Electronic Business Accepted Practices (e-BAP):
Standardion of HCI for E-Commerce in South Africa

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ABSTRACT: The popularisation of the Internet and the rise of Internet electronic commerce (e-commerce) has been one of the major social and business developments of the last few years. This phenomenon has not by-passed South Africa, but to the contrary is a thriving reality. This digital shift changes the way in which business is conducted. Previous implementations of business software involved acquiring (purchasing) a piece of software in order to install and use an interface. However, the World Wide Web and its associated standardized technologies provide the interface before transactions are deployed. The purpose of this paper is to describe theory and research from a number of disciplines, not generally understood by web developers, which the authors believe are applicable to creating engaging, immersive e-commerce environments for the Southern African context. These disciplines include human-computer interaction, Flow, and issues related to a multi-cultural user population. The authors also propose a framework called, e-BAP, for the development of e-commerce applications, incorporating the arguments of these disciplines.

KEYWORDS: Human-computer interaction, Flow, e-commerce.

1. INTRODUCTION

“The newest innovations, which we label information technologies, have begun to alter the manner in which we do business and create value, often in ways not readily foreseeable even five years ago”

Alan Greenspan  Chairman, Federal Reserve Board
May 6, 1999

Electronic commerce (e-commerce) is creeping into our everyday lives via websites and e-transactions. This digital shift changes the way in which business is conducted, not only as far as locale and methods are concerned, but also with regard to the culture of buying and the format of computerised business applications.

Computer-based information systems (CBIS) are information systems that require hardware, software, databases, communication technology, procedures, and people to accomplish their goals (Stair, 1992). The use of information and communication technology (ICT) has been growing, at an increasing rate, ever since the invention of the modern electronic computer in the 1950s. Until about ten years ago computer devices were mainly used by business to handle transaction processing (Stair, 1992). Now, with the widespread development of the Internet and the World Wide Web (WWW), change has accelerated even more (McNurlin and Sprague, 1998).

Meeting the needs of users who demand power without complication has made the computer industry increasingly sensitive to the design of the user interface. The user interface could be the most important determinant of success for e-commerce. In fact, to many users, the interface is the system (Turban and Aronson, 1998). In the past implementations of business software involved acquiring (purchasing) a piece of software in order to install and use an interface. The WWW and its associated standardized technologies have changed this and now provide the interface before transactions are deployed.

E-commerce that does not provide an experience to the user, will not thrive (Brandt, 1999). The traditional approaches of enticing a purchase in brick-and-mortar commerce, such as atmosphere, placement of goods, lightning, etc., do not transfer to online commerce. It is interaction and participation that are the emotional hooks for e-commerce, and the developers of e-commerce sites should keep this in mind. Ideas about how to accomplish this are beginning to be explored.

The ideas proposed in this paper for creating effective e-commerce sites are taken from the concept of cognitive aesthetics (Jennings, 2000), and more specifically Flow theory (Csikszentmihalyi, 1977), as well as the principles involved in human-computer interaction (HCI).

2. E-COMMERCE

The WWW as a vehicle for the implementation of trade and commerce has attracted the attention of business and government. There are many applications of the WWW, such as commerce, entertainment, leisure, and information resources.
The first electronic business applications were started 30 years ago in the early 1970s. The original applications were in the form of electronic fund transfers (EFT). These applications were limited to larger corporations and financial institutions (Turban et al., 2000). These types of transactions later included electronic data interchange (EDI). There is, however, a marked difference between EDI and e-commerce, as we see it today, in that e-commerce involves a much wider range of activities, including EDI (Greenstein and Feinman, 2000).

There is no standard definition for e-commerce. Various authors have put forward definitions for the concept, some of which is presented in Table 1. In principle, however, most authors are in agreement that e-commerce uses some form of transmission medium through which exchange of information takes place in order to conduct business (Barnard and Wesson, 2000).

E-commerce can be classified in different ways. Turban et al. (2000) provide the following classifications:

- **Business-to-Business (B2B):** This includes inter-organisational information systems and electronic transactions between organizations.
- **Business-to-Consumer (B2C):** B2C transactions are mostly retailing transactions with individual customers or consumers.
- **Consumer-to-Consumer (C2C):** C2C involves consumers selling directly to other consumers. This type of application includes auction sites and advertising personal services on the Internet. It can also include intranets and other organizational networks to advertise items and services.
- **Consumer-to-Business (C2B):** In this category one will find consumers who sell to organizations. It also includes individuals who seek sellers with whom they may interact in order to conclude a transaction.

### 3. HUMAN-COMPUTER INTERACTION

“There is no greater mistake than to call arithmetic an exact science. There are...hidden laws of number which it requires a mind like mine to perceive. For instance, if you add a sum from the bottom up, and then again from the top down, the result is always different.”

Maria Price La Touche, 1824-1906

HCI is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. From a Computer Science perspective, the focus is on interaction, and specifically on interaction between one or more humans and one or more computational machines. HCI is the study of people, computer technology, and the ways in which these influence each other (Dix et al., 1998).

The subject of HCI calls for the accommodation of human abilities and diversity in the design of systems that require human intervention of any kind. The remarkable diversity of human abilities, backgrounds, motivations, personalities and work styles challenges interactive-system designers. Understanding the physical, intellectual and personality differences among users are vital.

The history of the computer dates back to the invention of the abacus five thousand years ago. This humble tool was the first machine to assist human users in performing ‘intellectual’ work. The first number systems were not really intended for computation but to record the results of calculations worked out on the abacus. This system lacked the all-important concepts of the zero and fixed numerical places for tens, hundreds, and so on. The beauty of the abacus was, however, that you did not have to know any number system to use it, regardless of whether you could read or write (user friendly!). This could in many ways, be seen as the birth of HCI.

The Hindu-Arabic notation replaced the abacus and revolutionized the way people performed calculations. Most people at the time had a hard time with basic arithmetic (Augarten, 1985), mainly because the tools used were not intuitive or were presented in such a way as to make it accessible for people with a variety of backgrounds and ability. In many ways the Flow concept (see Section 4) was lost or absent.

With the introduction of electronic computerised systems, many users had a hard time not only understanding the tasks they had to perform, but also struggled to move to the point where the experience of using these systems became a natural, enjoyable activity resulting in maximum productivity. The reasons for this can in a large way be attributed to poor usability caused by ineffective user interface designs.

### 3.1 Cognition, Perception, and Physiology

We can divide human (user) resources into three categories (Kotzé, 2000):

- **Perception:** referring to the way humans detect information in their environment.
- **Cognition:** referring to the way humans process that information.
- **Physiology:** referring to the way in which humans move and interact with physical objects in their environment.

A vital foundation for interactive-system designers is an understanding of the cognitive, perceptual and physiological abilities of the user. The human ability to interpret sensory input rapidly and to initiate complex actions makes modern computer systems possible.
Perception involves the use of our senses to detect information (Kotzé and Johnson, 2001). In computerized systems this mainly involves using:

• Senses to detect audio output.
• Senses to detect visual output
• Tactile feedback.

This is affected by many factors such as:

• Change in output (loudness/size).
• Maximum and minimum detectable levels.
• Field of perception (can the user see the display?).
• Fatigue, circadian rhythms (biological rhythms).
• Problems with background noise, etc.

Cognition involves various cognitive processes, including (Kotzé and Johnson, 2001):

• Short-term memory
• Long-term memory and learning
• Problem solving
• Decision making
• Attention and scope of concern
• Search and scanning
• Time perception
• Perceptual or mental load
• Anxiety and fear.

When we operate a system, we gradually move from general knowledge to rules and then to skills. Users with greater expertise will be able to enter the process at a higher level. Ideally, we all want to work at the highest skill level. We don't want to spend time thinking about use of previous systems or sift through our general knowledge. The more we work at the knowledge and rule level the more uncertain we are about things. Users don't want to be forced to make guesses. Guessing introduces inefficiency and can consume lots of time in 'repair' tasks when things go wrong, for instance if we delete a file by accident.

The more we have to think about using the interface, the fewer cognitive and perceptual resources we will have at our disposal for our main task.

Physiology involves the study of the human anatomy (Kotzé and Johnson, 2001). It might seem strange to include a discussion on physiology when discussing user interface design but it can have a critical impact upon the design of a successful system.

As a minimum requirement, users must be able to ‘view’ the display, reach the input devices, etc. A number of factors may intervene to restrict /prevent users from achieving this.

Don't make interface objects so small that they cannot be selected by a user in a hurry, carrying a stack of books. Don't make disastrous options so easy to select that they can be started by accident.

It is important to note that interfaces often tend to reflect the assumptions that their designers make about the physiological characteristics of their users. Buttons are designed so that an ‘average’ user can easily select them with a mouse, touchpad, or a trackerball. Unfortunately, there is no such thing as an average user. Some users have the physiological capacity to make fine-grained selections but other do not. Even if systems are unaffected by these issues it is good to remember that workplace pressures, of time and concentration, may reduce the physiological ability of users.

The flexibility of computer software makes it possible for designers to provide special services to users who have disabilities such as visual, hearing and mobility impairments. Enlarging portions of a display or converting displays to Braille or voice output can be done with hardware and software supplied by many vendors. Text to speech conversion can help blind users to receive electronic mail or read text files, and speech-recognition devices permit voice-controlled operation of some software. Graphical user interfaces were a setback for vision-impaired users, but technology innovations facilitate conversion of spatial information into non-visual modes.

Users with hearing impairments can often use computers with only simple changes (conversion of tones to visual signals is often easy to accomplish), and can benefit from office environments that make heavy use of electronic mail and facsimile transmission.

Special input devices for users with physical disabilities will depend on the user's specific impairment. Devices available include speech recognition, eye-gaze control, head-mounted optical mice, etc.

Designers can benefit by planning early to accommodate users who have disabilities, since substantial improvements can be made at low or no cost.

3.2 Cultural and personality differences

Some people dislike computers or are made anxious by them; others are attracted to or are eager to use them (Kotzé, 2000). Often, members of these divergent groups disapprove or are suspicious of members of the other community. Even people who enjoy using computers may have different preferences for interaction styles, pace of interaction, graphics versus tabular presentations, dense versus sparse data presentation, step-by-step work versus all-at-once work, etc. These differences are important. A clear understanding of personality and cognitive styles can be helpful in designing systems for a specific community of users.
Another perspective on individual differences has to do with **cultural, ethnic, racial, or linguistic background** (Kotzé, 2000). It seems obvious that users who were raised learning to read Japanese or Chinese will scan a screen differently from users who were raised to read English or Afrikaans. Users from cultures that have a more reflective style or respect for ancestral traditions may prefer interfaces different from those chosen by users from cultures that are more action-oriented or novelty-based.

The term ‘culture’ is often wrongly associated with national boundaries. Culture should rather be defined as behaviour typical of a group or class of people. Culture is conceptualised as a system of meaning that underlies routine and behaviour in everyday working life. Culture includes race and ethnicity as well as other variables and is manifested in customary behaviours, assumptions and values, patterns of thinking and communicative style.

As software producers expand their markets by introducing their products in other countries, they face a host of new interface considerations (Kotzé, 2000). Little is known about computer users from different cultures, but designers are regularly called on to create designs for other languages and cultures. The growth of a worldwide computer market means that designers must prepare for internationalisation. Software architectures that facilitate customisation of local versions of user interfaces should be emphasized. The simplest problem is the accurate translation of their product to the target language. For example, all text (instructions, help, error messages, labels) might be stored in files, so that versions in other languages could be generated with no or little programming. Hardware concerns include character sets, keyboards and special input devices. Other problems include sensitivity to cultural issues, such as the use of images and colour. User interface design concerns for internationalisation are long and full of pitfalls. Whereas early designers were often excused for cultural and linguistic slips, the current highly competitive atmosphere means that more effective localization will often produce a strong advantage. Nowhere else is it more true than in the e-commerce environment.

### 3.3 Principles and guidelines to support usability

Recently, more and more companies have been looking at the process of introducing HCI concepts into software development. In particular, are they concerned to document the steps that they take to elicit the users’ requirements and to test the system. One of the central problems to be solved in a user-centred design process is how to provide designers with the ability to determine the usability consequences of their design decisions (Kotzé and Johnson, 2001).

Several researchers have over the years produced sets of principles or guidelines aimed at improving the usability of interactive systems. Guidelines are lists of rules about when and where to do things, or not to do things, in an interface. These guidelines can take a variety of forms and may be obtained from several sources such as journal articles, general textbooks, company in-house style guides, etc.

Dix et al. (1998), for example, put forward principles to support usability in three categories:

- **Learnability**, referring to the ease with which new users can begin effective interaction and then to attain a maximal level of performance. Usability principles related to learnability include predictability, synthesizability, familiarity, generalizability, and consistency.

- **Flexibility** referring to the multiplicity of ways the user and the system exchange information. A user is engaged with a computer in order to achieve some set of goals in the work or task domain. Usability principles related to flexibility include dialogue initiative, multi-threading, task migratability, substitutivity, and customisability.

- **Robustness** referring to the level of support provided to the user in determining successful achievement and assessment of goals. Usability principles related to robustness include observability, recoverability, responsiveness, and task conformance.

Shneiderman (1998) also focussed on this aspect. He advocates three groups of principles when he discusses user-centred design. Many of these overlap with the principles proposed by Dix et al. Shneiderman’s principles include:

- The recognition of diversity.
- The use of the eight golden rules of interface design (see below).
- The prevention of errors.

The eight golden rules for interface design (Shneiderman, 1998) presents the underlying principles of design that is applicable to most interactive systems. These underlying principles must be interpreted, refined, and extended for each environment and include:

- Strive for consistency.
- Enable frequent users to use shortcuts.
- Offer informative feedback.
- Design dialogues to yield closure (the completion of a group of actions).
- Offer error prevention and simple error handling.
- Permit easy reversal of actions.
- Support internal locus of control.
- Reduce short-term memory load.
All applications require user interfaces, the design of which is not a trivial matter. The same is true for e-commerce and any other web-based applications. Shneiderman (1998) states that within the ocean (WWW) of information ‘there are also lifeboat web pages offering design principles, but often the style parallels the early user-interface writings of the 1970s.’ The problem of early user interfaces, ignoring the abilities and preferences of the users, is therefore still present.

Nielsen (1996) focuses specifically on the user interface and the usability of web applications, and identifies ten common mistakes that web page authors make:

- Using frames.
- Gratuitous use of bleeding-edge technology.
- Complex user resource locations (URLs).
- Long scrolling pages.
- Lack of navigation support.
- Non-standard link colours.
- Scrolling text, marquees, and constantly running animations.
- Orphan pages.
- Long download times.
- Outdated information.

Following these principles and guidelines would not necessarily guarantee a successful interactive system, but would go a long way in preventing major disasters or failures.

The concepts of cognitive aesthetics and Flow are related to HCI, and we feel that it should be included as an essential sub-component of HCI. The following section focusses of this issue.

4. THE FLOW OF THE WEB

Cognitive aesthetics (CA) include perceptual, cognitive, and affective components that provide a model for creating engaging and immersive environments (Jennings, 2000). Affective components refer to human feelings, emotions, or desires, especially with regards to action.

Pleasing interactive displays (visual, auditory, or tactile) are important in any e-commerce situation, because they create first impressions which result in a desire to explore further. Many websites fail to do this, and are often cluttered and difficult to understand.

An aesthetic experience occurs when a person is astutely engaged and immersed in an activity (Jennings, 2000). In order to determine the functionality of a potential environment, it must be understandable and coherent to the user. Coherence implies legibility. In addition, an environment must be complex, it must have a rich and varied source of ‘food and shelter’. An environment must also have an element of mystery – a promise of further information which creates interest for exploration. The characteristics of an environment that determine coherence and legibility are important for safety. The characteristics that constitute complexity and mystery are important for subsistence. Understanding and exploring an environment are major aesthetic considerations.

Csikszentmihalyi has been studying what he calls ‘states of optimal experience’ or ‘Flow’ for more than thirty years (Csikszentmihalyi, 1990). Flow is related to autolectic activities – autolectic activities involve formal and extensive energy output on the part of the human, represent a discreet episode with a beginning and an end, characterised by clear goals, immediate feedback, a need for concentration, and a close match between skill and challenge level (Csikszentmihalyi, 1977). Flow is a cognitive state that has been characterized as an optimal experience that is intrinsically enjoyable (e-Lab, 2000).

Flow is the holistic sensation that people feel when they act with total involvement (Csikszentmihalyi, 1977). Privette and Bundrick (1987) state that Flow is associated with both peak experience and peak performance, as it shares the enjoyment of valuing of peak experience and the behaviour of peak performance. Flow per se does not imply optimal joy or performance but may include either or both (Ghani et al., 1991).

The two key characteristics of Flow are the total concentration in an activity, and the enjoyment which one derives from an activity. The precondition for Flow is a balance between the challenges perceived in a given situation and skills a person brings to it, and a related factor is the sense of control over one's environment.

The Flow state is characterized by four dimensions (Webster et al, 1993):

1. the user perceives a sense of control over the computer interaction,
2. the user perceives that his or her attention is focussed on the interaction,
3. the user's curiosity is aroused during the interaction, and
4. the user finds the interaction intrinsically interesting.

The concept of Flow is therefore closely related to the philosophies of HCI. We argue that the arguments of the two fields of study should be combined to form a uniform theory for the development of interactive websites, and in particular e-commerce sites.

Flow, in the context of the Web or e-commerce describes an online experience where the consumer is completely engaged with his or her interaction online to the extent that (s)he often loses track of time passing and of the immediate physical surroundings. Well-designed
user interfaces for e-commerce applications would support the user’s experience (flow) on the Web.

5. e-BAP

All the above principles and concepts are in many ways broad and vague. It is difficult to apply these principles to a particular situation taking into account the unique factors that propel that problem. Even if one is able to adhere to all these principles and steer away from the mistakes mentioned by, for example, Nielsen, one can still design e-commerce sites which are not effective – merely because of the fact that your approach might not suit your end-user group. For example, the South African context of multi-cultural and multi-linguistic groups might be a major obstacle to the dissemination of effective web-based information (Erwin and Singh, 2001). South Africa has first world and third world characteristics, with vast unfulfilled basic needs such as clean water, electrification, housing and land distribution (Zuma, 2000).

The ‘information superhighway’ is changing quickly, yet there are no formal procedures to provide guidance for those wishing to develop and apply ICT methodologies that capitalize upon it. This problem is exacerbated by the fact that compared to every other modern technology, the rate of change of the underlying technologies upon which the information superhighway is based is unparalleled.

South African Web users are now becoming aware of the power of the WWW and are now exerting their rights to well-designed systems with effective user interfaces.

A survey on South African educators usage of web features revealed, amongst others, the following (Erwin and Singh, 2001):

- ‘I consider it important that in addition to web sites with all the “bells and whistles”, a “text only” version should be made available for fast load times and for learners who do not have fast links and latest browsers’.
- ‘Tools need to support doing the basic functions quickly and easily rather than doing lots of fancy stuff’.
- ‘I (and most colleagues) hate frames, therefore tend to avoid them’.
- ‘Often “help” isn’t helpful!’.

From the statements above it is evident that the interface has a huge influence on the usage of the Web. The user interface is the basis for trust or mistrust, and can make or break effective communication between web entities and consumers.

Turban et al (1999) define legacy systems as older, usually mature, information systems. Some have been around for up to 30 or 40 years. Some are less than 10 years old. They are usually mainframe or distributed systems in which the mainframe plays a major role and the PCs act as smart terminals. Newer legacy systems may include one or more LANs and even some relatively recent client/server implementations.

Moores Law (1965) suggests that the processing power of computers doubles every eighteen months. Moore has also applied this law to the Web and E-commerce, immediately introducing the concept of legacy in such systems.

The rapid advancements in hardware and the proliferation of the WWW has now added a new dimension to legacy applications. An entire CBIS may join the ranks of a legacy application within one and a half years of its development.

To approach the development of e-commerce sites in the Southern African context that would take cognisance of both flow and HCI issues, whilst still based on sound business principles, requires the drafting of some standard or strict set of guidelines.

The authors propose a framework called e-BAP (Electronic Business Accepted Practice) specifically aimed at the Southern African market. The purpose of e-BAP is to provide guidelines for systematically and properly developing e-commerce websites. e-BAP would aim to eliminate poor design practices and prevent bad design features from becoming a commonly accepted standard. The application of e-BAP would, amongst others, aim at enriching the users experience (Flow) on the Web.

The foundation of this proposed framework is set in a collection of homogeneous style sheets for the website interfaces and other (mainly business) components.

It may be argued that the Web is a non-proprietary domain that should not have any restrictions imposed on it. This maybe true for developed countries which have the technology and infrastructure to support their digital economy. In developing countries, like South Africa and its neighbours, where multi-cultural issues and vastly different technological experiences characterize the society, together with a lack of technologically advanced human capital (well-trained IT personnel), this is not true. Well-defined procedures will see the development and growth of the digital economy.

There may seem to be a relationship between proposed e-BAP concept and concept of usability patterns. Patterns would, however, not be practical in this situation because it can be too general (resulting in the same problems as with general usability guidelines). The designer of a pattern needs to discover who the users of the system will be and study the workplace and work method before such a pattern can be derived or applied.
The e-BAP standard will, however, not only focus on usability issues, but also on wider business principles.

A draft example of what these proposed e-BAP style sheets would typically include for an e-commerce website, as far as the user interface aspects are concerned, is illustrated in Figure 1.

The example does by no means illustrate an exhaustive list or complete solution; each scenario requires investigation and a well-designed strategy. The exact content of each of these style sheets must still be researched in depth. Aspects related to good business practices for the Southern African environment should, for example, also be studied and included in such a standard. The same argument can be made for multicultural and multi-ability user interfaces.

![E-BAP style sheet for interface component](image)


Webster, J., L.K. Trevino, L. Ryan (1993), "The

