A Control Structure for Intelligent Emotion-Oriented eCommerce Systems

Simone Leon, Alexander Nikov, Derek Chadee

***Abstract*—There are various design factors that affect the customer's emotions in an eCommerce environment. A control diagram identifying the major elements and processes involved in an emotion-oriented eCommerce system has been created. The control structure and its components are identified and described. For supporting the simulation of emotion-oriented eCommerce systems the control structure is implemented as a MATLAB-SIMULINK-based control structure.**

***Index Terms*—Emotion-Oriented eCommerce, control structure, intelligent systems, simulation.**

I. INTRODUCTION

In any eCommerce environment, eliciting a particular emotion that leads to a purchasing decision depends on the right combination of design elements. Good design is more about making an interface look good. The main concept behind good design is creating an emotional reaction. Therefore a sign of good design is one that is able to encourage an emotion of happiness, excitement and trust. Particularly in an eCommerce environment, every aspect of the site should appeal to the emotions of the target customer. It is not only about revealing what product or service you may have to offer, it is also about how you want the customer to feel.

An intelligent emotion-oriented eCommerce system should be designed to effectively accommodate techniques that would identify affective behaviour in the customer [1]. The system should be able to identify the emotional state of the customer and provide the appropriate response.

Studies on the usability of eCommerce sites report major design problems [2]. An analysis of eCommerce major issues from a human-computer interaction viewpoint show that eCommerce should not only satisfy the needs of customers who have a rational style of buying but it should also satisfy the needs of customers who have an emotional style of buying [3]. It must be understood that human-computer interaction is a social process and the computer is seen as a social actor. The identification of the necessary design requirements in an emotion-oriented eCommerce environment will serve as an essential tool in developing the appropriate design geared towards securing a positive purchase decision from the customer.

Emotion-oriented eCommerce is a novel and very exciting field of study. The use of intelligent systems in eCommerce has increased considerably, providing a new perspective on the overall shopping experience for the online shopper. There exists tremendous literature on factors that influence people's emotions [12] and the process involved in people forming judgments about intelligence, knowledge, and reliability of others. Studies on intelligent emotion-oriented eCommerce systems are very limited up to this point [14]. An emotion-oriented eCommerce system would need to measure the affective state of the customer through affective sensing and recognition in order to determine an appropriate reaction [15]. Kim and Moon [16] investigated the role emotions play in the use of banking websites and they attempted to design customer interfaces that can induce target emotions. Experiments were conducted to identify the important emotive and design factors, and establish and verify causal relations between these factors. The results from the study showed that it is possible to design customer interfaces that will elicit target emotions from the user. The design factors from a user's perspective which seemed to elicit the most emotional responsiveness from the user are highlighted in Table 1 and are categorized into four categories.

Table 1 - Design Factors of Cyber Banking Interfaces [16]

Categories	Design Factors
Title	Format Graphics Position
Menu	Content Form Size
Main Clipart	Format Size Motion
Colour	Colour Tone Main Colour Background Brightness Symmetry

There are a number of design factors and elements involved in an emotion-oriented eCommerce system. The understanding of the right combination of design factors which may affect the emotions of the customer in this environment can be represented by using a control structure. The control structure identifies the inputs and possible outcomes that may exist.

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ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

II. DESCRIPTION OF CONTROL STRUCTURE

A control structure was created in an effort to understand and systematically define the design elements that are involved in an emotion-oriented eCommerce system. Such a system should be concerned with identifying, analyzing and responding to the emotions of the customer. Changing a negative emotion to a positive emotion is essential if companies want their products sold. A positive emotion would indicate the highest probability that the customer would make a favourable purchase decision.

A. Control Structure Components

The suggested components of the control structure are:

- **Targets** – which identify what the system should do and what must be the eventual outcome;
- **Inputs** – refers to the design elements required for the design of an emotion-oriented eCommerce system;
- **eCommerce Customer** – who would interact with the system through an interface;
- **eCommerce System** – the medium which satisfies the needs of the customer; and
- **Outputs**– refer to data collected from the customer relating to facial expressions, body movements and gestures, voice behaviour and bio-patterns.

1) **Targets** - The goals of an eCommerce environment are:
   - Identifying the emotional state of the customer;
   - Encouraging a purchasing decision; and
   - Satisfying the customer throughout the eCommerce experience.

   Each eCommerce system must be designed to meet the needs of a specific target audience. Companies engaged in eCommerce need to take a holistic view of their customers by understanding what motivates their behaviours and actions in a retail environment. Understanding the needs of the target audience will enable the company to provide value and continuous satisfaction.

2) **Inputs** - are the design elements that would be applied to the development of the eCommerce system. In designing a web site, the primary goal is to ensure that the customer experience the site the way they suppose to. The website design and content will have a magnificent influence on the customers' perception of the business thus affecting their purchasing decision. How information is presented is essential in product delivery and distribution. The design should be laid out in a manner which presents a stress-free and enjoyable online environment – in that customers are able to develop a level of comfort in doing business via the site. Typography, layout, navigation, graphics arts and images, video, theme and audio usage are design elements which affect the emotions of the customer and should be included in any eCommerce strategy as summarized in Fig. 1.

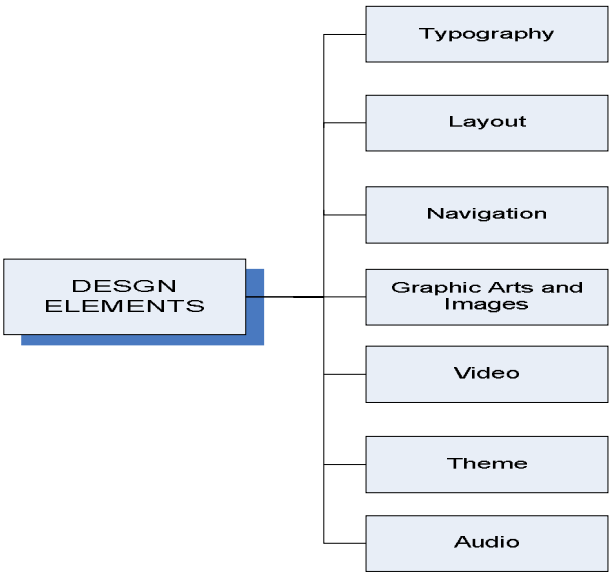

Fig. 1 – Design Elements

Typography supports the process of textual communication. Clear and understandable design especially in an eCommerce environment would increase the interactivity between the customer and the system. We may continue to ask ourselves, why extensive knowledge in typography is essential. The primary function of typography is the presentation of information that is easy to read and visually appealing. Typography features would include colour, text, fonts, styles, formatting and so on. For instance, the use of the right **colours** in design is imperative when trying to make a lasting first impression on any customer. Colours of our environment affect our behaviour and mood. It is the combination of colours that triggers an emotional response [7]. A study done by Dormann [12] indicated that the design element of colour might have a strong emotional value, especially background colour. In the experiment performed colours mostly generated positive feelings. There were also negative reactions towards colour expectations and products. Colours have the potential to elicit ***emotions*** or behaviours, yet there is little research which treats with how colour should be used in web design [17]. Designers must therefore assess the fitness of the proposed scheme, minimising the elements that may cause negative effects.

Layout is believed to be an essential foundation block for web design. The organisation of all the elements on an eCommerc1e site is important for capturing the user's attention. An eCommerce site that appears cluttered with too much text and graphical images would have a negative affect on potential customers. Layout therefore affects the clarity and content of the site and how other elements would influence each other. For example in western societies, people read and write from left to right and from top to bottom, whilst in Asian societies they read using a right to left alignment. Once a designer interprets how the eyes and brains views information, layout becomes an easy visual attribute.

ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

Many different types of formats have been used in web design and these designs can evoke different emotional responses. A study done by Bowker and Dillman [18] indicated that users showed visible signs of distress such as the re-alignment of the human body and negative facial expressions when a right aligned format is applied. The majority of the users surveyed stated they preferred the left-align format.

Navigation is also needed in good web design. However many designers believe that the inclusion of navigation buttons or links is just a matter of providing the user with a sense of direction. The purpose of navigation elements goes beyond this trivial thought. Navigation let the user know what is available and what action should be taken in order achieve a specific result. Navigation allows the customer to have access to all areas of the website. Such navigation features include hyperlinks, search and email links. A well organised website, with a profession look, and intuitive navigation and task oriented functionality influences the emotional interactions of perception of credibility, trust, perception of security, and perceived ease of use [19].

Graphics make any website come alive with exciting colours, personalized logos, and animated text. An image is a fun element that can be applied to a website. One image can tell a story of a thousand words**.** In order to make a user feel comfortable in an eCommerce environment, the site should be visually appealing. The user should be encouraged to stay and browse the website, which may lead to the eventual purchase of a product. For example when walking through a clothing store, a customer may enjoy the shopping experience because the store is colourfully displayed. However the customer may be turned off by a store that appears to be dull and boring and not properly laid out. Graphical effects, therefore, should complement the contents of the eCommerce site. Lee, Wright and Fisher [20] noted that apart from physical expressions like smiles or laughter, positive emotions were generally generated as a result of people's experience with graphics. People could also have a sense of satisfaction from their experience with graphical elements. Nevertheless, there should be balance in the amount of graphics used. Too many graphics may be distracting and cause a delay, depending on the speed of the user's computer system.

Video is also an exciting way to enliven the user's experience and add some interactivity. It helps to demonstrate and give the user a better idea of the functions of the product. As online videos become more popular, retailers' are using video as a site feature to assist the shopping research and purchase process. The *2009 State of Retailing Online Merchandising Report* indicated that approximately one third of retailers surveyed believed that the use of videos increased sales and interactivity [21]. Consumers who view videos have more positive emotions towards an item than consumers who are exposed to plain text [22].

Depending on the type of website, an appropriate **theme** also should be chosen. The theme of any site would encompass the type of text, fonts and graphics used. Themes would range from education, entertainment, professional, corporate and personal. Design and experiences [24] in a retail environment need to focus on an appropriate theme, which characterizes the company and appeals to customers' emotions.

Human are audible beings. **Audio** can enhance the features of a particular product and heighten the experience of the shopper. An eCommerce site that provides background music or sound can capture the interest of the customer. The importance of sound in an eCommerce environment is to communicate the attribute of the product. A survey was conducted by Fiorre and Kelly of the School of Computing and IT, showing that the lack of sound in many websites is failing [5]. Retailers should focus more on enriching the user's experience with sound, rather than only dealing with the hedonic aspects of the products. Verbal stimuli such as audio have a greater ability to evoke enactive imagery, which may go along with active or affective arousal participation compared to visual stimuli [23].

3) **eCommerce Customer** - Without the customer the question to be asked is, "Who are you planning for?" The customer's response towards an eCommerce site is important to web developers and their companies. Design elements are shaped to promote positive responsiveness from the customer. However, not all customers are the same. An eCommerce system should provide an environment that caters for three types of customers:
   1) The first time customer;
   2) The frequent customer ; and
   3) The occasional customer

   An eCommerce environment should focus on capturing the attention of the ***first time customer***. When accessing a site for the very first time, the first response is mostly likely going to be an emotional response. The visual appeal of the interface can directly influence the acceptability and the usage of the system. As Lingaard noted [6], "an immediate negative impression may well determine our subsequent perception of the site's quality and usability, whereas we may inherently judge a site making a good first impression to be 'better' ". The appropriate response to the emotional state of the customer would create a certain level of confidence in the eCommerce system.

   The system having gained knowledge on the ***frequent customer*** should maintain a relationship that would continually encourage the customer to visit the site. The system would already know what factors trigger the emotions of the customer. Knowing the customer's past purchases, profile details and interests is a maximising benefit to any eCommerce environment. The customer knows that the company is dedicated to satisfying their needs through the products or services that they offer.

   The ***occasional customer*** also plays an important role in the eCommerce environment. The key is to create a lasting impression on the customer. Despite the number of times a customer may visit an eCommerce site, they must know that this particular environment can satisfy

ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

their needs emotionally and physically and it is one they can rely on.

4) **eCommerce System** - Designers of an eCommerce system must be made aware that whether a design is sophisticated or simple, ease of use is an important factor. This element bridges the gap of customers remaining loyal to the company and attracting new customers. An eCommerce system that successfully bridges the communicational gap between the user and machine should have the following attributes:
   - Believability of the interaction;
   - Service and functionality being offered; and
   - Underlying personality and emotional capabilities.

5) **Outputs** - The aim of any eCommerce web developer is to create an environment that would ultimately lead to the customer purchasing a product or service. The precise combination of the previous mentioned design elements should convince the customer that they must purchase the product or service being offered. This is done by identifying the emotions of the user and creating an environment which would adapt to their disposition. There are various techniques that can be applied to recognise the emotions of the customer:
   - Speech Processing
   - Facial Expression
   - Motor Behavioural Patterns
   - Body gestures and movements
   - Biosignals

A well designed web site shows that the company is dedicated to providing a secure and comfortable online shopping environment. Many customers with internet access may go to the website of a company for further information. When a prospective customer visits a website, the company has a limited amount of time to make a first "virtual impression". A poorly designed website may lead to the loss of customers. Many customers buy emotionally, therefore a web design that generates positive emotions creates an environment where a customer is made to feel safe and well informed about the products or services being offered. When a customer is confused by what is being displayed on the web page, or does not want to deal with a company that's not professional in its design, they would leave. Therefore, an eCommerce design should incorporate the necessary design elements of colour, style, text formatting and appropriate use of graphics and images. Depending on the type of product or services emotional elements such as music, imitation of facial expressions and flashes of pleasant images may be used to persuade the user and capture their attention.

III. MATLAB-BASED CONTROL STRUCTURE OF EMOTION-ORIENTED ECOMMERCE SYSTEMS

A model of emotion should identify events and objects involved in the interaction process in an eCommerce environment. Emotion models would allow the computer to express emotions at the appropriate time. Appraisal theories have influenced the development of computational models of emotion. Fundamentally, our appraisal of a situation causes an emotional or affective response. Emotion energies prepare the individual to respond and have at least four different aspects – feelings, actions, physiological arousal, and motivational programmes [25]. The importance of appraisal to emotions (primary, secondary, reappraisal) was articulated by Lazarus [26] and later elaborated by Smith and Lazarus [27] who categorized six appraisal components related to primary and secondary appraisals. These categories fall within the primary and secondary appraisals and include motivational congruency (evaluation of goals), motivational relevance (commitment), accountability (assignment of responsibility of blame and praise), problem-coping potentiality (resolvability), emotional-focused potentiality (emotional management of situation), and future expectancy (changeability of situation).

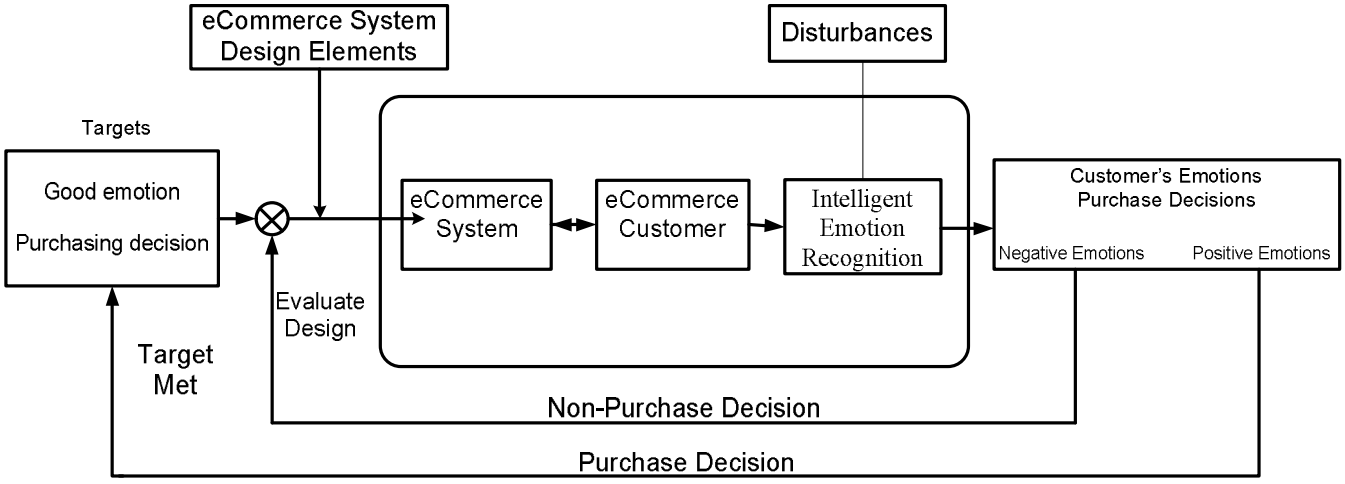

Figure 2 - Model of intelligent emotion-oriented eCommerce system

ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

A model for simulation of intelligent emotion-oriented eCommerce systems following the basic control structure shown in Fig. 2 is proposed. The targets identify what the system should accomplish. The inputs refer to the design elements required for the design of an emotion-oriented eCommerce System. The customer would interact with the system through a designed interface. The outputs will affect the eCommerce customer and the decision which is made. There is also the opportunity to identify and collect the necessary bio-physiological data produced by the customer. Positive feedback, may lead to the eventual purchasing of a product, whilst negative feedback will lead to product evaluation and system design modification. The decision made by the customer, will establish if further emphasis need to be placed on the inputs. In addition, designing such an environment must take into consideration the disturbances which may affect the purchasing decision of the customer and the creation of a good mood [1].

SIMULINK was used to create the model for simulation of the emotion-oriented eCommerce System. The SIMULINK control diagram shown in Fig. 3 is made up of six (6) subsystem blocks. These blocks individually carry the elements and processes needed to carry out the simulation. The **eCommerce system** block identifies the inputs which are the design elements as shown in Fig. 2. The right combination of design elements would produce the interface the customer would use to interact with the system. In the **Customer** block, during the interaction with the system the emotion of the customer would be recognized. The **Emotion Model** block is another subsystem which presents the selected OCC model *(Ortony, Clore, & Collins, 1988)* [4]. The emotion model identifies the basic emotions the customer may experience while in an eCommerce environment. The customer's emotion would be classified as either a positive or negative emotion.

However, there are a number of ***internal*** and ***external disturbances*** that may occur during a user's experience. Internal disturbances relates to those that are already present in such an environment, for example speed of the computer, malfunctioning software or lack of technical technique of the user. Internal disturbances can change the initial good mood of the customer to a frustrating mood. The emotion or mood that is felt by the user before entering an eCommerce environment is usually set by external factors. Stressful environments that are created by external factors such as demanding job, hectic family life or even a noisy alarm, will affect the initial mood of the user. The user would produce an emotion of frustration which the eCommerce environment must then try to change.

The **Decision Criteria** block accepts the positive or negative emotion input. The type of emotion would affect the purchase decision of the customer which is the eventually output of this block. If a favourable purchase decision is made the **Web Developer** block would know that the design has satisfied its intended targets of creating and maintaining a

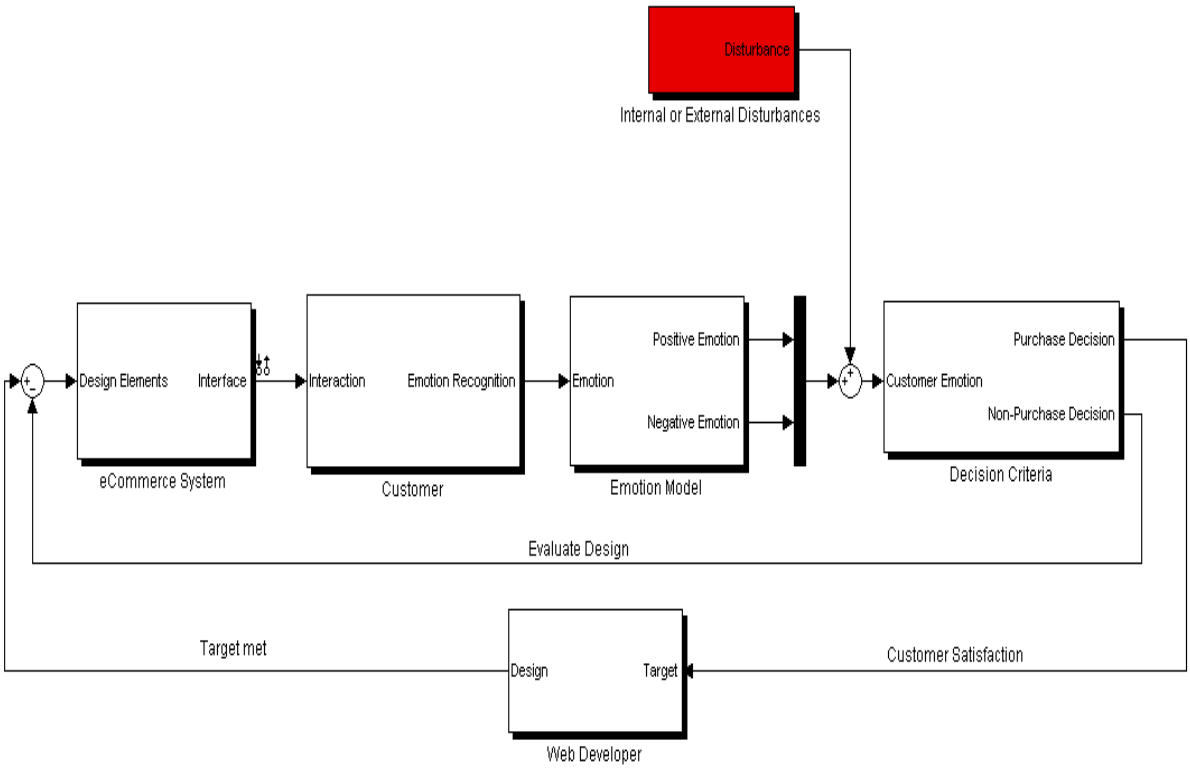

Figure 3 - MATLAB-based Control Structure for Emotion-Oriented eCommerce Systems

ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)

good emotion and encouraging a purchasing decision. If a non-purchase decision was made, there should be a system and design evaluation.

IV. CONCLUSIONS

The aim of any eCommerce web developer should be to create an environment that would ultimately lead to the customer purchasing a product or service. The right combination of design elements should convince the customer that they must purchase the product or service being offered. This is done by identifying the emotions of the user and creating an environment which would adapt and appropriately respond to their emotional state.

Many recent researchers [8],[9],[10] have incorporated the user's emotional nature as one of the key factors that can balance and broaden the development of human-computer interaction. The research presented in this paper forms part of that emotional approach to design interfaces that can improve the quality of communication between the computer and user.

Emotion plays an important role in the interaction process. In this study, we are investigating the elements that are involved in designing a customer interface for eCommerce systems that will evoke target emotions in the customer. The focus is on how design factors affects the transition from a negative emotion to a positive emotion. A positive emotion increases the probability of a customer wanting to purchase a product.

The design of customer interfaces that provide a pleasurable and comfortable shopping environment is an important research issue in eCommerce. An interactive online environment offers more opportunities to influence customers' emotions and decision making as oppose to traditional advertising or marketing techniques.

The components of a control structure for the design of an emotion-oriented eCommerce system were defined. A SIMULINK model for simulation of an emotion-oriented eCommerce system was discussed. Future developments would lead to more detailed blocks in the SIMULINK model and different parameter testing would occur before the real development and application of the system.

By commanding the science of persuasion and effectively recognising and appropriately responding to the emotions of the customer, we can therefore scientifically influence customers' online behaviour.

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ISBN: 978-988-17012-9-9
ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online)