



# An e-customer behavior model with online analytical mining for internet marketing planning

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## Abstract

In the digital market, attracting sufficient online traffic in a business to customer Web site is vital to an online business's success. The changing patterns of Internet surfer access to e-commerce sites pose challenges for the Internet marketing teams of online companies. For e-business to grow, a system must be devised to provide customers' preferred traversal patterns from product awareness and exploration to purchase commitment. Such knowledge can be discovered by synthesizing a large volume of Web access data through information compression to produce a view of the frequent access patterns of e-customers. This paper develops constructs for measuring the online movement of e-customers, and uses a mental cognitive model to identify the four important dimensions of e-customer behavior, abstract their behavioral changes by developing a three-phase e-customer behavioral graph, and tests the instrument via a prototype that uses an online analytical mining (OLAM) methodology. The knowledge discovered is expected to foster the development of a marketing plan for B2C Web sites. A prototype with an empirical Web server log file is used to verify the feasibility of the methodology.

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## 1. Introduction

In e-commerce, the current challenge is determining how to design responsive Web site infrastructure that provides a sustainable competitive advantage

through a better understanding of target customers. The quality of an e-commerce site depends on interrelated factors such as site architecture, network capacity, Web services, and the unpredictability of e-customer behavior. These characteristics imply the need to measure the behavior of the Web-based system and its users. Knowledge management is the key to business learning. The technologies that support knowledge management in e-business are data warehousing, data mining, the Internet, and document management systems [21,25,26].

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Online marketing aims to produce online revenue by understanding customer needs. Meeting this objective requires knowledge of how e-customers' online movements change from awareness of products to the exploration of options and further to purchase commitment. An online analytical mining (OLAM) system using an underlying cognitive model and e-customer behavioral graph can be used to articulate the online activities of e-customers on a particular Web site. This can provide the framework of an e-customer behavior (eCB) model that can be used to discover e-customer profiles which identify the significant dimensions of online behavior and identify Web pages that trigger behavior changes. The knowledge thereby obtained will foster informed Internet marketing decision making, and allow Web content and infrastructure refinement to support Internet marketing.

## 2. Current background, theoretical underpinnings and hypotheses

Electronic commerce (EC) is growing rapidly, and offers a diversity of related issues to investigate. Ngai [18] presents a literature review and classification scheme for EC research. Over 78% of EC research has been focused on applications, implementation and technical issues, and only 9% has touched the topic of e-customers, with very few studies directly addressing the issue of e-customer preferences and their effects on Web site acceptability. Because e-customers learn fast and want Web sites that are driven by their needs, the historical analysis of customer behavior will help to identify current preferences. This paper aims to establish an understanding of e-customers' online behavior, and uses an eCB model to discover this knowledge via OLAM. OLAM has been used in many applications of knowledge management and decision support in e-business. For instance, Menczer [15] proposes an adaptive population of intelligent agents that mine the Web when a query is made. The performance of the system is evaluated by comparing its effectiveness in locating recent and relevant documents with that of search engines. Menczer and Belew [16] propose a multi-agent model for online, dynamic information mining on the Web. Each agent navigates from page to page following hypertext links, trying to locate new documents that are relevant to the user's

query, with only limited interaction with other agents. Eirinaki and Vazirgiannix [6] analyze the collected data from content-based filtering, collaborative filtering, rule-based filtering and Web usage mining. Huang et al. applies online analytical processing (OLAP) technology in combination with data mining techniques for the prediction, classification and time-series analysis of Web log data [9]. Ohura et al. [19] clusters user requests from the access logs using an enhanced K-means clustering algorithm, and then applies them for query expansion by recommending categories that are similar to the request and suggesting related categories. Our target is to discover knowledge about the customers of an e-commerce Web site to foster the development of a feasible Internet marketing plan. The elements of our instrument include a three-phase e-customer behavior graph, a mental cognitive model, a set of OLAM algorithms and a webmaster.

### 2.1. The mental cognitive model

Internet marketing is the process of building and maintaining customer relationships through online activities to facilitate the exchange of ideas, products, and services that satisfy the goals of both parties [17]. It is concerned with using the Internet to create intense and profitable relationships with their customers. Three primary forces that are generated by the Internet effect e-marketing-individualization, information, and interactivity. Marketing research has begun to investigate how these forces can be utilized to create long lasting relationships with customers. The need to understand the target customers of Internet marketing has become obvious recently. Much recent research has investigated the human aspect of computing, with attempts to explore the meaning and effects of computer interface design and its interactive use [3,20]. Moreover, Devaraj et al. [5] examine the determinants of EC channel satisfaction and preference using survey data, and Koufaris [12] examines how emotional and cognitive responses to visiting a Web-based store for the first time can influence revisit intention. Kalakota and Whinston [10] discuss a six-step interactive marketing process on the Internet, in which the initial step emphasizes the study of e-customers' behavioral approaches. Kiang et al. [11] propose a scheme for determining e-product characteristics for Internet marketing. Dalglish [4] proposes

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