Emotion-Oriented eCommerce Systems

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Abstract: - During recent years, the use of intelligent systems in eCommerce has increased significantly, providing a new perspective on the overall online shopping experience. The rapid growth of eCommerce has motivated many studies on the relationship between website design, company reputation, and purchase intent. Understanding emotion is important in gaining insight on how to efficiently satisfy the needs of the eCommerce customer. Emotion recognition techniques based on modern mathematical models using computational intelligence are presented. Progression within this field of study is highlighted. The requirements for designing of intelligent emotion-oriented eCommerce systems are defined. A model for simulation of intelligent emotion-oriented eCommerce systems is proposed. It is an important tool supporting the experimental study and design of emotion-oriented eCommerce systems.

Key-Words: - eCommerce, Emotion Recognition, Computational Intelligence, Modelling, Affect

1 Introduction

Electronic commerce is increasingly popular in today's businesses [3] and is becoming an integral facet in the online shopping experience [1]. Emotions are influencing customer cognitive processes and eShopping behaviour [20]. 'Affect' is an umbrella term to describe human moods and emotions [12]. It is an important variable in cognition and decision behaviour. Future research should investigate affective eCommerce for online decision behaviour. Affect, emotion, and subjective experience should be factored into the design of eCommerce systems [16]. As people migrate from the use of the television to the Internet, advertisers are beginning to broaden their scope via the Web.

A number of factors, other than the demographics play an important part in increasing eCommerce activity [67]. The emerging 21st century electronic commerce model shows that a variety of open electronic marketplaces will be competing with one another for participants. Stakeholders of electronic marketplaces will, therefore, have an interest in making them as attractive to prospective "customers" as possible [24]. It is necessary to apply negotiation techniques that would appeal and adhere to the customers' emotions. If a customer attempts to purchase a flat screen television, apart from the technical criteria, there are many elements regarding the beauty of design, visual impact, quality of sound and manufacture specifications that are involved in the purchase decision. Before purchasing a product, a customer would imaginarily place that product in a future environment and develop various interactive scenarios with that particular product. The customer needs to be assured that the product would essentially satisfy their needs. Emotionally, the customer should be convinced that this product is for them.

Experiencing and expressing emotions is a fundamental aspect of our daily lives. In the business world of commerce, emotions play a significant role. When we choose to purchase a commodity or utilize a service, our emotional dimension is activated. We are social beings, we are influenced by others opinions, we have our own opinions and we like to bargain for everything, despite the means [9]. To represent the ideal emotion-oriented eCommerce environment means to create a model that incorporates the emotions of a potential customer. In the end, the software agent, having interpreted the various models of emotions, would capture and infer such knowledge in order to produce the desired result that would be satisfying to the customer. Therefore, emotions would play a tremendous role in an electronic commerce environment.

Although there are no commonly accepted definitions for emotion, most authors agree that emotion is a multifaceted phenomenon which encompasses a diversity of processes, such as appraisal, facial expressions, bodily responses, feeling states, action tendencies, or coping strategies [31]. Emotions are closely related to perception as humans try to perceive the emotions of others through visual, auditory and tactile senses. Emotions are also coupled with rational thinking and decision-making. They can take over our rationality in situations of fear, pain or love [32]. We are emotional beings from birth. Our world is based on interactions between us and the environment that surrounds us. According to the multiple theories of emotions, affect, together with cognition, directs the communication of needs, ideas, and personal states.

Extensive documented research in the field of psychology has shown that even secondary emotions (for example anxiety, amusement, frustration, depression, etc.) can have a major impact over current choices. Cognitive psychology has been the major contributor to understanding users as human information processors in order to further develop the concept of *usable* computer systems [33]. Psychological research shows that mood affects memory, assessment and search strategy in relation to eCommerce, judgement, expectations, opinions and motor behaviour [34].

Emotions are primarily a human issue which has no clear understanding or theory [32]. One description of emotions is that it refers to the physiological changes caused in our body, while others believe it relates to intellectual thought-processes. Emotions are much more natural in nature than rational intelligence [32]. Though computers may have unlimited calculating power and memory, its intellect is limited.

Recent advances in psychology and neurology are making cognitive and psychologists to rethink the behaviours of various emotions. Therefore there is presently no universally accepted emotional model [37]. However, theory is important. The answers to certain questions call for general psychological principles to be applied to specific situations. To *explain* an event means to apply a general principle to a situation. Discovering general principles and intertwining them into theory is what psychological research is

about [48]. Emotional theories therefore act as a map that determines the behavioural activities of human beings.

Emotion-oriented eCommerce is a new and very exciting field of research. During recent years, the use of intelligent systems in eCommerce has increased significantly, providing a new perspective on the overall shopping experience. The aim of the paper is to propose and discuss the application of computational intelligence models involved in emotion recognition, simulation and design of emotion-oriented eCommerce systems.

Computational Intelligence (CI) techniques are more suitable than standard techniques for emotion recognition [6]. CI can be used also in simulation of emotion-oriented eCommerce systems.

The first step towards the creation of intelligent emotion-oriented eCommerce should be to define its design requirements. Then a model for simulation of emotion-oriented eCommerce systems will be very useful for their study and design.

There are challenges in trying to achieve such a feat as computers do not possess the sensory organs of humans. There has been progress in software and hardware which recognizes voice, facial expressions and physiological signals associated with emotions. This study tries to realize a framework of some theories and techniques that may be applicable in such an intelligent environment. The framework should include the following components:

- Problem Identification – identifying gaps that may exists in research
- Research, Investigation and Analysis– conducted on the existing theories and initial formulation of models
- Problem Solving – developing a solution that is applicable
- Implementation – implementing the strategies and models that have been formulated as a result of the analysis.

Many times we have to employ different experiences and theoretical backgrounds in an effort to widen the study of emotion-oriented computing. The knowledge we construct during these experiences and experimentation may inform our ideas for further subsequent formal

hypothesis testing. Picard [16] suggests that the idea of affective computing should have balance. Some agents do not need emotional capabilities whilst other systems may need it for slight improvement. There is a time and place for everything: a time to express emotion and a time to ignore feelings. Designers can either develop static computers or computers with emotions.

Within the past decade researchers have developed dozens of scientific findings highlighting important roles of emotion in human computer interaction. These findings have reshaped scientific understanding of emotion and have led to the belief that an emotional dimension might be more valuable than previously believed. As a result, researchers have created machines that have several emotional abilities, especially: recognizing, expressing, modelling, communicating, and responding to emotion. However, as development ensues, there are a number of new criticisms and challenges ranging from recognition, expression, cognition and ethics [16], [56].

Humans do desire that a computer system is able to perform efficiently and respond accordingly and timely to the tasks given to them. An experienced agent functional over a certain period of time should be able to adapt to the emotional changes emitted from the user.

The recognition of the customer's emotions in the eCommerce environment would enable the system to interpret and analyze the customer's behavioural and emotional pattern in an online environment. This technology is essential and the participating company would have an edge in the competitive market.

1.1 Understanding Emotion

Many theorists have discussed what emotions are and its function in human life. This debate is continuous and presently there is no collectively accepted definition of emotions. However, humans do experience various dimensions of emotions on a daily basis.

A limitation in the study of emotion is the lack of a common language. Words like emotions, moods, drives, sentiments and attitudes are usually interchangeable by researchers. If a distinction is not made among the terms,

confusion may take place [21]. All these terms have meanings of their own [59].

1.2 Causes of Emotions

What causes emotions? The answer to this question is essential in determining how to deal with the multiple emotions that are generated when engaging in an eCommerce activity. In an eCommerce environment, interfaces should be designed in a manner that will encourage the desired emotion. Understanding the causes of emotions will enable designers to determine which design elements encourages positive or negative emotions.

1.2.1 Social Contagion

The **social contagion** theory is seen as a major cause of emotion. Emotions are based upon the emotions of others [60]. For example a sad person will often make another person feel sad. A simple smile or frown can affect the mood of another person [61]. Cacioppo [62] stated that social contagion represents the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person. In relation to interface design, what is presented onscreen will directly influence the emotions of the users. If a user sees a smile or a frown on the screen, the user's emotional state would reflect the emotion being portrayed. Emotions in interfaces can be contagious [63]. An online intelligent character that exhibit excitement over a particular product can make the users feel even more excited.

1.2.2 Appraisal theories

Appraisal theory is the idea that emotions are extracted from our evaluations or appraisals of events that cause certain reactions in people. Essentially, our appraisal of a situation causes an emotional, or affective, response that is going to be based on that appraisal [64]. We basically decide what to feel after certain events.

Appraisal theories of emotions are helpful in understanding the potential emotional impacts of design decisions and creating intelligent agents

that exhibit emotion. In a dynamic environment like eCommerce, the agent's emotional or affective state is suggested to be simulated in order for it to be believable [63].

Designing an emotion-oriented eCommerce interface with the intention to evoke or prevent a particular emotion, can be facilitated by understanding processes involved in achieving certain emotions. Appraisal theories can be used to understand these processes as it explains how different emotions are elicited after various appraisals.

1.2.3 Users' Needs

A user uses a computer to achieve a particular result – typing a document, accessing email, or purchasing a product. The degree to which an interface encourages or limits the achievement of the needs of the user, will ultimately affect their emotional state. A system which recognizes and interprets the emotions of the user can use such information to determine whether their needs are being met [63]. Zhang et. al. suggested revisiting Maslow's basic need hierarchy to ask what humans want or what they need in their lives and then use technologies to support humans' higher needs in the needs hierarchy [65]. When a certain situation satisfies the needs of the user, positive emotions would take place. The elements which interfere with satisfying these needs would cause negative emotions. In emotion-oriented eCommerce, the design of the interface requires good understanding of the customers' needs.

1.2.4 Internal and External Disturbances

A user's previous emotional state can affect the experience of subsequent emotions [63]. The previous emotional state of the user can highly be dependent on the internal or external disturbances that may exist in the customer's immediate environment. Internal disturbances that may affect the emotions of the customer include processor speed, user's lack of technical experience or experiencing technical difficulties whilst using the system due to a computer virus, etc. External disturbances refer to the elements around the customer's environment that will affect their

emotional state. A baby crying, loud music or an alarm ringing may have negative emotional responses from the customer. The goal of the emotion-oriented eCommerce system is to facilitate the transition of those negative and unwanted emotions to a positive emotion which will be more receptive to purchasing a product or service.

2 Intelligent Emotion Recognition

Emotion recognition is very important for the development of affective human-machine interaction systems [68] and emotions can be provoked using various methods. The main methods include imagination, hypnosis, music, social interaction, imitation of a facial expression, or memories of positive and negative life events [25].

Perhaps one of the most controversial and widely used methods to induce an experimental emotion or mood is the Velten (1968) Mood Induction Procedure [26]. In this procedure, subjects read a series of cards that either progress from mildly happy to absolutely euphoric, or from mildly depressing to clearly depressing. Because the actor is instructed to attempt to feel the emotion expressed in the cards, and because there can be no doubt what that emotion is, several investigators have argued that the emotion created by the Velten technique simply represents the actor's compliance to demand characteristics [27].

The importance of affect or emotion on cognitive processes and behaviour [20] and the growth in the use of the internet warrants the understanding of factors that would influence affect during someone's online experience. It is important to remember that 'affect' is an umbrella term to describe moods and emotions [12]. A study was done to examine whether positive or negative emotions can be induced by viewing positive or negative materials online. If an emotion can be induced online through visual and written stimuli, designers of websites may use these stimuli to induce certain reactions in users such as increasing their remembrance of advertisements or influencing their purchase decisions [28].

Once emotion shows to be an important variable in cognition and decision behaviour [49]

future studies can have potentially important implications for measurements in research that investigates online decision behaviour.

The study of emotion-oriented eCommerce falls under the purview of affective or emotion-oriented computing. Emotion-oriented computing relates to, arises from or deliberately influences emotion or other affective phenomenon. Research has contributed to [15]:

- Designing new methods for people to communicate affective cognitive states.
- Developing new technologies that would enter frustration, stress and mood indirectly through natural interaction and conversation.
- Show how computer can be more emotionally intelligent, especially reducing the person's negative feelings.
- Creating personal technologies for improving self awareness of affective states
- Examination of ethical issues in affect computing.

Once companies have applied the techniques to encourage the positive emotion in the eCommerce customer, the system must be able to recognise and respond to those emotions.

Emotion recognition involves assigning computers with the ability to observe, interpret and generate affect features. Its intent is to improve the quality of communication between the customer and eCommerce system. The capturing and processing of emotions by the computer is a new study. The standard procedures of affective interaction consist of affect information capture and modelling, and affect understanding and expression.

Researchers are utilizing various methods of capturing emotions of the user. Such data should be processed to generate an adequate emotional response that would satisfy the customer's needs. Bianchi-Berthouze [11] developed a technology that improves the sense of engagement or immersion of its users (positive usability) by taking into account their affective states. Their body postures were used as an indicator of human affective states. A comprehensive framework for the study relies on a computationally-tractable characterization of emotion in terms of the intensities of its autonomic response, its communicative intent, and the influence of cultural factors. The recognition of affective human communication may provide developers with a rich source of information for creating systems that are capable of interacting well with humans. Posture has been acknowledged as an important modality of affective communication. Behavioural studies have shown that posture can communicate discrete emotion categories as well as affective dimensions [11]. Picard [15] utilized a number of techniques for capturing emotive behaviour, namely eye-tracker, face reader, affective learning.

Measuring emotions is a valuable component in interface design and usability testing. Knowledge of the users' emotions provides useful feedback regarding the intended targets of the system to be achieved. Social interfaces should have the ability to recognise and respond to emotions emitted from users in an effort to effectively execute real-world interpersonal interaction strategies [15]. Emotional signals whether from visual or auditory responses are key elements in the social communication process. Scheirer et. al. [54] have described an approach of building computers that begins to recognise aspects of user frustration.

People express emotion through facial expression, body movements and gestures, voice behaviour and other bio patterns. Fig. 1 summarizes the key technologies in emotion recognition starting with input signals, data collection and processing, emotion recognition based on computational intelligence modelling and emotion expression.

2.1 Speech Processing

A powerful method for communicating and expressing emotion is through speech. There has been less work on recognizing human vocal emotions by computers than there has been on recognising facial expressions. Many times it is the only form of communication that can be used e.g. telephone conversations. Research on emotional speech focuses on typical acoustic features. Such elements like pitch (level, range and variability) and speaking rate have been analysed by researchers in addition to tempo and loudness [19]. People express their feelings by the acoustic features and by the content of what they want to say (words, phrases and syntactic
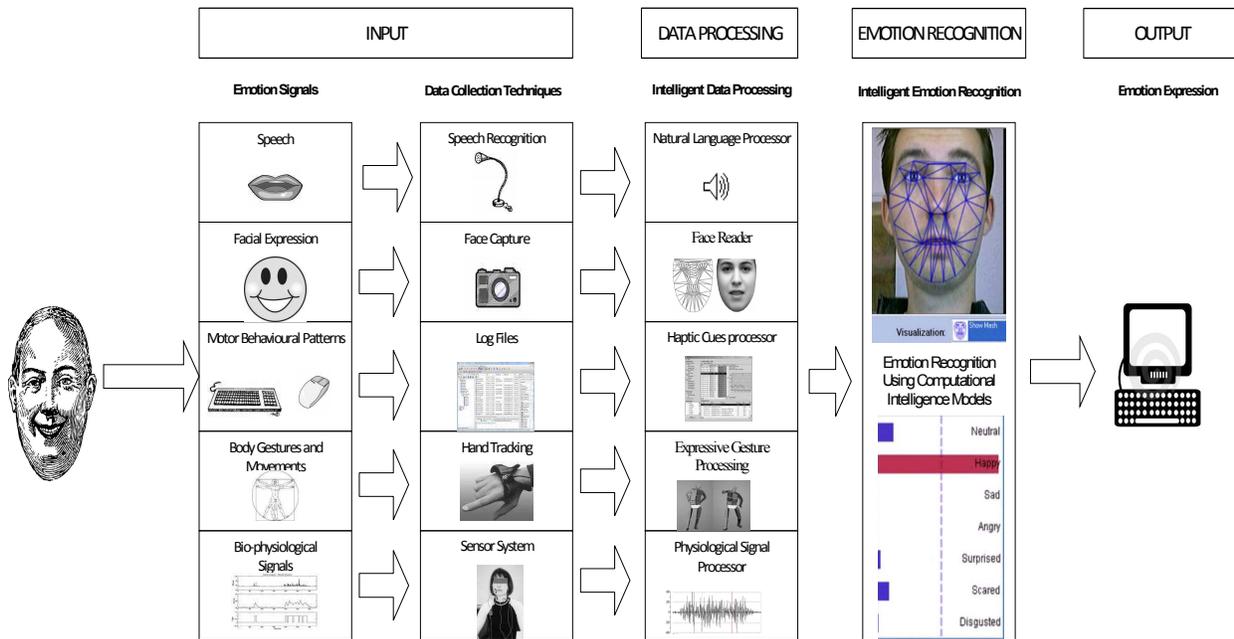
Fig. 1 Intelligent Emotion Recognition

structures). The use of speech recognition techniques is helpful as the user's tone and intonation depicts the emotional state of the user.

2.2   Facial Expression

Facial expressions are one of the principal methods that are used to detect human emotions [22]. Facial expressions and movements, for example a smile or a nod, are used to carry out a semantic function, to communicate emotions, or as conversational cues [19]. Ekman [5] outlined some typical features associated with the six basic emotions namely joy, anger, surprise, disgust, fear and sadness. These basic emotions can be related to movement in the mouth, cheeks, eyes, eyebrows and forehead. The Facial Action Coding System (FACS) details a set of muscular movements for each of the basic emotions [4]. Whether these basic emotions are indeed universal remains an open question. However, most of the "vision-based" facial expression studies rely on Ekman's definition about the universal categories of emotions [69].

2.3   Motor Behavioural Patterns

Behavioural measurement methods are based on the fact that the body usually responds physically to an emotion (e.g. changes in muscle tension,

coordination, strength, frequency) and that the motor system acts as a carrier for communicating affective state [29].

The written language is an influential method of expressing an emotion. Many times we would come across an emotional story or poem. People can state how they are feeling by using words such as 'happy', 'sad', or 'depressed'. The font (colour, shape, size) of the word can also be changed to signify the intensity of the emotion [22]. Emoticons for example, :-) or :-(are used to depict an emotional state in such forums as email and text messaging [21]. This form of communication can be easily conveyed by using the standard mouse and keyboard provided by any computer system. The mouse and keyboard can identify motor-behavioural parameters from log-files. The analysis of mouse clicks, mouse speed, or keystroke speed provides an uncomplicated method of measuring emotions without any additional devices.

2.4   Body Gestures and Movements

Body gesture and movement refer to the different positions of the body and its changes over a period of time [19]. At present the study of body gestures and movements is focused on hand tracking. It conveys many meanings, for example a clenched fist may indicate an aroused emotion of

fear, anger, or excitement. Another example is arm-crossing, which may signify a state of anxiety, depression or despair. There are two methods of analysing the movement in the hand: the apparentness or the 2-D method [14] which analyses the apparent features of hand movement using 2-D images and the 3-D method which does the same as the former in a 3-D environment [23].

2.5 Biosignals

A series of biological changes occur when people have emotions [66]. Detecting and recognising biological signals is an essential aspect of emotion recognition [15]. Picard [17] developed a sensor system measuring biosignals such as heart rate, skin conductivity, respiration, temperature, pulse, electrical activity in the muscles, etc. that allows the detection of various emotional states in a user.

2.6 Intelligent Data Processing

Recognizing the emotional state of the user is essential for computers to successfully interact with humans. Most of the research does not combine different modalities into a single system for the analysis of human emotional behaviour: different channels of information (mainly facial expressions and speech) are considered independent to each other [1]. An ideal system for automatic analysis and recognition of human affective information should be multimodal [30]. Studies have shown that there is a need to consider the integration of different behaviour modalities in the communication process [30]. As data is collected it must be processed and analysed and the appropriate intelligent data processing techniques like computational intelligence must be applied.

2.7 Emotion Recognition based on Computational Intelligence Models

In the research industry the interest of computational models of emotions and emotional behaviour is steadily growing. Computational models can be used to facilitate studies on the modelling, interpretation and analysis of human behaviour. Computational intelligence declares its ability to understand the beliefs, motives, intentions, perceptions and inference involved in human behaviour.

Emotions do play a significant social role as certain emotional displays seem designed to elicit other social responses, purposely manipulated or unintentional. Modelling applications can explain how people behave when experiencing strong emotion during the eShopping experience.

Models of emotion would assist in building models of intelligent behaviour. Several authors have argued that emotional influences that seem irrational do have some important social and cognitive functions that would be required by any intelligent system [36]. In an emotion-oriented eCommerce environment, if the customer is confused or angry whilst using the system, this is an indication that there is some form of constriction or limitation in using the system. Designers are immediately alerted that design evaluation and modification needs to be done as the system is eliciting undesired or negative emotions.

Computational intelligence has been defined as "the study of adaptive mechanisms to enable or facilitate intelligent behaviour in complex and changing environments" [6]. Over the years, computational intelligence has been used by many research disciplines to explain and simplify the complexity of computerised systems. CI tries to examine the many aspects of designing artificial systems. The challenge which exists is to integrate more and more models and principles involving intelligence. Appropriate for emotion recognition are CI methods like Fuzzy Systems, Genetic Algorithms, Neural Networks, and especially Swarm Intelligence which includes Particle Swarm Optimization, Ant Colony Optimization, Bee Colony Optimization and Wasp Colony Optimization. Combinations of these approaches are frequently used to solve real world problems.

3 Intelligent emotion-oriented eCommerce Systems

Studies on intelligent emotion-oriented eCommerce systems are very limited up to this point [9]. Any affective eCommerce system would need to assess the affective state of the customer through affective sensing and recognition in order to determine an appropriate

reaction [8]. According to Schleiffer [18], affective responses to web interfaces play a significant role in the acceptance of certain websites.

Intelligent emotion-oriented eCommerce system can be seen as a system that can effectively identify, interpret and respond to a customer's emotions in an eCommerce environment.

The idea of developing emotion-oriented eCommerce systems may be difficult to conceive, however, this type of eCommerce systems provide many advantages. Despite the many capabilities the computer system may possess, e.g. storage of large volumes of data, processing speed and performing complex calculations, computers are unable to determine the way the user may feel or think. An eCommerce system which is able to detect the emotional state of the customer should be able to take the necessary steps to produce a positive emotional environment.

Electronic commerce entails business-to-business, business-to-customer and customer-to-customer transactions. It encompasses a wide range of issues including security, trust, reputation, law, payment mechanisms, advertising, ontologies, electronic product catalogs, intermediaries, multimedia shopping experiences, and back office management [50]. The rapid growth of e-commerce has motivated many studies on the relationship between website design, company reputation, and purchase intent. Users are influenced by assurances of goodwill, integrity and the ability to complete the transactions. Emotional-oriented factors increase feelings of attraction and loyalty. Such factors help reduce awkwardness, complexity and uncertainty, and increase confidence in an eCommerce environment [51]. Providing information that elicits emotions would reduce and limit reasoning to those that induce positive feelings [35]. Designing human-computer interfaces that are easy to use is important for the use of computer technology today. The approach of allowing emotional agents to interpret and respond to consumers' emotions is imperative as emotions have a strong influence on interactions. As technology develops users are looking for emotional satisfaction from using and interacting with the products and the companies who are involved [52]. In a recent study on emotions, films and slides were found to elicit common target

emotions [53]. Computer interfaces can be seen as a collection of slides composed of an assorted array of visual and auditory stimuli. These computer interfaces have the potential to induce emotional reactions from users which further has implications for the design of customer interfaces in electronic commerce systems. Kim and Moon [10] also investigated the possibility of designing emotive interfaces which involve customers emotionally, in order to enhance the quality of decisions made during the interaction process. Experiments were done to identify the emotive reactions of the participants to the interface design of cyber banking sites. Additional research also identified the influence of induced emotions on motor-behaviour parameters while shopping on an eCommerce website for office supplies [58]. Bio physiological parameters like respiration, pulse, skin conductance level and corrugator activity were measured. The experiments proved that emotive behaviour can be successfully analysed through the use of the mouse and keyboard.

In the internet world, some people may enjoy the process of randomly browsing the internet for pleasure [38] while others may decide to seek out internet sites for informational purposes [39]. Numerous literature sources indicate that in order to understand and analyse the role emotions play in an online shopping environment, designers should identify what factors motivates the customer to use the website. McGuire [40] noted that it seemed less important to understand how a medium could hold a user's interest. However, internet scholars have voiced the importance of understating the holding power of Web site content [40]. Therefore, while browsing may be a general motivation for internet use, what a commercial web site provides as content [42], and the application of the right combination of design factors are important in influencing positive purchase decisions in consumers.

Understanding the emotions which bring consumers to a site can be profitable [39]. Knowledge of what consumers' desire to purchase and how these desires can be turned into a final purchasing decision will provide Internet marketers with the ability to efficiently serve their shopping audience. A study was done by Stafford & Stafford [42], applying the understandings of general consumer motivations for accessing the commercial areas of the internet. The research

identified five (5) key dimensions of web use motivation: searching, cognition, new and unique, socialization and entertainment. Results showed that the web provides a rich audio-visual environment of multimedia presentations and information transmissions. Ultimately, web designers and their clientele need to understand their customers in relation to their personal and web usage and their feelings towards the computer.

Ease of use, in online shopping includes easy to use navigational tools, search functions, fast download speeds and the overall design [43]. These factors are essential in the design of eCommerce [44]. When websites are not functioning properly (e.g. website unavailable, long download times), it can seriously harm the customer's experience and emotional state [43]. Download delays can have a negative impact on the online experience [45]. In an emotion-oriented eCommerce design all of these considerations must take place.   The application of such dimensions will strike a balance with satisfying the needs of the customer and maintaining that favourable purchase decision.

Traditionally it was considered that intelligent behaviours could only be produced from pure rational reasoning processes [55]. In the case of user centred interface design multimodality, emotionality and agent based interactions deserve particular attention. Focus should be placed on the incorporation of these approaches into a unified theoretical framework and conception of human-computer interface design.

3.1 Requirements for Design of Intelligent Emotion-oriented eCommerce System

An intelligent emotion-oriented eCommerce system should be designed to effectively accommodate techniques that would identify affective behaviour in the customer. The identification of the emotional state of a potential customer should be followed by the appropriate response from the system which will encourage the customer to make a favourable purchase decision.

The design of such a system should allow mixed interaction where control is shared between the customer and the system. There are two scenarios that could be investigated in relation to intelligent emotion-oriented eCommerce systems:

(1) *Customer - to - the intelligent emotion-oriented eCommerce systems* – The customer communicates with the system via the chosen input medium.
(2) *Intelligent emotion-oriented eCommerce systems - to - Customer* - The system would request input from the customer and in return provide the necessary feedback.

An intelligent emotion-oriented eCommerce system is best suited for a *business-to-customer* eCommerce environment as the aim is to gain the customer's trust and loyalty. The ultimate goal is customer satisfaction and appealing to the emotions of customers provides a pathway for solidifying a positive purchase decision. The intelligent emotion-oriented eCommerce system should therefore adapt to the following requirements:

- Follow a social model that takes into consideration the affective behaviour of the customer;
- Follow a framework that would address the aesthetic dimensions of an interface, interaction and information delivery which would facilitate easy communication between the system and the customer;
- Make provision for rational and reasoning requirements in which the system would know how to appropriately respond to the customer's state and requests.

It is important that an intelligent emotion-oriented eCommerce system is able to seamlessly adapt to a real world environment. It must be able to respond intelligently to unorthodox situations posed by the customer. Therefore, the design consideration for this system should involve but not be limited to emotion models, various interactive techniques, adaptability and knowledge of perception, reasoning and customer's profile and their general environment.

Many dimensions of website design have been outlined by authors focusing on aesthetics, customers' trust and web usability. However, there are few articles that answer the question - *What emotions influence the customer's purchase decision and how these emotions can be encouraged by the use of proficient website design?* In essence, research studies lack a comprehensive framework explicitly geared towards emotion-oriented eCommerce systems.

Design requirements should include the identification of *non-purchasing emotions* verses *purchasing emotions*. This determination can be made by conducting simulations and experiments designed to identify those emotions that are involved in the purchasing process. Companies want their products sold, therefore changing a negative emotion to a positive emotion that leads to a favourable purchase decision, should be of paramount importance as illustrated in Fig 2**.**
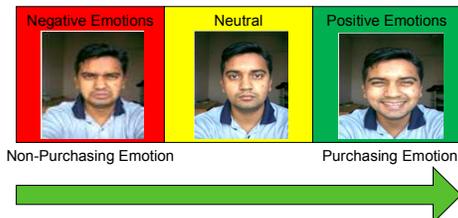

Fig. 2 Moving from Non-Purchasing Decisions to Purchasing Decisions

There are a number of factors that can be considered in achieving the purchase decision:

- Design elements – e.g. typography, graphics, audio, use of colours, frames, navigation, etc.;
- Customer's initial mood;
- Internal and external disturbances that affects the customer's experience – e.g. noise, computer's speed, etc.

A simulation model of the system should take into account these factors.

3.2 Simulation Model

A model of emotion should be able to identify events and objects involved in the interaction process. Emotion models should demonstrate the computer's ability to express emotions at the right intensity and appropriate time. Appraisal theories have influenced the development of computational models of emotion. Essentially, our appraisal of a situation causes an emotional or affective response.

The model most often used to incorporate emotion into eCommerce system which is based upon the appraisal theory is the *OCC model (Ortony, Clore, & Collins, 1988)* [13]. It addresses the problem of representing emotions not by a set of basic emotions but by grouping emotions according to cognitive eliciting conditions. It believes that emotions arise from valenced (positive or negative) reactions to

situations involving events, agents and objects [15]. Another computational model of emotions based upon the appraisal theory is the EMA (EMotion and Adaptation) [7]. The agent's interpretation of its "agent-environment relationship" is considered to be a representation of beliefs, desires, intentions, plans and probabilities, which is referred to as causal interpretation to emphasize the importance of causal reasoning as well as the interpretative (subjective) character of the appraisal process [7].

A model for simulation of intelligent emotion-oriented eCommerce systems following the basic control structure shown in Fig. 3 is proposed. The target variables identify what the system should do and the input variables are appropriately linked to the eCommerce system. The input variable refers 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 output variables will affect the eCommerce customer and the decision they make. There is also the opportunity to identify and collect the necessary bio-physiological data emitted from 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 input variables. 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.

A control-oriented method for simulation of eCommerce environment using MATLAB SIMULINK is suggested. SIMULINK allows for the visual understanding how a dynamic system like eCommerce system operates. Detailed dynamic models are required for performing ephemeral stability studies and SIMULINK applications can be applied to represent this dynamic environment of emotion-oriented eCommerce.

4   Conclusions

Computers and the internet have become an embedded fabric in people's lives and they
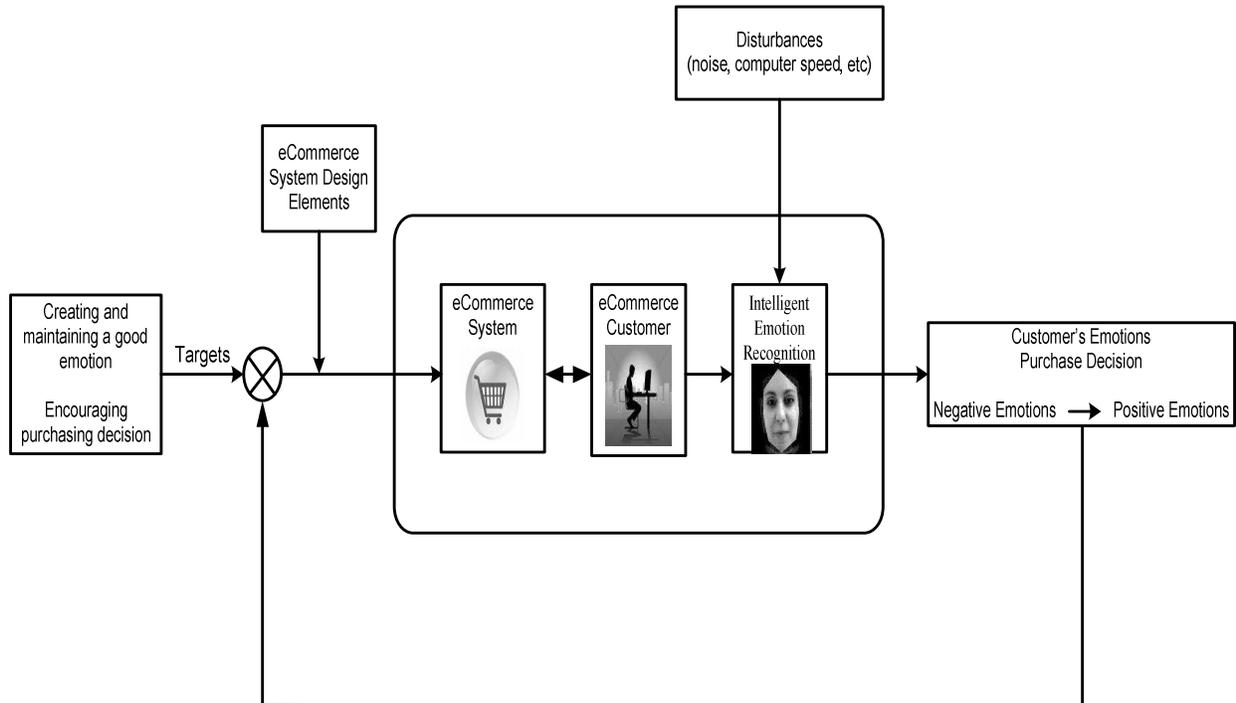
Fig. 3 Simulation model of intelligent emotion-oriented eCommerce system

simply cannot live without them [38]. This technology is used for work, communication, shopping, seeking new information and entertainment. The growing dispersal of computers in society has warranted the need for improved human-computer interaction (HCI) in technological activities. The study of emotion-oriented or affective computing proposes to improve the communication level between the human user and the machine taking into consideration the following [57]:

- Reducing user frustration;
- Enabling comfortable communication of user emotion;
- Developing infrastructure and applications to handle affective information; and
- Building tools that help develop social-emotional skills.

Much thought and analysis should be invested in designing an interface that would elicit positive emotions. The business community would benefit significantly if they understand and apply the right tools when considering the emotions of the customer. Consumers are emotional beings and the emotions which they

exhibit will ultimately affect their purchase decision. It is imperative that studies and research in the area of intelligent emotion-oriented eCommerce systems has a scientific and empirical foundation.

This paper raises issues of studies in intelligent use of computers in an emotion-oriented eCommerce environment. Intelligent emotion recognition techniques based on modern mathematical models using computational intelligence are presented. The requirements for designing of intelligent emotion-oriented eCommerce systems are defined. A model for simulation of intelligent emotion-oriented eCommerce systems is proposed. It is an important tool supporting the experimental study and design of emotion-oriented eCommerce systems.

Emotion-oriented eCommerce research field is relatively new which presents many opportunities to research subject matters that show computers beginning to recognise and respond to certain expressions of customer emotion in an online shopping environment.

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