedia systems) by creating loyalty. We propose to create loyalty by addressing the customer's $I^2P^2R^2$: i.e. the value of information and interaction, personalisation and privacy, and respect and re-use. The MAPPA system has been using agent technology to support customer's $I^2P^2R^2$: currently there is support for realising the value of information, interaction, and personalisation, while future work will enhance personalisation and address privacy and respect. By using MAPPA technology, we believe that retailers can leverage the loyalty of their existing customer base and create loyalty in electronic commerce, thereby retaining market share.

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