

Loyalty versus Attraction in a Dual Object Oriented Modelling Framework for Marketing Simulations on the Internet

Introduction

Marketing - The art of attracting and keeping customers

Marketing is the art of attracting and keeping profitable customers (Kotler and Armstrong, 1996). It is a dual approach to competition that alternates attraction and customer retention. The shift from transactional and relationship marketing facilitated by new information technology reinforces this duality.

Relationship marketing as opposed to traditional transactional marketing is based upon maintaining long term relationships with the customers, that are not simply a sequence of discrete transactions, and are obtained by creating satisfaction and additional value for the customer.

Loyalty and Attraction as Market Response

The main objective of marketing is to generate response. Response is fundamental to marketing and is the starting point in this modelling approach. At customer level response can be seen as dual and can ultimately be reduced to Loyalty and perceived Attractiveness toward a brand, a company or a service.

Progressive modelling approach based upon Response

Response, the expected effect of any marketing action, is central to this modelling approach. Complexity of response functions is increased progressively forming a hierarchy of abstractions. This complexification process progressively integrates various response effects and continues up to a point

where a marketing model representing monopoly situations is prefigured.

At this point the complexification process changes direction. It favours entity abstractions as opposed to action abstractions and gives priority to modularity at the expense of hierarchy of abstractions in order to introduce duopoly and oligopoly situations, multiple products' offer and demand segmentation. At this stage the order of complexification goes from framework models, to generic and specific ones.

This progressive modelling approach aims to improve productivity, and flexibility in building and implementing marketing models.

Object oriented design to manage modelling complexity

Definition

Object oriented design is a way of analysing and building complex systems and decomposing them into logical models (classes and objects) and physical ones (processes and module architecture) with their static and dynamic interactions.

It has been largely developed in computer science and it is standard on the World Wide Web. As a system analysis method and a programming method it marked an important evolution compared to the procedures oriented approach.

Model based marketing decision support systems are complex systems and can largely benefit from this evolution.

Objects as Gestalts

The Gestalt theory, developed at the beginning of the twentieth century in order to sustain psychology of perception, came up with a metaphor that facilitates decomposing and composing complex systems.

The "Gestalt" is defined as an organised and organising (tangible or intangible) shape, identified by a cognitive act of perception (LeMoigne 1990). For example the atom, the molecule, the macromolecule, the cell, the tissue, the organ are "gestalts" that make it possible to describe the complexity of the universe by a hierarchy of stable successive functional levels.

Conversely, during a complexifying process that grows by stabilising stages like a modelling project, being able to identify such gestalts can keep the process intelligible, low cost as regards computing resources and able to generate

diversity.

Object oriented design is such a method that is able to sustain such a complexifying process.

Object orientation a method for sustaining a complexifying process

In object oriented design terminology classes play the role of gestalts.

Classes are types or categories while their instantiations are objects. Classes of objects are described by a state (properties or characteristics) and by behaviour (operations or methods).

Attributes of a complex system

Curtois (1985) has suggested five attributes of a complex system that justify a object oriented approach:

1. Complexity takes often the form of hierarchy within which a complex system is decomposed in subsystems linked to each other, having their own subsystems. This decomposition continues till elementary components are attained. A model decomposes the marketing system into marketing environment, the competing firms acting in this market and the market segments that respond to the actions of the firms. Each firm has its marketing mix decision subsystem. Each segment has its response subsystem to marketing mix stimuli and so on.

2) The choice of primary components is relatively arbitrary and depends on the observer's judgement.

3) The links within the components are generally stronger than the ones between the components. This allows a separation between high frequency dynamics concerning the internal structure of components from low frequency dynamics concerning interactions between components (Simon, 1982).

4) Hierarchical systems are usually formed of a small number kinds (categories) of subsystems appearing in various arrangements and combinations (Simon 1982).

5) A complex system that is working has always evolved from a simple system that worked. A complex system built ex-nihilo never works, it must be derived from simple ones that work (Gall, 1986).

Major and minor elements defining object orientation

The object oriented model is defined by four major elements (abstraction, encapsulation, modularity and hierarchy) and by three minor ones (typecasting,

simultaneity and persistence).

Abstraction

Abstraction is a simplified description or specification of a system, highlighting only some details or characteristics of the system and suppressing the others (Booch, 1992, p.41). An abstraction emphasises essential characteristics of an object, that distinguish it from other kinds of objects and gives rigorously defined conceptual boundaries from the point of view of the observer. A model itself is an abstraction. In a decreasing order of utility we distinguish the following four kinds of abstractions: entity, action, virtual machine and coincidence abstraction.

Entity abstractions define objects representing the model of an entity from the domain of the problem. In a marketing model market, firms and segments as objects are entity abstractions.

Action abstraction defines an object implementing a generalised group of operations having the same kind of functions. In a marketing model the "response" object can be such an abstraction because it has the same functions for the market and segments seen as objects.

Encapsulation

Encapsulation is the "occultation of information" it is a procedure by which all details of an object are hidden, that are not part of its essential characteristic.

For a manager the essential characteristics of a model are the inputs and outputs. They should be visible and adapted to the manager's understanding and language while the internal parametrisation of the model should be hidden. Encapsulation makes a model easy to communicate with.

Modularity

Modularity is a feature of a system which allows it to be decomposed into coherent modules weakly linked.

Hierarchy

Hierarchy is an arrangement or ordering of abstractions. Heritage is a special kind of hierarchy in which a subclass inherits from one (simple heritage) or several (multiple heritage) super-classes.

Typecasting

Typecasting is imposing the class to an object, in such a way that objects

belonging to different classes could not be inverted. Polymorphism is a linked concept, meaning that a unique name, like a method declaration could denominate several kinds of objects (classes) which are connected by a common super-class.

Simultaneity

Simultaneity is concentrating on processes and their synchronisation. Each object (abstraction of the real world) can have a separate control task (process abstraction), such objects are called active. Thus simultaneity is a property distinguishing between active objects and those that are not. Interactiveness in model based marketing decision support systems relies a lot on simultaneity.

Persistence

Persistence is a characteristic that is marking the existence of the object in space and time.

Modelling response

Generic response as super-class

Response as a hierarchy of abstractions

Figure 1. Object oriented modelling framework for Response in Marketing

Dual marketing modelling framework

A progressive modelling framework

The progressive model building approach suggested here is particularly adapted to marketing simulations. It is illustrated by a sequence of framework, generic and specific models with variable degrees of complexity.

Figure 2. A dual framework model

A generic marketing simulation model

The latest in this series is a minimalist marketing simulation model combining transactional and relationship marketing, the two paradigmatic dimensions

coexisting in nowadays marketing strategy.

In this model, transactional marketing mix is represented by brand positioning and repositioning strategies supported by traditional communication activities. The market is a perceptual space governed by gravity laws. Brands are positioned and exert attraction upon customer segments who have mass and "ideal point" positions in the market space.

Relationship marketing mix is represented by interactive marketing activities (e-commerce and/or direct marketing), by customer retention and loyalty programmes aimed to increase product/brand quality and indirectly customer satisfaction or to increase switching costs (loyalty cards, frequent flyer programmes etc.). A comprehensive review of loyalty programmes can be found in Meyer-Waarden and Benavent (2001).

Dual market segmentation

Each positional segment has relationship sub-segments (key and non-key customers) with variable responsiveness to transactional and relationship mix efforts. Key customers tend to be more sensitive to relationship mix incentives than non-key.

Market share results from a subtle transition mechanism governed by attraction and loyalty: new customers come into the market, others leave the market, some become loyal and others turn "versatile".

Loyalty and perceived Attractiveness - Segment's Response

Market Segment's response to marketing efforts is dual. It results in loyalty and perceived attractiveness.

Traditional, transactional marketing mix activities like "4P" programmes generate primarily attraction while newer relationship marketing mix is supposed to generate customer retention and loyalty.

Loyalty toward a brand is measured as the proportion of "hard core loyal" customers. The distinction between "hard core loyals" and "potential switchers" was first used in marketing by Alfred Kuehn (1961) and more recently by Colombo and Morrison (1989) and Bultez (1996 and 1997)

Figure 3. Loyalty and Attraction at Segment level

Segments' varying response to marketing mix

Key and non-key segments have their own response function and varying reactivity to marketing mix efforts. The reactivity to "retention mix" is modelled to

be stronger than the reactivity to offensive marketing. It uses the generally accepted assumption that it is less costly to keep existing customers than to attract new ones.

The market response functions are S-shaped and use relative input. This means that, compared to a previous period, one can estimate the needed effort in order to maintain the same market response and one can identify the lower and higher limit within which the market response can vary given different relative amounts of marketing effort.

Response parameters and functions vary by segment and mix element according to a given scenario (Figure 3)

Figure 3. A scenario with varying response functions for key and non-key customers

Customer Flows

The customer flows from one period to the other between a given brand and the market are shown by the transition diagram in Figure 4.

There are two kinds of repeat buyers: hard core loyal customers and regained switchers. The customers gained from other brands and those lost to other brand are also considered to be switchers. Market entry and exit is modelled using a combination of market specific renewal and growth rates. The renewal rate is constant and indicates the number of quitting customers that are replaced by new ones as compared to the total number of customers. The growth rate can be positive when additional customers enter the market and negative when additional customers leave the market. Both renewal and growth rate are exogenous values, given in a predetermined scenario.

Market transitions

The transitions mechanism on the market (or market segment) is controlled by a transition matrix like the one in Figure 5.

Transitions are governed by retention and attraction forces generated by brands' transactional and relationship marketing mix efforts.

Figure 5. - Customer transitions determined by brands' attraction and retention, and market entry and exit rates.

In order to distinguish market entry and exit from customer transitions between and within brands, the transition matrix is divided into four areas. They are highlighted with different colours. The same division is maintained in the formal

representation of the same matrix given in equation (4). Market entries are controlled by the first row, a vector recording the part of new customers attracted by each brand. The first column controls the proportion of customers that are leaving the market. The remaining matrix defines the transitions between and within brands. The main diagonal of the latter matrix contains customer retention probabilities which consist of loyalty (the part of hard core loyal customers) and the part of regained switchers as suggested by Bultez (1996 and 1997).

where: b = customers' renewal rate; g = customers' growth rate ; d = dummy variable that is one when $g \leq 0$ and zero otherwise; F = diagonal matrix of loyalty rates; f = vector of loyalty rates ; a = attraction vector.

The proportion of "hard core loyal" customers a firm has in each segment is given by the loyalty index. It depends on the defensive mix it opposes to other brands.

The relative attractiveness of the competing firms on each segment (at market level) determines the share of switchers and new customers it obtains.

The variations in market share and in customer structure from one period to the other determine overall gains.

Within versus Between segments transitions

Market transitions represented above are operated at segment level. They can be seen as within segment transitions as there is no exchange with other segments. RFM like transitions dear to direct marketing are typically between segment transitions.

In this model between segments transitions are limited to relationship sub-segments (key and non-key customers) and are implemented in a simplified way. They are predetermined by the market environment (scenario induced) and cannot be influenced directly by interactive marketing activities.

It is relatively easy to change this exogenous transition mechanism to an endogenous one where transitions from key to non-key are described by a customer migration tree and governed by probabilistic response rates, that can be influenced by direct marketing activities.

We have here a loose integration point with the direct marketing model presented above and a demonstration of the flexibility of this modelling approach.

Marketing simulation as a web application

Separating presentation, business and data access logic

The simulation is built as an e-business application. It follows the latest multitier technology that separates presentation, business and data access logic (Figure 6.). Presentation logic uses server pages (Java Server Pages - JSP, Extensible Server Pages - XSP) to deliver information in a visually rich, human readable form. Java Beans are used as part of a middle "business-logic" layer meant to buffer the presentation logic from the data-access logic. Business logic in this application encapsulates at least three separate tracks, game logic, internal model logic and persistence logic.

Figure 6. The Marketing Simulation as multitier e-business Application

Persistence logic

Persistence logic is common to all e-business applications based on this technology. The beans, not the JSP pages, contain this logic that directly accesses the database. The database is managed by a database server. It contains tables where business logic information, structured as bean properties, is persistently stored. Besides domain and application specific behaviour, Beans have also persistence behaviour enabling them to create a persistent state by inserting new records in database tables and load or store their properties that need to be persistent from or to the corresponding table records. In this application most of the beans representing Economies (or Games), Companies (or Players), Brands, Segments etc. have corresponding tables in the database, where their persistent state is kept.

Game logic

The simulation is organised as a marketing game, that although minimalist, covers all important aspects of marketing. A more detailed description is given in Annex A.

As an online game it is a kind of service (like banking or tourism) and can be regarded as a simple e-commerce application. The game logic is rather generic, it can be applied to several applications of this kind (Financial-, Business or Marketing games). It introduces several important topics in e-commerce

applications like security, registration, authentication, session management, cookies etc.

This logic is mainly encapsulated in the Game and Player Bean.

Model or Simulation logic

The model or simulation logic is application specific. An illustration is given in Annex A. The behaviour concerning this logic is integrated to the Brand, Segment and Market Bean.

As many e-business applications, this marketing simulation also makes heavy use of Javascript and Java applets as client side programming capabilities. Client side programming is not only used as presentation helpers to produce 2D or 3D perceptual maps, visual brand positioning tablets or customer migration illustrations but they enable full fledged model simulations for the whole generic model and for any specific marketing or direct marketing activity. In this way the player can either experience the mechanics of the whole marketing game or train on specific aspects concerning decisions they have to take. On the same occasion they can experience and understand the important difference between only client side application and client-server applications.

Decision support systems are also included for the more difficult tasks, like finding the optimal brand position or the best budget allocation between transactional and relationship mix elements.

Integrated decision support

Flexible modelling scheme

The suggested modelling scheme is flexible enough to accommodate decision support systems on specific subjects. The main model is generic, its components, representing specific marketing activities, can be expanded or reduced; industry specific vocabulary can be added in order to obtain several distinct simulations. This results in simulation models for specific marketing activities or particular industries. Learning tracks on the subjects the models represent can be easily built around them.

Decision support with client side simulations

Decision support in this simulation framework, consists of client side simulations and decision support systems.

The client side simulations allow the user to train offline with the simulation

models having only his computer as a partner. A simple framework model, a more complex generic model and a specific direct marketing are implemented as client side simulations. Simpler computational simulations on particular CRM subjects like LTV, customer migration etc. are also available.

Decision support systems

Two decisions support systems have been developed in order assist users in brand positioning and repositioning policies and in marketing budget allocation.

The brand positioning support system evaluates market share a company can obtain by changing the positioning and attractiveness of a brand. It also finds the optimal positioning for a brand taking into account given positions of partner and competing brands. The optimisation model is adapted from an optimal location model presented by Drezner (1994).

Allocating marketing budget between marketing mix programmes and especially between customer acquisition (offensive marketing mix) and retention (defensive marketing mix) is an important and difficult decision. The decision support system used here implements a model by Blattberg and Deighton (1996). The model finds the optimal balance between spending on acquisition and spending on retention using estimated responsiveness to acquisition and retention budget variations.

Conclusions and Further Research

Contributions

In this paper a modelling framework is developed and implemented as an Internet application using new technologic concepts.

A progressive marketing model building approach is presented. It starts with a dual framework model seeking to capture the essence of marketing action as a generator of attraction and loyalty. It continues with a generic model, adding detail and tending to become "realistic" while still remaining general purpose. Finally specific models can be developed.

In order to cope with growing complexity that is inherent to such a progressive modelling approach, flexibility, modularity, task separation and object orientation are guiding principles. While dealing with these concepts in a web application many important topics concerning building e-commerce and e-business applications are illustrated.

Wrapping models in simulation games and heavy use of metaphors are ways to make models more user friendly and easier to understand. They are the bit of

sugar that makes the medicine go down. Besides their pedagogical purposes, they are also meant to open up the rather fragile communication between model building academics and managers or practitioners who are supposed to use them.

Limitations

The developments presented here have certain limitations some of which need to be evoked.

Some of the metaphors used and presented here have limitations that can be discussed. Seeing market competition as warfare equates it to a zero-sum game, which is rarely true. Loyalty to a brand is rarely absolute

A detailed discussion on use and abuse of metaphors and a comparison between metaphors and models can be found in Van Den Bulte (1994)

Further developments and research