A new model to support the personalised management of a quality e-commerce service

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Giovanni Giannì and Fiorenzo Franceschini
Dipartimento di Sistemi di Produzione ed Economia dell'Azienda, Politecnico di Torino, Torino, Italy

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Abstract *The paper presents an aiding model to support the management of a high quality e-commerce service. The approach focuses on the service quality aspects related to customer relationship management (CRM). Knowing the individual characteristics of a customer, it is possible to supply a personalised and high quality service. A segmentation model, based on the "relationship evolution" between users and Web site, is developed. The method permits the provision of a specific service management for each user segment. Finally, some preliminary experimental results for a sport-clothing industry application are described.*

Introduction

The Web is quickly becoming the platform by which many companies deliver services to businesses (business to business (B2B)) and to individual customers (business to consumer (B2C)). The spread of the Internet asks for many efforts by researchers to provide new aiding tools for on-line quality services. Service customisation, user relationship care and integration of interaction channels are believed to be successful elements. New technologies for Web service personalisation and new software applications are emerging: from data-mining to advanced customer profiling, from virtual data-warehousing (stocks and orders management) to "one-to-one" e-marketing (Davydov, 2000). In spite of these new tools, the central question remains the adoption of a "correct" customer relationship management (CRM) strategy. The topic is critical to manage both for the market changeability and the more increasing competition. These aspects are amplified in the new "virtual world", in which customers are only one click away from competitors and therefore have higher expectations. In this new framework companies must immediately recognise customer needs and preferences (Franceschini and Rossetto, 1998; Barnes and Vidgen, 2001, 2002).

A literature survey shows a very large number of organisations performing interactive business transactions by means of Web technologies (Poon and Swatman, 1999; Westland and Clark, 1999). Web quality is a complex emerging concept and its measurement is expected to be multi-dimensional in nature. From the literature scenario it appears that only a limited and fragmented research has been directed towards Web service quality (SQ) issues (Gemoets and Mahmood, 1990; Kettinger and Lee, 1994; Lindroos, 1997; Kaplan *et al.*, 1998; Bhattacherjee, 2001; Krauss *et al.*, 2001; Boyer *et al.*, 2002; Aladwani and Palvia, 2002; Barnes and Vidgen, 2001, 2002; Loiacono *et al.*, 2002).

Two general aspects come out from the above review. The first is that Web quality research is usually focused on specific topics; it lacks a global structured overview. Second, the investigations are normally led according to Web designers' point of view, neglecting both customer needs and relational management.

In this paper we consider e-commerce as a service. The theoretical background comes from the SQ and customer satisfaction (CS) literature (Lehtinen and Lehtinen, 1982; Grönroos, 1983; Carman, 1990; Teas, 1993, 1994; Cronin and Taylor, 1992, 1994; Parasuraman *et al.*, 1990, 1994, 1996; Franceschini and Rossetto, 1997, 1998).

Expectation confirmation theory posits that satisfaction with a product/service is the primary motivation for its continuance (Oliver, 1980, 1981). Satisfied consumers continue using services, while dissatisfied users discontinue them. Perceived usefulness is another determinant for continuance. To ensure customer retention, a service provider must "educate" its own users about the potential benefits resulting from the supplied service. Loyalty incentive programmes are effective only when customers find the service useful and of "good quality" (Jarvenpaa and Todd, 1996; Bolton *et al.*, 2000).

A lot of attention today is given to customer loyalty and retention as indicators of profitability in Internet services (Reichheld and Schefter, 2000; Szymanski and Hise, 2000; Peterson *et al.*, 1997; Kiang *et al.*, 2000). The "satisfaction-trust" connection is crucial for the understanding of market relationship development. Trust and loyalty are both grounded on satisfaction over time (Wilson, 1995; Oliver, 1997).

A dynamic approach to this phenomenon can explain the different configurations of customer loyalty in the various stages of the relationship life cycle (Oliver, 1999; Costabile, 2000a). We adopted these ideas as a conceptual reference framework.

Owing to the advances in information and communication technologies, new marketing approaches have been appearing (Jackson, 1985; Pine, 1993; Peppers *et al.*, 1999; Peppard, 2000).

In this paper, we explore one-to-one customer interactions from three perspectives: SQ, marketing and information technology. We propose a support model based on relationship duration and profitability, taking into account the risk of opportunism. The proposed model analyses the ways by which site managers can collect and estimate e-customer needs over time to perform a better and more personalised service. The focus of the study is given to new e-CRM systems based on active customer involvement (Thompson, 2000).

Using new Web functionalities, integrating the relationship history, and tracking each single contact and knowing customer preferences, we introduce a dynamic model to cluster Web users. The main aspect of the method is the ability to manage a tailored "set of actions" to condition the evolution of the relationship between each customer and the Web store (when and how to take action). The paper is completed with a preliminary practical Web store testing in a sport-clothing industry.

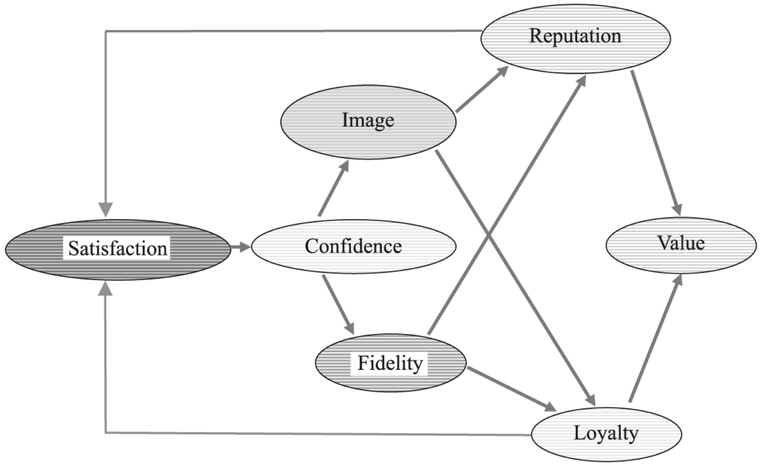
Users management: analysis and actions

In order to understand the performances of a Web site, it is necessary to analyse the data recorded by the Web server. This is a database containing all the site-users' hits[1] recorded in an invisible way during the browsing sessions. From customer tracks, it is possible to characterise weaknesses and force points of the Web site architecture, and to recognise the behaviours of the various user segments. This analysis can be done by mixing site-browsing data with transactional data (purchases and sales data). In accordance with Wilson (1995) and Oliver's (1997) argument, the purpose of the model is to arrange an updated profile of each customer that is not only based on purchases and preferences, but also on the number of times and duration of contacts with the Web site. Furthermore, this information should be integrated into a unique database which contains the records of all user interactions (direct contacts, telephone calls, faxes, e-mail, chat and forum). At present, this aspect can be critical, since almost all on-line store-data are recorded in different platforms. Traffic data are stored into server log files, while purchases/sales data are contained in the so-called "commerce database". Other interactions (telephone calls, e-mail) usually are not recorded at all (Gomory *et al.*, 1999a).

For the user segmentation, we propose a logical model based on the customer relationship evolution. The model consists of some "loyalty states" (LS) that allow the site manager to distinguish customers on the basis of their relationship maturity. The maturity concept is related to the duration of the relationship, the frequency of the contacts and the number of purchases (Meltzer, 2000).

With the aim of characterising homogenous groups of customers better, for each LS, we define also some "within loyalty state segments" (WLSS). The integration of these two classifications allows for both knowing the customer's behaviour (browsing frequency, site navigation time, purchase frequency, pay mode preferred, total orders value, type of interaction channel, reactions to site manager actions) and his/her specific profile (when he/she usually surfs, where he/she comes from, what he/she purchases and prefers).

As reference for the LS structure, we adopt the conceptual model shown in Figure 1 (Oliver, 1999; Costabile, 2000b). It represents in which way the customer-site relationship leads to the "value" creation. According to the concept of relational value, the model considers seven different steps for the customer-company relationship evolution: satisfaction, confidence, image, fidelity, reputation, loyalty and value.



Sources: Oliver (1999); Costabile (2000b)

Figure 1.
Perpetual customer satisfaction machine, relational stock configuration

Figure 1 shows that CS represents only the first step in long-time relationship building. The affection that is developing is characterised by the customer's awareness that a confidence relationship is associated with a remarkable time/resource saving.

The "true" fidelity increases with long relationship duration and numerous transactions and interactions (increase of the brand image reputation). Companies must keep this feeling alive through a continuous effort, anticipating and satisfying new increasing customer needs. By this approach we can achieve a twofold advantage: customer fidelity (buying back and dialogue availability), and brand building/reinforcement. The conceptual model of Figure 1 can be adapted to the e-commerce context.

From the model, we can define the following characters: accidental users, potential customers, occasional customers, satisfied customers, confidence customers, fidelity behaviour customers, fond customers and loyal customers. The user classification is articulated in mutually exclusive classes related to the relationship maturity achieved. The subdivision is organised according to two main criteria: interaction frequency and purchase frequency. The characters are defined in more in detail as follows:

- *Occasional customers*. With this name, we consider those people that make only one order, and do not maintain a continuous dialogue with the Web site organisation. We associate them with a default opportunistic behaviour. Customers do not manifest a real interest to build a long-term relationship with the Web site.
- *Satisfied customers*. They make a unique order, but unlike the previous ones, they interact with the site organisation, showing interest and availability to engage in a long-term relationship.

- *Confidence customers*. Those people maintain frequent contacts with the Web site, having bought only one product.
- *Fidelity behaviour customers*. Those people reconfirm their Web store preference with further purchases, not engaging in any site communication.
- *Fond customers*. Those are people who make many orders, confirming a strong affection to the Web service. They are characterised by confirmed dialogue availability.
- *Loyal customers*. They represent the most desirable of the hierarchical segmentation, a sort of "ideal customer group". The site-manager focuses all his/her efforts on enlarging this segment.

On-line interactions do not only occur with existing customers, capitalising on existing relationships, but also with a wider group of Internet users. With reference to the different Web site products/services, a further distinction between "accidental users" and "potential customers" can be introduced. Therefore, the LS can be structured in eight levels (see Figure 2).

For each segment, we define the user belonging rules and the "basic" actions taken by the Web site manager. Key indicators used to define the segmentation rules concern both the transactional aspects (quantity and frequency of purchases) and the browsing aspects (frequency, duration, timing and contact channel). Table I shows these indicators.

The model database is updated "on fly", allowing monitoring how user parameters and user segmentation change over time.

In accordance with products/services purchased, preferences and access/origin data, for each LS segment, WLSS identify homogeneous customer clusters. The number of WLSS depends on the number of customer profiles we can recognise. In detail, we analyse the following ten attributes:

(1) Type of information requested for the various product/service categories.

(2) Information detail level (general, specific).

(3) Purchased product/service category.

(4) Language (English or other).

(5) Belonging to geographic region.

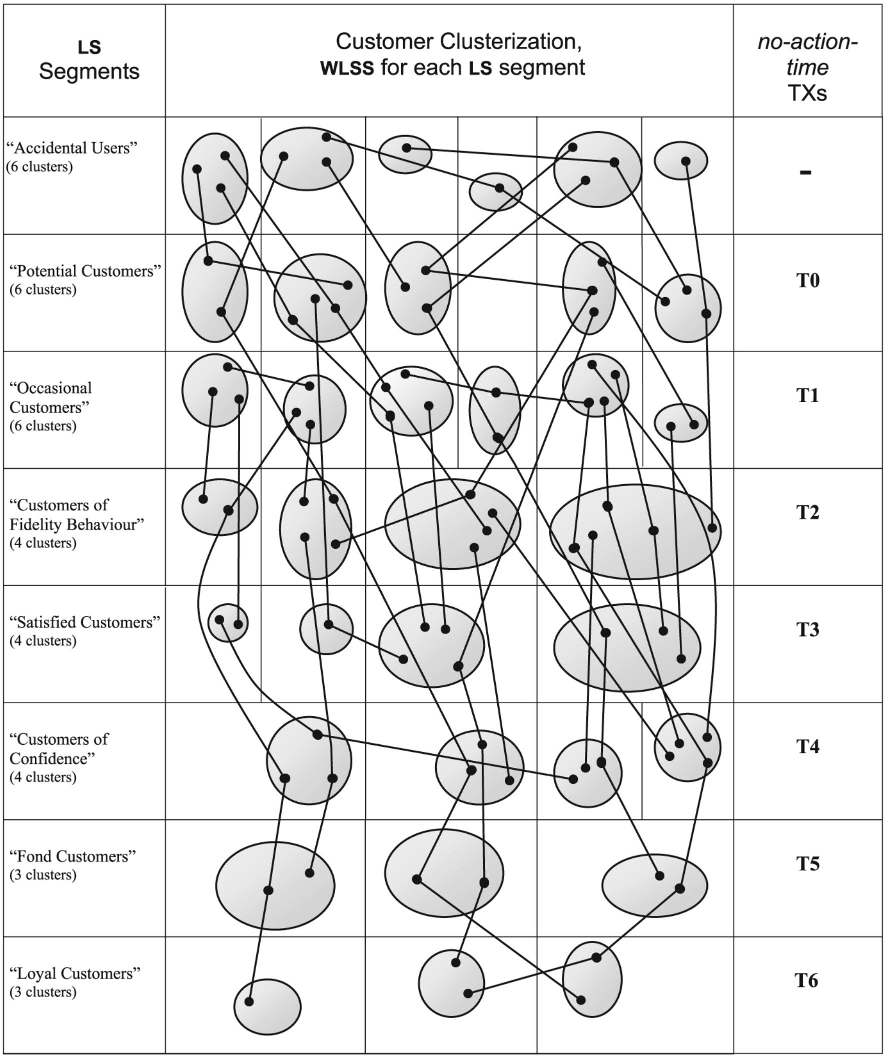
(6) Access: timetable, days (weekend, working days) and time zone.

(7) Origin (advertising banners and their position, links present on internal pages or on Web partner sites, advertising e-mails, direct URL typing).

(8) Purchase with: credit card, smart card, cheque.

(9) "Evolution stage" according to the eight LS.

(10) User computer system (graphic card, screen resolution, CPU, memory, browser . . .).



Notes: For each **LS** the maximum number of managed clusters is presented. Each zone is obtained by a combination of **LS** and **WLSS** states. The figure shows paths for each customer (linked points). In the extreme right hand column, the *no-action-time* periods TXs are showed

Figure 2.
Segment-tidy complete graph, at a time *t*

The ten-values vector describes each customer profile. It represents the core of the clustering process adopted to identify homogeneous groups. The specific LS segment is identified by the (*i*) vector component. The idea is to group "close" customers together (i.e. characterised by similar vector values). Two facts may determine cluster reconfiguration. The first happens when a customer travels from a LS segment to another one; the second when the system acquires new customer information (e.g. a customer moves his/her

Variable description	Variable name
Total browsing time	*T*
Number of user contacts in the month	*N*/30
Total number of loaded pages	*P*
Average permanence time per Web site page	*T*/*P*
Number of user downloads in the month	*D*/30
Number of purchases made in the last four months	*A*(4)
Binary variable that indicates if a purchase has followed a query for some problem	RPA
Number of interactions	*I*

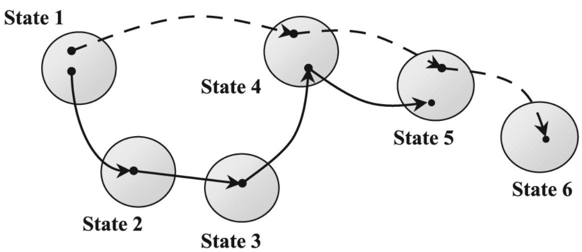
Table I.
Loyalty states (LS) indicators

attention towards a different product or service). The model allows dynamic transitions between different LS and WLSS states.

The historical analysis of each customer relationship is an important tool for identifying recurrent customer group behaviours.

Depicting by graph nodes the customer evolution states and by arcs the state changes, it is possible to trace the relationship evolution of all customers. Each combination of LS and WLSS states defines a cluster of customers with homogeneous profiles. As an example, Figure 3 shows two customer dynamics. Customers are initially grouped inside of the same node (State 1).

Considering the complete Web site graph, which describes the evolution of all customers (see Figure 2), it is possible to analyse what are the common paths for homogeneous customers. When different users starting from the same state arrive to another common state, probably there is a sort of customer "incentive" to follow this path. Other interesting situations are the critical graph states (characterised by a high abandonment or demotion rate), the recurrent states (characterised by a high transit rate), the related permanence time and the stationary states due to users' immobilisation.



Notes: Each node represents a combination of the two **LS** and **WLSS** states. The customer history is described through the sequence of linked nodes. Dotted and continuous lines are related respectively to Customer 1 and 2

Figure 3.
Graph "histories" of two customers

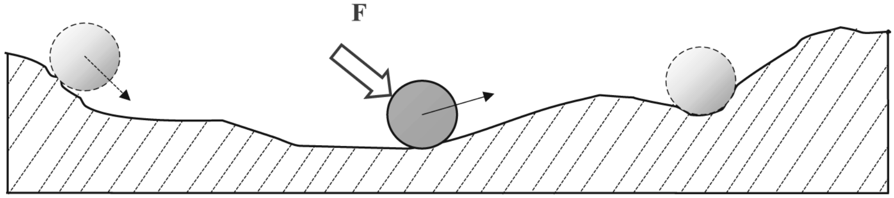
In order to reduce the model complexity, the maximum state number has been *ex ante* fixed for each evolution stage. Figure 2 shows an example of a complete graph with all the possible users "paths", at the time *t*. For each customer, his/her position on the segmentation chart and his/her history are highlighted. This information can support a site manager to set up a pro-active Web site management strategy.

The model suggests a strict analogy between the customer-site and a physical system consisting of a body (customer) moving along a defined path (Web site). For example, Figure 4 shows a spherical body motion, subject to the gravity force. The movement depends on both the layout characteristics (plains, slopes), and on eventual external actions (for example, a force acting on the body). The user-Web site relationship can be analysed in the same way as the body movement. When a customer gets in touch with a Web site, he/she receives some spurs (home-page look and feel, product/service typologies and pricing) that can or cannot determine an interacting or purchasing interest. As an external force can influence the body motion, the site manager can stimulate users to buy back or simply to revisit the Web site again (pushed by price reducing and personalising promotion). The role of the manager comes on "stage", taking specific actions towards customers, modifying the site structure and its graphical look, personalising e-mails ...

This phase is particularly delicate. In order to choose the most suitable and effective Web site actions, it is necessary to pay much attention to customer characteristics. The integrated segmentation model (LS plus WLSS) can become a very useful tool to support the work of the Web site manager.

The basic idea of the model is that of setting up an automatic action system driven by the evolution speed of each user along the different segmentation states (see Figure 2). As strategic regulation, we propose the policy to maintain a uniform flow throughout the reference LS scheme. Following the metaphor of the body motion, this means maintaining a uniform movement along the path. The method implements a feedback regulation based on successful/unsuccessful results obtained by the site manager's actions.

The first difficulty with implementing a "set of actions" is to establish the timing choice. In order to deal with this difficulty, we chose to define the



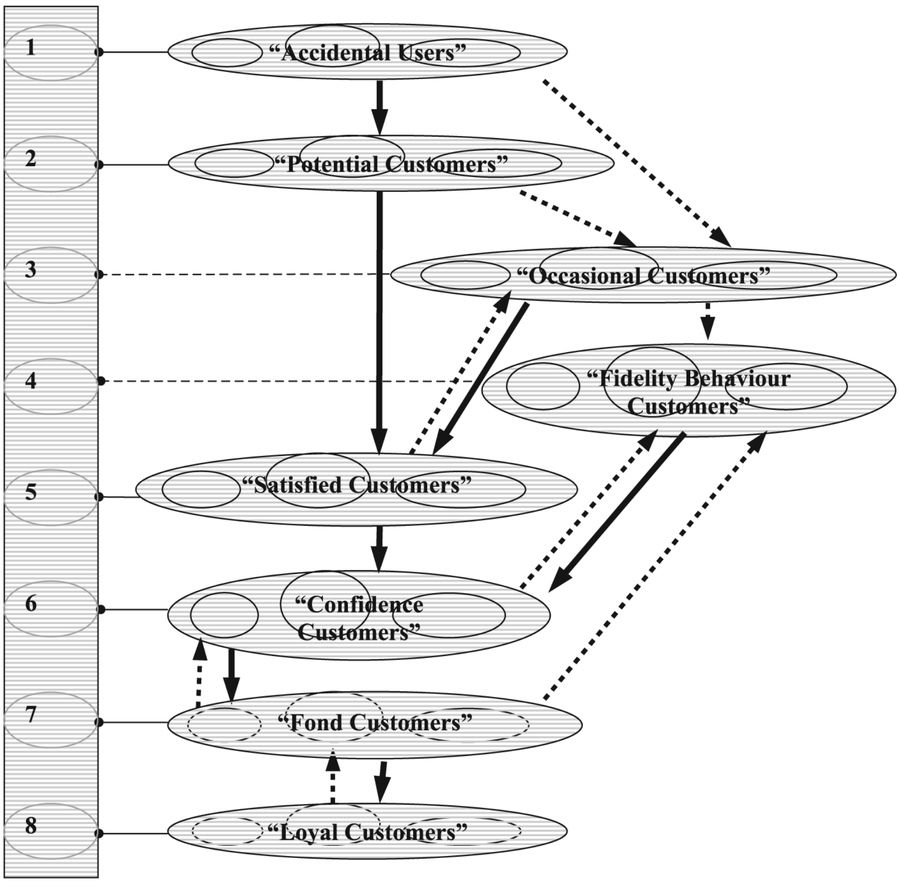
Notes: A spherical body moves in presence of the gravity force. Body motion is conditioned by the layout morphology and by the action of an external force (F)

Figure 4. Scheme of a free-motion body along a defined path

so-called TXs periods (no-action-times), during which the manager limits him/herself to observe customer behaviours.

Figure 2 shows the "no-action-times" TXs for every LS segment. TX values are estimated on the basis of the particular dynamic characteristics of each evolution stage.

Following again the metaphor of the body motion, we can formalise the cinematic aspects of the customer-Web site relationship. In order to simplify the presentation, we refer only to the LS. As it is shown in the Figure 5, each node groups all WLSS clusters, pertaining to the same LS segment (small internal dotted ovals). The model assumes a limited number of possible transitions among LS states. This assumption is supported by our preliminary



Notes: Maturity increasing transitions are indicated with bold arrows, and those associated to relationship deterioration with dotted arrows. In order to emphasize customer opportunistic behaviours, the "occasional customers" and the "fidelity behaviour customers" segments have been arranged in parallel with the "main evolutionary flow". On the left, there are the serial numbers used to indicate the **LS** segment order

Figure 5. Logical scheme describing all the possible state transitions that the *i*-th user can do during his/her relationship evolution

experimental results. Other transitions are not expected, although the method is open to other extensions. In accordance with the relationship maturity, segments are ordered as follows:

(1) accidental users;
(2) potential customers;
(3) occasional customers;
(4) fidelity behaviour customers;
(5) satisfied customers;
(6) confidence customers;
(7) fond customers;
(8) loyal customers.

Figure 5 shows the evolutionary path from the "accidental users" to the "loyal customers". LS states are ordered in a way which gives greater importance to the demonstrated interest for the products/services, and to the number of interactions (site visits, e-mail, chat, forum). Moreover, we mark in a different way the transitions that determine an advance (bold arrows) or a demotion (dotted arrows) of the relationship maturity level.

Figure 5 evidences two segments ("occasional customers" and "fidelity behaviour customers") that are subject to the risk of opportunistic behaviours. By the logic of building a long-time relationship, the transition from "potential customers" to "occasional customers" is considered less important than that from "potential customers" to "satisfied customers". In the first case, the generic user limits him/herself to do a "simple" purchase; in the second, he/she also interacts with the Web site organization (through e-mails, chat and forum) showing interest and availability to establish a long-time relationship.

According to SQ and customer relationship literature, not all evolutionary steps have the same importance. In relational terms, the relationship improvements become more difficult to achieve as the segments are closer to those of the "loyal customers" (Gomory *et al.*, 1999b; Poon and Swatman, 1999).

Associating a serial numeration to the evolutionary steps, and continuing with the body motion analogy, the advancing speed of the i-th customer can be defined as:

$$\mathrm{VM}_i(a - \bar{b}) = \frac{(b - a)}{t_{i,b} - t_{i,a}}$$

where:

$(b - a)$ is the covered distance between the a and b segments.

$VM_i(a - \bar{b})$ is the average speed of the i-th customer.

$t_{i,a}, t_{i,b}$, are the incoming times into a and b segments, for the i-th customer.

The average customer speed between a and b is:

$$\mathrm{VM}(\overline{a\text{-}b}) = \frac{\sum_i \mathrm{VM}_i(\overline{a\text{-}b})}{n_{(\overline{a\text{-}b})}}$$

where $n_{(\overline{a\text{-}b})}$ represents the total number of customers.

The speed calculation is used to define the "no-action-times" TXs. In particular, we set the TXs equal to the average time required to pass throughout each LS segment. This choice is based on the hypothesis that actions induce evolutionary accelerations to the movement (progress-speed variations).

Evolutionary acceleration allows observing customer dynamics after Web manager actions. Speed and acceleration information in absence or in presence of actions are recorded. In absence of direct actions, customer behaviour represents the natural inertia of the Web system.

Together with no-action times TXs, it is crucial to choose the action categories to apply. As an example, one can think of the different effects produced by a generic e-mail or a personalised one (e.g. containing a discount for a specific product line on the Web store). The aim is to maintain a constant evolutionary customer relationship progress. Therefore, Web manager action is stronger, as the respective customer progress speed is lower than the average of the evolution stage. The opposite is true if the customer progress speed is higher.

The construction of a complete "set of actions"[2] allows the Web site manager to implement an automated and personalised CRM system.

Preliminary experimentation at www.kappastore.com

www.kappastore.com[3] is a B2C Web site. It allows users to purchase sportswear articles. The site, operating since January 2000, belongs to the Italian holding BasicNet SpA. The target is to arrange together with an old retail channel a direct channel for on-line purchases (B2C). Moreover, Kappastore.com is a mono-brand Web site.

The main aim of the preliminary experimentation has been the implementation of the user segmentation model in an operating context. In order to limit the testing complexity and the technical restraints related to the integration of transactional and relational data, a simpler version of the model has been applied. Only four LS segments with three WLSS per each LS have been considered. In detail, the following transactional data have been considered:

- the total purchase number;
- the total purchase value;
- the product type/line;
- access and origin data;

- the relationship duration (period between the first and the last purchase); and
- the elapsed time from the last purchase.

Table II shows some preliminary results, which point out customer profile progresses. Being confidential data, we transformed real values by using a scale factor.

The empirical validation of the model is still in progress. At the moment, the preliminary results seem to confirm the model ability to support the on-line decision of the Web site manager.

As one can observe, the "occasional customers" segment represents the largest component of the customer population. This aspect introduces a great interesting stimulus for the site-manager, whose goal is to establish long-time relationships with customers.

Based on both the user classification and the site-performance analysis, the following actions have been engaged:

- Purchase boosting (buy back) of the "occasional customers" and "critical customers", promoting discounted products/services.
- Offer to the "fond customers", a periodic information about the most attractive products and Web site promotions.

All these e-mails have been personalised as a function of the customer preferred product lines. The result of this preliminary operational implementation is not only an average 15 per cent profitability increase (number of purchase and order value), but also a "relational return" measured by a communication and cooperation increase (site surfing, e-mails and calls). The experimental results

Table II. Total customer numbers characterising the four user segments, at a same date

Date	Total customers	Occasional customers	Not classified	Critical	Fidelity behaviour customers	Fond customers
31 January 2001	160	142	16		2	0
28 February 2001	289	219	54		16	0
27 March 2001	421	306	78	8	37	0
3 April 2001	447	311	119	11	17	0
10 April 2001	484	330	132	14	22	7
17 April 2001	513	346	142	21	25	7
24 April 2001	550	339	188	27	23	14
30 April 2001	562	382	142	32	24	14

Note: Total customer numbers characterising the four user segments, at a same date: "occasional customers"; "fidelity behaviour customers"; "fond customers"; and the so-called "not classified", inside of which there are the "critical customers". These last ones are who, after a long interaction period, have not made more purchases in the last 30 days. Customer profile evolution is shown by the gradual population increase for the most "mature" segments show a weak reduction of "fidelity behaviour customers" and an increase of the "fond customers".

During the experimental campaign, the site manager appreciated the use of e-questionnaires to obtain a complete feedback about fond customers' interests.

Conclusions

The paper introduces a new model to support the relationship management of a quality e-commerce Web service. The advantage of virtual transactions is the ability to follow a large amount of users without losing the necessary level of detail.

The main novelty of the method is the proposal of a new customer knowledge database. Monitoring and controlling the customer profile evolution allows companies to define a structured strategy to manage customer relationships.

Preliminary results for a sport-clothing industry application seem to confirm the model ability to support the on-line decision of the Web site manager. The model tends to increase the customer interest for an overall transaction experience, since the progressive interactions create a sense of personalisation and cooperation between customers and Web site manager. Managers also feel empowered through being able to generate, exchange and thus influence market signals. Another possible implication of this work is that Web site managers may eventually superseded by intelligent software systems. This issue of disintermediation will also be addressed in our future research.

The method can be easily extended to other e-retailing contexts and B2B services. In addition, the adoption of this method could be more effective in B2B e-commerce services if the number of customers is small and the transaction values are high.

Some future developments of this work will be the following:

- setting up of more sophisticated techniques for the acquisition and the management of information collected during customer interactions (data-mining);
- definition of reference standards in order to benchmark Web site performances;
- testing of the model stability by means of a Monte Carlo simulation (stochastic processes).

Notes

1. Activities made by user during his/her surfing (page loading, file downloading …).
2. Set of manager's actions towards different customers.
3. Special thanks to Lodovico Marengo (the site manager), for his invaluable help.

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