

# FEATURE MIX

## AGENT SYSTEM FOR FORMULATING MARKETING MIX FOR ECOMMERCE WEBSITE

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# INTRODUCTION

Marketing Mix concept describes a list of marketing categories that marketer should reconsider when formulating a strategy, but also an idea of *the marketing man as an empiricist seeking in any situation to devise a profitable "pattern" or "formula" of marketing operations from among the many procedures and policies that were open to him* (Borden, 1964, str. 9). As these two basic foundations of the mix concept became in next years reduced and oversimplified to the 4Ps marketing management tool (McCarthy, 1960), the core of Marketing Mix idea as a process of mixing of marketing ingredients is still actual. However, the concept of persuasive Marketing Mix actions crafted for mass production, mass consumer and mass media environment seems to be difficult to apply in a new global, networked, segmented, customized and finally digital world; the idea of mixing process that result in a mixture of ingredients most suitable for the group of customers can be advocated by introducing new ideas into the concept: interactivity and feedback, consumer and service orientation, knowledge and experience usage. Digital environment for running e-commerce businesses offers technological tools for achieving these goals.

Technology has changed consumers and their behavior. Globalization and e-commerce gave the consumers a possibility to choose the product from enormous offer. Internet and social media gave them full access to information and a power to create global relationships. The digital revolution in communication, information and commerce changed consumers' behavior, needs and desires (Constantinides, *The Marketing Mix Revised: Towards the 21st Century Marketing*, 2006, 22). New consumer is better informed and more critical, demanding, individualistic, involved and independent (Capon & Hulbert, 2000). Following this changes, marketing gained interactive nature and became market-oriented and customer-oriented, as a process of taking care of the fulfillment of customers' and other partners' needs and behavior (Gronroos C., *Quo Vadis, Marketing? Towards a Relationship Marketing Paradigm*, 1994,10).

*The marketing concept became notion that the firm is best off by designing and directing its activities according to the needs and desires of customers in chosen target markets (Gronroos C. , Quo Vadis, Marketing? Towards a Relationship Marketing Paradigm, 1994,10).*

According to a new logic of marketing as service-centered process companies continuously adapt to consumers' preferences and needs that dynamically change over time, identify consumers' needs and design the product to fit them rather than create consumers' needs to fit the product.

*The service-centered view of marketing means more than simply being consumer oriented; it means collaborating with and learning from customers and being adaptive to their individual and dynamic needs (Vargo , Stephen; Lush, Robert, 2004, str. 6).*

When the same product or service is available at a number of e-commerce websites that are a click away from each other, the value offered shifts from a product or service itself, to the usage experience and consumption process. When companies are competing on electronic markets by using knowledge, skills and technology to manage the process of relationship building and consumption, the main problem addressed in this paper arise: how to formulate *a dynamic and interactive and individualized marketing mix* within an e-commerce environment.

Clickstream data available for every website contain information about customer interaction with a website. Mining this data can be helpful in designing new targeting procedures, giving the base for the mixture of marketing actions (Moe & Fader, Capturing Evolving Visit Behavior in Clickstream Data, 2001). Literature points out two types basic of online consumer behaviors: goal directed and experimental (or exploratory) browsing (Wolfenbarger & Gilly, 2000). Goal directed customers derive their satisfaction from speed and convenience of fulfilling their shopping goal. On the other hand for users driven by experimental browsing an experience, fun and positive surprise are main sources of satisfaction. Knowing that there are different motivations for users visiting a website we can try to modify website marketing and user experience to better fulfill visitor needs and expectations. Can differentiating marketing mix for visitors having different motivations be profitable for a company? In fact it is already known that consumers that don't plan any purchase, are more sensitive to the incentives (Janiszewski, 1998) what can be used to increase sales. Clickstream data contain full record of interaction between a visitor and a website, thus may reveal customer motivations behind a visit.

Goal of this thesis is to develop a formalized method for using this data to optimize marketing mix for each website visitor separately. To achieve this goal we need a system that will be able to discover patterns in clickstream data that reveal user motivations and optimize a mix of marketing actions for each of the patterns discovered. It should be underlined that each website is a specific environment with specific users, specific goals and motivations driving their behaviors. Also marketing actions that can be performed are specific for each website. Therefore the method proposed should be able to discover all those specifics of a given website while still being general enough to be broadly applicable. However this goal can be surely achieved in many different ways we use an multi-agent system to model and modify the shopping experience. Multi-agent systems are composed of agents and rules that drive interactions between them and the environment. Even though a single agent can be a quite simple computer program without any adaptive capabilities, a system composed of many such entities is able to change itself with time to adjust to the environment. Those adaptive capabilities of an agent system as a whole are used to model all the specifics of the website environment.

*“An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators” (Russel & Norvig, 2003, str. 32)*

In the proposed method the *environment* is a website itself. Agent *sensors* analyze clickstream data to provide information about user behavior within this environment, and agent *actuators* are marketing actions that can be performed within a given website. This novel approach let us explore unique adaptive capabilities of multi-agent systems in website marketing optimization problem. Creating an opportunity to create a method that is both general and formalized while still being able to capture and model all the specifics of a given website and motivations driving its users. Designed system attaches one or more agents to each visitor individually thus creating an unique mix of marketing actions. Therefore each visit is becoming a micro experiment in which a marketing composition is tested whether it fits visitor preferences. An outcome of this experiment creates a feedback loop validating both rules for analyzing clickstream data and marketing actions performed by an agent.

The proposed method has been tested on a real world website where over 70 agents has been dynamically mixing marketing actions for eight months serving over 600 thousand visitors. A few profitable marketing actions and clickstream analysis rules have been discovered and validated in over 800 thousand experiments, but much more

of them has been discarded as not generating any profit. For instance the system was able to discover that users visiting a website for a first time are much more price sensitive than others. However outcomes of those experiments should not be generalized for of all e-commerce websites, they show that the method is able to discover patterns in traffic data that joined to marketing actions lead to increase in both sales and profit. Optimizing marketing mix for generating more profit for an e-commerce website seems an attractive perspective from a business point of view. Nevertheless marketing mix is important for e-commerce, user experience depends on much more than marketing. In the last chapter of this thesis the method is generalized to mixing website features rather than just marketing elements.

# THEORETICAL BACKGROUND

*Marketing* is a knowledge and philosophy on how to run a business, more precisely on how to act and react with market and consumers. Not surprisingly, when market and consumers change, also marketing theories and practices evolve. In the economy of industrial age, market characteristics were rather opposite than common with market features of the age of information. In the economy of mass production, mass market, mass communication and highly competitive distribution channels one way mass media communication allowed persuasive advertising actions. Hence, companies were rather likely to act on the market rather than interact with a market. In 20<sup>st</sup> century, economy and societies went through technological revolution that formed new, digital forms of business, digital markets and consumers. Information has become crucial both for consumers and for companies; exchange of information slowly replaces exchange of goods. These were phenomena that influenced and redefined consumers, market and companies; in a result also marketing. In 1948 Culliton noticed, that a business man running a business is as a decider, an artist that mixes ingredients while considering business decision (Culliton, 1948) and create mixture of different marketing actions in any given situation (Borden, 1964). Then, the concept quickly evolved to the 4Ps Marketing Mix theory (McCarthy, 1960) in which marketer push market and consumers in optimized mixes of actions, next targeted to statistically segmented groups of consumers (Smith, 1956). The concept assumed that it is possible and profitable to influence consumers with various versions of the product, price modifications, distribution channels and communications, composed in the best possible way for studiously matched segments. Nowadays the concept of marketing seems to be no longer focused on tangible goods and pushing actions to the market, but considers mainly the exchange of information, interaction and the process of learning and co-creating value together with consumers.

*Marketing has moved from a goods-dominant view, in which tangible output and discrete transactions were central, to a service-dominant view, in which interchangeability, exchange processes, and relationships are central (Vargo , Stephen; Lush, Robert, 2004)*

## MARKETING MIX THEORY

The idea and marketing mix concept emerged in the 1950s and was inspired by interesting social and economic observations made in food manufacturers market (Borden, 1964). Culliton noted that a company executive is a decider *who sometimes follows a recipe prepared by others, sometimes prepares his own recipe as he goes along, sometimes adapts a recipe to the ingredients immediately available, and sometimes experiments with or invents ingredients no one else has tried* (Culliton, 1948). It was quite intuitive idea that decision maker is rationally thinking individual, who varies different scenario for coming situation to rationally consider best solution in actual circumstances. Not having a lot time for the decision, business executive often uses social heuristics like *follows a recipe prepared by others, and adapts a recipe to the ingredients immediately available*. But also individually *prepares own recipe, experiments with or invents ingredients no one else has tried*. A businessman running a new marketing strategy uses different ways and tools to create each scenario from different elements, what makes the process complex. Hence it's often a company secret how to run a business and make good strategic decisions and the reason why process innovations usually give a company greater competitive advantage than product innovations. It's really hard to copy know how and processes, hence competitors often have to reinvent them what often takes a long time. Economic research findings were similar. Each company while forming marketing strategies had tended to uniqueness. Observed food manufacturers (1929, 1948) formed similar groups when product lines, sales amount and territorial extent were analyzed, but they differ from the ratios of *sales devoted to the various function of marketing such as advertising, personal selling, packaging, and so on* (Borden, 1964). When researchers considered costs relatively to different marketing components, the data varied widely, even for companies with the same product lines, sales amount and territorial extent ratings hadn't created any common patterns. The conclusion was that the marketers of analyzed food companies had probably chosen a different scenario in a base of available marketing components what could explain observed costs diversity. The marketer challenges company limited

resources and actual market forces (consumers', competitors', trade's and governmental behavior) and creates individual strategies, personalized to company actual situation and further plans. That was the beginning of marketing mix concept.

*The marketing man as an empiricist seeking in any situation to devise a profitable "pattern" or "formula" of marketing operations from among the many procedures and policies that were open to him (Borden, 1964, str. 9).*

The idea involved three basic conclusions that changed marketing theory and practice for many years.

- The marketing man composes personalized manner the company lead the business.
- This manner is created in a base of chosen processes relative to different marketing areas from which Borden proposed twelve to consider: product planning, pricing, branding, channels of distribution, personal selling, advertising, promotions, packaging, display, servicing, physical handling, fact finding and analysis.
- The mix of procedures and policies should be the most profitable possible. Profit function for the chosen mix should be optimized by a marketer.

In next years the twelve marketing mix elements originally presented by Borden as guidelines and areas to consider many times became reduced to four P's: Product, Price, Place, Promotion (McCarthy, 1960) and were understood as a list of categories of marketing variables. 4Ps as variables possible to control, manage and optimize. Few years later Kotler confirmed in 1<sup>st</sup> edition of Marketing Management that is possible *finding the optimal marketing mix tool that allows the optimal allocation of the marketing effort* (Kotler , Marketing Management, 1967). The 4Ps became treated as parameters in marketing strategy that can measured and used to influence consumer buying process and decisions (Kotler, Marketing Management , 2003).The foundations of Management School of Marketing emerged, together with theory and practice of marketing management focused on mix elements shown in Figure 1.



**DIAGRAM 1 – MARKETING MIX (KOTLER, MARKETING MANAGEMENT, 2008)**

The marketing mix defined by Kotler is *the set of marketing tools the firm uses to pursue its marketing objectives* (Kotler, Marketing Management, 2008). Marketing manager can choose from tools showed in Figure 1 (e.g. advertising, packaging, and price list) and can especially engage in one of the activity areas: product marketing, price marketing, place marketing and promotion marketing or mix of them. Moreover, *Marketing-mix decisions must be made for influencing the trade channels as well as the final consumers (...). The four Ps represent the sellers' view of the marketing tools available for influencing buyers* (Kotler, Marketing Management, 2008).

#### *CONCEPT REVISION AND EVOLUTION*

Despite the essence of mixing ingredients and 4Ps remained the same, since the 1960s the concept was changed, extended and criticized: Kotler 1984, Ohmae 1982, Robins 1991, Virginalli and Davies 1994, Bennett 1997, Yudelso 1999, Schultz 2001 (see e.g. Constantinides, 2006). During last 50 years concept changes followed economy drifts, from the world characterized with mass consumer markets, mass media and mass production in 1960s toward increasingly global, networked, segmented, customized or even personalized markets of today (Kotler 2001, Castells 2007) *where innovation, customization, relationship building and networking have become issues of vital significance* (Constantinides, *The Marketing Mix Revised: Towards the 21st Century Marketing*, 2006, 22). Negative concept reviews focused mainly on three marketing mix

limitations (Constantinides, *The Marketing Mix Revised: Towards the 21st Century Marketing*, 2006, 22):

- The 4P's marketing mix concept is internally orientated
- Lack of consumer interactivity in the 4Ps marketing mix concept
- The 4Ps marketing mix concept doesn't involve strategic elements.

Concept of 4Ps was created while observing food manufacturers in the mass product and mass consumer market of 1950s. It was also mass media market, where the most profitable marketing actions were based on an approach where firms push information in ads monologue to influence consumers. Nowadays market has different characteristics; it is global, highly competitive, with networked and informed consumers that create information about product and companies. Moreover, consumers are blind on ads, more powerful and better informed than ever and hence push strategy doesn't work that well. In a new economy pull strategy seems to be taking over. Web 2.0 forced companies into dialogue with clients, where they try to engage consumers in conversation, product inventing and company growth. That's the second 4Ps model limitations – lack of interactions on a line company-world. In classical marketing mix strategy no interaction between company and consumers is took under examination. Moreover, the 4Ps classical theory and practice doesn't consider market in wider, strategic perspective. It's understood more as a set of marketing tools uses by marketer to act in a given situation, or to examine the effects of chosen mix by observing changing costs and profits. Critics noticed that marketing mix was not considered as a complete planning instrument for company operating nowadays in environment with uncontrollable, external factors in highly competitive, innovative, dynamic, often changing, networked and technology-mediated markets. The Marketing Mix limitation that makes the concept inadequate for modern economy is basic for the concept assumption that consumers' behavior is predictable and controllable and company can strongly influence it by marketing actions. It's an assumption from mass product and mass consumer market with relatively high consumers' switching costs. Nowadays, for consumers that can choose the product from enormous market offer and compare quickly its prices proposed by competition, the switching costs decreased significantly, and no pattern relative to consumers' behavior is sure in a long perspective. Furthermore, in networked world and economy, consumers' decisions are more socially influenced. Hence, human behavior in large groups (e.g. segments) is hard to predict, because it is a complex phenomenon where a little change at the beginning of the process lead to huge differences at the end of the

day. The last serious methodological limitation of Marketing Mix model derives from its construction as a list of categories of marketing variables. *This way of defining or describing a phenomenon can never be considered a very valid one. A list never includes all relevant elements, it does not fit every situation and it becomes obsolete* (Gronroos C. , Quo Vadis, Marketing? Towards a Relationship Marketing Paradigm, 1994,10). Well known critic made by Constantinides articulated this limitation and pointed weak model validation in different types of context. Constantinides collected literature's criticism of Marketing Mix theory relatively to six marketing sub-disciplines: Consumer Marketing, Relationship Marketing, Services Marketing, Retail Marketing, Industrial Marketing and Electronic Marketing (Constantinides, The Marketing Mix Revised: Towards the 21st Century Marketing , 2006, 22). In foregoing concepts new lists of Ps emerged, or a classic list was enlarged with a new elements to fit different marketing context. For specific marketing areas, the more marketing keyfeatures differ from the original ones, the less valid 4Ps approach probably is.

The milestone and shift in Marketing Mix paradigm was the idea that sellers' 4Ps correspond to the customers' 4Cs and deliver a customer benefit. Product became Customer solution, Price became a Customer cost, Place became Convenience for buyer and Promotion became the way of Communication (Lauterborn , 1990). Marketing management theory focused on customers' perspective and the relationship between company and customers. Paradigm shifted from classical, traditional marketing theories to customer-orientated, concentrated on observations of customers' needs and behavior considered in a long term. In the new paradigm, the company should track and discover consumers' needs and follow them. The marketer's main task became to understand customers' changing needs and to create, communicate and deliver them a value or experience. The main idea of profitable mixing ingredients remained, but the goal of mixing procedure shifted to deliver a value to customers.

*Marketing deals with identifying and meeting human and social needs. One of the shortest definitions of marketing is "meeting needs profitably."* (Kotler, Marketing Management, 2008)

By corresponding in Marketing Mix the 4Ps sellers' perspective with the 4Cs consumers' perspective, the concept became more interactive and external orientated. The concept was also an inspiration for many theories focused on factors external for companies, for example the 3Cs Theory, in which company should consider Customers, Competitions and Corporations in the strategy (Ohmae, 1982). 4Ps concept with

additional Ps' and Cs' theories became more complex and adequate for nowadays economy as a good practical tool for marketing strategy and marketing effort optimization.

Despite limitations of Marketing Mix model present above, the crucial assumption of the model remained stable. The core of Marketing Mix concept is still to observe and examine different consumers' reaction to different marketing mix components. If we are able to do so, the next step is mix optimization. *We try to differentiate our Mix so that it is more valuable for the target segment(s) than the offers of the competition. In sum, the deriving of an optimal marketing Mix involves solving a market segmentation problem* (Moller, 2006, 22). As in the original work of Borden, the strength and core of Marketing Mix concept - the idea of mixing ingredients by a marketer to find best possible response from customers seems to be still a valid.

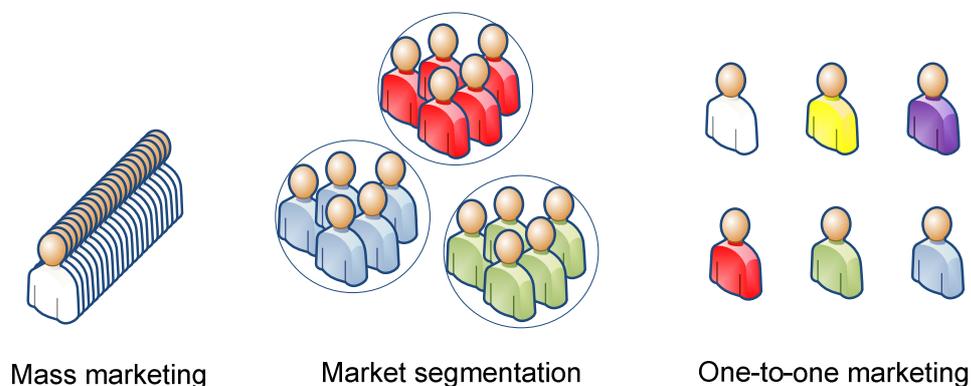
## MARKET SEGMENTATION AND TARGETING

In 1956 Smith proposed the idea of market segmentation as an market influencing technique alternate to product differentiation. He noticed, that *market segmentation involves viewing a heterogeneous market as a number of smaller homogenous markets, in response to differing preferences, attributable to the desires of customers for more precise satisfactions of their varying wants* (Smith, 1956). As Smith suggested, market segmentation is a procedure in which marketer assumes, that the customers' preferences and behavior can be formed in some homogenous groups, according to marketers' strategic view of the market. These groups don't naturally occur in the market and customers don't form them intentionally, but segments reflect the way the marketer considers the market and groups clients' preferences according to some strategic assumptions. In practice, two segments formation procedures are usually executed as outlined above *a priori segmentation design* or *clustering based segmentation design* (Wind, 1978), where the two or more characteristics of observed market respondents correlate in the way, they form groups, named clusters.

Similarly, customers' need and wants can be homogenous (the same for all customers), diffused (different for all customers) or clustered (Kotler, Marketing Management, 2008)p. 241. Theoretically, created segments should be distinct one from another, internally homogenous with common characteristics and should internally respond

similarly for marketing stimuli. Usually one or more characteristics of the segment cause similar product demand, what creates the base for price discrimination procedures, but also other marketing mix elements that are considered. Marketer uses segment distinction to differentiate the marketing mix actions and customize them for the preferences in targeted groups better than the competitors. The segmentation procedure is profitable when faces heterogeneous demand, because correspond to different consumers' needs, differentiating and simplifying them in homogenous segments. The segmentation can be formed for example in a base of customers' characteristics: geographic, demographic and psychographic, but also on benefits sought (Harley, 1968), service qualities (Gronroos C. , 1998) or buying behavior e.g. (McDonald & Dunbar, 1998).

There are alternatives to market segmentation approach. Created segments are in the middle of the continuum that represents possible levels of aggregations of the markets. The continuum ranges from extreme aggregate *mass marketing* to extreme disaggregate *on-to-one marketing*, in which the personalized mix offer is proposed for each individual consumer (Wedel & Kamakura, 2002). Between these two extremes lies the identification of market segments and targeting the mixture of marketing components, present below.



**DIAGRAM 2 - DIFFERENT WAYS OF SEEING MARKET**

*One-to-one marketing does not preclude segmentation. When implementing one-to-one strategies, firms currently first develop a limited number of marketing mixes targeted to market segments and then personalize some of their components to each member of these target segments. The available technology enables this customization of the marketing mix (Wedel & Kamakura, 2002).*

The limitation of the segmentation theory is the assumption that homogenous segments are created and verified, or observed by a marketer are in limited number. Hence the best number of segments is always questionable, the same as number of mixes targeted to the market segments. Moreover, the consumers' preferences change in time, but often in practice, segments once settled by a marketer are not studied over time and can lose their validity. Both limitations were already noticed 30 years ago (Wind, 1978), but are still valid and present in current literature. There is the need for *empirical tests of the predictive validity of segment solutions and the study of the stability of segments over time*, as well as *the development of better theoretical underpinning of heterogeneity* and in summary *development of models that integrate segmentation, one-to-one marketing, targeting and positioning and enable empirical validation of the segmentation concept through model comparison* (Wedel & Kamakura W, 2000)p. 183. Authors conclude: *An understanding of the dynamic nature of preferences and market segment composition is essential for strategies focused on the evolution rather than the proliferation of products and business.* (Wedel & Kamakura W, 2000)

## NEW LOGIC FOR MARKETING

Technological, social and economic changes appeared in 1980s and 1990s influenced market, consumers' needs and their behavior. They forced business and academic research to reconsider basic marketing assumptions. Essential for the dominating transactional, product orientated and price dominated approach was the marketing concept of exchange, as *the process of obtaining a desired product from someone by offering something in return* (Kotler, Marketing Management, 2008, str. 6). Product orientated exchange is made in transaction, where a trade of values between two or more parties takes place. Value created in transaction is usually the fulfillment of needs for the buyers that receives a product and for sellers that reach a profit. The company profitability long-last concept was based on economics of scale microeconomic theory, where a producer's average cost per unit is going to fall as the scale of output is increased. The more transactions are made and the more products are sold, the more profitable company is. Hence, marketing efforts focus on the ways that result in transactions and the marketer's task is to devise marketing activities and assemble fully integrated marketing programs to create, communicate, and deliver value for consumers. Moreover, marketers thinking about how to complete transaction by using

marketing mix tool are more orientated to the structure of marketing actions than to the marketing process (Kent, 1986).

In 1980s and 1990s emerged new ideas on how to run business and hence new ways of developing marketing strategies. Marketers started to focus more on marketing as a long lasting process rather than on the moment of exchange in single transaction where a company meets with a customer. *Relationship marketing*(e.g. Laurerborn 1990, Gummerson 1990, Gronroos 1994)and *service marketing*(e.g. Booms & Bitner 1981, Fryar 1991) emerged as the consumer-orientated concepts, where services and relationship created with customers started to be central. The idea of relationship that company should build, maintain and manage with the customers assumes:

- interactions instead of one-way persuasive actions,
- long-term process creation instead of exchange in a single transaction at time,
- integrated engagement of each person from the company (so called *part time marketers*) instead of the actions made only by marketing department, *as its staff cannot be at the right place at the right time with the right customer contacts* (Gummesson, 1990, str. 13)

Hence, marketing mix concept useful for consumer packaged goods businesses was not very suitable to support services businesses based on relationship since it is an *approach, which makes the seller the active part and the buyer and consumer passive* (Gronroos C. , Quo Vadis, Marketing? Towards a Relationship Marketing Paradigm, 1994,10, str. 353).Relationship building and managing long lasting perspective marketing assumed *consumer relationship profitability* (Gronroos C. , From Marketing Mix to Relationship Marketing: Towards a Paradigm Shift in Marketing, 1994)instead of economies of scale profitability. Consumer relationship profitability can be achieved by understanding and following the customers in place of concentrating on economies of scale maximization, as first noticed Heskett in the concept of *market economies* (Heskett, 1987).

*Long-term relationships where both parties over time learn how to best interact with each other lead to decreasing relationship costs for the customer as well as for supplier or service provider. (...) A mutually satisfactory relationship makes it possible for customer to avoid significant transaction costs involved in shifting supplier or service provider and for supplier to avoid suffering unnecessary quality costs.* (Gronroos C. , From Marketing Mix to Relationship Marketing: Towards a Paradigm Shift in Marketing, 1994, str. 8).

It is possible, because relationship marketing creates additional value for customers, a kind of tie connecting customer with a company and making a purchase process more valuable. Such ties may be in various types, for example: social, technological, knowledge related or information-related. Thanks to interaction, it is possible to collect feedback from customers, and form personalized relationships. That gives the buyer values emerging from the process of exchange, and not from exchanged product. As a result, consumers having extra value emerging from the relationship become less sensitive to the price of main object of the transaction, a service, or a product. Moreover, the quality that consumer perceives of what receives from the company has two dimensions: the “quality of what” and “the quality of how”, what means that buyers perceives quality of the object of exchange(e.g. product or service) and the quality of the various interactions with the company.

	<b>Transaction</b> marketing	<b>Relationship</b> marketing
Time perspective	Short term focus	Long term focus
Price elasticity	Customers tend to be more price sensitive	Customers are less price sensitive
Quality perspective	Quality of output (product)	Quality of interactions
Source of value	Product	Product and interactions
Source of profitability	Economy of scale	Relationship profitability
Main focus	Transaction	Process

**TABLE 1 - TRANSACTION VS RELATIONSHIP MARKETING (GRONROOS C. , FROM MARKETING MIX TO RELATIONSHIP MARKETING: TOWARDS A PARADIGM SHIFT IN MARKETING, 1994, STR. 11)**

To achieve relationship profitability according new a paradigm, companies should focus on interaction; feedback and dialogue with buyers; consumers understanding; and process perception. The analysis of relationship and service marketing literature result in more interesting findings. The concepts that are becoming increasingly important are: individual relationships, promises, common trust, real-time customer feedback and long lasting perspective (Gronroos C. , On defininf marketing: finding a new roadmap for marketing, 2006), process, participants and physical evidence (Booms, B.H; Bitner, M.J., 1981), personalization, personnel and procedures (Goldsmith, 1999) as well as differentiation based on segmentation and positioning, customer contact and unique vision of quality (Fryar, 1991).

Markedly the shift of marketing paradigm was expressed by Stephen Vargo and Robert Lush. Authors made visible the evolution of marketing thought and practice from goods-dominated to service-dominated way of thinking (Vargo , Stephen; Lush, Robert, 2004). As a consequence of changing economy, in which the most important resources became knowledge and skills (Zimmerman, 1951), intellectual capital became the companies' crucial asset (Stewart, 1997), the way of thinking about marketing also changed. According to a new logic exchange of tangible goods (manufactured things) is no longer essential. Crucial for transactions in a new economy is rather exchange of intangibles, specialized skills and knowledge, as well as processes and relationships.

*Marketing has moved from a goods-dominant view, in which tangible output and discrete transactions were central, to a service-dominant view, in which interchangeability, exchange processes, and relationships are central (Vargo , Stephen; Lush, Robert, 2004)*

Vargo and Lush made distinction between operant and operand company resources. *Operand resources* are those on which some operation has to be done to produce an effect, while *operant resources* are the ones that produce an effect. Illustrating operant resources, authors give an example of microprocessor. It is made mainly from sand (silicon) transformed on a base on knowledge and skills in innovative technological product. Thinking deeper about microprocessor, we realize that it is a pure idea rather than a tangible product made of sand.

*Operant resources are often invisible and intangible; often they are core competences or organizational processes. They are likely to be dynamic and infinite and not static and finite, as is usually the case with operand resources. Because operant resources produce effects, they enable humans both to multiply the value of natural resources and to create additional operant resources (Vargo , Stephen; Lush, Robert, 2004, str. 3).*

The *service dominant logic*, proposed in the title of article suggest the idea of replacement both – goods and services marketing with a service (expressed in singular) marketing. Hence, *all economies are service economies*, but the definition of service changed. *We define services as the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself (Vargo , Stephen; Lush, Robert, 2004, str. 2).*

This conception changed dramatically the way that marketing is understood. Marketing is no longer a strategy how transfer the goods, but it is a continuous series of social and economic processes, a kind of learning process between company and customer, where

the value is not proposed or offered by a company in goods or services, but it is jointly created by both consumer and supplier in the usage and consumption process.

*The service-centered view of marketing means more than simply being consumer oriented; it means collaborating with and learning from customers and being adaptive to their individual and dynamic needs (Vargo , Stephen; Lush, Robert, 2004, str. 6).*

The shift in paradigm resulted in marketing viewed as an activity with new characteristics. New marketing is focused on processes based on interactions between company and its customers, common learning and adopting. Nowadays companies' theory and practice should be a result of service-based, knowledge-based, experience-based (McKenna, Marketing Is Everything , 1991) and relationship-based marketing actions which is a long term process of adaptation created both by company and customers.

## E-COMMERCE

E-commerce is the *electronic commerce and refers generally to all forms of transactions relating to commercial activities, including both organizations and individuals, that are based upon the processing and transmission of digitized data, including text, sound and visual images (OECD, 1997, str. 9)*

This abstract definition is related to great number of human ordinary activities related, mediated or embedded in digitalised commercial proces of exchanges in various types.

*In ever greater numbers, people are shopping, looking for jobs, and researching medical problems online. Businesses are moving their supply networks online, participating in and developing online marketplaces, and expanding their use of networked systems to improve a host of business processes. And new products and services are being created and integrated into the networked world (DIGITAL ECONOMY 2000, p.7).*

In the last 50 years, digital economy revolutionised the business. Internet with digital technology individualised consumers behavior, communication patterns and needs; changed the marketplace, by opening digital space and finally created informational economy in which information is a main source of exchange.

*The virtual marketplace epitomizes the evolution process from the mass markets of the 1960s to the increasingly segmented, niche-dominated or even mass-customized, highly interactive and global markets of today (Constantinides, The 4S Web-Marketing Mix model, 2002, str. 59)*

## DIGITAL ECONOMY

Term *digital economy* appeared in 1995 in a book of Negroponte as a metaphor of contemporary economical shift from processing atoms to processing bits.

*The best way to appreciate the merits and consequences of being digital is to reflect on the difference between bits and atoms (Negroponte, 1995, str. 4).*

In a technologically revolutionized world after 1990s Internet developments and computer usage information became crucial. In a new economy exchange of information mirrored by bits, smallest form of information on a computer, gradually replaces prior exchange of atoms that had formed tangible goods. Hence, digital simply means the latest phase of the informational revolution, *the change from atoms to bits is irrevocable and unstoppable* (Negroponte, 1995, str. 4). Industrial age was dominated by mass production and economies of scale microeconomic concept in which profits came from manufacturing uniform goods and repetitive methods. The manufacturer operated in one given space and time; and world of trade was considered mainly as goods, hence atoms exchange. Coming post-industrial age of computers presented the same economies of scale, but surprisingly with no space and time limitations. In the post-industrial age, named information age, production of bits could happen anywhere and anytime. Mass media, characteristic of industrial age, broadcasted information in opposite to information age where information became narrowcasted, till nowadays when it's extremely narrowed to the audience often the size of one person. In digital world a person becomes a real individual receiving personalized information often addressed only to him. What was before impossible became common in a base of technological revolution. In digital world space and time changed their basic characteristics and compressed: *place without space* emerged, where *the transmission of place itself will start to become possible* (Negroponte, 1995, str. 165), and *time became asynchronous* and irregular with no need for co-existent actions and external

clock signal. Thus, the new digital world can be shortly described as world with *no time and no space*. (Negroponte, 1995, str. 165)

### *NETWORKS AND FLOWS*

Sociologist Manuel Castells on 1200 pages of his trilogy presented a new phase in human history (Castells M. , 1996). Moreover, he assumes that important social shifts do not occur as a continuous phenomenon, but rather as discrete changes after which new forms emerge.

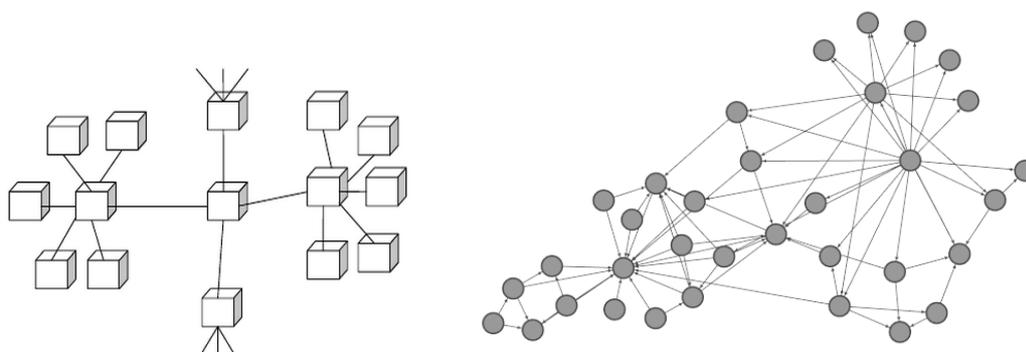
As a result of technological revolution, economic crisis, and new social movements (e.g. feminism) in 1960s and 1970s, three fundamental social spheres changed dramatically. Castells noticed the discrete change and emergence of: new social structure as a network society, new economy as a global informational economy and a new culture of *real virtuality*. They were symptoms of a deeper social development mode, in which information became as the raw material to act on (real virtuality), that is exchanged (informational economy), and technology became widespread and commonly used (thereby network society). The 21<sup>st</sup> century development mode is *informationalism*. This is *the attribute of a specific form of social organization in which information generation, processing and transmission become the fundamental resources of productivity and power'* (Castells M. , 1996, str. 21). Castells observed globalized and digitalized modern world and noticed that technological revolution had deeply changed society. Pervasiveness of Internet, the global network called *the Net*, influenced mainly human communication what resulted with new structure of society. Basically, time and space dimensions elementary for the physical world, changed their characteristics in a digital environment.

*Capital and labor, global institutions and particular social movements live in different temporalities. The first ones in the instant time of computer networks and the second ones in the clock time of everyday life. Increasingly they live in different spaces as well: the first ones in cyberspace and in the highly mobile cosmopolitan jet set spots of the information elite; the second ones in the old place-bound localities of cities and country sides. See: (Van Dijk, 1999, str. 3).*

In digital world time gained permanent, incremental nature and asynchronous communication became possible. Space became cyberspace of pure information. The new digital media and Internet have no time and no space what Castells called *timeless time* and a *space of flows*, in which flows of information transcend physical space of

places. *Together, the space of flows and timeless time produce a culture of real virtuality* (Van Dijk, 1999, str. 3). Moreover in a new information age, space is inseparable from time; it is crystallized time (Castells M. , 1996, str. 411). Therefore, a space of flows produces timeless time (Van Dijk, 1999, str. 5).

What Castells supposes is a new social structure called *network society*. In societies acting and operating in a new digital world (with asynchronous time and dematerialized geography) by processing information, new networked social structure emerged. Alike computers connected to the Internet form *the Net*; people, institutions and companies using computers became similarly joined in a networked structures.



**DIAGRAM 3 - COMPUTER & SOCIAL NETWORK (ZACHARY, 1977)**

*Networks constitute the new social morphology of our societies and the diffusion of networking logic substantially modifies the operation and outcomes in the processes of production, experience, power and culture* (Van Dijk, 1999, str. 2).

The network structure influences all operations made by humans, if they are mediated by a computers. Hence, in 21<sup>st</sup> century almost all spheres of our life are embedded in networked structure with new logic and new dynamics based on new time and space creations. As Castells notices, the most important change is a *break in the sequential order of phenomena in networks: time is compressed; things are happening instantaneously and linearity is broken in the discontinuity of hyperlinks, menu's etcetera* (Van Dijk, 1999, str. 4). According to this networked logic, it is for example possible to explain the results of contemporary social researches, in which scientists observed *the opposition between processes of scale-extension, e.g. globalization, and scale-reduction, e.g. strengthening identities, in high- or postmodern society* (Harvey, 1989, Featherstone, 1990, Giddens, 1991, van Dijk, 1991/, 1993, Lash & Urry, 1994, Barber, 1996), see: (Van Dijk, 1999). Moreover, the real network data are possible to study and visualize. By graphing a social structure in a framework of network proposed by Castells we can

observe the dynamics of social phenomenon in merely real time, like Egyptian Revolution that blew up on February 2011<sup>1</sup> or evolution of the knowledge created on Wikipedia in the same time<sup>2</sup>.

In the new networked social structure *informational economy* has emerged. After the stage of hunting, agriculture, and manufacturing we entered the stage of information economy (Castells M. , 1996), in which humans deal rather with bits than with atoms (Negroponte, 1995). Economy became digitalized and networked; consumers, companies, governments and investors connected in digital space and time are influenced by new network logic and dynamics. Power and capital are constantly flowing in many networks through geographical space and linear time. In this informational, global, digitalized and networked economy; information gathering, processing and transforming became crucial and possible by gathering, proceeding and transforming bits, instantly remembered and kept in digital form.

### *NET CONSUMERS*

As McKenna noticed in 1991, *the 1990s will belong to the customers. Technology is transforming choice and choice is transforming the marketplace* (McKenna, Marketing Is Everything , 1991, str. 1). This truth 20 years later is still valid and even more powerful than before.

Internet has become an important (digital and networked) social sphere. The best way to discover how this sphere influenced our world - is to observe and talk with digital generation, people born in years 1977-1997 already aged 14-34. *Net generation* differs from previous generations with one characteristic they never have experienced the world with no Internet. It is a *generation bathed in bits* since has been born, now often constantly connected and online with their smartphones. Moreover, *this generation is revolutionizing the very nature of the Internet itself*, by e.g. creating content and

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<sup>1</sup>The research of Andree Panisson is the data collection and visualization from Twitter network in February 2011 when Egypt's vice-president had just made the resignation announcement.

The work, possible to watch on YouTube (<http://www.youtube.com/watch?v=2guKJfvq4ul>) is part of a research project involving the Computer Science Department of the University of Turin ([www.di.unito.it](http://www.di.unito.it)), the Complex Networks and Systems Group of the ISI Foundation ([www.isi.it](http://www.isi.it)), and the Informatics department of Indiana University (<http://cnets.indiana.edu/>). Aswrote the Author: *It was like covering in real time a virtual event, a big event that was happening in the Twitter virtual world.*

PanissonAndré (15/02/2011) *The Egyptian Revolution on Twitter*: <http://gephi.org/2011/the-egyptian-revolution-on-twitter/>

<sup>2</sup> Wikipedia Edits During the Middle-East Protests, available to see on YouTube: <http://www.youtube.com/watch?v=z3Wo22jI4Ac&feature=related>

democratizing the creation process (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008, str. 40). There are also few more features. Net generation is better adapt to the technologically dominated world, that their parents. It is better educated to new reality: mainly by following technological trends and participation in creating a virtual reality. It is also smart generation and generation placing great importance to the family, having different values and expressing different social behaviors. Moreover, people already stepped in youth at the same time can process information in many levels with multimedia devices. They can also create information, having an impact on their digital and real world. In summary, they use digital information in a different way: more natural and more sophisticated.

### **Important for Net generation<sup>3</sup>:**

Today young people act different as a consumers, students, workers, and family members. They build their personal social networks and communicate differently. According to the research of Don Tapscott (2007), Net Generation has also new basic values and norms: (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008).

1. *They want freedom in everything they do, from freedom of choice to freedom of expression.*
2. *They love to customize and personalize.*
3. *They are the new scrutinizers.*
4. *They look for corporate integrity and openness when deciding what to buy and where to work.*
5. *The Net Generation wants entertainment and play in their work, education, and social life.*
6. *They are the collaboration and relationship generation.*
7. *The Net Generation has a need for speed.*
8. *They are the innovators.*

For marketers these are crucial clues that help them understand choices and behavior made by digital consumers that company interact with. New consumers are informed, educated and demanding. They want the product any time, any space and in any form

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<sup>3</sup>The Don Tapscott and his team in the research conducted in 2007 on almost 11 thousand youth studied the difference between Net Generation and the further one, their parents' Baby BoomGeneration. More in the book (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008)

they desire. Speed and integrity in interactions with them is crucial, personalization and customization is universal. They can choose a product from the enormous offer, being informed about it from other consumers. New consumers scrutinize watch and co-create the company with the powerful *word of mouth marketing* and creation of opinion and recommendations. For this consumers more influential are friends, acquaintances, critics and experts from the network of various relationships, rather than the one-way ad communication from companies. Thinking about brands and products, digital consumers are embedded in the influence network (*N-net fluence Network*), circles composed of their few *best friends*, dozen people from *the new social network* and *the world* (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008). These last ones are people that influence others by writing notes about products, creating comments or expressing their own opinion in any other digital way. Net Generation has formed a group of *prosumers*, willing to participate in co-creation of the brand and products with a company.

## RETHINKING MARKETING

What can be proposed for a marketer focusing on new consumers in digital market? Don Tapscott suggests replacing 4Ps marketing principles to the following ABCDE guidance that a marketer should focus on (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008):

- A (*Anyplace*) as the possibility for customers to choose anyplace and anytime they want. Companies compete in two markets: *marketplace* of real goods and *marketspace* - information market. Value for consumer derive from both, place and space interactions. Moreover, we are in moment where Internet access in mobile phones is becoming universal. M-mobile arrived.
- B (*Brand*) – prosumers help and participate in brand and products creation, they want to co-create.
- C (*Communication*) – customers prefer to interact with brands, and don't want to interact with ads. Ads can exist only if they give a customer value. It can be for example entertainment, or knowledge.
- D (*Discovery*) – consumers uncover product prices and negotiate them. They have freely access to information about products and prices. Thus, they negotiate the price dependent on product's values. If delivered within 24 hours,

price can be higher. The product with defect is accepted if the price is much lower.

- E (*Experience*) – consumers in a process of transaction and relationship with brand desire to experience some entertainment, idea sharing or knowledge building.

*Net Geners want to buy things Anyplace, where and when they want. They'll help shape the Brand, and the product. And they won't tolerate a lecture, however amiable. The standard ad will be replaced by Communication, a two-way conversation. As in any relationship, integrity will be one of the key building blocks of this new interactive brand. Since Net Geners research the product and its price online, they'll negotiate the price. I call this the Discovery of Price. And finally, they expect products to be at the same time an Experience* (Tapscott, Net Gen Transforms Marketing, 2008)

Similar observations McKenna has made 20 years ago: *Today technology has created the promise of "anything, any way, any time"* (McKenna, Marketing Is Everything , 1991, str. 6) and *In fact, like light, consumer is more than one thing at the same time* (McKenna, Marketing Is Everything , 1991, str. 7). Thus, digital technology changed fundamentally marketing procedures and goals. Since 1990s the old marketing school and practice summarized as choose *'any color as long as it's black'*, changed to the practice *'tell us what color do you want'* (McKenna, Marketing Is Everything , 1991, str. 1). Companies faced with new reality where *marketing is everything* and firms interact with customers trying to engage them systematically. Also market definitions evolved from the segmentation concept to flexible concept of: *sometimes owning a market means broadening it; other times, narrowing it*, or sometimes both. *Customization, the capacity to deal with a customer in a unique way* became practiced and the communication shifted from monologue to dialogue (McKenna, Marketing Is Everything , 1991, str. 6). *The line between products and services is fast eroding* and both, product and service become a hybrid we can observe *the servicization of product and the productization of services* and only companies able to follow that trend can build *loyal customer relationship* (McKenna, Marketing Is Everything , 1991, str. 9). The *'do more'* marketing is successfully replaced with *knowledge-and experienced-based marketing* (McKenna, Marketing Is Everything , 1991, str. 1) that is able to interact constantly with customers and flexible react to their needs.

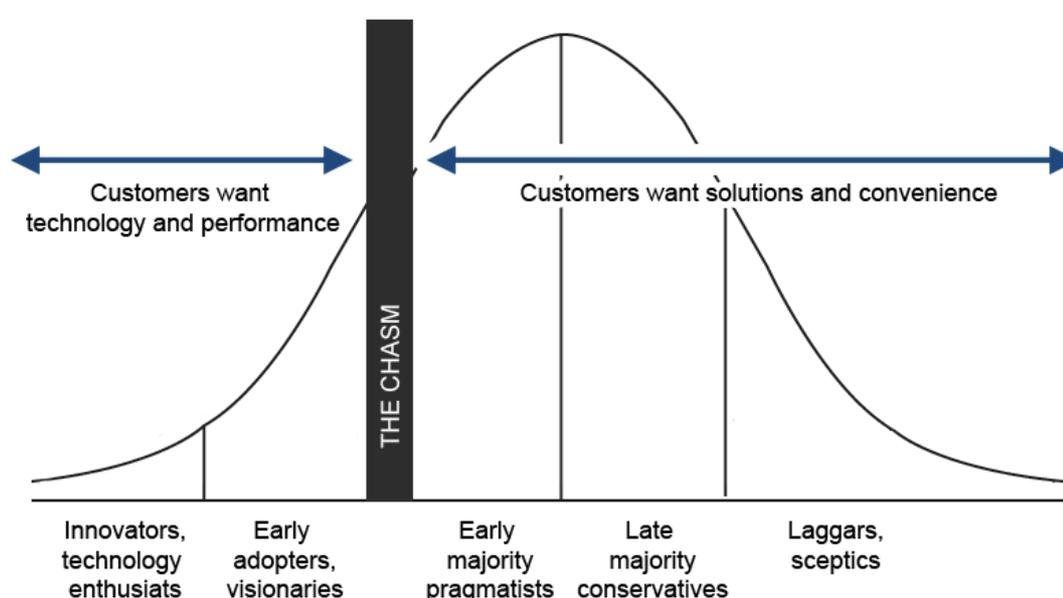
*NEW FINDINGS*

According to Nirvikar Singh, three observations (made by Regis McKenna, Geoffrey Moore, and Donald Norman) were the milestones in marketing of high-tech products (Nirvikar, 2000):

McKenna created the concept of *real time marketing* for high tech products (McKenna, Real Time, Preparing For the Age Of The Never Satisfied Customer. , 1997)

*A real time marketing systems uses relationship marketing thinking leveraged by information technology (IT) to provide a cost effective (i.e. scalable) method of developing and maintaining an online interactive relationship with customers, and with people who might become customers*

Moore observed diffusion of innovation and in his *Crossing the Chasm* concept argues that high tech firms' marketing problem is crossing the chasm between early product adopters (technology enthusiasts and visionaries, gatekeepers for new technology) and early majority of (being pragmatists) potential customers (Moore , 1991). *According to Moore, the marketer should focus on one group of customers at a time, using each group as a base for marketing to the next group. The most difficult step is making the transition between visionaries (early adopters) and pragmatists (early majority), see: (Nirvikar, 2000).*



**DIAGRAM 4 - FIVE SEGMENTS OF TECHNOLOGY ADOPTION CYCLE (MOORE , 1991)**

Donald Norman argued that *User Experience* is important enough to separate it from marketing in the strategy on how to run a business (Norman, 1999). Three domains should be considered: user experience, marketing and project development.

*E-COMMERCE MARKETING*

Classical 4Ps Marketing Mix composition seems to be incompatible with E-commerce (Constantinides, The 4S Web-Marketing Mix model, 2002, str. 59), mainly because there is no interaction between company and customers considered in the concept. Moreover, Marketing Mix actions are deeply embedded in the environment of a Web Site, creating *Web Experience* - the factor often uncontrolled by marketer but likely to influence consumers' behavior. Hence, as Constantinides noticed, 4Ps elements (Product, Price, Place and Promotion) *are heavily interrelated and for all intents and purposes jointly experienced by the online consumer, being merely parts of the content of the Customer interface, better known as Web Site, where:*

- Product – *the Web site is the prime online product.*
- Price – *the majority of commercial sites function as price lists. Web site is also perceived by customers as a cost element (due to connectivity cost, transaction cost, time and opportunity costs).*
- Promotion – *the Web site is the promotional medium as well as the promotional content.*
- Place – *the Web is the counter, helpdesk and sales outlet where the actual commercial or non-commercial transaction takes place*

Moreover, *for products delivered in digital form (music, information, software and online services) the site fulfills even the task of physical distributor by allowing the product delivery online*(Constantinides2002, str. 60). Web Site is also an important channel of communication between company and customers that forms the *Web site based customer experience*, by elements like *findability of the site, ease of navigation, prompt replies to e-mails and easy to use shopping and payment procedures.* (Constantinides, str. 60)

In a base of these new digital circumstances for running business, Constantinides proposed the replacement of 4Ps Marketing Mix elements to the *4Ss concept of the Web-Marketing Mix*(Constantinides2002, str. 62-69)

- Scope - involving the consideration of strategic elements, scope and objectives,
- Site - involving operational issues of Web construction, features and content forming the Web Experience for the customer,
- Synergy –involving integration into physical process, integration with the physical world, Web site and networks of partners in the business,

- System – involving technical software and hardware issues engaged into the business.

For the purpose of this paper, we focus on *the Site*, as main communicational, interactional and transactional E-commerce interface.

*The Web Site is the company-customer interface, the prime source of customer experience and therefore most important communicational element of E-Commerce. (...) Web site is the virtual product display, promotional material, price catalogue and sales/distribution point. (...) The prime mission of the Web Site is to attract traffic, establish contact with the online target markets and brand the online organization (Constantinides2002, str. 64-65).*

Similarly to the previously described works (McKenna 1991, Gronroos 1994, Moore 1991, Norman 1999, Vargo&Lush 2004, Tapscott 2008), Constantinides sees opportunities for leading e-business with the customer-company interactions and transactions marketing concentrated on Customer Experience (the Front Office) and long-distance relations based on common learning (the Back Office), both possible with digital technology. *The online organization is likely to benefit from economies of scale and learning effects (Constantinides 2002, str. 66)*

# AGENT SYSTEM FOR FORMULATING MARKETING MIX

## PREVIOUS WORKS

### *USER MOTIVATIONS AND BROWSING BEHAVIOR*

A consumer visits online as well as offline shops not only for goal driven motives such as purchase, but also for experiential motives such as fun and entertainment (Hirschman & Holbrook, 1982), (Bloch & Richens, 1983), (Hoffman & Novak, 1996). At the very basic level two types of consumer behaviors can be observed: goal directed and experimental browsing (Wolfenbarger & Gilly, 2000). Goal directed customers derive their satisfaction from speed and convenience of fulfilling their shopping goal. On the other hand for users driven by experimental browsing an experience, fun and positive surprise are main sources of satisfaction. The factors important for the two groups of consumers with different search motivations presents the following table:

<b>Goal directed search and buying</b>	<b>Experimental browsing and buying</b>
Accessibility/Convenience	Ambiance/Atmosphere
Selection	Positive Sociality
Information Availability	Positive Surprise
Commitment to goal, not experience	Commitment to Experience more
Control of Sociality	

**TABELA 1: IMPORTANT FACTORS FOR GOAL DIRECTED AND EXPERIMENTAL SEARCH BEHAVIORS (WOLFENBARGER & GILLY, 2000)**

An online shopping is more often goal directed and focused on the purchase a specific needed or wanted product comparing to offline shopping behavior that is more often impulsive. Nevertheless, there are also online consumers that shop for fun or experience. Moreover, consumers perceive easier to leave an online (than offline) shop without any purchase, but *find their online shopping trips interesting, informative, useful and involving*. (Wolfenbarger & Gilly, 2000). *Online buying environment facilitates goal or transaction oriented buying because search costs are dramatically reduced* (Klein, 1998). On the other hand in more than 70% of e-commerce websites a large quantity of visits (98%) do not result in purchase transaction (Forrester Research, 1999). In other words, only 2% of visits on the ordinary e-commerce website convert a visitor into a buyer. There are many explanations of this results: it might be a result of poor shopping experience (Moe & Fader, Dynamic Conversion Behavior at E-Commerce Sites, 2004), inability for user to easily navigate the shop to find a product they search for, difficulties in finalizing the transaction, lack of trust to online retailer, etc.. Consumers also search for information about products online if they plan offline purchases (Tapscott , Grown Up Digital: How the Net Generation is Changing Your World, 2008). Visits that did not end with a purchase can result with a purchase of another person, as the more digitally competent family members advise their relatives or family in purchasing decisions. Online visits can be driven by different motivations and users' goals. Some of those motivations can be effectively inferred from user browsing behavior. *Clickstream data* provide a rich source of behavioral information about customers, their visit, searching and browsing behavior. It is a source of information available *before* a consumer makes the decision about a purchase. It includes information about the source of visit, time spent on a website, number of pages that consumer viewed and other past experiences, searching words etc. *Hidden in the clickstream data available to many e-commerce sites is precious information that can provide better diagnostics and more accurate forecasts, allowing e-commerce sites to more profitably target and market to their customers* (Moe & Fader, 2001, p. 107).

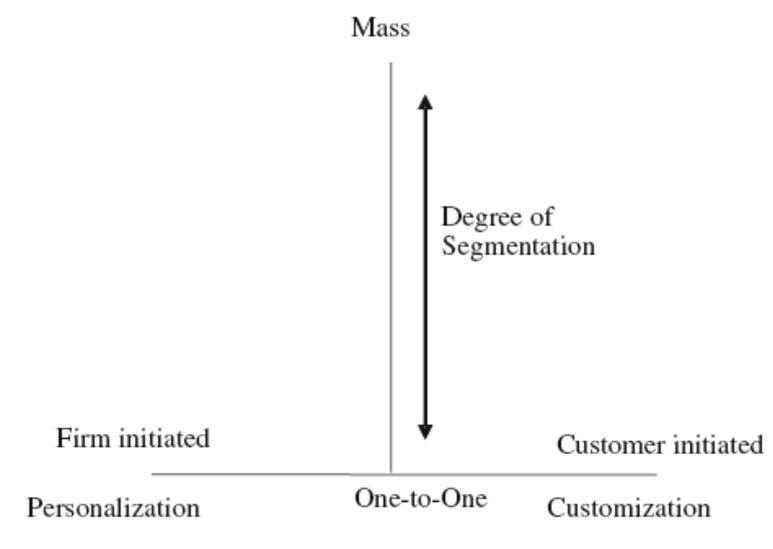
### *ONE TO ONE MARKETING*

By exploiting clickstream data more and more websites deliver mechanism that allows addressing marketing actions and product propositions individually tailored to the customers' behavior, needs and desires. Marketing practice shows that one-to-one marketing solutions are with new technology possible and are more and more frequently used in digital media environment.

*The One-to-one marketing (1:1) concept is the idea of one or more marketing actions targeted to the customers individually, and individually tailored to the requirements of each customer separately. The new paradigm is one to one (1:1)-mandated by cheaper and faster data management, interactive media, and increasing capability for mass customization (Peppers, Don ; Rogers, Martha ;, 1997). These are the three one-to-one marketing fundamentals:*

- *the database allows us to tell your customers apart and remember them individually,*
- *interactivity means the customer can now talk to you (rather than serve as a passive target for your messages),*
- *mass customization technology enables business to customize products and services as a matter of routine (Peppers , Don ; Rogers , Martha ;, 1999)*

One-to-one marketing represents an extreme form of market segmentation, with mass marketing on the opposite extreme, and can be observed in two different practices: personalization and customization presented in Figure.



**DIAGRAM 5 - PERSONALIZATION VS CUSTOMIZATION (ARORA, ET AL., 2008)**

### *PERSONALIZATION AND CUSTOMIZATION*

*Personalization is when the firm decides, usually based on previously collected customer data, what marketing mix is suitable for the individual (Arora, et al., 2008, p. 307)*

The best known example of personalization made by company in a mass scale is Amazon.com's personalized book and music recommendations. The advantages of personalization are greater customer satisfaction, greater consumer trust and higher profits.

*Customization is when the customer proactively specifies one or more elements of his or her marketing mix* (Arora, et al., 2008, p. 307). For example, Dell computer taps advantage of letting the customers to customize the computer they buy, or Google Company, which allows their users to customize the Gmail service to their needs. Customization procedures permits the customers to receive an extra value proposition embedded in the product or service.

### *A/B SPLIT TESTING*

Currently the most popular website optimization techniques rely on statistical methods. The key factor for those methods to work is a well-defined goal. A goal represents an action that generates a value for a website owner. Optimization techniques provide means to increase percentage of users that reach a goal and (or) increase a goal value. Usually in e-commerce environment a goal is defined as a purchase action. Hence website optimization shall lead to higher conversion rate defined as number of customers divided by number of visitors and higher net order values. Those methods focus on testing different layouts, promotional materials or generally website variants while collecting necessary data that can be statistically analyzed so the most effective variant can be determined.

This simplest form of statistical testing is A/B split testing. This method is an equivalent of performing an experiment with a control group. In this method we present two different variants of a website, assigning each one to randomly chosen visitors, usually showing one variant to 50% of visitors and another to other 50% of visitors. For each group we measure website performance with previously defined metrics. The website variant performing better according to those metrics is a winning variant. This method does not only provide website owner an evaluation of each of the website variants, hence making the decision about which one to stick with quite easy. This method is very useful when testing new versions of websites, when changes are fundamental. Measuring performance metrics of both variants within randomly chosen experimental and control groups give website owner a strong evidence of which variant is performing better. Moreover it is even easy to calculate the performance gain

and measure the exact difference between the website variants. Even though it is quite simple technique it is very useful for estimating the ROI of introducing new website to customers. Having the impact of change exactly measured make us able to calculate the exact return on investment on introducing new features or redesigning existing website.

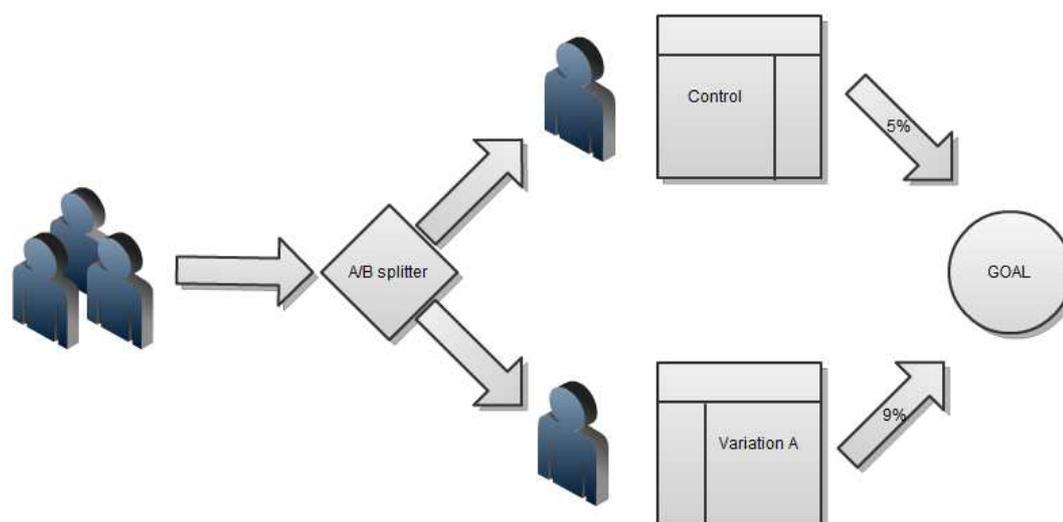


DIAGRAM 6 - A/B SPLIT TESTING

### *MULTIVARIATE TESTING*

More advanced website optimization technique comes from a statistical method called multivariate testing. In this technique a web page is split into independent elements, each having different variants. For instance a product page can be represented as a combination of a headline, offer description, model and call to action button.

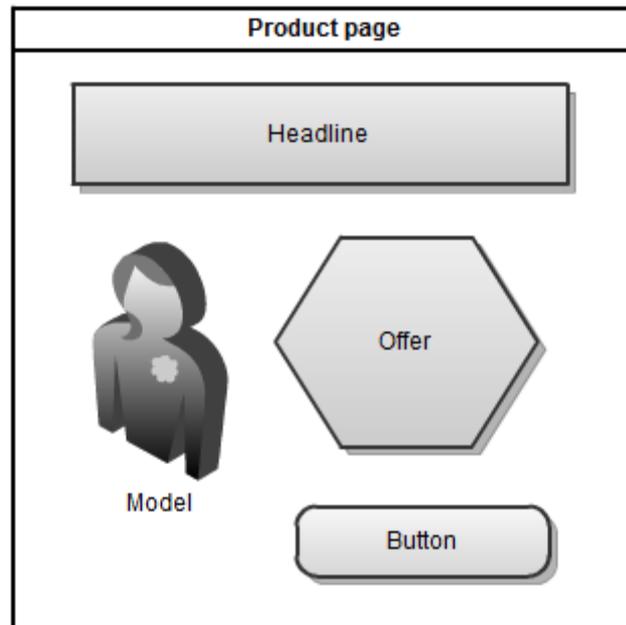


DIAGRAM 7 - PAGE ELEMENTS

Each of elements is considered to be a factor that might lift or lower the overall conversion rate depending on which variant is presented to the user. For instance we might consider three different headlines, three different models, offers, call to action buttons, etc.

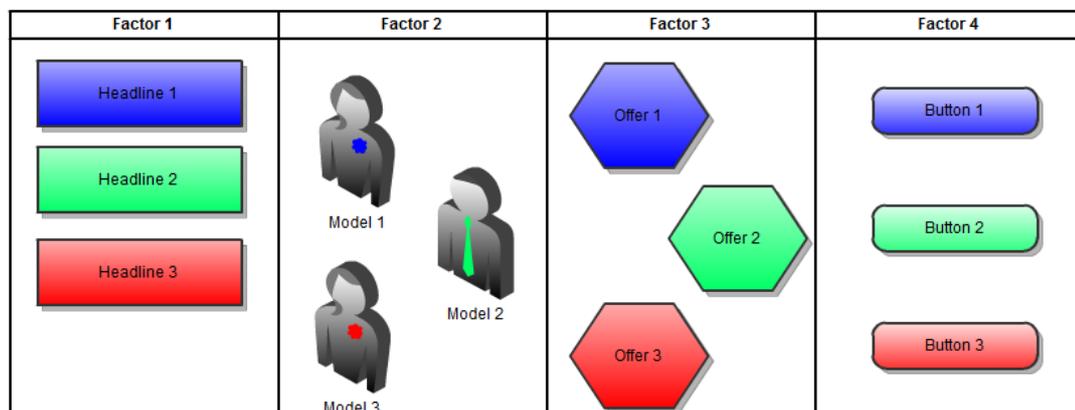
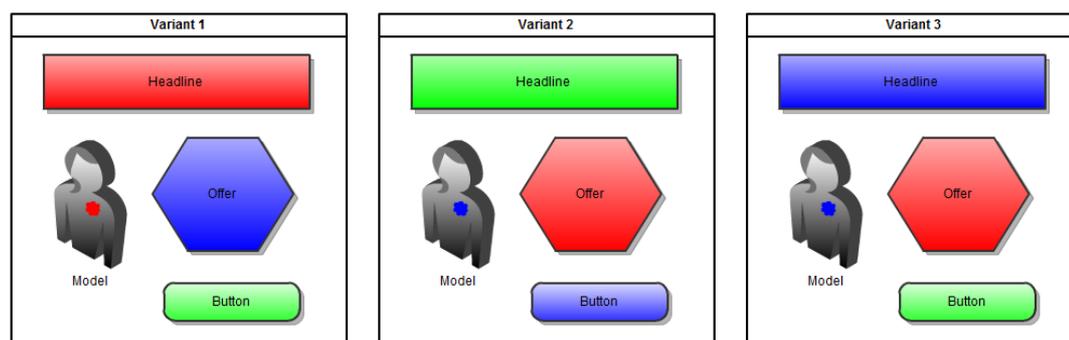


DIAGRAM 8 - EXAMPLE CONVERSION RATE FACTORS

While using multivariate testing we present to the user one randomly chosen combination of the previously defined web page elements - a variant. Each customer visit hence is actually a test of a given variant, and for each such a visit conversion data is collected.



**DIAGRAM 9 - DIFFERENT WEBPAGE VARIATIONS**

Using statistical method MANOVA (multivariate analysis of variance) it is possible to determine the most effective variant without excessively testing all the combinations. However this method has certain limitations that are rarely considered, one of them is an assumption that the factors are fully independent variables what is rarely true in practice. To overcome this and other limitations a post test is usually performed, to verify the actual effectiveness of the winning variant, on larger group of visitors.

As described above multivariate testing in its basic form is assigning a variant to a visitor randomly. While such a strategy is reasonable if one wants to collect an objective statistical data, it might not be an optimal solution when you look from profit maximization point of view. It is quite probable that different segments of customers react differently to different variants. Optimization services offered by some companies in fact include targeting integrated with multivariate testing<sup>4</sup>. This significant extension allows website owner to perform test within precisely defined group of visitors.

### *DYNAMIC PRICING & REVENUE MANAGEMENT*

#### **Price discrimination**

Price discrimination occurs when different price is charged for identical goods or services by a single vendor. The oldest and most common form of price discrimination is haggling. This process known mainly from a street market is widely used also in business markets under a form of negotiated pricing.

There are three degrees of Price discrimination (Kotler, Marketing Management, 2008, str. 453):

<sup>4</sup>For instance Test&Target by Omniture.com

**First-degree price discrimination** when seller charges different price to each customer depending on the intensity of his or her demand. This model is known also as complete price discrimination, where each unit is priced at the benefit that the unit provides to its buyer. In this case the supplier is capturing the entire customer surplus. To implement this policy, however, the seller would have to know each potential buyer's individual demand curve and be able to set different prices for every unit of the product (Png & Lehman, 2007).

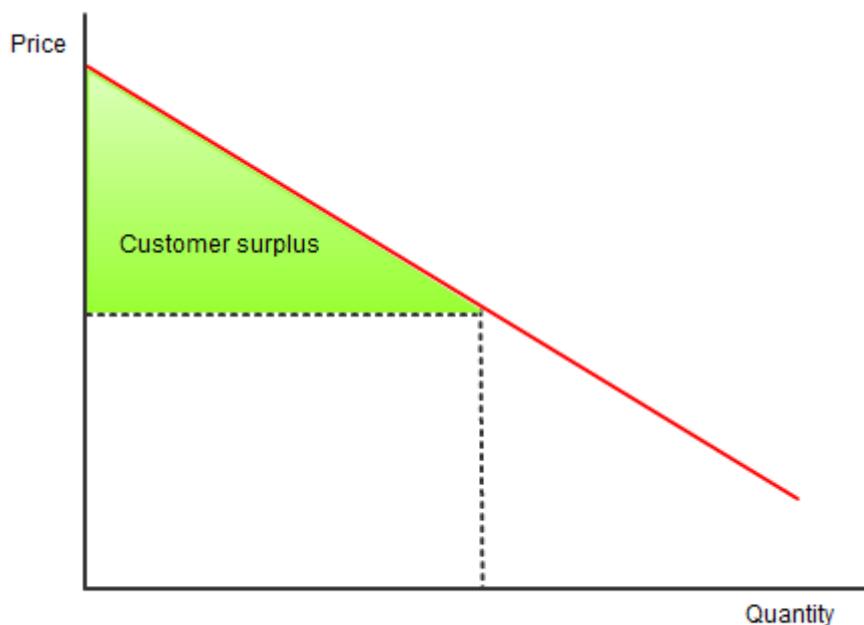


DIAGRAM 10 -CUSTOMER SURPLUS

**Second-degree price discrimination** when seller charges different price to customers depending of the volume of purchase. An example of this pricing model is a volume discount, when a vendor offers discount for large volume purchases.

**Third-degree price discrimination** when seller charges different price depending on a class or segment of buyers. For instance Coca-Cola carries a different price depending on whether it is purchased in a fine restaurant, a fast-food restaurant, or a vending machine. Segments of clients can be created upon location, distribution channel, time of purchase, and other arbitrary criteria like season or temperature.

#### *Price Discrimination by Purchase History*

Purchase history of a consumer can reveal his price sensitiveness to certain products. "A customer who reveals a preference for firm A's product at current prices is precisely the person to whom firm B would like to offer a price reduction" (Sole, 2003). Authors

of this thesis explain this purchase history pattern with a concept of switching costs. While changing one product into its substitute, customer is facing a cost of switching from using one product to another; therefore he is willing to pay less for a substitute so he can cover his switching cost. A model explaining the “consumer poaching” strategy has been proposed in the literature (Kosmopoulou, Liu, & Shuai, 2009). This strategy is a common practice in a telecom industry where customers receive bonus when switching from one carrier to another. Some companies send targeted discount coupons to customers using competitive products. If the coupons can be traded among customers on the market we shall find that “when the fraction of coupon traders increases, firms respond by promoting less frequently (sending fewer coupons out) and reducing the face value of coupons. This reduces competition and leads to higher equilibrium prices and profits” (Kosmopoulou, Liu, & Shuai, 2009).

Purchase history and buying behavior of a client in data abundant e-commerce environment can potentially rise many more opportunities for profitable price discrimination not always that ethically questionable as “consumer poaching”.

### **Dynamic pricing**

Ecommerce environment and customer relationship management systems bring possibility to change prices really dynamically. Different demand models have been proposed in literature for predicting the elasticity of demand as well as pricing strategy optimization algorithms (Maglaras & Meissner, 2006). Availability of excessive amount of sales data makes the demand modeling process possible even within relatively small client categories. Airline industries research travelling patterns of their clients to segment them into business and family travelers, thus differentiating the pricing models on destination to fit the demand shape for a given destinations. Business traveler are much less price elastic than family travelers, thus they are willing to pay more for tickets. Therefore destinations more popular for business users are priced higher. Therefore weekend flights are priced less than business-days flights. Similarly flight tickets are priced lower if a flight is booked early in advance. The closer it is to the date of flight the higher is the price. Perhaps late flight booking is a behavioral pattern for group of clients with inelastic demand. The opposite group – that book far in advance, and is not concerned about specific time of a flight – shall have more elastic demand. Such rules combined together form a pricing model that is truly dynamic, where almost every ticket is priced differently even though it might consider the same airplane seat. All “cheap” and most of major airlines employ a revenue management

system that is responsible for modeling the demand across different time, direction and travelers behavioral patterns to find an optimal price in a dynamic environment. Revenue management system revolutionized the airline industry in 1980 after the market has been deregulated. Deregulation and innovative pricing strategies made air travelling more accessible to group of people with elastic demand, while keeping high prices for business travelers. By implementing dynamic pricing strategies an airline can reach a new relatively big market segment of people with very elastic demand while still being able to charge business customers relatively high prices. This makes their services accessible for more people and helps to discover and capture new market niches. An airline industry is a bright example of third degree price discrimination. Customer segmentation is based on the ordering time, and separate demand models are used for various destinations.

### **Limitations**

Price discrimination techniques are limited to markets having features of imperfect competition (Sole, 2003). Although fully competitive markets theoretically do not offer the opportunity for revenue management, perfect competition is a theoretical construct that rarely exists in reality. Nevertheless to implement a revenue management strategy a company shall have some market power – in fact the more market power it has the more it can benefit from price discrimination strategies. This is one of the reasons those strategies work that well in airline industry, which have a lot of oligopolistic features like barriers to entry and usually just a few competitors offering services at the same destination.

Reduced transaction costs, relatively small barriers to entry and shopping comparison websites make e-commerce industry much more competitive and closer to perfect competition than many other markets. Even though larger e-commerce websites still have some market power which arises from their marketing efforts, brand values, know how, distribution networks, loyal customers, etc. and hence shall be able to benefit from revenue management systems. Anyway when researching opportunities for implementing dynamic pricing strategies, company's market power shall be considered as a key success factor. Therefore a company operating on a perfectly competitive market, with little or no market power is unlikely to benefit from price discrimination strategies.

## THEORETICAL FRAMEWORK

Borden defined a marketing executive as someone who is “constantly engaged in fashioning creatively a mix of marketing procedures and policies in his effort to produce a profitable enterprise” (Borden, 1964). This definition is so general that even in an age of electronic commerce it well defines a job of an e-marketing executive. The difference between 1964 and 2011 is tools, procedures and policies available to marketer. However the basic problem of how to choose ingredients for a profitable mix is still unsolved. Markets, customers and business environment are constantly changing, therefore a profitable mix from yesterday might be at least suboptimal today. Fortunately technology enables organizations to react rapidly to changes in the environment. Nevertheless to develop such technology we need a formalized method for solving this problem, that can be repetitively executed in an automated manner.

### *PROBLEM DEFINITION*

The main problem addressed in this thesis is how to effectively *formulate an marketing mix* for an *e-commerce website visit* using *clickstream data* as an information about visitors, their behavior and indirectly their motivations. To solve this problem we will propose a system that will be able to discover patterns in clickstream data that reveal user motivations and optimize a mix of marketing actions for each of the patterns discovered. It should be underlined that each website is a specific environment with specific optimal marketing mix. Therefore it is not possible to propose a single general solution to this problem. What we can do however, is to propose a general formalized method for solving this problem that can be repeatedly executed in many such environments and hence be broadly applicable.

However the problem can be surely solved in many different ways we use an multi-agent system to model user behavior and dynamically modify website marketing mix. Multi-agent systems are composed of agents and rules that drive interactions between them and the environment. Even though a single agent can be a quite simple computer program without any adaptive capabilities, a system composed of many such entities is able to change itself with time to adjust to the environment. Those adaptive capabilities

of an agent system as a whole are used to model the specifics of the website environment.

*“An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators” (Russel & Norvig, 2003, str. 32)*

In the proposed method the *environment* is a website itself. Agent *sensors* analyze clickstream data to provide information about user behavior within this environment, and agent *actuators* are marketing actions that can be performed within a given website. This novel approach let us explore unique adaptive capabilities of multi-agent systems in website marketing optimization problem. Creating an opportunity to create a method that is both general and formalized while still being able to capture and model all the specifics of a given website and motivations driving its users. Designed system attaches one or more agents to each visitor individually thus creating an unique mix of marketing actions. Therefore each visit is becoming a micro experiment in which a marketing composition is tested whether it fits visitor preferences. An outcome of this experiment creates a feedback loop validating both rules for analyzing clickstream data and marketing actions performed by an agent.

### *DEFINITIONS*

At the beginning we shall define the three very basic building blocks of the system. Those are *profile*, *agent* and *mix* – the smallest objects that travel between modules. Defining what they actually represent is crucial for describing the more complex modules where those basic objects interact with each other.

## Profile

The profile consists of a rule that describes a segment of visitors. This rule is encoded as a binary tree that consists of two types of nodes: functions and terminals. Functions are binary, two argument operators such as AND, OR, XOR, NAND. Terminals are logical (true or false) statements that refer to information the system collects about each visitor such as: visit number, shopping cart state, most visited categories, etc.

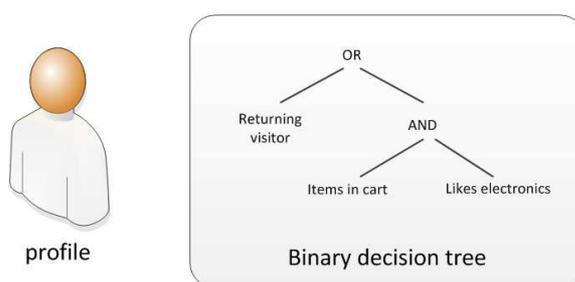


DIAGRAM 11 - CUSTOMER PROFILE

The possible set of terminals is defined by the sensor system that transforms incoming click stream data into semantic information about the visitor (referred as *sensor readings*). Binary tree representation of a profile covers a large space of all possible logical rules that could be defined using terminals. Such representation is commonly used with genetic programming, because it is easy to construct, evaluate and transform (Koza, 1992).

## Agent

Multiple agent definitions can be found in a literature, one of the most commonly used was proposed by Russel & Norvig.

*“An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators” (Russel & Norvig, 2003, str. 32)*

Sensors are provided by the sensor system described later in details. Website is the environment, and actuators can be described generally as means to modify this environment<sup>5</sup>. The system considers agents as programs that generate output properties and client scripts while interpreting the sensor readings.



DIAGRAM 12 - AGENT AS A SIMPLE PROCESSING ELEMENT

According to (Jennings & Wooldridge, 1998) the essential properties of agents are:

- “autonomy: agents operate without direct intervention of humans, and have control over their actions and internal state;
- social ability: agents interact with other agents (and possibly humans) via an agent communication language;
- reactivity: agents perceive their environment and respond in a timely and rational fashion to changes that occur in it;

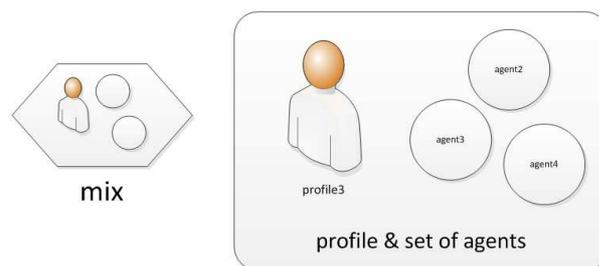
<sup>5</sup> A website shall provide generally two types of interface for integration with the agent system: client interface and server interface. From technical perspective on the client side the system is integrated with javascript embedded in html code while on the server side website is influenced with configuration properties. For instance a promotion banner is emitted with a script on the client side, and the 30% discount is a configuration property that is interpreted on the server side.

- pro-activeness: agents do not simply act in response to their environment, they are capable of taking the initiative (generate their own goals and act to achieve them).”

To fulfill all these requirements we shall define an agent broadly as a computer program that is processing input information provided by sensor system API and influences the website environment through an agent API<sup>6</sup>. It is an autonomous program that might run in a remote server environment or in the cloud. It interacts with user via a website client scripts. It reacts to environment perceived by sensor system, and it might, but doesn't necessarily have to, be pro-active (what depends on individual implementation).

### Mix

Finally, mix is a composition of agents and a profile that might be matched against user characteristics.



**DIAGRAM 13 -MIX = PROFILE + SET OF AGENTS**

The composition of agents shall implement product, price and promotion tactics within a website environment. For instance one agent implements a promotion message and a “discount=30” property, while another one shows electronics products on a home page and the profile that match all returning visitors that have been browsing electronics products during last visit.

<sup>6</sup> Detailed API specification is provided in an attachment ...

## METHOD

The proposed agent system consists of four integrated modules: profile repository, agent repository, sensor subsystem and evolution engine. Each of the modules plays different role in formulating marketing mix for a website. Sensor subsystem transforms incoming tracking data stream into semantic information about visitors. Profile repository provides customer profiles that can be matched against incoming information from the sensor subsystem. Agent repository provides the system with agents that interact with users. Finally, the evolution engine is a subsystem responsible for marketing mix optimization using evolutionary programming techniques. The diagram bellow presents interactions between modules. The modules themselves are described later in this paper.

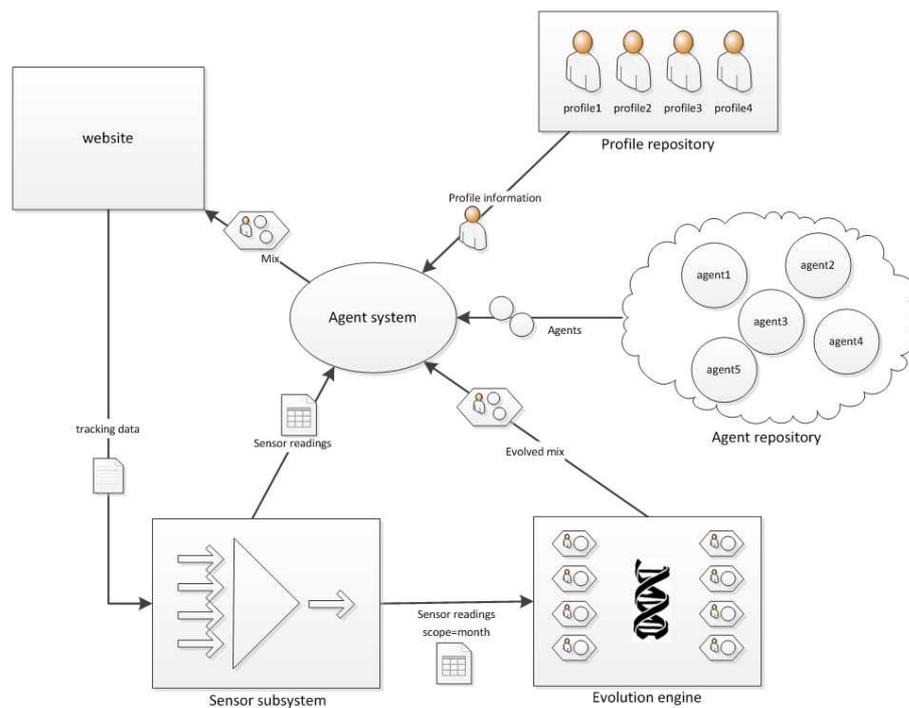


DIAGRAM 14 - SYSTEM OVERVIEW

## SENSOR SUBSYSTEM

Sensor subsystem consists of tracking data processing algorithms that transform incoming data stream into semantic information. The subsystem consists of individual sensors. Each sensor is responsible of recognizing different user property. For instance

one sensor might count the user visit number, another a total number of items in a shopping cart; visit duration; visit depth; recently seen product list, etc..

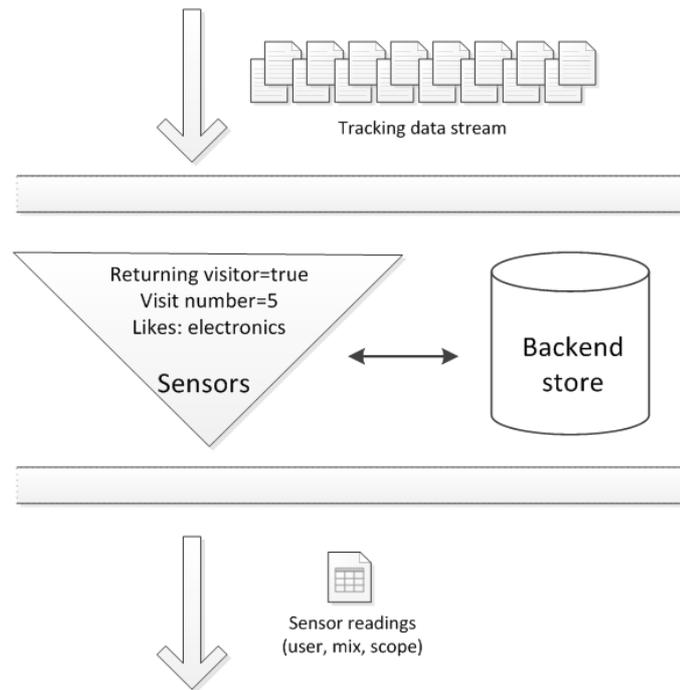
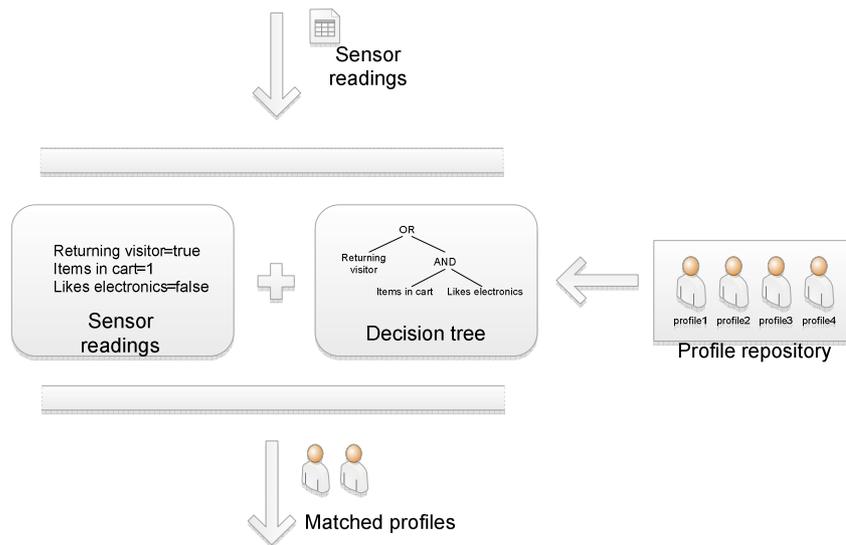


DIAGRAM 15 - SENSOR SUBSYSTEM

### PROFILE MATCHING

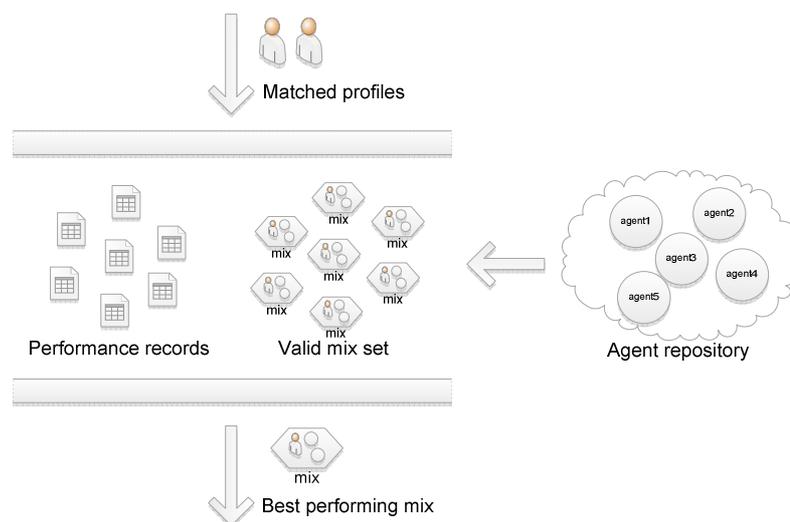
When user visits a website an agent system assigns a mix that will serve the user along the whole browsing session, and for few following days. The process of assigning a mix to a user can be described with two steps: customer profile matching and mix evaluation. To match incoming sensor reading data, customer profile is evaluated against sensor readings. The profiles are evaluated and when the rule described with binary tree evaluates to *true* value, then the profile is considered to be valid to handle the current user. The whole operation can be also seen as substituting true/false values in place of terminals in the profile binary tree, and then evaluating binary operators.



**DIAGRAM 16-CUSTOMER PROFILE MATCHING PROCESS**

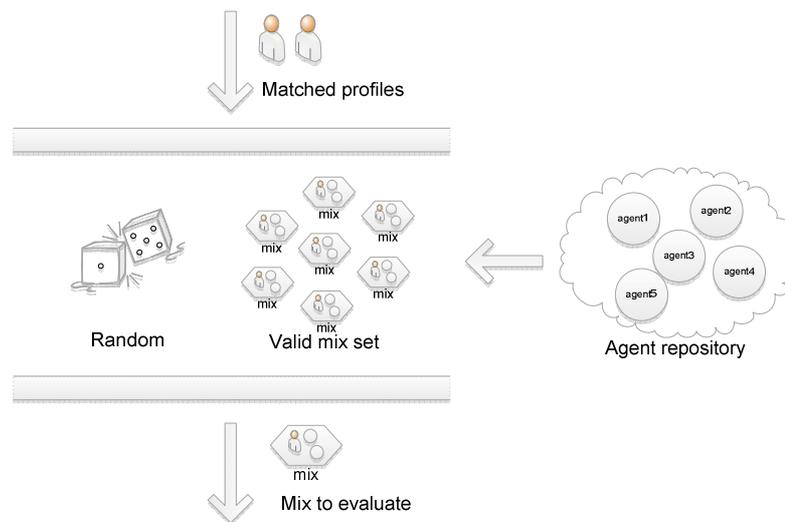
*MIX EVALUATION*

Consecutive step of assigning mix to visiting user is mix evaluation, where the best mix for serving user described by matched profiles is found. During this step we first find valid mixes that contain matched profiles, and then each valid mix is evaluated against its performance records. The best performing mix within the valid mix group is chosen to serve the customer.



**DIAGRAM 17-MARKETING MIX EVALUATION PROCESS**

To be able to discover the best performing mix we need some traffic to perform tests. During a test a valid mix is attached randomly to visitor and its performance record is evaluated. Since we select a random representative from a set of valid mixes, this randomness is still kept within the domain constraints. Some amount of not predictive system behavior is necessary to maintain the adaptive capabilities. One task the system is given, is to explore the area of possible solutions. Being given a unique possibility to easily perform experiments, with ready to apply marketing mix and real live visitors, testing valid but still not evaluated solutions seems to be an effective approach.



**DIAGRAM 18 - RANDOM VALID MARKETING MIX SELECTION**

The percentage of traffic we use for testing vs. the percentage handled by the best performing mix is a tradeoff between the system performance and adaptive capabilities. It is usually a good idea to perform extensive tests in the beginning of the system operation and focus on performance later on.

### *EVOLUTION ENGINE*

The task of evolution module of the system is to mix and match profiles and agents to optimize an evolution goal. One of the simplest goal that can be defined for such system is to maximize profit generated for each user visit. Having goal defined as such we can propose a basic *fitness* function, that quantifies quality of any mix generated by the system.

$$fitness(mix) = \frac{profit}{number\ of\ visits}$$

A task of an evolution engine is to generate new valid mixes while at the same time those that do not perform well. An automated evolution engine itself has not been fully implemented in the prototype system. A partial implementation allowed marketer to semi-automatically mix and match profiles and mixes to generate new possible solutions. Provided that marketer has a full information about how each profile and mix performed across a series of experiments, the task involved mixing the best performing agents with each other, while eliminating the worst solutions from both profile and agent pools. Semi-automated approach seems to be quite effective for smaller websites, as it gives a marketer full control over the process. It can be however almost fully automated. Design of such an automated module has been described in details in the last chapter of this thesis (see Further Research).

# EXPERIMENT I

The testing environment is an ecommerce website, which offers around 10000 art prints for sale. The art prints offered by the website can be framed online with one of 100 offered frames. Art prints and framed art prints are the final products sold on the website.

## PLAN

In the first experiment we will test the agent system in the live environment. To be able to easily track the system operation we shall simplify the system to the minimum. In the pre-test we will test six simple mixes, one sensor and three different agents handling very simple pricing strategies (offering a percentage discount).



**DIAGRAM 19 - PROFILES(LEFT) AND AGENTS (RIGHT) EXAMINED IN THE FIRST EXPERIMENT**

The only sensor we will use in the initial experiment is *new or returning visitor sensor* that is providing an information whether the visitor coming to the website has already visited us before. This simple sensor defines two possible user profiles:

- “Returning visitor” – the sensor recognized the visitor as a returning one
- “New visitor” - the sensor didn’t recognized the visitor as a returning one – it’s a first visit on a website

The only three agents has been implemented to the initial experiment. They represent simple discount strategies, and those are:

- “Discount 10% strategy” - give visitor 10% discount
- “Discount 20% strategy” - give visitor 20% discount
- “No discount strategy” - Don’t offer any discount

The resulting set of agents that we will test is all the 6 combinations of the available sensor reading and the strategy, those are:

- 1) New visitor => no discount - if a new visitor is coming to the website the agent will not offer him any discount
- 2) New visitor => discount 10% - if a new visitor is coming to the website the agent will offer him 10% discount
- 3) New visitor => discount 20% - if a new visitor is coming to the website the agent will offer him 20% discount
- 4) Returning visitor => no discount - if a returning visitor is coming to the website the agent will not offer him any discount
- 5) Returning visitor => discount 10% - if a returning visitor is coming to the website the agent will offer him 10% discount
- 6) Returning visitor => discount 20% - if a returning visitor is coming to the website the agent will offer him 20% discount

The graphical representation of possible mixes is presented bellow. Please note that colors of profiles and agents correspond to those used in previous illustration.



**DIAGRAM 20 - A GRAPHICAL REPRESENTATION OF POSSIBLE MIXES IN A FIRST EXPERIMENT**

To track the performance of the mixes a simple performance indicators have been implemented, those are initially:

- Handled visitors – represents the number of visitors the agent has handled
- Page views – shows the total number of page views the agent has handled
- Revenue – shows the revenue generated by the agent, i.e. the sum of orders values the agent has acquired

- Discount – shows the total value of discount the agent has given to clients, those are promotion costs
- Profit – shows the total profit the agent has generated during his lifetime. The profit is the revenue minus promotion costs minus the costs of the goods. We assume that 70% of revenue is the cost of the goods.
- Fitness (profit per visitor) – is the profit divided by the number of visitors handled.

## HYPOTHESES

Before event starting the experiment we can find out that new and returning visitors behave quite differently within this particular website. Data provided by Google Analytics tells that time spent on site for returning visitors is 7 minutes, whereas new visitors spend only 4 minutes browsing the website. Returning visitors on average see almost 11 pages, while new visitors only 7. The conversion rate (purchases per visit) for new visitors is almost ten times lower than for returning. Therefore it seems reasonable to assume that returning visitors have different motivations for visiting the website than new visitors. Probably returning visitors represent more often goal directed browsing while most of new visitors came to the website accidentally and their motivation represents more experimental browsing (Wolfenbarger & Gilly, 2000). If in fact consumers that don't plan any purchase, are more sensitive to incentives (Janiszewski, 1998) then offering discounts to new visitors should be more profitable than offering discounts for those that have visited the website before. Therefore hypothesis that can be stated is: New visitors are more sensitive to price incentives than returning.

## RESULTS

The data presented bellow contains a preprocessed agent performance data. From the raw data all the cancelled orders (test orders, doubled orders, orders cancelled by customers) and orders made by internal customer service stuff were removed.

	<b>Handled visitors</b>	<b>Page views</b>	<b>Orders</b>	<b>Revenue</b>	<b>Discount</b>
<b>new visitors (<math>\Sigma</math>)</b>	<b>35246</b>	<b>84308</b>	<b>46</b>	<b>6 524 zł</b>	<b>409 zł</b>
no discount	11748	41944	11	1 779 zł	- zł
discount 10%	11749	41028	17	2 192 zł	141 zł
discount 20%	11749	43280	18	2 552 zł	268 zł
<b>returning visitors (<math>\Sigma</math>)</b>	<b>6691</b>	<b>24629</b>	<b>99</b>	<b>16 605 zł</b>	<b>1 211 zł</b>
no discount	2230	14154	28	4 715 zł	- zł
discount 10%	2231	10054	33	6 376 zł	360 zł
discount 20%	2230	14575	38	5 514 zł	851 zł
<b>Grand Total</b>	<b>41937</b>	<b>108937</b>	<b>145</b>	<b>23 129 zł</b>	<b>1 620 zł</b>

TABLE 2 - EXPERIMENT RESULTS

*Handled visitors* – number of visitors handled by each agent, agents having the same activation rule have handled visitors (almost) the same number of visitors. This is implied from the system implementation. The experiment was performed on total number of 41937 website visitors.

*Page views* – number of page views handled by each agent. We can notice an aberration in the agent *returning visitor => discount 10%* that handled 30% less. Before the experiment has begun, a 10% promotion was active for a few weeks on the website, which might be the reason of the aberration.

*Orders* – number of client orders acquired by each agent. We might see that this number grows with the discount offered by agent, so it follows the basic economic principled of demand elasticity.

*Revenue* – the total value of orders acquired by each agent after discount and tax. We might see that returning visitors (16% of all total visits) generate around 72% of website revenue. This proportions fit well within the Pareto principle.

*Discount* – the total value of discounts offered by each agent. This is the cost of promotion.

*PERFORMANCE INDICATORS*

The table below shows already processed experiment results, all the derived agent performance indicators are described below.

Activation Strategy	rule	Visits per order	Profit per visitor	Revenue per visitor	Average order value	Average discount
<b>new visitor (Σ)</b>		<b>766</b>	<b>0,067 zł</b>	<b>0,185 zł</b>	<b>141 zł</b>	<b>5,9%</b>
	no discount	1068	0,061 zł	0,151 zł	161 zł	0,0%
	discount 10%	691	0,067 zł	0,187 zł	128 zł	6,1%
	discount 20%	653	0,073 zł	0,217 zł	141 zł	9,5%
<b>returning visitor (Σ)</b>		<b>68</b>	<b>0,884 zł</b>	<b>2,482 zł</b>	<b>167 zł</b>	<b>6,8%</b>
	no discount	80	0,846 zł	2,115 zł	168 zł	0,0%
	discount 10%	68	1,046 zł	2,858 zł	193 zł	5,3%
	discount 20%	59	0,760 zł	2,473 zł	145 zł	13,4%
<b>Grand Total</b>		<b>289</b>	<b>0,221 zł</b>	<b>0,552 zł</b>	<b>159 zł</b>	<b>6,5%</b>

**TABLE 3 - AGENT PERFORMANCE INDICATORS**

*Visits per order* – this indicator tells how many visitors on average the agent have to handle before it will convert one visitor into a customer. We might notice a huge difference between the two groups of visitors (new & returning). Returning visitors are over ten times more likely to make a purchase.

*Profit per visitor* – this is the key performance indicator (KPI) from business point of view. Tells how big profit on average each agent generate from a single visit. This indicator is discussed in details later in this chapter.

*Revenue per visitor* – this indicator tell how big revenue on average each agent generate from a single visit.

*Average order value* – tells the average value of order purchased within the group of clients handled by an particular agent

*Average discount* – tells the average discount offered by each agent. One might notice that this value lower that the percentage discount offered by an agent. This is because the discount was offered only for art prints not for framing services, while many customers buy framed prints.

## PROFIT ANALYSIS

As mentioned above the key performance indicator for an agent from the business point of view is the profit it can generate per single visit. Agent activation rule defines the group of visitors an agent can handle. Each group of visitors have a different characteristics, therefore comparing agent performance makes sense only within the same activation rule group.

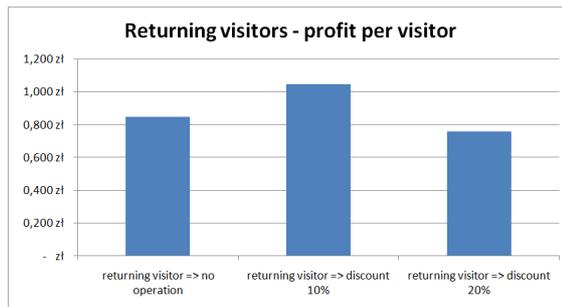


DIAGRAM 21 - RETURNING VISITORS - PROFIT PER VISITOR



DIAGRAM 22 - NEW VISITORS - PROFIT PER VISITOR

The experiment shows that the best performing agents are:

- *new visitor => discount 20%* - Profit per visitor = 0,073 zł per visitor
- *returning visitor => discount 10%* - Profit per visitor = 1,046 zł per visitor

This actually confirms the hypothesis that new visitors are more sensitive to price incentives than returning. It also shows that differentiating marketing mix for different segments of users might be an effective strategy for optimizing a marketing mix within a website.

## CONCLUSIONS

Before introducing an agent system to the website it was impossible to reliably track the onsite promotion efforts because the sales figures vary significantly in time. Hence the pricing strategy was to offer a discount from time to time when there is an occasion e.g. Christmas time, valentine's day, mother's day etc. Having the agent system we can precisely measure the impact of discount offered, and compare previous discount strategy to the one optimized by the agent system.

<b>No segmentation:</b>	<b>Profit per visitor</b>		<b>Total profit<sup>7</sup></b>
	<b>new visitors</b>	<b>returning visitors</b>	
no discount	0,061 zł	0,846 zł	7 794 zł
discount 10%	0,067 zł	1,046 zł	9 378 zł
discount 20%	0,073 zł	0,760 zł	7 666 zł
<b>No segmentation average:</b>			<b>8 280 zł</b>
<b>Agent system:</b>	<b>0,073 zł</b>	<b>1,046 zł</b>	<b>9 582 zł</b>

TABLE 4 - SALES STRATEGIES WITH &amp; WITHOUT THE AGENT SYSTEM

The table above shows that that optimization of the discount strategy, and even a very basic visitor segmentation with an agent system offer a rise in profit generated by a website, comparing to the previous pricing strategy. This relatively simple experiment shows that the idea of using agent system for formulating a marketing mix strategy is an effective method for optimizing the promotional budget. Moreover the natural experiments performed during the operation of the agent system give the website owner a deep insight into the effects of the promotional efforts performed onsite, and characteristics of each tested target groups, and therefore might replace other customer studies.

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<sup>7</sup>For total number of 35246 new visitors & 6691 returning visitors in the sample

# EXPERIMENT II

The next research step was an attempt to implement the system to solve marketing optimization problem at a full scale in a real life environment. The same e-commerce website was used for testing the solution, but this time much more agents, mixes and profiles were tested.

## PLAN

Because system was tested in a real life environment it could not be fully controlled. The plan had to be elastic and be able to respond to changes in business requirements and conditions. The system was applied to test and control all the marketing efforts carried out on the host website. Initially this was all discounts and rebates that have been offered to customers, promotional banners, and homepage graphics that usually represent the current promotion. Later on the system was also used to find out how many products should we present to the customers on a search result page.

## *MEASUREMENT AND METRICS*

The system was tagging all the customer orders with information which agent combination was active when order has been placed. Moreover Google Analytics data have been imported to the system to provide precisely measured analytical metrics. Overall more than ten metrics have been tracked for each marketing mix composition, the most important are:

- Page views – how many pages visitors have seen for each given mix composition
- Visits – how many visits a mix have served

- Orders – how many orders have been placed
- Product sales – how many products have been sold
- Discount – amount of discount offered by a given mix composition
- Revenue – amount of revenue generated by a mix
- Profit – profit generated by a mix
- Time on site – amount of time spent on site by visitors handled with given mix composition

Having those metrics key performance indicator (KPI) and fitness function has been calculated. As already stated before our fitness function is defined as “profit per visit”, i.e. the ability of a mix to generate profit from each single visit. The formula for the fitness function is very simple.

$$Fitness(mix) = \frac{Profit}{Visits}$$

### AGENTS

Throughout the experiment over 70 agents have been tested. Agents can be grouped into four basic categories:

- **Discounts** – 22 agents that offer discount for different categories of products.
- **Banners** – 21 promotional banners that have been displayed on top of each page.
- **Homepage promos** – 25 promotional graphics displayed on website homepage.
- **Product list customizations**– 4 agents controlling the number of products displayed on category pages.
- **Others** – few other experimental agents for testing other website features.

The table below shows names of all the tested agents. Using the classical marketing mix nomenclature (product, price, promotion, place) the *discount* agents would represent the *price* component of marketing mix. Banners and homepage promos is the *promotion* component. The *product* component is represented partially by homepage promos, since they usually contained graphics that promoted certain subset of products offered by the website, as well as product list customization agents. Similarly as in the previous experiment the place component of marketing mix is constant and we don't manipulate it.

Discounts	Banners	Homepage promos	Product list customizations
10% off - framed pictures	banner - 10% off - living room	homepage - 10% off - living room	15 products per page
10% off - living room			18 products per page
15 products per page	banner - 20% off - bedroom	homepage - 20% off - bedroom	21 products per page
18 products per page			30 products per page
20% off - bedroom	banner - 20% off - in stock	homepage - 20% off - in stock	
20% off - everything	banner - 20% off - living room	homepage - 20% off - living room	
20% off - framed pictures			
20% off - in stock	banner - 20% off everything	homepage - 30% off - bedroom	
20% off - living room		homepage - 30% off - in stock	
21 products per page	banner - 30% off - bedroom	homepage - 30% off - kids room decorations	
30 products per page		homepage - 30% off - kids room decorations (pink)	
30% off - bedroom	banner - 30% off - in stock	homepage - 30% off - kitchen	
30% off - canvas	banner - 30% off - kids room decorations	homepage - 30% off - kitchen (garlic)	
30% off - everything	banner - 30% off - kids room decorations (pink)	homepage - 30% off - living room	
30% off - in stock	banner - 30% off - kitchen	homepage - 30% off - office room	
30% off - kids room decorations	banner - 30% off - kitchen (garlic)	homepage - 30% off - office (elegance)	
30% off - kitchen decorations	banner - 30% off - living room	homepage - 30% off - office (elegance)	
30% off - living room	banner - 30% off - office decorations	homepage - 30% off - office decorations	
30% off - office decorations	banner - 30% off - office (elegance)	homepage - 40% off - in stock	
40% off - in stock	banner - 30% off - office decorations	homepage - 60% off - in stock	
50% off - in stock	banner - 30% off canvas (red)	homepage - art prints	
60% off - in stock	banner - 30% off everything	homepage - canvas category	
	banner - 40% off - in stock	homepage - canvas prints. NEW!	
	banner - 60% off - in stock	homepage - canvas prints. NEW!	
	banner - canvas prints. NEW!	homepage - christmas flyer	
	banner - christmas flyer	homepage - decorations	
	banner - living room up to 50% off	homepage - framed art prints	
		homepage - framed decorations	
		homepage - living room up to 50% off	
		homepage - posters	
		homepage - top products	

TABLE 5- AGENTS EXAMINED DURING A CASE STUDY

Please note that not all the agents have been implemented and introduced on the website on the first day of the experiment. As it happens in the real life web development, initially only half of the agents have been implemented and along with the time new ones were developed and included within the experiment.

### SYSTEM OPERATION

As new agents have been developed when the system was already running, they have been deployed just after being developed; hence this didn't happen within equal periods of time. Instead new agents have been introduced to the system in groups, since it was more effective for the design & development team to implement few new agents at a time, than one by one. As soon as they have been developed they needed to be tested to bring feedback for the team on how they are performing. After enough data have been collected (and the team has had spare resources) new agents were developed. The whole system operation process can be visualized as follows.

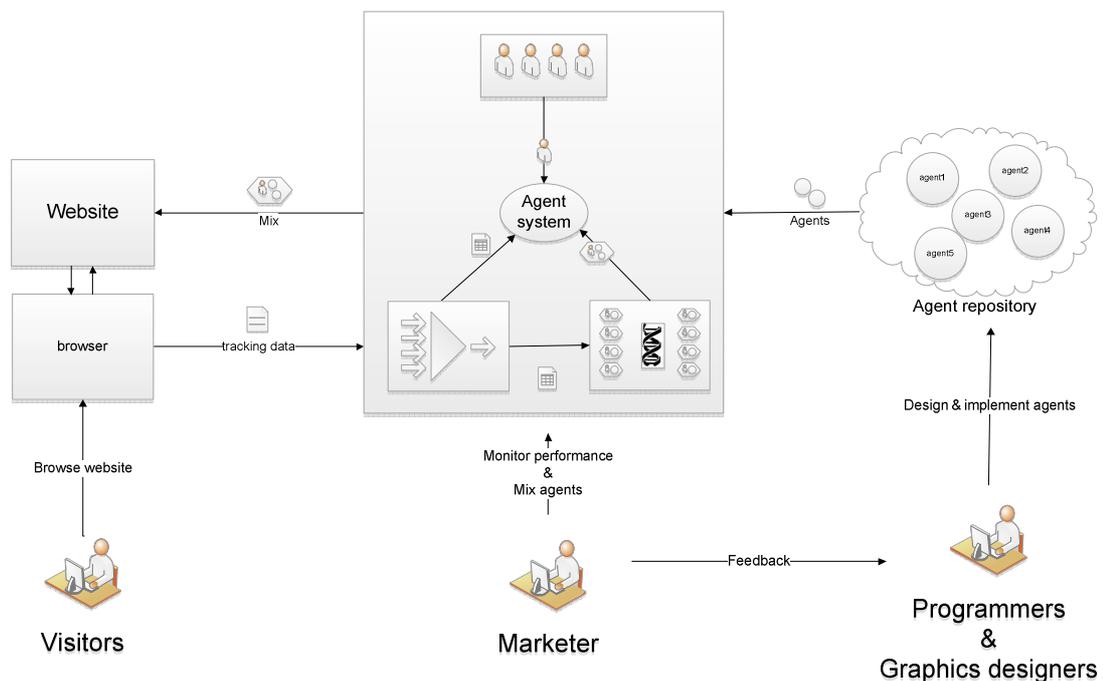


DIAGRAM 23 - SYSTEM OPERATION PROCESS

The process involves three main actors and roles associated with them:

- Programmers & graphics designer – they form a development team with responsibility is to design and develop new agents.

- Marketers – are responsible for mixing the agents in a reasonable way, assigning them to proper target groups (profiles) and monitoring the system performance in terms of profit generated.
- Visitors – use the website and with their purchasing decisions vote for the best mixes.

It is vital that the marketers give feedback to development team on how the agents are performing. If we want the system to move forward in terms of performance newly developed agents should not carry old mistakes.

### *PROFILES*

Total ten customer profiles have been evaluated; they can be divided into four major groups:

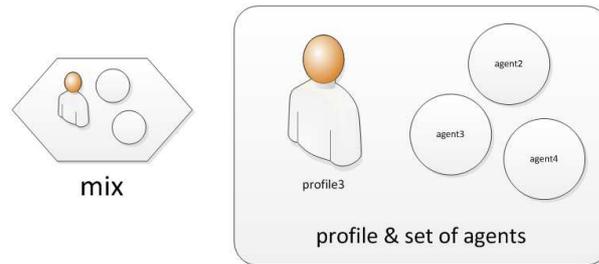
- New visitors – users visiting the website for the first time
- Returning visitors – users that have visited the website before
- Keywords based profiles – users that visited the website by typing in google keywords specific for one of the product groups: bedroom, canvas, kids, kitchen, living room, office, posters,
- Flyer – users that landed on an URL that was printed on a physical (offline) flyer distributed among company former customers

### *EVOLUTION*

As stated before the automatic evolution component have not been implemented in the prototype system. Instead the genetic operators have been applied manually. I.e. the described heuristics have been applied to generate new population of marketing mix compositions. In fact this was quite time consuming process, and therefore should be automatic in the production environment. Because of that during the experiment 10 populations of mixes have been tested. The whole experiment has been carried since April 2009 until December 2009. After this date the system was still running, assigning agents to clients but no new populations of mix compositions have been introduced. Therefore during the analysis we will focus on the time period when the whole system actually evolved.

## HYPOTHESES

Given over 70 agents and 15 different user profiles we can create over 1000 possible marketing mixes for this single particular website. Each website visit handled by the system is actually a micro experiment testing performance of a single marketing mix. To remind ourselves as a mix we define as a user profile + a set of agents.



Given that we optimize a fitness function defined as:

$$Fitness(mix) = \frac{Profit}{Visits}$$

It implies that each marketing mix that is tested during the system operation is actually a hypothesis saying:

$H_i$ : A particular set of agents contained by a given mix is more profitable than any other set of agents for a given user profile.

As we are testing over a thousand of hypotheses it is not feasible to make up a theory behind each single one. This is however not our goal. Our goal is to explore a space of possible marketing mixes for a given particular website to find out which one is the best performer. We should treat this research as exploratory rather than confirmative and therefore provide insights into observed user behaviors and reactions to particular marketing efforts, rather than validation of theoretical assumptions. However we should try to come up with some general findings after performing all the experiments it should be again underlined that each website is a specific environment. Therefore not all findings that come out from this research might be valid for other websites. What should be valid and general however, is the proposed method and a procedure for exploring a space of possible marketing solutions.

## INSIGHTS

During the nine months testing period (May-December) the website running the agent system have been visited 873610 times, by 641066 unique visitors that generated over 8 milion page views. Those visitors have made 4634 transactions and purchased 9046 products. Managing over 70 website features that form multiple combinations that are displayed differently to each of the 15 group of customers require insights into what actually happens inside the system. Which features and promotions are displayed more often, which work better than other, which group of customers respond best to our marketing efforts, etc.

### *INSIGHTS USER INTERFACE*

During the experiment vast amount of data have been generated that yield the need for developing tools to visualize them to gain insights into what they actually represent. For this sake a data visualization library developed by Stanford University Visualization Group called Protovis have been used. This allowed development of dynamic and visually rich graphs and visualizations using state of art technology. The diagrams presented later on in this work are dynamic graphs accessible through a modern HTML5 web browser throughout a simple web interface. To analyze the experiment data an analysis package has been developed. Most of the graphs in the next chapters have been generated with the package.

#### **Mix performance analysis**

Start date: 2009-05-01 End date: 2009-12-30

Metric: Visits Period: month Type: Line

Mixes All None By profile

- G5: 21 products
- G5: 30 products
- G5: combination 4
- G5: combination 5
- G5: combination 6
- G5: combination 7
- G6: combination 1
- G6: combination 2
- G6: combination 3
- G6: combination 4

**DIAGRAM 24 - MIX PERFORMANCE ANALYSIS QUERY USER INTERFACE**

The developed analysis package lets the marketer query the collected data and visualize them with Protovis library developed by (Stanford Visualizations Group). Performance data can be visualized with line, area and stacked area charts, the collaboration data is visualized with matrix, and force-directed graph algorithm (Stanford Visualizations Group).

### Agent performance analysis

Start date: 2009-05-01 End date: 2009-12-30  
 Metric: Visits Period: month Type: Line

Agents All None Active

- 10% off - framed pictures
- 10% off - living room
- 15 products per page
- 18 products per page
- 20% off - bedroom
- 20% off - everything
- 20% off - framed pictures
- 20% off - in stock
- 20% off - living room
- 21 products per page
- 30 products per page
- 30% off - bedroom
- 30% off - canvas
- 30% off - everything
- 30% off - in stock
- 30% off - kids room decorations

Profiles

- All visitors
- Flyer
- Keywords: bedroom
- Keywords: canvas
- Keywords: kids
- Keywords: kitchen
- Keywords: living room
- Keywords: office
- Keywords: posters
- New & adwords campaign "2008"
- New & keywords: art prints
- New & keywords: posters
- New visitors
- Returning & keywords: posters
- Returning visitors

DIAGRAM 25 - AGENT PERFORMANCE ANALYSIS QUERY USER INTERFACE

The data can be filtered to match applied time frame and presented daily or aggregated into weeks or months. Moreover we can visualize various the most important metrics visits, revenue, profit, profit per visit, as well as others: page views, product sales, discount, orders, time spent on site, bounces, unique pageviews, search visits, search uniques, search depth, search refinements.

### Profile performance analysis

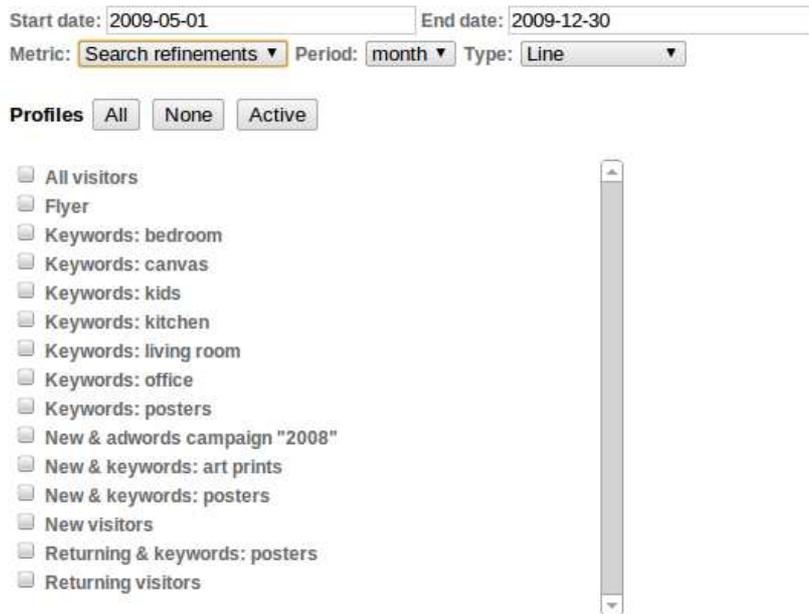


DIAGRAM 26 - PROFILE PERFORMANCE ANALYSIS USER INTERFACE

### VISITOR SHARE

Mixes compete between each other for visitors. The better the mix (higher profit per visit) the more visitors it will handle. Therefore measuring visitor share for each mix is a good start to analyze what is happening inside the system. The diagram below shows how the mixes did compete for visitors along the time the experiment was carried.

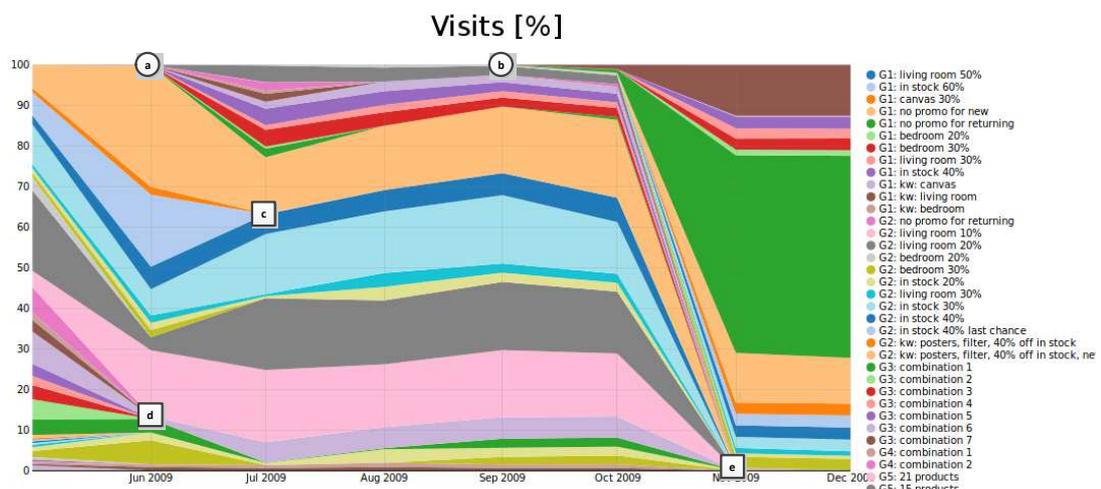


DIAGRAM 27 - MIX VISITOR SHARE

Each colored area on the graph corresponds to one marketing mix. Size of the area represents the relative number of visitors handled by this mix - that is a “visitor share”. On the graph we can observe when new mixes have been deployed (e.g. points a & b), when some mixes got extinct (e.g. points c, d, e), and which mixes gained significantly larger visitor share (green, light orange, light blue, etc.). Nevertheless this diagram is only a bird’s view on what was going on, the mixes occupying largest visitor share are actually the one that match profiles that are most common among all the visitors. So actually mixes with biggest overall visitor share are the ones playing in the biggest niche, not the ones that are best performing. Anyway since they handle a lot of visits they should be examined more carefully than less popular mixes. Anyway this kind of diagram gives marketer only an overview, while it is important to actually get insight, we shall dig the data a lot deeper.

We shall see a much more regular picture when we consider visitor profiles. Drawing the above graph separately for new and returning visitors uncovers much more regularity in the system behavior.



**DIAGRAM 28 - MIX VISITR SHARE - NEW VISITORS**

Visits [%] - returning visitors (monthly)

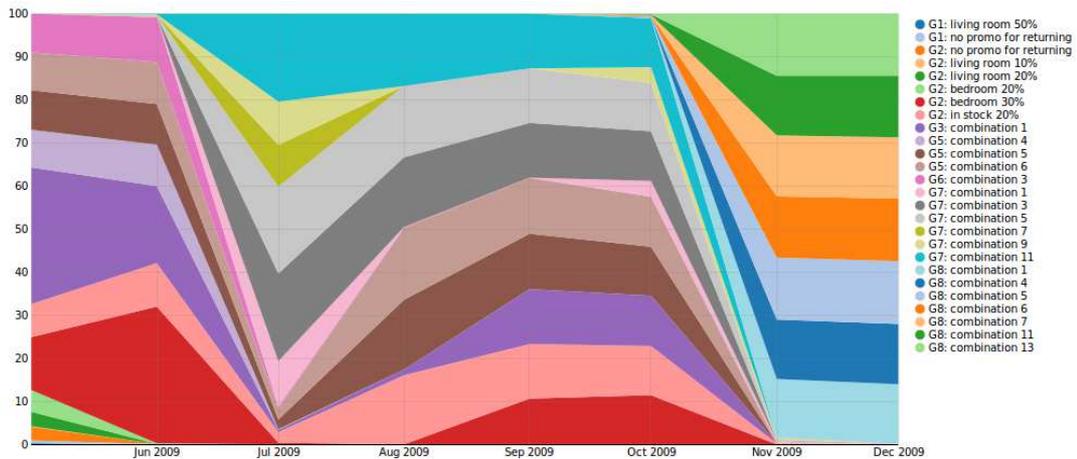


DIAGRAM 29 - MIX VISITOR SHARE - RETURNING VISITORS

Drawing separate graphs for each visitor profile reveals that visitor shares among mixes handling the same type of visitors are not very different from each other. In fact we might observe that after new mixes are introduced, some of them fall immediately and those who survive split the visitors quite equally between each other. Although the above graphs show up monthly averages and the daily picture shows a bit more complex system behavior.

Visits [%] – returning visitors (daily)

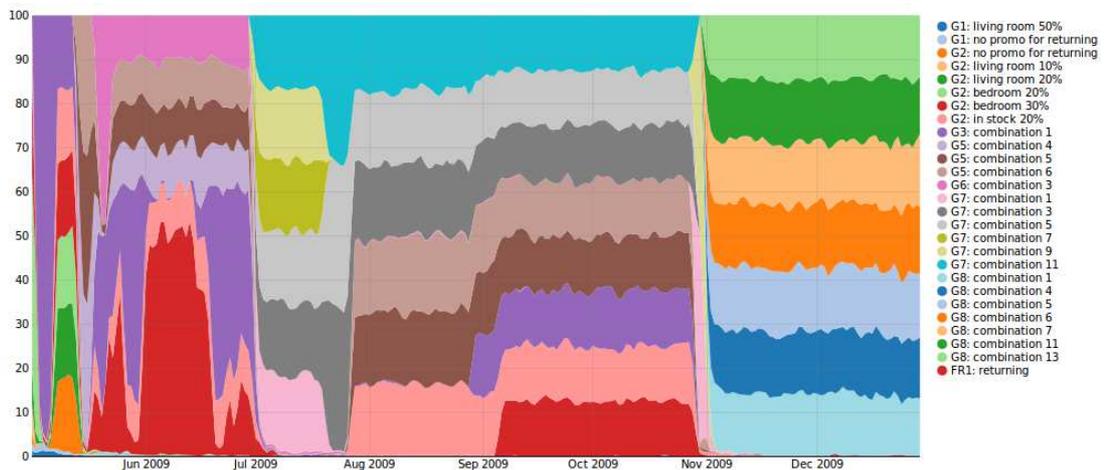


DIAGRAM 30 - MIX VISITOR SHARE - RETURNING VISITORS (DAILY)

If we compare the two above graphs we shall notice that they differ mainly at the beginning – from April till July – this was the time when the whole system was deployed and mixes have been introduced more often than one a month. Hence the monthly averages do not show the real picture, especially if we consider the first month of experiments. Yet it is far too early to draw any conclusions besides “mix xyz had the

biggest visitor share in August”. Hence the next step in analyzing the data should be an insight into how the mixes were composed.

**MIX COMPOSITIONS**

The matrix below shows how the mixes have been composed. Columns of the matrix represent agents sorted by the date and time they have been introduced, and rows represent mixes sorted in the same way. A red dot in a row X, column Y states that a mix X contained an agent Y. Hence when we look on one row in the matrix we shall see all the agents a mix (represented by the row) was composed of.

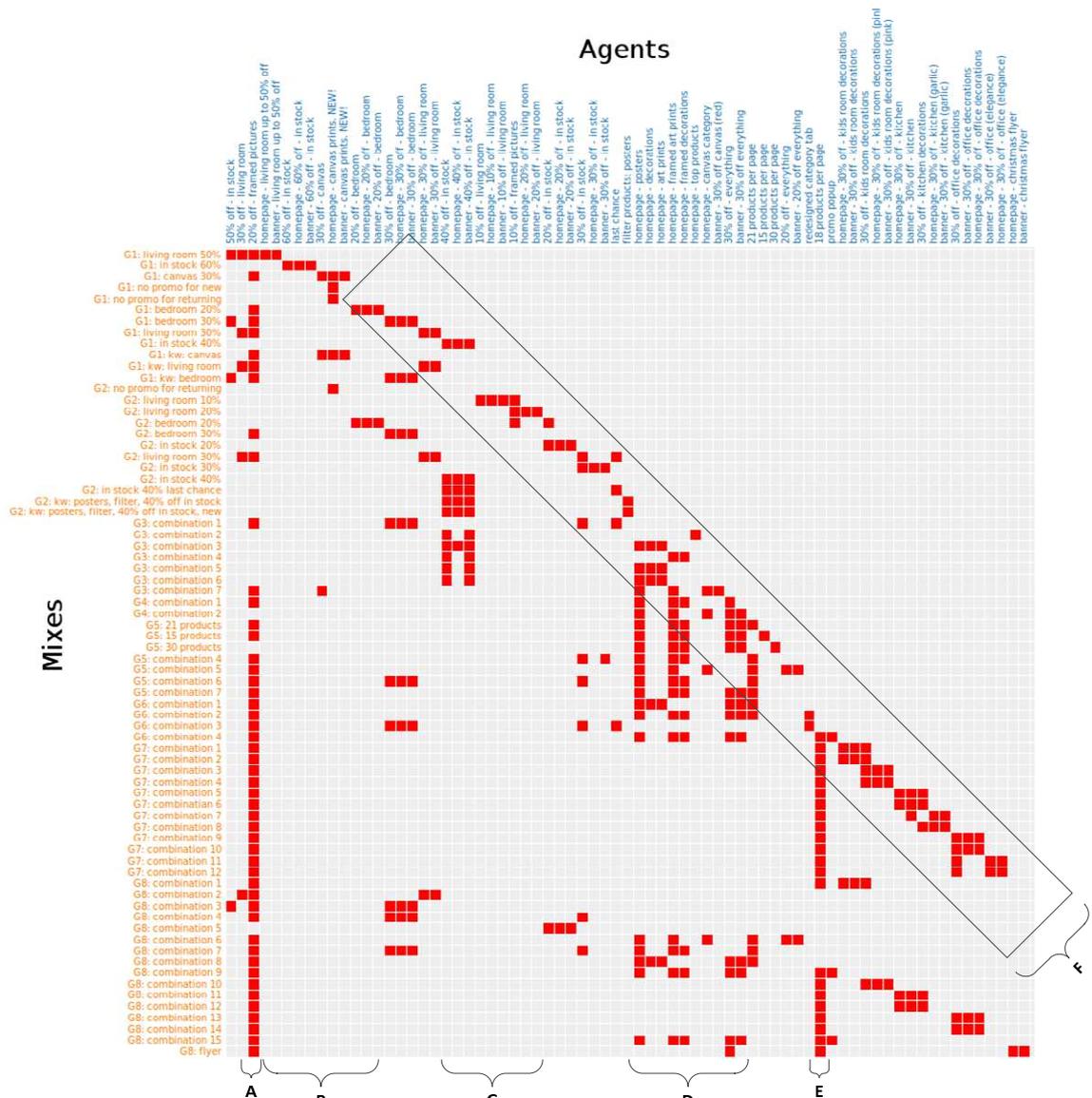


DIAGRAM 31- MIX COMPOSITION MATRIX

A few striking patterns emerge when we visualize the data on the matrix. Firstly we might notice that there are few agents that are very popular across the mix population (marks A & E) – because they are common to most of the mixes they become almost permanent feature of the website. On the other hand there are agents that didn't make it to survive to final generations of mixes, and have been eliminated along the initial populations (marks B & C). We shall also notice some promising agents that aren't that popular as former but since they have place in many agents of the final population they are likely to become permanent features later on (mark D). Eventually we might notice quite dense red area along the diagonal (mark F), this pattern shows up that simply new agents have been introduced along new mixes that came into the system.

### *AGENT COLLABORATION*

Since mixes are composed with multiple agents we might actually see agents collaborating with each other. To visualize this data we can construct a graph, where nodes represent agents and link connecting two nodes represent the fact that two agents have collaborated with each other, i.e. they were both present on a website at the same time. Diagram below is a visualization of such a graph.

Agent collaboration graph

size of a node = profit per visit



DIAGRAM 32 – AGENT COLLABORATION GRAPH

Besides the collaboration the graph above visualizes the main agent performance indicator -*profit per visit* which is indicated by the size of a node. The larger the node, the bigger profit the agent was able to generate upon a single visit. This indicator is calculated simply by dividing the total profit the agent has generated by the total number of visits it has handled. The graph itself has been drawn using the force directed layout, described by the Stanford Visualization Group as follows:

*An intuitive approach to network layout is to model the graph as a physical system: nodes are charged particles that repel each other, and links are dampened springs that pull related nodes together. A physical simulation of these forces then determines node positions; approximation techniques that avoid computing all pairwise forces enable the layout of large numbers of nodes. In addition, interactivity allows the user to direct the layout and jiggle nodes to disambiguate links. Such a force-directed layout is a good starting point for understanding the structure of a general undirected graph. (Stanford Visualizations Group)*

This kind of layout places the most connected nodes in the middle of other less connected, i.e. the most collaborating agents are in the middle of the graph. What we might notice is that the most connected nodes are also the biggest ones. This means that the best performing agents have been actually the ones that have been included in most of the mixes. Well, this should be quite intuitive, since the aim of the system is to promote the agents that generate the most value for the website.

The same graph can be presented with an adjacency matrix. In such case rows and columns represent agents and a point at intersection between a row and column tells that there is a link between the two. On the diagram below additionally a color on the row-column intersection represents an average profit per visit of the two collaborating agents ranging from yellow (low) to red (high).

### Agent collaboration matrix



DIAGRAM 33- AGENT COLLABORATION MATRIX

We might notice that the matrix is quite sparse, i.e. we have lots of blanks untested combinations. On one hand those are these not tested combinations, so we don't actually know how well they would be performing; on the other we didn't waste the traffic for testing all the combinations that didn't make sense and would probably confuse our visitors.

Unfortunately the graph above contains aggregate data, not segmented by visitor profiles. As the system pretest has shown the profit per visit indicator vary largely across different segments of visitors, and is few times larger for the returning than the new. Therefore red dots on the diagram above are likely to represent agents that have been used more often serving the most profitable groups of visitors, not the ones that

are best-performing in general. To overcome this problem we shall analyze the data just within a single visitor segment.

Agent collaboration matrix – returning visitors

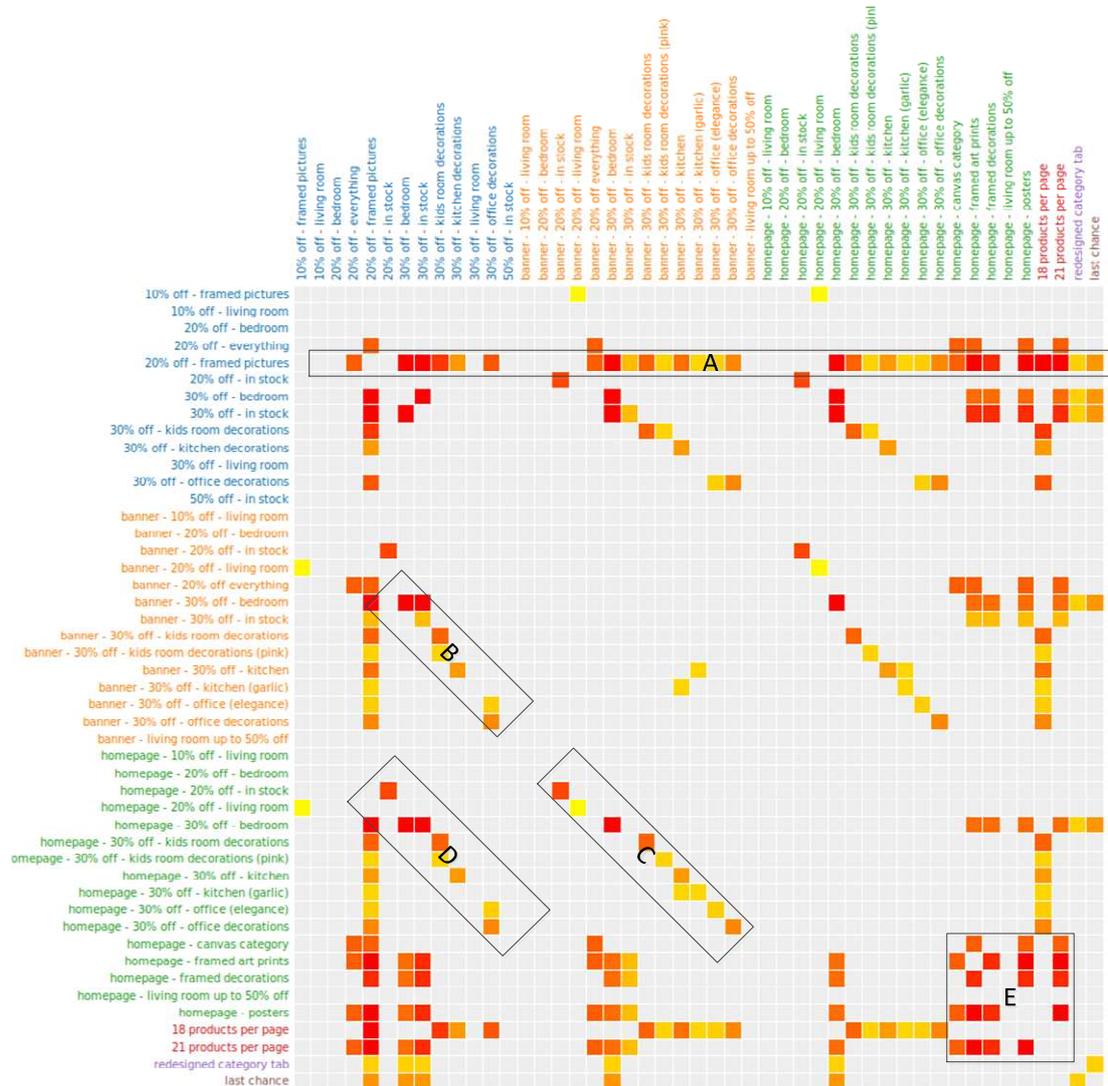


DIAGRAM 34 - AGENT COLLABORATION MATRIX - RETURNING VISITORS

The diagram above show the collaboration matrix filled just with data collected from a single visitor group. Therefore comparing the performance of different combinations makes much more sense that with the former matrix. We can actually quite quickly notice a group of high performing combinations (region E) – those are the combinations that generate the most value for the website, and therefore shall be examined thoroughly. Although what might be even more interesting is that a performance of a single agent can vary a lot when it is collaborating with other agents. On the region A, an agent (offering a discount for framed pictures) has been marked,

one can notice that this particular agent is performing either exceptionally well (red dots) or poorly (yellow dots) depending with what agents it does collaborate. This clearly shows that combination of agents is what actually matters. A single promotion or website feature is not necessarily a value generator; it is a mix of features and promotions that visitors either respond well to or not.

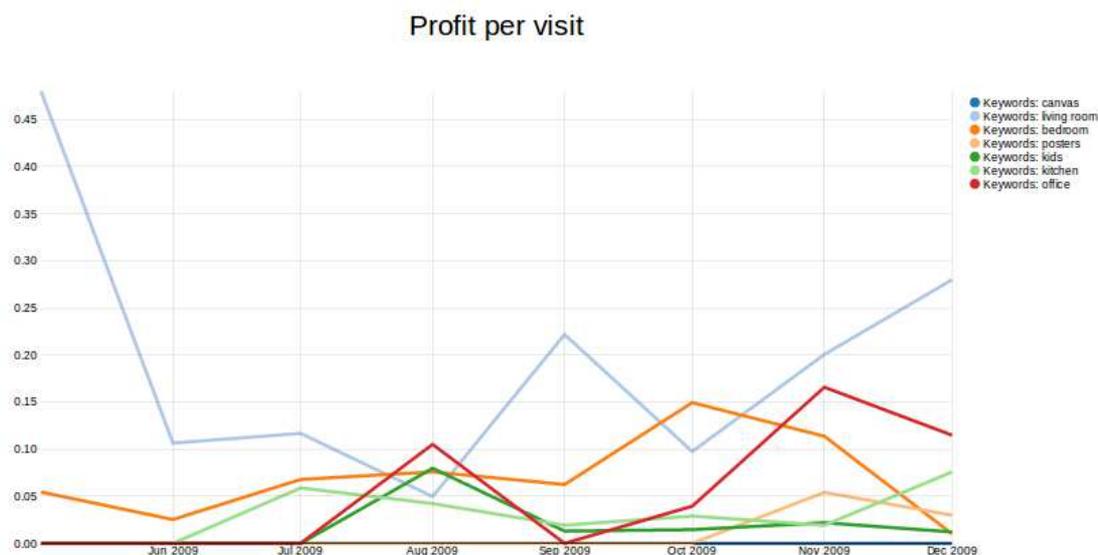
Patterns B, C, D marked on the matrix show that there are combinations of agents created to work with each other, like discount for “kitchen category” together with corresponding banner message and homepage promotional graphics. Those agents are not very “collaborative” i.e. they are so specific that they are unlikely to collaborate with lots of other agents. Therefore they form a diagonal pattern across different group of agents.

#### *PROFILE PERFORMANCE*

Customer segmentation is vital for effective marketing. Being able to target marketing message to specific group of customers might be a key competitive advantage for a company.

#### **Keyword based segmentation**

One strategy that have been examined was targeting the marketing message with a keyword user has typed in the search engine before visiting the website. For instance if user came from a keyword “kitchen decorations” a discount for this category has been offered together with relevant promotional message. Unfortunately this strategy yielded lower than website average profit per visit, for all seven groups of keywords.



**DIAGRAM 35 - KEYWORD BASED PROFILES PERFORMANCE**

### Offline advertisement response tracking

An interesting application of user profiling was response tracking for a physical flyer. While online advertisements are easy to track and most modern web analytics packages will simply calculate a ROI of an online campaign, things get more difficult when company starts to advertise offline. Since we are unable to track neither flyer impressions, clicks nor any other interactions, it is very difficult to measure whether an investment in offline ads did generate revenue whatsoever. Quite easy trick have been used to overcome this problem. A specially crafted, but easy to type in URL was printed on a flyer, and all the visitors that landed on this URL have been matched against a prepared profile, and served with a specialized mix that carried a promotional message relevant to one printed on the flyer. This way we were able to track all the visitors that came to the website by typing the URL that was printed on the flyer.

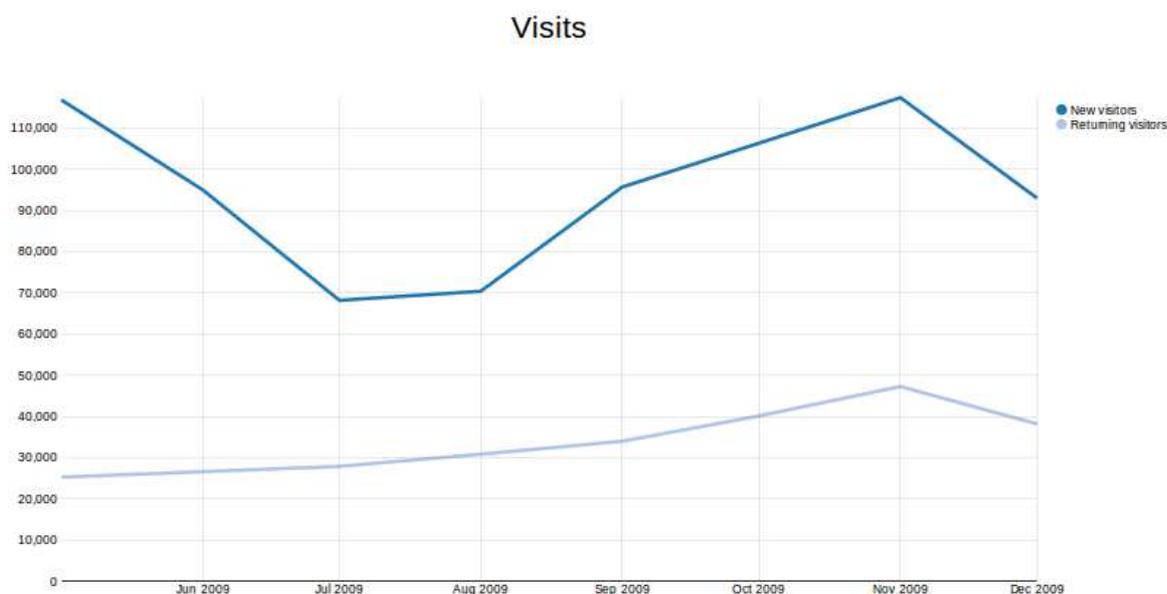


**DIAGRAM 36 - VISITS FROM AN OFFLINE ADVERTISEMENT (FLYER)**

All together 3000 flyers have been distributed. Although we cannot tell if all visitors actually came to website by typing the URL printed on flyer, but if most of them did then results were far from expected. The three thousand printed flyers brought only 76 visitors to the website that generated just one product sale. Well, there might have been several reasons for such a failure including an unconvincing copy on the flyer, the distribution method, etc., but even if the results were even ten times better the profit would not probably exceed the costs. This makes offline marketing for online business a risky path. Anyways, being able to track performance of such offline campaign let the company quickly adjust and reallocate its budget back to online advertising methods.

### **New & returning visitors**

The most interesting differences appeared between new and returning visitors. Results are similar to those obtained in the previous chapter, although now we have much more data, and we can carry much more detailed analysis.



**DIAGRAM 37 - NEW & RETURNING VISITORS**

There were more than twice more new visitors than returning, although the proportions have been shifting towards returning visitors along the testing period. Because after the pretest we knew that actually returning visitors are very important in generating profit, an effort has been put to keep them on site. In fact mixes that were able to turn new visitors into returning have been preferred along the selection process, as they could be easily identified within Google Analytics (see Diagram 38 - Mixes best converting new visitors into returning).

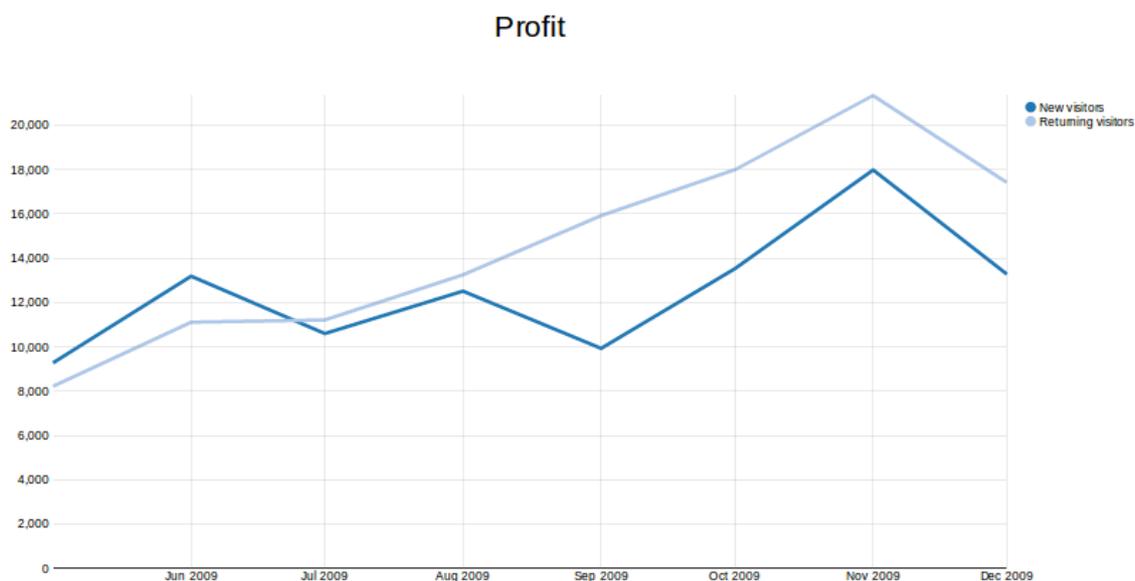
User Defined Value		Visits	Pages/Visit	Avg. Time on Site	% New Visits ↑	Bounce Rate
1.	G2: nowi - salon 30% + magazyn ostatnia sztuka 30%	1,110	7.80	00:10:50	78.11%	51.53%
2.	G3: nowi - magazyn 40% - homepage kategorie ogolne	5,215	7.50	00:04:48	76.05%	50.47%
3.	G3: nowi - magazyn 40% => homepage kategorie, opravione	2,347	6.80	00:05:32	78.48%	52.24%
4.	G3: nowi - magazyn 40% - homepage promo + kategorie	3,658	6.41	00:04:10	78.43%	51.56%
5.	G5: nowi => wszystko 30%, homepage: reprodukcje, obrazy, plakaty...	3,406	8.07	00:05:17	78.57%	49.47%
6.	G3: nowi => magazyn 40%, homepage: reprodukcje, obrazy, plakaty	3,158	6.76	00:04:22	79.45%	50.66%
7.	G4: nowi => wszystko 30%, homepage: reprodukcje, obrazy, plakaty	1,821	6.53	00:04:17	81.16%	52.83%
8.	G3: nowi - kw.obrazy - magazyn 40% => homepage canvas produc...	3,006	7.73	00:04:55	82.83%	49.53%
9.	G2: nowi - keyword:plakaty, filtr produktow, magazyn 40%	1,427	6.37	00:03:36	85.98%	41.70%
10.	G4: nowi - kw.obrazy - wszystko 30% => homepage canvas produc...	6,583	7.68	00:04:51	83.28%	48.35%

**DIAGRAM 38 - MIXES BEST CONVERTING NEW VISITORS INTO RETURNING (SOURCE: GOOGLE ANALYTICS)**



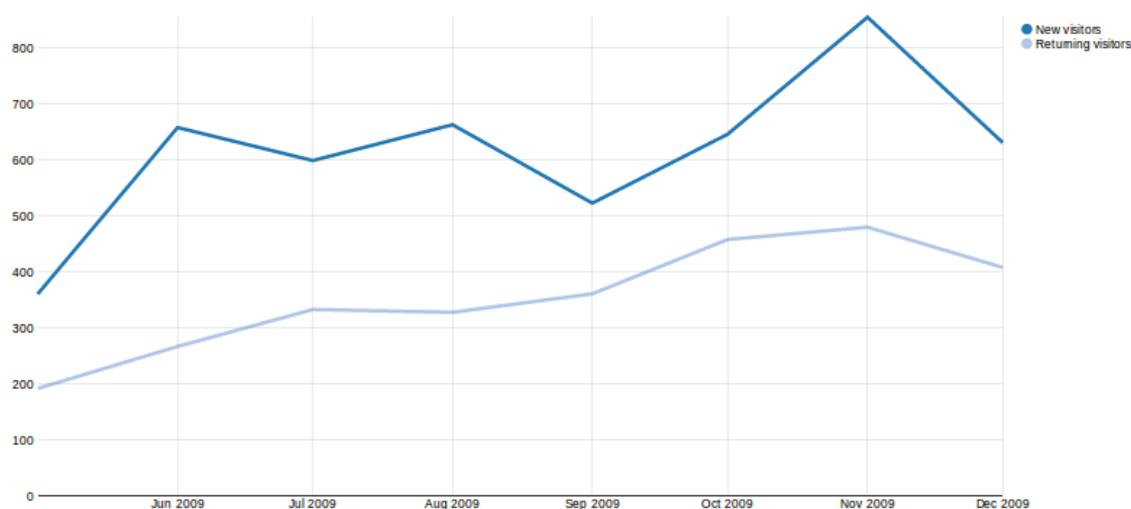
**DIAGRAM 39 - REVENUE - NEW & RETURNING VISITORS**

It is very interesting to see the relation between revenue (diagram above) and profit (diagram below) for new and returning visitors. Even though new visitors generate bigger revenue than returning, the discount and promotion costs are much greater if it comes to new visitors and so in case of profit the relation is opposite: returning visitors generate bigger profit for a website than new. This is far from obvious while there are more than twice new visitors on the website than returning.



**DIAGRAM 40 - PROFIT- NEW & RETURNING VISITORS**

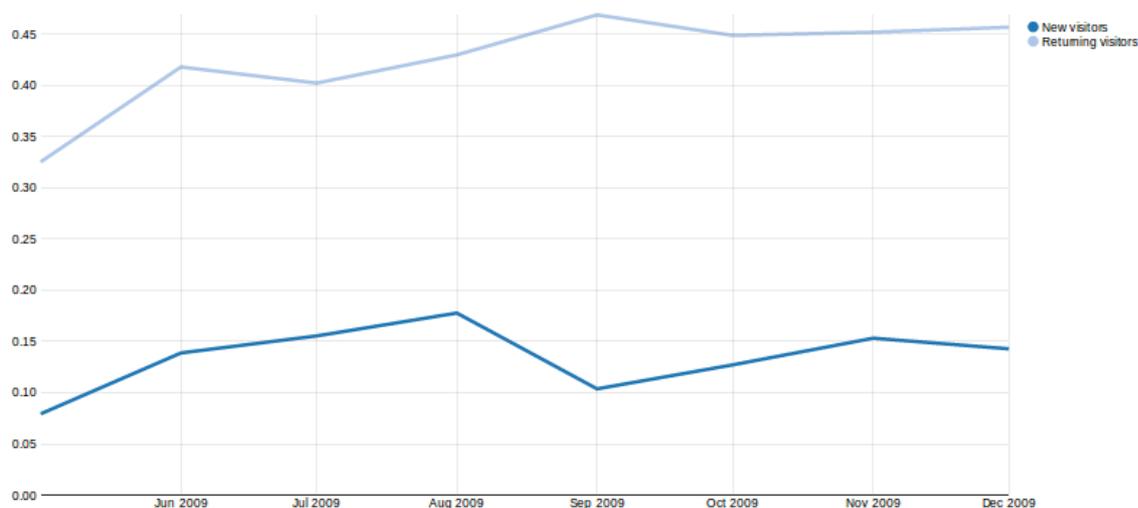
## Product sales



**DIAGRAM 41 - PRODUCT SALES - NEW & RETURNING VISITORS**

Another interesting difference between new & returning visitors shows the diagram above. We can see that new visitors purchased much more products than returning, even though they have generated less profit and only slightly larger revenue. This shows obviously that the new visitors are purchasing cheaper products and / or making smaller orders, while the returning are more confident and hence place orders larger in value. Larger orders are usually more profitable for company since usually the order processing costs are close to constant. This again this shows how important the returning visitors are in general and for this particular website.

## Profit per visit



**DIAGRAM 42 - PROFIT PER VISIT - NEW & RETURNING VISITORS**

Ultimately the profit per visit graph points out almost four times difference in profitability of new & returning visitors.

### **Summary**

The visitor segmentation capabilities of the system showed to be limited in real life applications. Keyword based segmentation surprisingly did not yield in increased marketing performance. However it is also possible that new ways of targeting a marketing message require new creative approach to copy and design. Finally marketing is far from being just technology; it always involves strong creative component, and only a harmonious combination of the two yields to high performance.

The research shows however, that there is a huge gap between new and returning visitors. They show different behavioral patterns, they differ significantly in all important metrics, and hence they should be handled differently. Following the Pareto efficiency rule, if a company cannot afford a live person support for all its visitors it still should provide it for returning visitors. Those are people that came to website to make a purchase and it is just a matter of whether they will find products they are looking for. We do not have to use any strong marketing to convince them to make a purchase or offer large discounts to facilitate sales; just help them find what they were looking for. Probably the things they are looking for are the ones they have seen in the previous visit; therefore it should be a good idea to instantly present them products relevant to their previous visit. Major e-commerce websites like amazon.com, ebay.com, allegro.pl etc. already actually replace the main marketing message on the homepage with presentation of products visitor have seen on the previous visit, sometimes with recommendation related to those products. The next picture shows amazon's approach to help returning visitors continue shopping.

### More Items to Consider

You viewed	Customers who viewed this also viewed			
ASUS G73JH-X5 Republic of Gamers 17.3-Inch... <del>\$1,799.00</del> <b>\$1,541.86</b>	ASUS G73JW-XA1 Republic of Gamers... <b>\$1,449.00</b>	Toshiba Qosmio X505- Q898 18.4-Inch... <del>†\$1,999.99</del> <b>\$1,798.00</b>	Alienware m15x- 472CSB 15-Inch Gaming... <del>†\$1,799.99</del> <b>\$1,519.01</b>	Toshiba Qosmio X505- Q894 18.4-Inch... <del>†\$1,599.99</del> <b>\$1,289.99</b>
<a href="#">View or edit your browsing history</a>				

### Related to Items You've Viewed

You viewed	Customers who viewed this also viewed			
Dell Inspiron i17R- 2857MRB 17.3-Inch... <del>†\$999.99</del> <b>\$898.00</b>	DELL i15R-2105MRB Core i5 2.53ghz... <b>\$770.18</b>	ASUS K72F-B1 17.3- Inch Versatile... <b>\$823.43</b>	Dell Inspiron i15R- 2646MRB 15.6-Inch... <del>†\$959.99</del> <b>\$869.99</b>	Samsung RF510-S02 15.6-Inch HD LED... <del>†\$1,079.99</del> <b>\$849.99</b>
<a href="#">View or edit your browsing history</a>				

#### DIAGRAM 43 - AMAZON.COM APPROACH TO HELP RETURNING VISITORS CONTINUE SHOPPING

The traditional marketing message is replaced with product recommendations based on what products the visitor has browsed during the previous visit. This slight homepage adjustment might be difficult to notice instantly, but the above research shows that this is very important. It just puts the returning visitor instantly back on the browsing path he has left leaving the website last time. Persistent shopping carts, that do not forget products visitor has put in it for at least few days, is another way to help visitor continue shopping. Notice that it is an easy way to actually personalize the website experience, since the products visitor has seen on the previous visit is unique for each person. This is the kind of marketing that does not try to convince people to buy products they don't want; instead it does the hard job of finding all the products a person is looking for and helps to continue shopping.

#### AGENT PERFORMANCE

So what have actually worked? Which promotions have proven to be the most effective? As the previous analysis tried to be more general, now let's focus on details. Since we shouldn't analyze aggregate data we will consider only returning visitors and agents that had been handling them during the experiment. The agents will be analyzed

separately in groups that served similar functionalities, to avoid the mistake of “comparing apples to oranges”.

### Number of products per page

One very important question the system has answered was the number of products that should be shown on a category page. The tests had shown that we could get significant 16% profit improvement just by limiting the number of products on page from 30 to 21.

TABLE 6 - NUMBER OF PRODUCTS PER PAGE TESTS RESULT

Agent	Visits	Profit	Profit per visit
18 products per page	107255	37790,54	<b>0,35</b>
21 products per page	68458	33914,98	<b>0,50</b>
30 products per page	94477	40563,62	<b>0,43</b>

Number of products presented on a single page is a tradeoff between choice offered to the end user and page load speeds. There are no rules to follow while it is a factor individual for each website, hence testing is probably the only way to find out the right number. Note that further limiting the number of product per page (to 18 per page) actually lowers the website performance.



DIAGRAM 44 - NUMBER OF PRODUCTS PER PAGE PERFORMANCE IN TIME

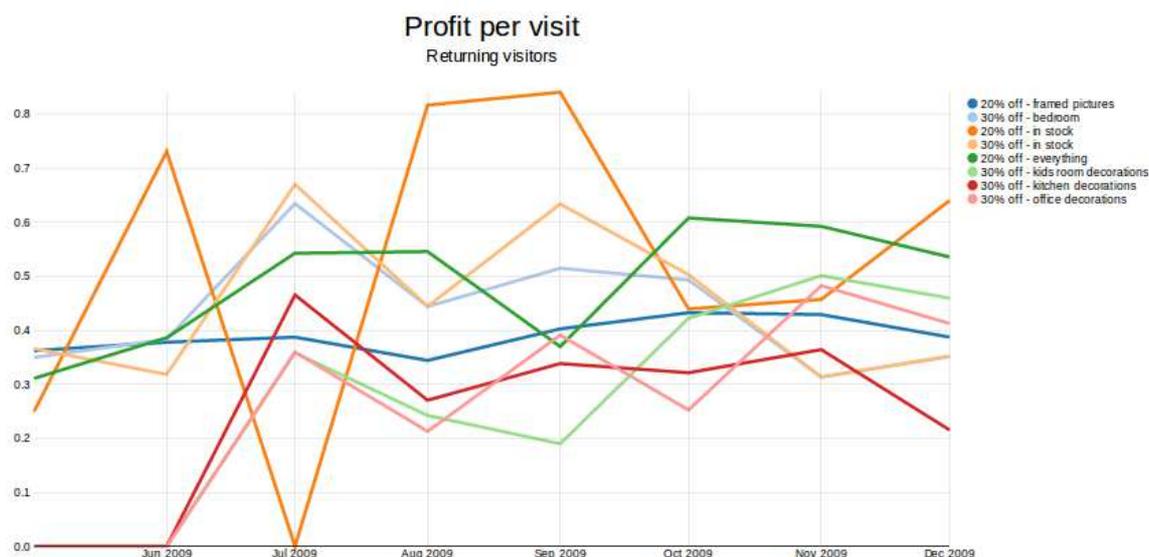
### Discount

Another group of agents represented discounts offered to clients. Only percentage discounts have been tested, but they have been applied to different types of categories. Discounts could overlap, for instance discount for framed pictures have been often offered with other product category discounts. The results are presented in the following table:

**TABLE 7 - DISCOUNTS PERFORMANCE**

Agent	Visits	Profit	Profit per visit
20% off - in stock	32956,00	19184,78	<b>0,58</b>
20% off - everything	31734,00	16144,44	<b>0,51</b>
30% off - bedroom	91368,00	37003,49	<b>0,40</b>
30% off - in stock	76270,00	30856,91	<b>0,40</b>
20% off - framed pictures	235261,00	92990,31	<b>0,40</b>
30% off - kids room decorations	36195,00	13520,22	<b>0,37</b>
30% off - office decorations	36699,00	13054,36	<b>0,36</b>
30% off - kitchen decorations	31620,00	10472,95	<b>0,33</b>

As previously stated, we do not really have to convince returning visitors to make a purchase. If the website is purely ecommerce, they have probably come again with intent to order products they have found during a previous visit. This is probably the reason of why the top agents in this category are those offering the lowest discount. If offering a larger discount does not contribute proportionally to higher sales, then the discount itself becomes a promotion cost, and hence lowers the profit. The best agent offered discount only for products that have been in stock, so only for very limited number of products. The worst thing we can probably do with returning visitors is to offer them large promotion for products that they do not want to buy. They might reconsider their intent for buying products they have previously selected, since they are not covered with significant discount, and choose to buy them later and hence leave the site. Unfortunately we risk that they will never come back.



**DIAGRAM 45 - DISCOUNTS PERFORMANCE IN TIME**

### Banner promotional message

There was a large group of agents tested that carried a banner message for the customer. The following table shows the differences in raw numbers. How important are proper promotions within an ecommerce website shall be underlined by the over 100% difference in performance between best and worst agents in terms of “profit per visit” indicator.

**TABLE 8 - BANNER PERFORMANCE**

Agent	Visits	Profit	<b>Profit per visit</b>
banner - 20% off - in stock	31643	19184,78	<b>0,61</b>
banner - 20% off everything	31734	16144,44	<b>0,51</b>
banner - 30% off - kids room decorations	16456	7965,97	<b>0,48</b>
banner - 30% off - in stock	4808	2068,94	<b>0,43</b>
banner - 30% off - bedroom	91368	37003,49	<b>0,40</b>
banner - 30% off - office decorations	16924	6772,18	<b>0,40</b>
banner - 30% off - kitchen	34361	11215,96	<b>0,33</b>
banner - 30% off - office (elegance)	19775	6282,18	<b>0,32</b>
banner - 30% off - kids room decorations (pink)	19739	5554,25	<b>0,28</b>
banner - 30% off - kitchen (garlic)	2741	743,01	<b>0,27</b>

To understand which banners have been most effective within the investigated website, we have to take into consideration that banners have been depended in some part on discounts. For instance a discount for “kids room decorations” came usually

(but not always) with a relevant banner. Therefore results are biased, but fortunately we can take the bias into consideration by looking at a cooperation matrix, for discounts and banners.

### Agent cooperation matrix (returning visitors)

Color = profit per visit (red=high; yellow=low)

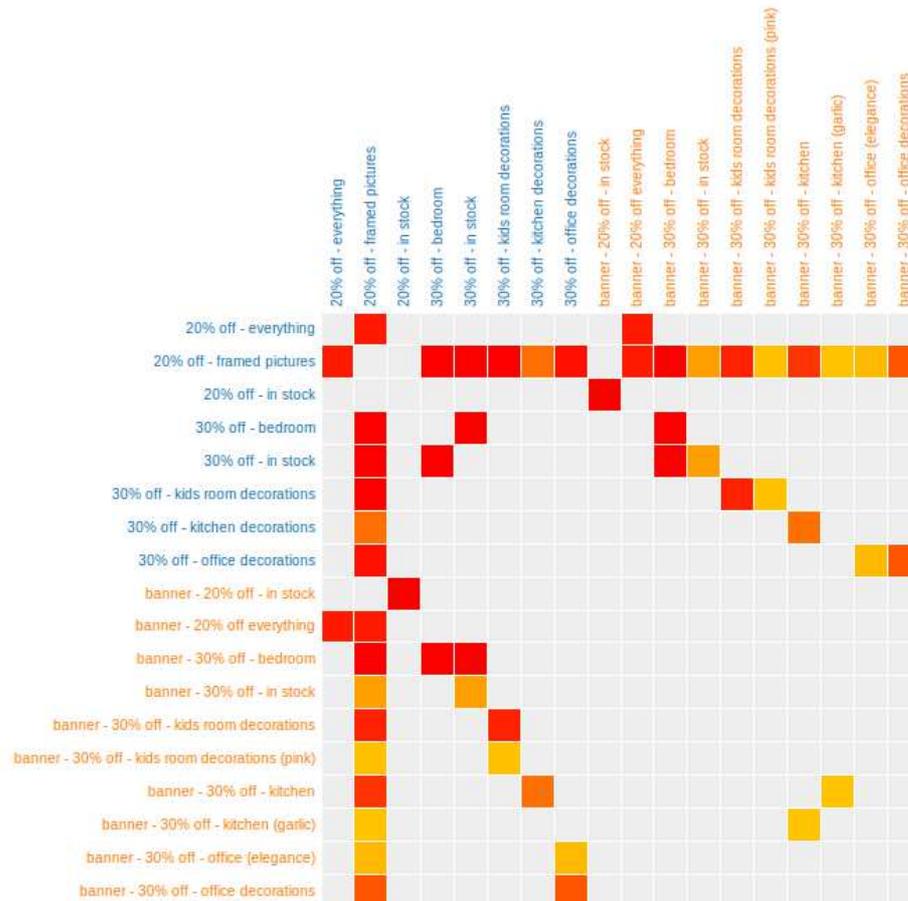


DIAGRAM 46 - DISCOUNTS & BANNERS AGENT COOPERATION MATRIX FOR RETURNING VISITORS

The following image shows best and worst banner agents, along with their actual “profit per visit” performance. Well, it is hard to draw definitive conclusions about why exactly one banner is better than the other since they are so much different, and their performance is assessed only within one particular website. Nevertheless we might notice that the best banners have some distinctive features that the worst have not. The first is sharp, clear and underlined indication of the fact that there is a discount offered (20%, 30%, etc.). The other is a face on two best banners that probably is able to draw an attention better than other graphical elements, since human brain is wired to notice and respond to human faces especially if they carry an emotional message. Probably

besides that we cannot tell much more about “why” some of the banners worked and some not. The quantitative experiment we have conducted will allow us to draw many conclusions that are restricted to qualitative approach. The system is able to answer precisely the “what does work?” question, while the “why it works?” question is an area of qualitative research it does not cover.

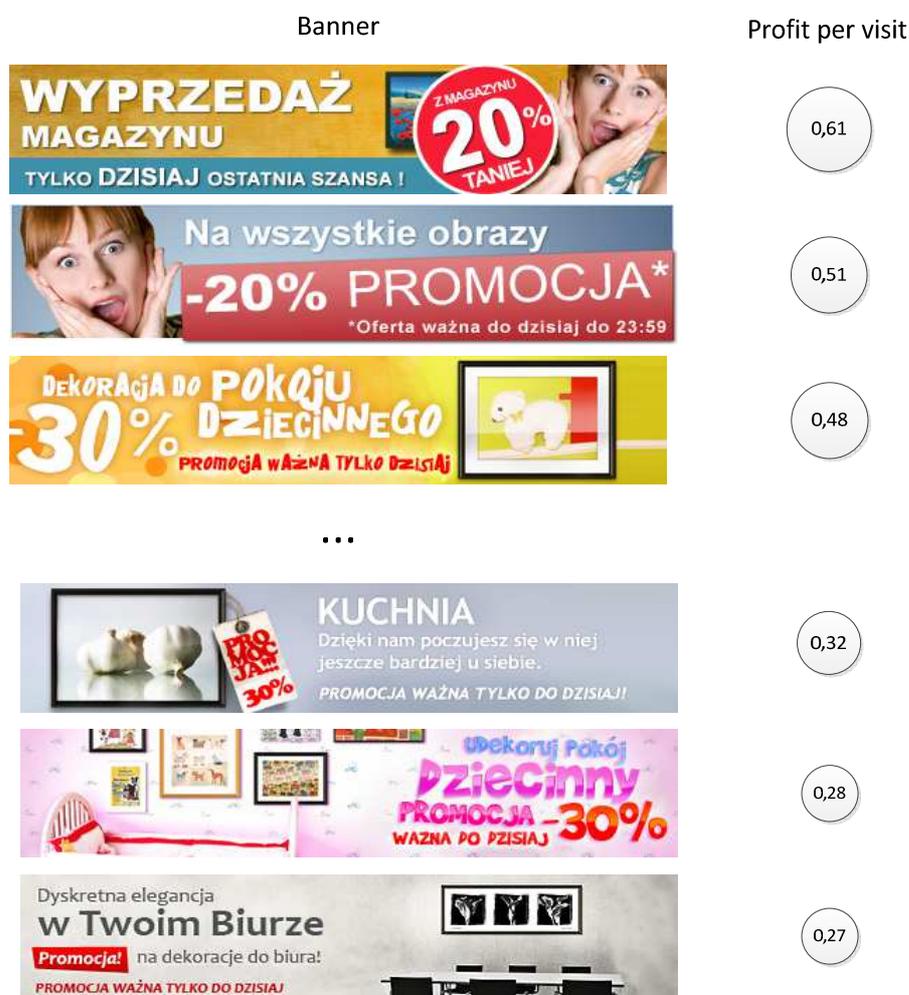


DIAGRAM 47 - BEST AND WORST PERFORMING BANNERS

## Homepage

Similar conclusions can be drawn when we will analyze the homepage promotional message, but first let's look on the raw data.

Agent	Visits	Profit	Profit per visit
homepage - 20% off - in stock	31643	19184,78	<b>0,61</b>
homepage - canvas category	31734	16144,44	<b>0,51</b>
homepage – posters	68458	33914,98	<b>0,50</b>
homepage - framed art prints	68458	33914,98	<b>0,50</b>
homepage - 30% off - kids room decorations	16456	7965,97	<b>0,48</b>
homepage - framed decorations	36724	17770,53	<b>0,48</b>
homepage - 30% off - bedroom	91368	37003,49	<b>0,40</b>
homepage - 30% off - office decorations	16924	6772,18	<b>0,40</b>
homepage - 30% off - kitchen	31620	10472,95	<b>0,33</b>
homepage - 30% off - office (elegance)	19775	6282,18	<b>0,32</b>
homepage - 30% off - kids room decorations (pink)	19739	5554,25	<b>0,28</b>
homepage - 30% off - kitchen (garlic)	2741	743,01	<b>0,27</b>

**TABLE 9 - HOMEPAGE PROMO PERFORMANCE**

It is very interesting that the 2,3,4,5 place in the above table is occupied by agents that instead of promotional message carried simply information about the offer and links to most popular product categories. The best informational message has proven to be almost two times better than the worst promotion. It is significant for the returning visitors group that the discounts and promotions do not work very well. Unfortunately the best homepage message is an exception, a purely promotional, aggressive marketing message. It is not clear how to explain this result, but it seems that simply this message is very well done – it contains an emotional face expression that initially grabs attention, a clear promotional message and a sharp discount statement. A combination of all those elements have proven to be the most effective, however we shall not draw a general conclusions since it represents the preferences of a particular group of visitors and a very specific website.

#1

Clear promotional message

An emotional face expression

Sharp discount statement

#2

Obrazy na płótnie

An informative product presentation

Profesjonalne podobrazie płócienne, zagruntowane.

Farby produkowane z wysokiej jakości pigmentów. Kolory wyraziste i trwałe.

Drewniany blejtram wraz z klinami, które pomagają w regulowaniu napięcia płótna (opcjonalnie).

kwiaty      krajobrazy      ludzie      abstrakcja

Visual links to most popular categories

#3

Plakaty - ponad 1500 wzorów!

Visual links to most popular categories

znani i kochani (455 plakatów)

Plakaty filmowe (484 plakatów)

Plakaty muzyczne (228 plakatów)

Śmieszne plakaty (161 plakatów)

Plakaty artystyczne (61 plakatów)

...

#12

A vague promotional statement

Grey color that do not focus attention

Arbitrarily chosen product, that might not comply with average customer taste

Garlic might not be a positive association

The font is hardly readable at a glance

## DIAGRAM 48 - THE BEST AND THE WORST HOMEPAGE PROMOTIONAL MESSAGES

## SUMMARY

The case study have shown that in fact the system is able to improve the marketing mix for e-commerce website and provide important insights for marketer about visitors and performance of investigated elements of marketing mix. The outcomes delivered by the system come from experimental testing therefore they should be considered more reliable than from observation or web analytics. Nevertheless the system has failed to deliver one-to-one marketing to the users. In fact user segmentation based on simple metrics that have been examined proved to yield a difference only for new and returning visitors. The initial assumption that it is possible to effectively segment users based on information about when they have come from has failed simply because segments created in this way did not react differently to marketing mix. The data user share with the website upon the first page view is simply not enough to perform segmentation. Another weakness of the system comes from the key performance indicator that has been used for optimizing the marketing, i.e. "profit per visit". Since profit maximization is an economic goal of any company operating in free market conditions, the indicator seemed to be well suited to reach the goal. The problem might be that what seems as profit maximization in a short run, in the long run might be a disaster. Trying to squeeze the most profit out of existing user base using aggressive marketing might be good for a company in a short term, but in might ruin it in the long term. Therefore we should consider other metrics to maximize. Although the system has been implemented to optimize marketing mix for e-commerce websites, during the project development it has become obvious that the approach can be generalized to other types of websites like blog or information portal. In the following chapter we will examine ways to overcome the main weaknesses of the project.

# DISCUSSION OF RESULTS

## USER SEGMENTATION

One of the basic issues discovered during the case study was inability of system to create segments of users that would have differed significantly from each other. For instance differentiating visitors by keyword entered into search engine to find the host website did not create segments of users that reacted differently to marketing messages. We shall keep in mind that the whole system has been tested on a small e-commerce website that has offered one basic kind of product (art prints), so it might not be true for larger websites with more heterogeneous user base. However there was one attribute of that could strongly differentiate the users across most of the indicators that have been measured: profit per visit, time spent on site, page views per user, etc. This was cookie saying whether or not the user has visited the website before. The profit per visitor was over three times higher for returning visitor than the new ones; time spent on site by returning users was more than double that newcomers, etc. The study has shown that aggressive marketing messages have not been convincing for returning visitors while it did work for those coming for the first time. Therefore we might state a hypothesis that the intent and the way of using a website for a first time differs significantly from a way of using website if one has visited it before. This hypothesis actually follows the intuition that new users need first to find out what the website is about, how to navigate it and just how it works. On the other hand returning visitors have already made through it and are simply more experienced with the website. Of course for well-designed websites it should be obvious at a first sight, how to use it and what it is all about, but it is just a theory. In practice users need time to gain experience and unleash the full potential of a website no matter if it is an e-commerce website (eg. Amazon), social network (eg. Facebook), blog (eg. Mashable) or a Portal (eg. Yahoo).

### PARTICIPATION LADDER

Li & Bernoff conducted a large scale research aimed to segment users according to their participation in different online activities (Li & Bernoff, 2008). They came with a *participation ladder* that shows the basic idea that people do not use the internet in the same way.

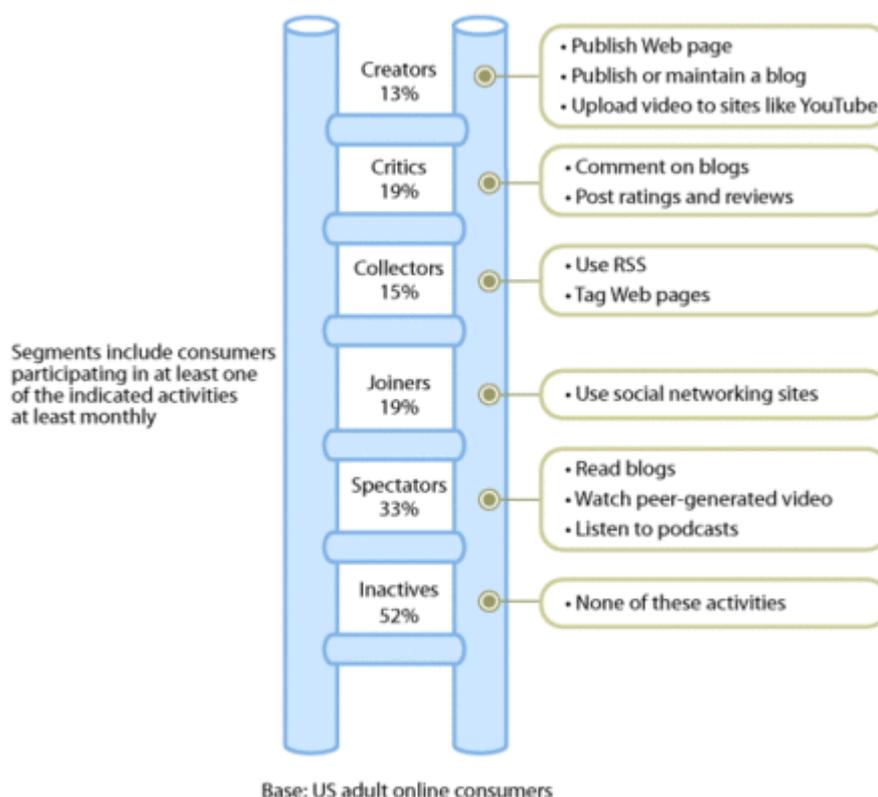


DIAGRAM 49 - PARTICIPATION LADDER. SOURCE: FORRESTER'S NACTAS Q4 2006 DEVICES & ONLINE ACCESS SURVEY. FORRESTER RESEARCH INC. (LI & BERNOFF, 2008)

There are different levels of participation in web 2.0 activities, on two distant ends of the ladder there are the majority of *Inactives* that only browse the web, and on the other end there is quite significant number of *Creators* that create content and lead the web 2.0 movement. The ladder shows that when designing for the majority we might skip very important segments of the web population. Since users differ in what they actually do and use the web for, they probably have different needs, and perhaps we shall adjust websites toward those needs - one segment at a time.

### ONE FITS ALL MODEL

Website feature set should follow user expectations about the website. Usually when user visits a website for a first time it is a good idea to present him something really simple, so in few seconds he can get an idea what the website is all about, so he can start using it immediately. After few visits the user is no longer a beginner and becomes intermediate in what he knows about how the website operates. This is the moment he will see features that are missing in the website crafted for beginners.

Today most of the websites on the internet follows the “one size fits all” model, where a single feature set is prepared for all the users visiting a website. It is obvious that visitors differ from each other. This observation is already applied in practice by internet leaders such as yahoo.com that according to Carol Bartz, the company's CEO, serves up to “6 million [different] front pages per day”<sup>8</sup>. User experience is personalized by using machine learning, data, and manpower in the goal of providing users "the type of content they want in the place they want it".

The screenshot shows the Yahoo! homepage interface as of May 25, 2010. At the top, there are navigation links for Web, Images, Video, Local, Shopping, and More, along with a search bar and a 'Web Search' button. Below the search bar, there are links for 'My Yahoo!', 'Make Y! your homepage', 'Sign In', 'New here? Sign Up', 'Have something to share?', and 'Page Options'.

The main content area is divided into several sections:

- MY FAVORITES:** A vertical list of links to various services like View Yahoo! Sites, Yahoo! Mail, Autos, Finance, Games, HotJobs, Messenger, Movies, Personals, Shopping, Sports, Twitter, Updates, and Weather (64°F).
- TODAY - May 25, 2010:** A large featured article titled 'Hubble spies planet being devoured by star' with a dramatic image of a star and a planet. Below the main article are smaller thumbnails for 'Planet devoured by star', 'Extremely tall hoops brothers', 'Mystery space plane spotted', and 'Who's in charge of oil spill?'.
- NEWS WORLD LOCAL FINANCE:** A section with a list of news headlines such as 'Stocks plummet on economic worries', 'North Korea severs all ties with South Korea', and 'BP tells feds key areas probed as Gulf spill cause'.
- MARKETS:** A small section showing market data: 'Markets Dow: 9,893.20 -1.72% Nasdaq: 2,170.80 -1.93%' with a 'Get Quotes' button.
- TRENDING NOW:** A list of 10 trending topics including Phil Jackson, iPhone, and LeBron James.
- Yahoo! Travel:** A section with travel-related images and links for Mexico, Australia, The Bahamas, and Italy, including a search bar for travel.
- Hot shots: Latest celebrity photos:** A section with small images and captions for celebrities like Katie Couric and Nicole Richie.
- DAILY OFFERS:** A section with a 'Yahoo! Music: The New Now' offer, featuring a Canadian singer/songwriter.

DIAGRAM 50 - ONE OF 6 MILLION DIFFERENT YAHOO HOMEPAGES SERVED AT MAY 25TH 2010

<sup>8</sup> Interview by John Battelle at Web 2.0 Summit

Web Images Video Local Shopping More

**YAHOO!**

My Yahoo! Make Y! your homepage Sign In New here? Sign Up Have something to share? Page Options

**MY FAVORITES** + Add

- View Yahoo! Sites
- Yahoo! Mail
- Autos
- Finance (Dow Jones)
- Games
- HotJobs
- Messenger
- Movies
- Personals
- Shopping
- Sports
- Twitter
- Updates
- Weather (57°F)

Edit Add

RECOMMENDED

- Facebook
- omg!
- Travel
- Shine
- Fantasy Sports

QuickView on Rollover

**TODAY - May 25, 2010**

**Extremely tall brothers' potential 'unlimited'**

The jaw-dropping size and agility of Sim and Tanveer Bhullar are wowing big-time college scouts. » Their basketball path

- Tallest NBA player ever
- Teen golfer steals show
- Debate over mouth guards

1 - 4 of 28

**NEWS** WORLD LOCAL FINANCE

- Stocks plummet on economic worries | Home prices drop
- North Korea severs all ties with South Korea | Video
- BP tells feds key areas probed as Gulf spill cause | 'Top kill'
- Ex-Detroit Mayor Kilpatrick sentenced to 5 years in prison
- World Cup mystery: Who's England's starting goalkeeper?
- Study: Moderate drinking may protect brain from Alzheimer's
- Brooklyn prosecutors drop charges against... - New York Dai...
- More Scrutiny as Charter Schools Look to Expand - N.Y. Times
- Fergie To 'Start Fresh' In NYC? - CBS 2
- NBA · NHL · MLB · Tennis · Golf · Soccer · NASCAR

updated 05:56 pm More: News Popular Buzz

Markets Dow: 9,896.00 -1.69% Nasdaq: 2,172.20 -1.87%

Get Quotes

**TRENDING NOW**

- Simon Monjack
- Cleveland Cavali...
- Retirement Plann...
- Mark Twain
- Don't Ask, Don't...
- Phthalates
- Chris Klein
- Smashing Pumpkins
- X-37B Space Plane
- iPhone

**Yahoo! Search**  
What's Happening Now

24 Glee Lost  
Boston Celtics Pittsburgh Penguins Cleveland Cavaliers  
Carey Mulligan Kristen Stewart Miley Cyrus

**Get real-time World Cup coverage** **Toolbar**

- See live scores right on your Toolbar.
- Customize with your team's flag.
- Enter to win a signed team jersey.

Download and enter >>

1 of 5

**DAILY OFFERS**

**Self to Me** Drive traffic to your website  
Advertise in Yahoo! search results.  
Attend a free webinar to learn more.

Advertise your products to one of the world's largest and most engaged web audiences. Sign up today.

DIAGRAM 51 - YAHOO HOMEPAGE CONTAINS DIFFERENT SECTIONS AND CONTENT FOR DIFFERENT VISITOR'S COOKIE.

## FEATURE MIX

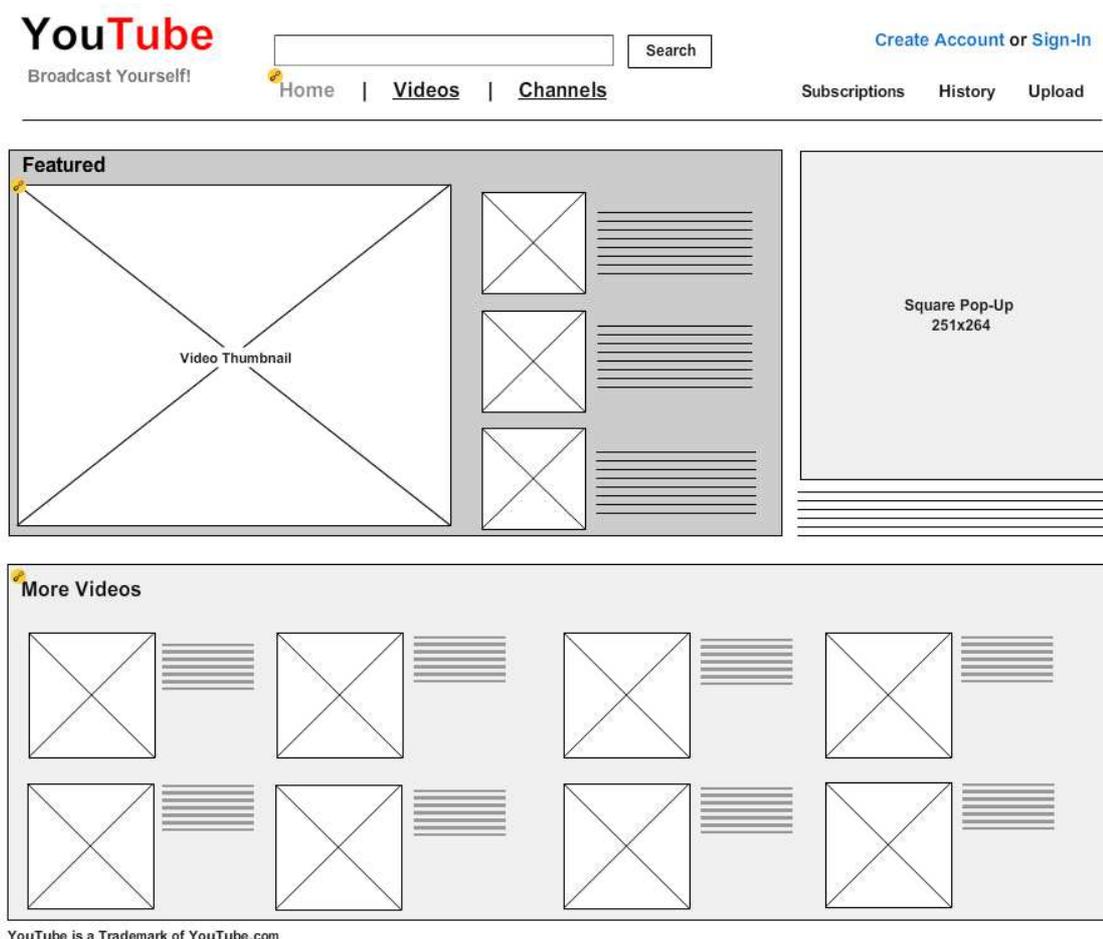
The system described in the previous chapter can be understood as a multiagent system, where agents cooperate to build a website in a real time; the evolution engine acts as a optimization module that controls this process; and agents are building blocks of the website. Previous chapter brings an idea that this kind of system can be used to formulate marketing mix for ecommerce website, but maybe this approach and the system itself can applied for other tasks and for solving other problems? Probably it could be well applied for optimizing internal marketing of an information portal by maximizing time spend on site instead of product sales. Visitor *engagement*, is often operationalized as time spent on site. We could push the selective pressure toward mixes that can engage visitors for the longest time. While engagement is a good

predictor of future sales this shall be an important measure for many types of websites. This evolution goal should be also very effective for websites that earn money from advertisements, because the more time visitors will spend on your site the more ads one might show to them.

The idea of marketing mix applied to websites seems a little bit awkward. Website is not a classical tangible good. It is more a service, a virtual assistance that lets user access different kinds of information. Of course there is 7P marketing mix concept for describing aspects of services marketing process, but it still do not fit well into our topic. The core of almost any website is information it contains. The information can be products for e-commerce world, it can be news for portals, and it can be friend's updates or photos for social networks. The aim of a website is to present this information in a form that is usable and easy to understand for users. The means via users' access (or update) the information are features. A Facebook wall is a feature, amazon recommendations is a feature, product catalogue is a feature, and basically every website can be fully decomposed into separable features. In fact the first step in the any website development process should be a selection of features that will be developed.

### *WIREFRAMES*

One of the first artifacts created during website design and development process are wireframes. A website wireframe represent a simplified layout of fundamental elements of future user interface. It should not contain any artwork, as its role is to model basic user interaction. Usually a person in a role of an Information Architect is responsible do draw wireframes, a representation of information architecture of a website yet to be developed.



**DIAGRAM 52 – A POPULAR VIDEO SHARING WEBSITE WIREFRAME**

If we look closer at a wireframe we see a website divided into functional parts. As wireframe represents only a basic layout, the final look and functionality might differ significantly from initial wireframe design. Internal functionality and design details of those functional parts at this level is not fully determined, hence even though they shall keep their initial places, along with the website development process, they might go in very different directions. So, if there are still many possibilities how each functional part may look like and behave, we shall probably test some of the ideas and choose the best ones. It is also quite possible that more simplified designs and implementations will work better for novice users, while more advanced features will be appreciated by advanced visitors, using the website for a longer time. If we go beyond “one size fits all” way of thinking we shall start to notice that many people would like to use websites in their own way. There are computer savvy people that use online services with ease and like to discover and use advanced functionalities, but most of people crave for simplicity and might be overwhelmed by too many options. With traditional approach we usually have to focus on one of the groups, usually the majority, hence develop for

simplicity and ease of use. While this is generally a good approach, we risk losing more advanced and loyal users that might be very valuable for our business. In Web 2.0 era where blogs become more important than press releases companies should care for their most loyal and advanced customers. Even if they don't buy products, they often generate value in other ways: by generating content, writing products reviews, leaving comments, giving ratings or even being evangelists influencing others to follow the brand.

### *DEFINITION*

If we focus more on usability and features than on marketing we can use the same system as described in the previous chapter to optimize the website usability and features and adjust them to user segments. In such situation an agent shall represent not just a banner or promotional message, but it might implement a single website functionality. This way *marketing mix* changes into a *feature mix* and using the same method we try to find the optimal *feature mix* for each segment of visitors. When we look at the sample wireframe, an agent might represent a single functional block (for instance a video player) and implement a different set of functionalities within this functional block - for instance commenting, rating, add to favorite or add to playlist option. And since there might be many agents implementing a single functional block, each of them may implement different set of features. A set of agents previously called *marketing mix* hence becomes a *feature mix*, i.e. a set of agents implementing different website features plus a visitor profile that this feature set can handle. Eventually marketing mix optimization in case of websites is a sub problem of *feature mix* optimization. All the aspects that have been optimized can be expressed as features. Banners and homepage promos fit easily into wireframe layouts and represent the simplest kind of agent which is a static content that fits into certain pixel dimensions. Product list is another feature that can be implemented by different agents, one showing 15 products per page and another showing 21 or 30 products. Price is a feature of a product and manifests itself visually as a discount (eg. "\$50 new price \$30") or regular price (eg. "\$50"). This way every aspect of marketing mix (product, price, promotion, place) is considered as a kind of website feature. This point of view seems to be more accurate from website development process perspective as marketing is just one of the elements of the final website. The approach opens new perspectives for things that can be optimized and broadens the range of websites and applications. Let's

consider an web based email client such as Gmail. What could be called features of an email client?

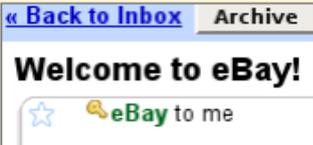
Enabled Labs		
	<b>Apps Search</b> by the Apps Search team  Extends search with Google Docs and Sites results. Apps Search will find the most relevant Docs and Sites and show them below Gmail search results.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>
	<b>Authentication icon for verified senders</b> by E R  Displays a key icon next to authenticated messages from certain senders that spammers attempt to fake. Currently works for mail from PayPal and eBay only.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>
	<b>Canned Responses</b> by Chad P  Email for the truly lazy. Save and then send your common messages using a button next to the compose form. Also automatically send emails using filters.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>
	<b>Create a Document</b> by Jeremie LE & David K  Allows you to create a Google Document from an email conversation or a new blank document if your keyboard shortcuts are enabled by hitting 'g' then 'w'.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>
	<b>Default 'Reply to all'</b> by Mark K  Make 'Reply to all' your default option for responding to emails.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>
	<b>Google Calendar gadget</b> by Ben K and Garry B  Adds a box in the left column which shows your Google Calendar. See upcoming events, locations, and details.	<input checked="" type="radio"/> Enable <input type="radio"/> Disable  <a href="#">Send feedback</a>

DIAGRAM 53 - GMAIL FEATURES (SOURCE: GOOGLE GMAIL)

As short look at Gmail labs answers the question: it can be an extra link to create a new document, it may be a “reply to all” button, a calendar gadget, an icon that appears near authenticated messages. Google gave users power to customize the mail client features up to their preferences. One can open labs tab in the gmail client and enable or disable certain features, or even propose the labs team an idea for a new feature that could be useful within the application. This approach lets gmail stay simple when people start using it and then as user becomes more experienced he can enable new features that can potentially make him more productive. The majority will probably

never even notice that they can enable extra features in gmail and stay with the minimal feature set. On the other hand heavy users who need more advanced productivity features such as “canned responses” will simply enable them instead of seeking for another – more advanced email client. This is a great approach for fulfilling expectation of different segments of users – if you are novice - you get a simple service, if you are advanced you can enable more features.

# FURTHER RESEARCH

## EVOLUTION ENGINE

Evolution is a good metaphor for the way websites are developed. Using a service like Wayback Machine from archive.org we can actually observe how most of today's large websites changed throughout the time. We can observe that some features arrive with time, some get removed, websites get redesigned etc. The development is nowadays a continuous process and, as long as we don't plan to shut down, it assumes a constant change and service improvement. One of the first continuous software development processes was described by Boehm (Boehm, 1995), named as the Spiral Model. This model assumes a continuous repetition of process steps along a spiral, so that we could early test and verify the software concept. Each time we make a full circle within this process, we end up with either a working prototype or a software release. Even though current common Agile development methodologies differ in steps we take, and the full circle has shrunk to weeks instead of months, the process is still repetitive, continuous and follows the spiral path.

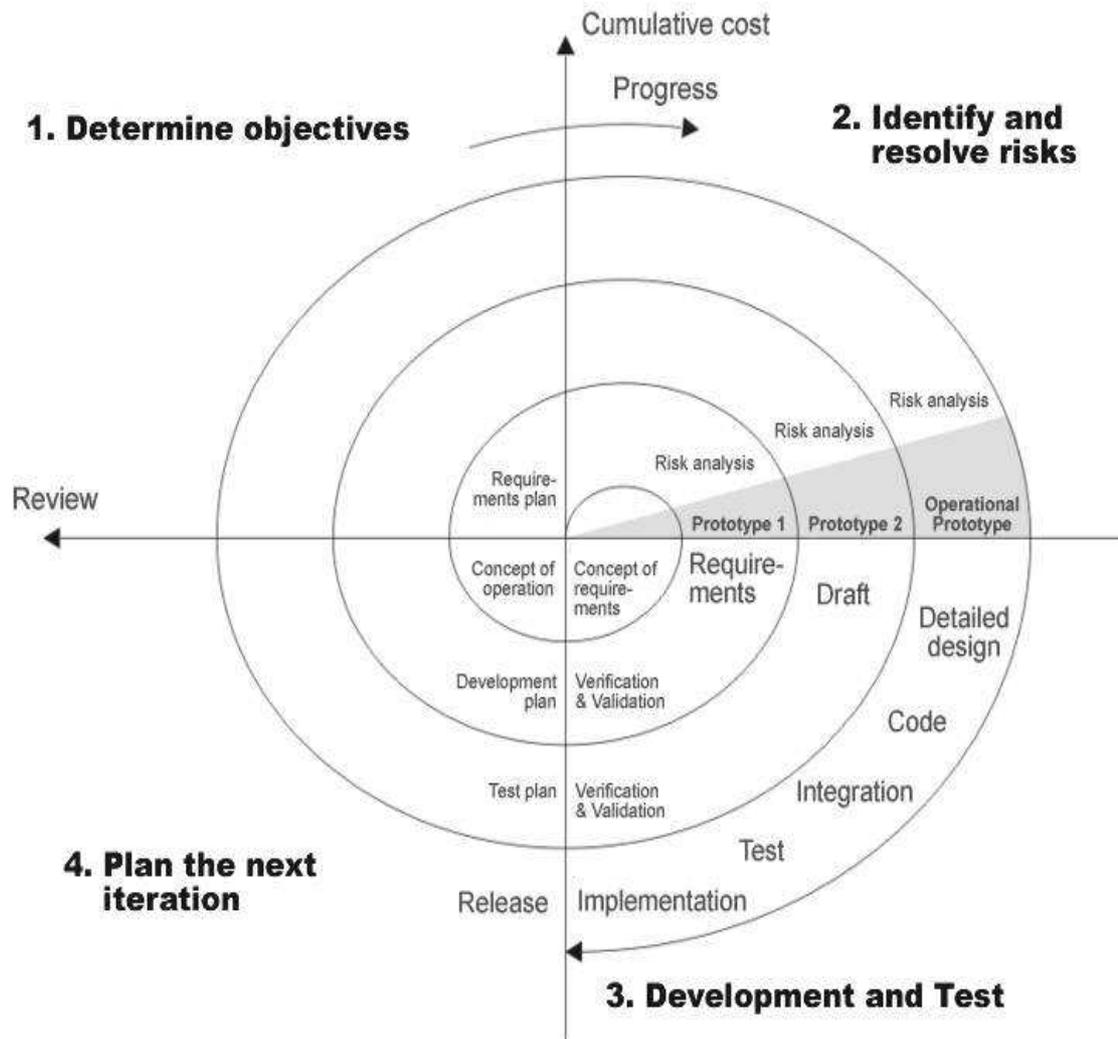


DIAGRAM 54 - THE BOEHM'S SPIRAL MODEL (BOEHM, 1995)

An evolution of a websites and web-apps is kind of trial and error process, when development team tries to deliver new features to the users and improve the old ones. Some of the innovations are then to stay but, as we are all humans and we make errors, some must be removed. Would it be possible to actually fully automate this spiral process? To deliver, test, accept or remove features in time automatically. Well this is what we have basically done already and described in the previous chapters. The feature mix of an e-commerce website did evolve within a limited scope of a banners, promotional messages, discounts and product list customization. The evolution of the website with the proposed agent system is in a way similar to how websites are actually developed, with a one difference – the development and deployment processes are completely separated. The agent system allowed tracking of how each features influenced user behavior in a live environment. Moreover it made possible to target

features to specific group of visitors. Would it be possible to fully automate this evolution process to speed it up?

### *GENETIC ALGORITHMS*

The task of the evolution engine is to find the best possible mix for a given visitor. Even though genetic programming techniques do not guarantee finding the optimal solution, it can be effectively applied to approach this task. Since anything like “the optimal marketing mix” in reality probably doesn’t exist, we shall be happy with good but sub-optimal solutions. Since e-commerce is usually a dynamic environment, an ability to adapt automatically brought by an evolution makes the genetic approach very attractive.

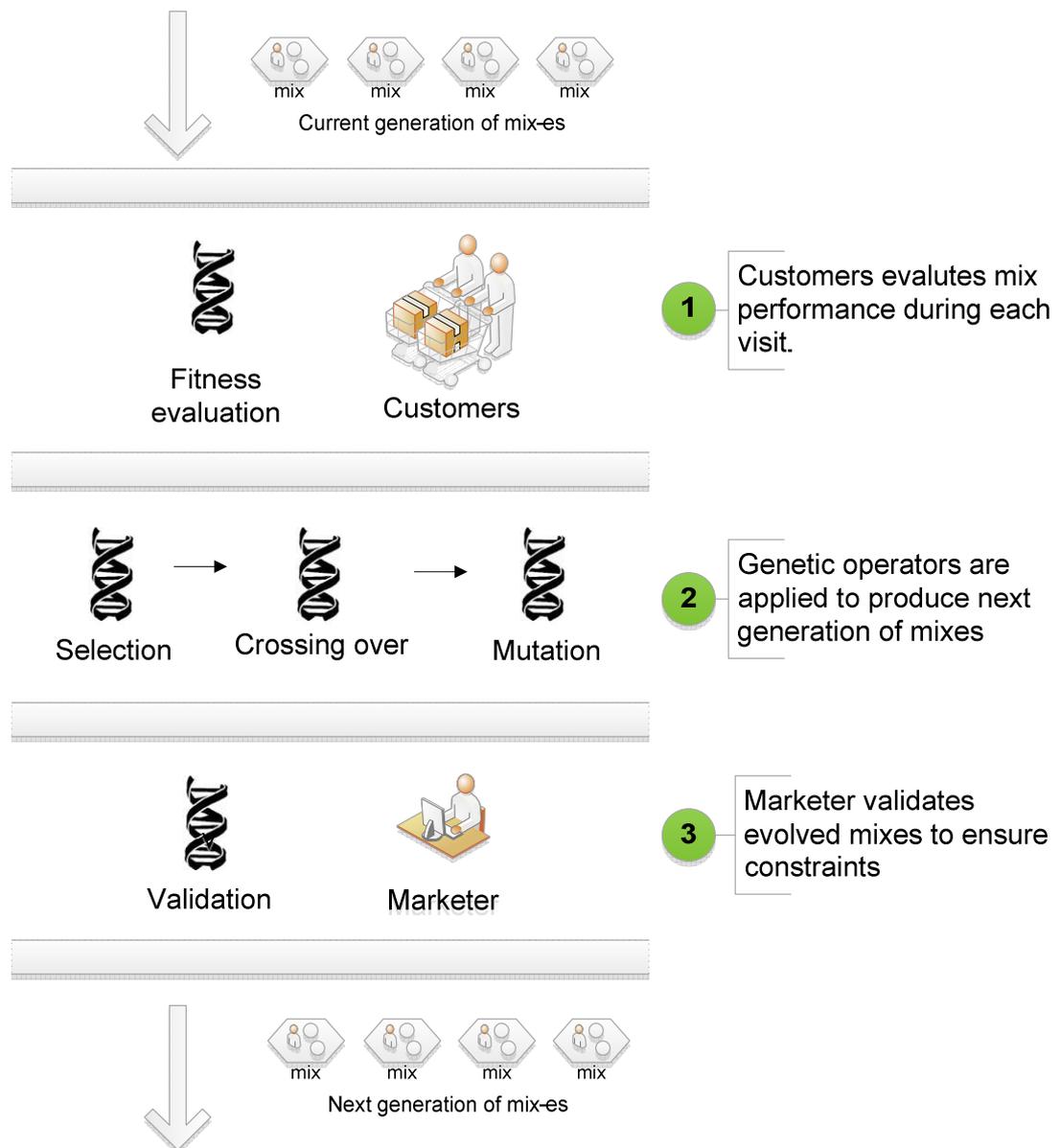
Genetic algorithms is an inspired by biological evolution method of creating the best program solving a given task (Segaran, 2007, str. 250). In our case the task is finding the best mix to handle a website visitor. In other words our goal is to maximize the average profit generated upon each visit. Stating the goal in a more formal way will result in a definition of our fitness function:

$$fitness(mix) = \frac{profit}{number\ of\ visits}$$

The aim of a genetic algorithm is then to maximize the fitness function, hence finding a mix that generates a maximum profit from each visit. Please keep in mind that each mix contains the user profile definition, hence there might be different optimal solutions for different segments of visitors. The solutions, along with profile definitions, might overlap. But this follows the intuition, that since visitors differ from each other, we should craft the marketing mix for each segment individually. And the more segments we create, the more personalized and effective the marketing shall be.

### *GENERATIONS*

The evolution happens in steps called *generations*. Each generation is a population of mixes representing the current solution to our fitness function optimization problem. The generations shall not overlap in time and during each moment exactly one generation is active - we call it the *current* generation. To transform the *current* generation into the *next* generation, we apply three basic genetic operators: crossing over, mutation and selection.



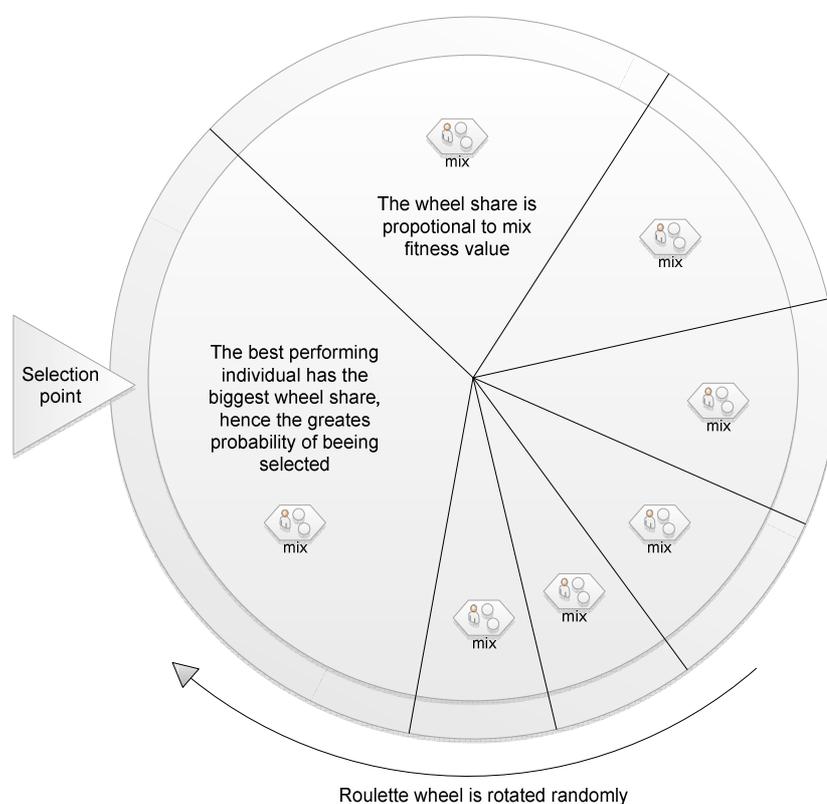
**DIAGRAM 55 – SINGLE MARKETING MIX EVOLUTION STEP**

Before we apply any genetic operators we should calculate the fitness of each individual. To be able calculate the fitness function for each mix in the population we need the data about how each mix was performing. This is a necessary step if we want to select the best performing individuals mating and reproduction, and remove the worst performance from the population. To evaluate the fitness function of each mix we have to perform a series of experiments to test what average profit each mix is able to generate. This process was already described earlier in a paragraph “mix evaluation”. Because evaluation of the fitness function involves human-computer interaction the algorithm falls into a category of interactive genetic algorithms, i.e. an algorithm that requires human action (in our case a visit on a website) to proceed. When enough data

to evaluate fitness function for each mix has been collected we can apply selection procedure and then genetic operators to create next generation of mixes. Genetic operators might produce individuals that do not follow constraints. Therefore before mixes are put into the wild marketer evaluates them to ensure constraints and marketing mix sanity.

### SELECTION

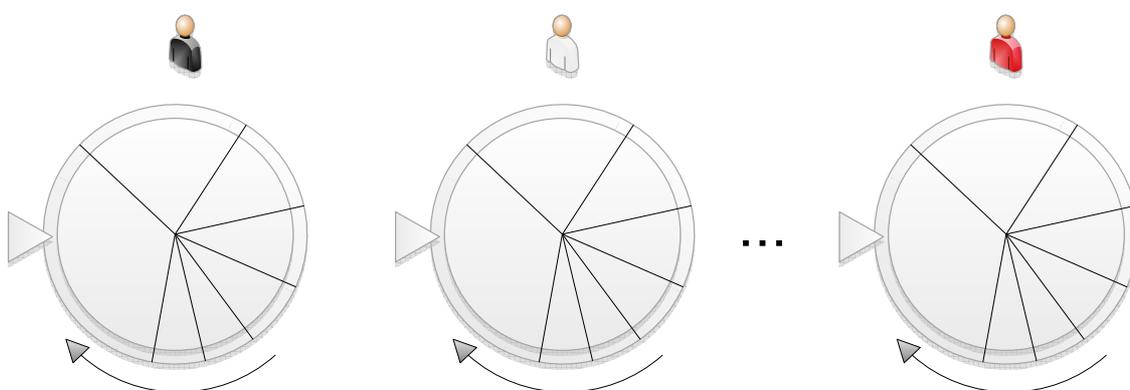
After collecting enough data to evaluate fitness function for each mix with required statistical accuracy, we select individuals for breeding. A standard *roulette wheel* procedure is used to quasi-randomly select best performing individuals for crossing over.



**DIAGRAM 56 - ROULETTE WHEEL SELECTION**

Each individual is assigned an area on the wheel that is proportional to its fitness value. Therefore the most fit individual has the biggest chance of being selected, and chances of the least fit are the smallest. The wheel is then rotated randomly and an individual is selected. Even though the selection procedure is therefore random the chances are not even for each mix. Some segments of customers are more profitable than others, and

hence agents serving the most profitable customers will have higher chance of being selected. Agent serving loyal customers is very likely to generate more profit per visit than agent serving visitor that see the website for the first time. We want the system to populate agents in all niches and evolve marketing mix for multiple niche segments; hence we should put some selective pressure on customer profile diversity. An easy way to accomplish this task is to roll the wheel separately for each customer profile segment. This way during the selection procedure we compare agents only within the same segment of customers, therefore making the selection fairer, and pushing more pressure toward customer profile diversity.

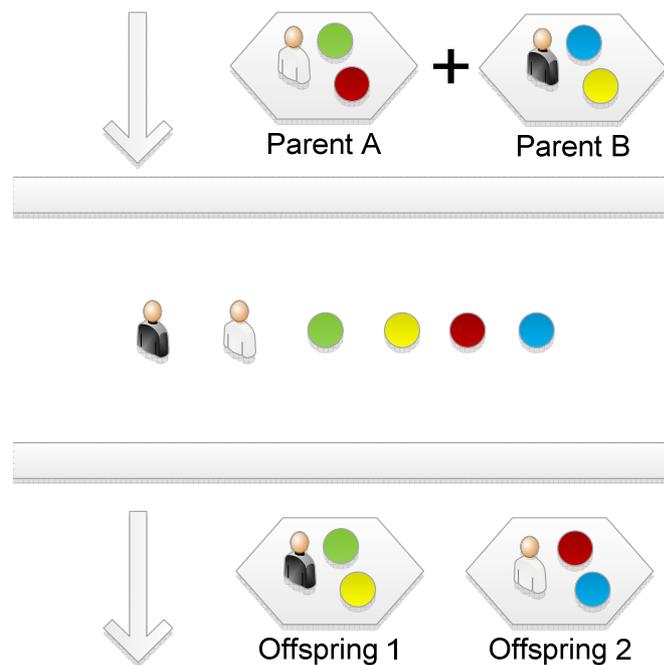


**DIAGRAM 57 - SEPARATE ROULETTE WHEEL SELECTION FOR EACH NICHE CUSTOMER SEGMENT**

We would like the mix population within each niche to be proportional to profit this niche generates. Therefore we select from each niche a number of individuals proportional to profit the customer segment has generated. Even though selection is separate in each niche it is a good idea to exchange genetic material between all niches and hence cross-over mixes representing different segments.

*CROSSING-OVER OPERATOR*

One of the most intuitive genetic operator is called crossing-over. As an input it takes a pair of individuals and combines the genetic information to produce an offspring. The first step of performing crossing-over is extracting the genetic information carried by each mix, i.e. profiles and agents each mix is composed of. The second step is recombination of the genetic material into two new individuals.



**DIAGRAM 58 – MARKETING MIX CROSSING-OVER OPERATOR**

Offspring individuals produced with this operator contain parts of solutions carried by both of the parents. There is a large chance that one of the offspring will contain the best features of both parents, therefore pushing the evolution forward towards the optimal solution.

### **Subtree crossover**

One might notice that although offspring individuals contain different sets of agents than their parents, the profiles did not change at all. To be able to explore new customer segments defined by user profiles we shall define the crossing-over operator separately for user profiles. As described before in this chapter, user profile is

represented by a binary tree. Fortunately crossing-over operators for binary trees have been thoroughly examined in the literature (Koza, 1992), hence we might just apply already described techniques. One approach to recombine binary trees is a “Subtree Crossover” algorithm described by Koza (Koza, 1992).

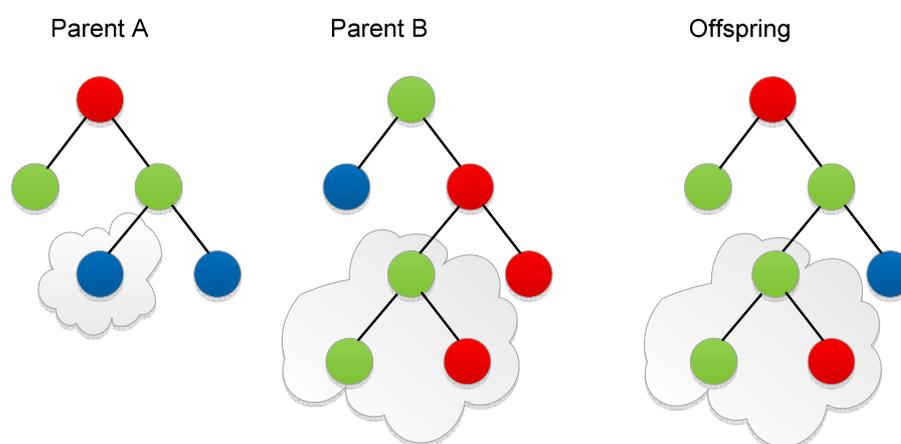


DIAGRAM 59 - SUBTREE CROSSOVER ALGORITHM FOR CUSTOMER PROFILE RECOMBINATION

The algorithm consists of two steps. First we randomly choose subtrees in both parents. Second we replace the subtree from parent A with the subtree from parent B. A new tree that is created during this operation is made of elements from both of the parents, but it is different from any of them. Again, if we were lucky we will end up with an offspring profile that better describes a customer segment than any of the parents.

### *MUTATION OPERATOR*

To avoid too fast convergence of the algorithm at local optima and preserve diversity in a population, we shall define the mutation operator. Mutation operator introduces genetic material to a population by randomly modifying individual genotype. During a *single point mutation* process one agent from a mix is replaced by another chosen randomly from the agent repository. This is a way to introduce new agents to gene pool in the population as well as recover those that have been removed earlier because of selective pressure. This might be especially useful in a rapidly changing environment where solutions outdate quickly and system is often required to adapt to new conditions.

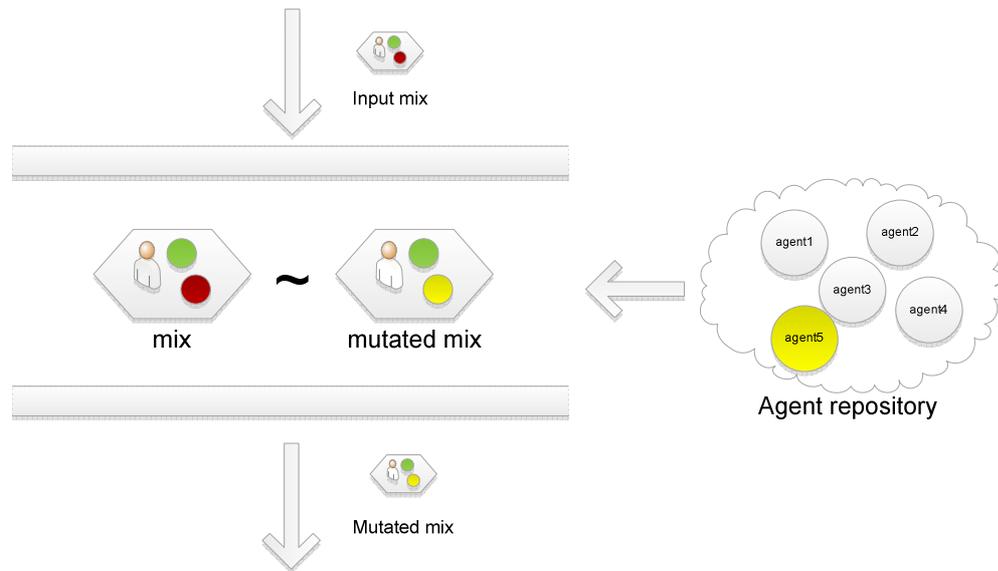


DIAGRAM 60 – MARKETING MIX MUTATION

### Node replacement mutation

We shall define the mutation operator separately for customer profiles, because of their binary tree representation. Node replacement mutation is a very similar to *single point mutation* process that might be applied to binary trees. It consists of two steps: first we select a random tree node, and then we replace it with another randomly chosen from the pool.

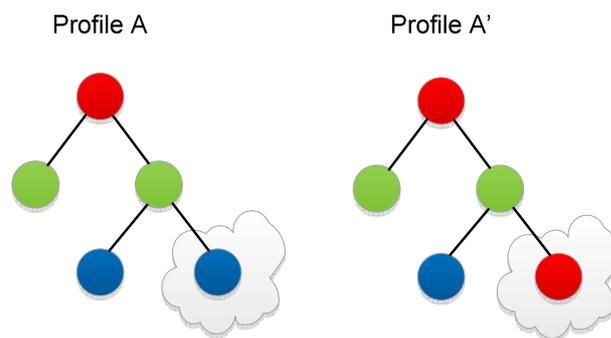


DIAGRAM 61 – CUSTOMER PROFILE NODE REPLACEMENT MUTATION OPERATOR

### Hoist mutation

Hoist is a type of mutation that aims to reduce complexity of individual profiles. During this process we select a random subtree and create new profile from it. This kind of operation might remove unnecessary information from the customer profile matching algorithm representation. For example a profile matching “returning customers that

have one item in a shopping cart and have been browsing electronics products” might be reduced into profile matching “customers browsing electronics products”. As the example illustrates this operation makes customer profile less specific, giving a chance to generalize marketing mix solution developed during the evolution process.

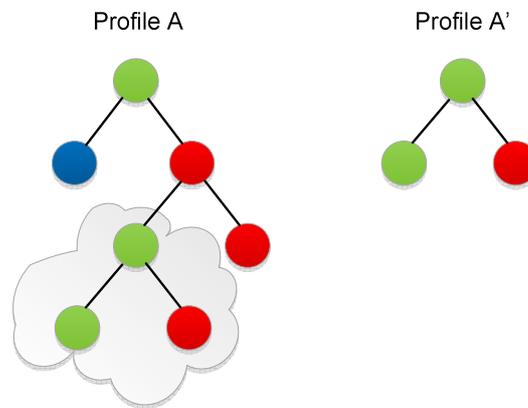


DIAGRAM 62 – CUSTOMER PROFILE HOIST MUTATION

*REPRODUCTION (CLONING)*

The last and the simplest operator used is reproduction or cloning. To preserve best performing individuals within each customer segment niche, we simply copy them without changes to the next generation. This lets the whole system remember best solutions it have already found and so accumulate them in time. It is quite important operator if we keep in mind that, because evaluation of a single generation might take a few days, we should limit the number of generations needed to find a reasonably good solution. Not forgetting the best mixes also follows expectations we put on the system, that it shall be not only scientific research project but also a working and effective solution to real life marketing problems.

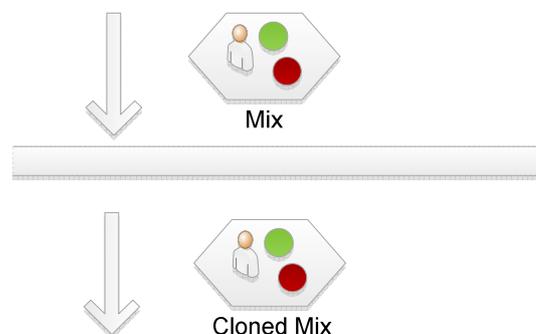


DIAGRAM 63 – MARKETING MIX CLONING OPERATOR

*INTERACTIVE GENETIC PROGRAMMING*

The idea of genetic programming is inspired by theory of biological evolution. It generally starts with large set of initial population of random or hand designed programs that represent possible solutions to previously defined problem (Segaran, 2007, str. 250). The programs then are evaluated with so called fitness function that indicates the quality of the solution each program represents. Then programs are ranked according to the fitness function. Having ordered list of solutions ranked according to their quality, genetic operators are applied. Usually two basic genetic operators inspired by nature are used, those are mutation and crossing-over. The first operator slightly changes the program by modifying randomly a part of it, so that the solution it represents is close to (but not exactly the same) the solution before the mutation was applied. The second - crossing over - operator takes two input programs and produces an offspring program whose half implementation is taken from the first parent program and the other half from the second parent. Having fitness function, genetic operators and initial solutions defined we select the best performing programs, reproduce and mutate them to create an offspring population. The offspring population is evaluated according to the same fitness function, and the same selection method and genetic operators are applied, thus creating an evolutionary loop that theoretically shall sooner or later generate a program, which will represent an optimal (or close to optimal) solution to the problem defined.

The most common problem this method implies is preserving constraints. For many problems a random mutation or automated crossing over will generate an invalid solution that can't even be evaluated. This unfortunately is our case. Crossing over and mutating marketing compositions will in many (if not most) cases generate invalid marketing mix that cannot be presented to customers. For instance offering a 30% rebate and displaying banner saying "20% cheaper" might be very confusing to potential customers, and such marketing composition cannot show up on production website. Fortunately there is an easy way of overcoming this problem by introducing a human that will evaluate the sanity of marketing strategy generated by genetic operators before it can be presented to customers for further evaluation. Bringing interactivity to the algorithm not only solves the constraint problem, but also brings the control over the whole process back to the human marketer. This makes a very important feature of the designed system. Even though complex calculations are performed on each step of the marketing mix evolution, the final decision of what gets presented in production environment is always made by human. The sense of control

over the process is probably a must have feature, since marketing mix is one of key factors making the e-commerce website sell or not. Hence many website owners wouldn't let it be introduced automatically by a complex process that might be very difficult to trace and understand.

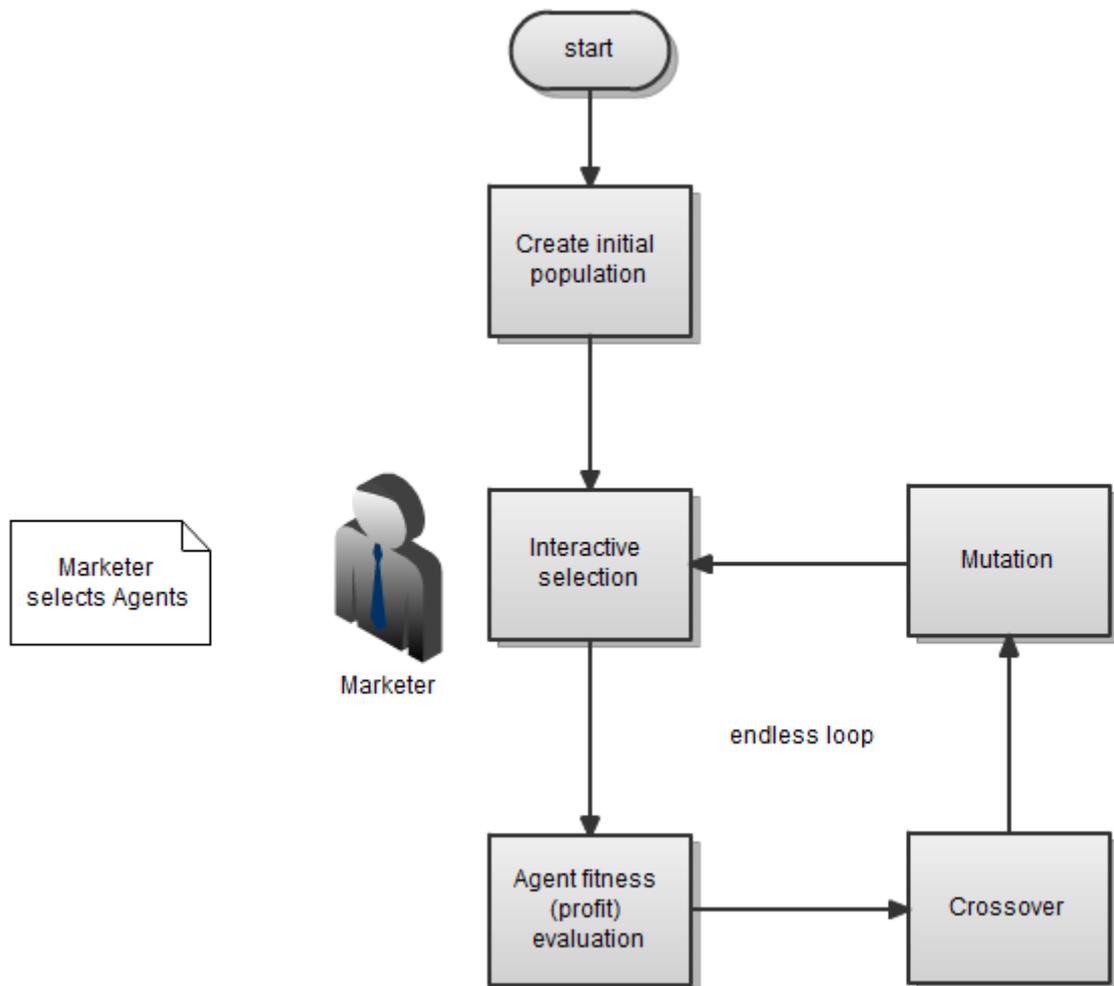
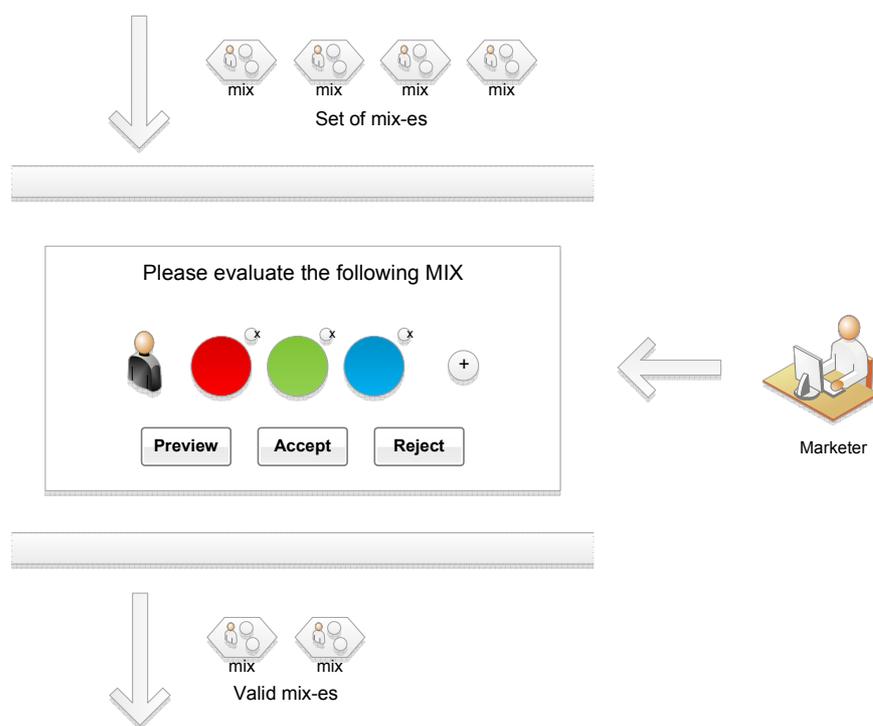


DIAGRAM 64 - INTERACTIVE GENETIC ALGORITHM

*INTERACTIVE CONSTRAINTS EVALUATION*

Evolution process involves a lot of randomness. One of the most common problem it implies is preserving constraints. For many problems a random mutation or automated crossing over will generate an invalid solution that can't even be evaluated. This unfortunately is our case. Crossing over and mutating marketing compositions will in many cases generate invalid marketing mix that cannot be presented to customers. Therefore it is likely that we will sometimes evolve a marketing mix that will not make any sense. A simple example of such a mix is a "10% discount promotion" together with a banner saying "everything 30% off". We wouldn't like such a mix to go live, and be presented to real-life visitors. Fortunately there is an easy way of overcoming this problem by introducing a human that will evaluate the sanity of marketing strategy generated by genetic operators before it can be presented to customers for further evaluation.



**DIAGRAM 65 - INTERACTIVE CONSTRAINT EVALUATION**

Bringing interactivity to the algorithm not only solves the constraint problem, but also brings the control over the whole process back to the human marketer. This makes a very important feature of the designed system. Even though complex calculations are performed on each step of the marketing mix evolution, the final decision of what gets presented in production environment is always made by human. The sense of control over the process is probably a must have feature, since marketing mix is one of key

factors making the e-commerce website sell or not. Hence many website owners wouldn't let it be introduced automatically by a complex process that might be very difficult to trace and understand. This approach has another important advantage: it gives the operator an insight into what is actually happening on the website, how it actually appears to visitors and what mixes are active and perform well. Because each step in the evolution involves collecting lots of performance data, it is not very fast. Even on a medium traffic website we might need a few days to collect enough data to perform single evolution step. Therefore a requirement for a marketer to validate newly evolved marketing mix every few other days doesn't seem to be burdensome.

## OPTIMIZATION GOAL

The algorithm is a method for finding an optimum of the defined fitness function. We have previously defined the fitness function as a profit generated by each user visiting the website. Therefore the proposed method is in fact a profit maximization algorithm. But profit isn't the only way to define the fitness function; in fact it might be defined in many other ways. We might define the fitness function with virtually any measure we can track, to name a few those might be:

- time spent on site
- number of newly registered users
- number of returning visits
- number of clicks on ads
- number of comments or other content generated
- average product rating

Each of the above variables represents a goal different from profit maximization. Those measures might be useful for applying described method to optimizing websites where profit cannot be measured directly; but even ecommerce websites should perhaps consider other – non necessarily transactional values a visitor generates. For instance consider a visitor that isn't buying anything, but came to the website to write a review of a product, which will be read afterwards by thousands of other visitors, among whom dozen will get convinced to make a purchase. If we measure just profit generated by this user it will be zero, but the user has obviously generated value for the company and if we think long term it shall be taken into account. Direct profit calculation might

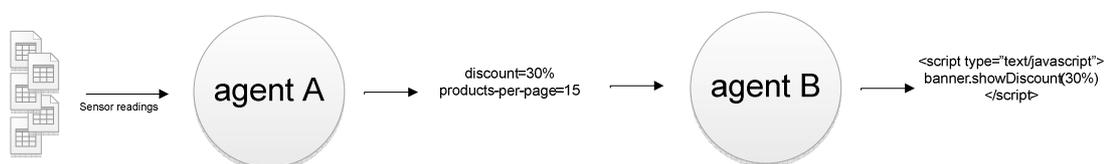
even not be possible for websites different from e-commerce. Therefore we shall consider building a little more complex fitness function that takes into account more than just sales, but also other sources of value generated by the user. Maximizing profit for each single visit is a short term goal, which might lead to long term success, but does not necessarily have to.

## CUSTOMER SATISFACTION

If we consider marketing as a process of fulfilling customer wants and expectations, then customer satisfaction is one of the most common key performance indicators. Satisfied customers are likely to come back and thus contribute to one of the most important company's assets – loyal customers. Methods for measuring customer satisfaction are well covered by the literature. One of the most common is a just to ask customers to rate their experience with the product or service. Similarly a satisfaction from using a website is often measured. Websites visitors are asked to rate their experience on a simple survey, results are collected

## COMMUNICATION BETWEEN AGENTS

Agents are allowed to read each other's output, therefore allowing them to communicate. This is a simple way of fulfilling the social ability aspect of agent definition proposed by (Jennings & Wooldridge, 1998). The communication language is composed of simple name-value pairs.



**DIAGRAM 66 - COMMUNICATION BETWEEN AGENTS**

Making agents able to communicate, even with a very simple language, makes division of work between agents possible. If we consider agent as a processing component of

the system, then communication is a way to implement code reuse. Processing can be split between agents and since agents are able to communicate the processing results, it doesn't need to happen multiple times. Therefore some agents can act as sensor reading processors interpreting user tracking data and taking it into more abstract level. For instance an agent might calculate responsiveness of a user to a promotional offer by tracking whether he clicks on items that are currently promoted or not. This information might be then interpreted by other agent to choose more or less explicit promotional message. Hence more responsive user will see more promotional messages than a user that doesn't respond well to our promotional efforts.

## CONCLUSIONS

A prototype of the created Traffic Data Multi Agent System has been tested in two experiments carried out for nine months when over 0,5 million visitors used the website to purchase over 9000 products. Empirical data shows that the system is able to increase performance of internal website marketing efforts by offering groups of visitors different marketing compositions, while observing how visitors will react to them. Data gathered during the system operation is processed to calculate a performance of each mix together with specific target group. Various visualizations of the data are analyzed to reveal insights into visitor behavior. We discover significant differences between groups of new and returning visitors that explains why it is profitable to provide different marketing mixes to these groups. The research shows that there is a huge gap between new and returning visitors. They can be described with different behavioral patterns, they differ significantly in all important metrics, and hence they should be handled differently. Returning visitors are people that came to website to make a purchase and it is mostly a matter of whether they will find products they are looking for. We do not have to use any strong marketing to convince them to make a purchase or offer large discounts to facilitate sales; just help them find what they were looking for. Probably the things they are looking for are the ones they have seen in the previous visit; therefore it should be a good idea to instantly present them products relevant to their previous visit.

It should be also noticed, that the visitor segmentation capabilities of the system showed to be limited in real life applications. Keyword based segmentation surprisingly did not yield in increased marketing performance. However it is also possible that new ways of targeting a marketing message require new creative approach to copy and design. Finally marketing is far from being just technology; it always involves strong creative component, and only a harmonious combination of the two yields to high performance.

Proposed approach can be generalized to mixing also other - not marketing related - website elements. During the system implementation it become obvious that it can be used to optimize mix of website features, not only marketing elements. The approach is verified by testing variations of product lists on the examined website. We find out that a number of products displayed in one category page is a significant parameter determining profitability of e-commerce website. Although other features have not been tested during the case study we find examples of other websites where users can customize their experience. As customization is rarely used by less experienced users in real world, optimizing user experience automatically seems as an attractive approach.

# BIBLIOGRAPHY

1. Aaron F., Macedo M., Poulsen J., Waterson T., Yu A.: *Multivariate Analysis of Variance (MANOVA)*. Retrieved from the Web on October 19, 2009, at: <http://online.sfsu.edu/~efc/classes/biol710/manova/manovanewest.htm>
2. Arora N., Dreze X., Ghose A., Hess J. D., Iyengar R., Jing B., et al.: *Putting one-to-one marketing to work: Personalization*. *Market Lett*, Vol. 19, 2008, pp. 305–321.
3. Bloch P. H., Richens M. L.: *Shopping without Purchase: An Investigation of Consumer Browsing Behavior*. In Bagozzi R. P., Tybout A. M. *Advances in Consumer Research*, MI: Association for Consumer Research, Vol. 10, 1983, pp. 383-393.
4. Boehm B.: *A Spiral Model of Software Development and Enhancement*, *IEEE Engineering Management Review*, 1995, pp. 69-81.
5. Booms B. H., Bitner M. J.: *Marketing Strategies and Organization Structures for Service Firms*. In Donnelly J., George W. (ed.) *Marketing of Services*. Chicago: American Marketing Association, 1981, pp. 47-51
6. Borden N.: The concept of the Marketing Mix, In Schwartz G. (ed.) *Science in Marketing*. New York: John Wiley, 1964,
7. Capon N., Hulbert J.: *Marketing in the 21st Century*. Pearsons Education, 2000
8. Castells M. *The Rise of the Network Society*, In: *The Information Age: Economy, Society and Culture Vol. I*. Cambridge, MA; Oxford, UK: Blackwell. 1996, second edition 2000.

9. Catholijn M., Jonker R. A.: *A Reusable Multi-Agent Architecture for Active Intelligent Websites*. Journal Applied Intelligence Volume 15 Issue 1, July-August 2001, pp. 7 - 24.
10. Chesbrough H. *Open Business Models*. Boston: Harvard Business School Press., 2007.
11. Constantinides E.: *The 4S Web-Marketing Mix model*. Electronic Commerce Research and Applications, 2002, pp. 57-76.
12. Constantinides E.: *The Marketing Mix Revised: Towards the 21st Century Marketing*. Journal of Marketing Management, 2006, pp. 407-438.
13. Culliton J.: *The Management of Marketing Costs*. Division of Research, Graduate School of Business Administration, Harvard University, 1948.
14. Department for Business Innovation and Skills: *Digital Britain*, London: Crown. The Secretary of State for Culture, Media and Sport. 2009.
15. Doan A., Ramakrishnan R., Halevy A.: *Crowdsourcing systems for the World-Wide Web*. Communications of the ACM, Vol. 54, No. , April 2011, pp. 86-96.
16. Fawcett T., Provost F.: *Combining Data Mining and Machine Learning for Effective User Profiling*. KDD-96 Proceedings, AAAI Press, 1996.
17. Fryar C.: *What's Different About Service Marketing*. The Journal of Marketing Services, Vol. 5, 1991, pp. 53-58.
18. Galeotti A., Moraga-Gonzalez J. L.: *A Model of strategic targeted advertising*. CESifo Working Paper, Vol. 1196, May 2004.
19. Goldsmith R.: *The personalised marketplace: beyond the 4Ps*. Marketing Intelligence&Planning, Vol. 17, 1999, pp. 178-185.
20. Greenwald J. O.: *Dynamic Pricing by Software Agents*. Computer Networks, Vol. 32, 2000, pp. 731-752.
21. Gronroos C.: *From Marketing Mix to Relationship Marketing: Towards a Paradigm Shift in Marketing*. Management Decision, Vol. 32, 1994, pp. 4-20.
22. Gronroos C.: *Marketing services: a case of a missing product*. Journal of Business and Industrial Marketing, Vol. 13, No. 4/5 1998, pp. 322-338.

23. Gronroos C.: *On defining marketing: finding a new roadmap for marketing*. Marketing Theory, SAGE, Ed., Vol. 6, 2006, pp. 395-417.
24. Gronroos C.: *Quo Vadis, Marketing? Towards a Relationship Marketing Paradigm*. Journal of Marketing Management, Vol. 10, 1994, pp. 347-360.
25. Gummesson E.: *Marketing Revisited: The Crucial Role of the Part-Time Marketer*. European Journal of Marketing 25(2), 1991, pp. 60-7.
26. Harley R.: *Benefit segmentation: a decision-oriented research tool*. Journal of Marketing, Vol. 32, 1968, pp. 30-35.
27. Heskett J.: *Lessons in the Service Sector*. Harvard Business Review, Vol 65, March-April 1987, pp. 118-126.
28. Hirschman E., Holbrook M. G.: *Hedonic Consumption: Emerging Concepts, Methods and Propositions*. Journal of Marketing, Vol. 46, 1982, pp. 92-101.
29. Hoffman D. L., Novak T. P.: *Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations*. Journal of Marketing, Vol. 60, No. 3, 1996, pp. 50-68.
30. Janiszewski C.: *The Influence of Display Characteristics on Visual Exploratory Search Behavior*. Journal of Consumer Research, Vol. 25, No. 3, 1998, pp. 290-301.
31. Jennings N. R., Wooldridge M.: *Applications of Intelligent Agents*. In Jennings N. R., Wooldridge M. (ed.) *Agent Technology: Foundations, Applications, and Markets*, New York: Springer, 1998, pp. 3-28.
32. Johnson E. J., Moe W. W., Fader P. S., Bellman S., Lohse G. L.: *On the Depth and Dynamics of Online Search Behavior*. Management Science, Vol. 50, No. 3, 2004, pp. 299-308.
33. Kent R.: *Faith in Four Ps: An Alternative*. Journal of Marketing Management, Vol 2, 1986, pp. 145-154.
34. Kephart J., Hadson J., Greenwald A.: *Dynamic pricing by software agents*. Computer Networks, May 2000, pp. 731-752.
35. Klein, L.: *Evaluating the Potential of Interactive Media through a New Lens: Search versus Experience Goods*. Journal of Business Research (41) , pp. 195-203.

36. Kosmopoulou G., Liu Q., Shuai J.: *Customer Poaching, Coupon Trading and Consumer Arbitrage*. Proceedings of 8th Conference on Research on Economic Theory and Econometrics. Tinos, 2009.
37. Kotler P.: *Marketing Management*. Englewood Cliffs, New Jersey: Prentice-Hall, 1st edition, 1967.
38. Kotler P.: *Marketing Management*. Englewood Cliffs, New Jersey: Prentice Hall International Editions, 11th Edition, 2003.
39. Koza J.: *Genetic Programming: On the Programming of Computers by Means of Natural Selection*. A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, 1992.
40. Lauterborn B.: *New marketing litany: four Ps passe: C-words take over*. Advertising age, Vol. 61, No. 41, 1990. pp. 26.
41. Leimeister J., Huber M., Bretschneider U., Krcmar H.: *Leveraging Crowdsourcing: Activation-Supporting Components for IT-Based Ideas Competition*. Journal of Management Information Systems, Vol. 26, 2009, pp. 197–224.
42. Li C., Bernoff J.: *Groundswell. Winning in a world transformed by social technologies*. Harvard Business School Press, 2008.
43. Maglaras C., Meissner J.: *Dynamic Pricing Strategies for Multiproduct Revenue Management Problems*. Manufacturing and Service Operations Management, Vol. 8, No. 2, 2006, pp. 136–148.
44. McCarthy E.: *Basic Marketing*. Homewood, IL: Irwing, 1960.
45. McDonald M., Dunbar I.: *Market Segmentation*. Palgrave Macmillan, 2nd Revised edition ed., 1998.
46. McKenna R.: *Marketing Is Everything*. Harvard Business Review, January 1991
47. McKenna R.: *Real Time, Preparing For the Age Of The Never Satisfied Customer*. . Harvard Business Press, 1997.
48. Mehdi Dastani N. J.: *Modelling User Preferences and Mediating Agents in Electronic Commerce*. In Dignum F. (ed.) Agent Mediated Electronic Commerce, Springer Verlag, 2001, pp. 163-194.

49. Moe W. M., Fader P. S.: *Dynamic Conversion Behavior at E-Commerce Sites*. Management Science, Vol. 50, No. 3, March 2004, pp. 326-335.
50. Moe W. M., Fader P. S.: *Uncovering Patterns in Cybershopping*. California Management Review, Vol. 4, 2001, pp. 106-117.
51. Moe W. M., Fader P. S.: *Capturing Evolving Visit Behavior in Clickstream Data*. Journal of Interactive Marketing, Vol. 18, No. 1, 2001, pp. 5-19.
52. Moe W. M., Fader P. S.: *Which Visits Lead to Purchases? Dynamic Conversion Behavior at e-Commerce Sites*. Wharton Marketing Department Working Paper, 2000.
53. Moller K.: *Comment on: The Marketing Mix Revised: Towards the 21st Century Marketing by E. Constantinides*. Journal of Marketing Management, Vol. 22, 2006, pp. 439-450.
54. Moore G.: *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers*. HarperBusiness. 1991.
55. Negroponte N.: *Being Digital*. Knopf Publishers. 1995.
56. Nirvikar S.: *Marketing and Selling*. University of California Santa Cruz, Economics Department, Working Papers, April 2000, Nirvikar Singh. Retrieved from the Web on July 5, 2011, at:  
<http://people.ucsc.edu/~boxjenk/bookchapters/Bkch15.pdf>
57. Norman D.: *The Invisible Computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution*. The MIT Press, 1999.
58. Ohmae K.: *The Mind of the Strategist: The Art of Japanese Business*. NY: McGraw-Hill Inc., 1982.
59. Peppers D., Rogers M.: *Enterprise One to One*. Crown Business, 1999.
60. Peppers D., Rogers M.: *The One to One Future - Building Relationships One Customer at a Time*, Bantam Press, 1997.
61. Png I., Lehman D.: *Managerial Economics*. Wiley-Blackwell, 2007.

62. Russel S., Norvig P.: *Artificial Intelligence - A Modern Approach*. New Jersey: Pearson Education International, 2003.
63. Segaran T.: *Programming Collective Intelligence*. Sebastopol: O'Reilly Media, 2007.
64. Smith W.: *Product differentiation and market segmentation as alternative marketing strategies*. Journal of Marketing, Vol. 21, 1956, pp. 3-8.
65. Sole L., A.: Price Discrimination and Imperfect Competition. (2003). Retrieved from the Web on January 19, 2010, at: <http://web.mit.edu/14.271/www/hio-pdic.pdf>
66. Stanford Visualizations Group. (n.d.). *Force Directed Layout*. Retrieved from the Web on December 12, 2010, at: Protovis: <http://vis.stanford.edu/protovis/ex/force.html>
67. Stewart T.: *Intellectual Capital: The New Wealth of Organizations*. New York: Doubleday. 1997.
68. Stubblebine C. G.: *Secure Distributed Human Computation*. Proceedings of ACM Conference on Electronic Commerce. ACM Press, 2005, pp. 155-164.
69. Surowiecki J.: *The Wisdom of Crowds*. New York: Random House, 2005.
70. Tapscott D.: *Grown Up Digital: How the Net Generation is Changing Your World*. NY: McGraw-Hill, 2008.
71. Tapscott D.: *Net Gen Transforms Marketing*. Retrieved from the Web on May 7 2011, at: <http://www.businessweek.com>: [http://www.businessweek.com/technology/content/nov2008/tc20081114\\_882532.htm](http://www.businessweek.com/technology/content/nov2008/tc20081114_882532.htm)
72. U.s. department of commerce: *Digital economy 2000*. Economics and Statistics Administration. Office of Policy Development. 2000.
73. Van Dijk J.: *The One-Dimensional Network Society of Manuel Castells*. New Media and Society, Vol. 1, 1999, pp. 127-139.
74. Vargo S., Lush R.: *Evolving to a New Dominant Logic for Marketing*. Journal of Marketing, Vol. 68, 2004, pp. 1-17.

75. Wedel M., Kamakura W.: *Market Segmentation: Conceptual and Methodological Foundations*, Norwell, MA: Kluwer Academic Publishers, 2nd edition, 2000.
76. Wedel M., Kamakura W.: *Introduction to the Special Issue of Market Segmentation*. *International Journal of Research in Marketing*, Vol. 19, 2002, pp. 181-183.
77. Wind Y.: *Issues and Advances in Segmentation Research*. *Journal of Marketing Research*, Vol. 25, 1978, pp. 317-337.
78. Wolfinbarger M., Gilly M.: *Consumer Motivations for Online Shopping*. *AMCIS 2000 Proceedings*. Paper 112, 2000.
79. Wyckoff A.: *Imagining the Impact of Electronic Commerce*. *The OECD Observer*, 1997.
80. Zachary W. W.: *An Information Flow Model For Conflict And Fission In Small Groups*. *Journal Of Anthropological Research*, 1977, pp. 452-473.
81. Zimmerman E.: *World Resources and Industries*. New York: Harper and Row, 1951.

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