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NON-LINEAR USABILITY: A SHIFT IN OUR ORIENTATION FROM TASK DRIVEN TO EXPERIENCE DRIVEN APPLICATIONS

R Brian STONE[1] **and Daniel P ALENQUER**[2]
[1]The Ohio State University, USA
[2]Pontifícia Universidade Católica de Minas Gerais, Brazil

ABSTRACT
Over the last decade, the concept of usability has gained traction in the domain of design education. Usability is based on delivering applications that support the completion of tasks. Whether it is a physical product, a space, or an on-screen application such as a web site, the artifact should be easy to use, easily learned, have good affordances, and offer the end user accelerators and the ability to quickly recover from error. Usability concepts are of increasingly more important concern to design and engineering practitioners and educators. Products and artifacts that deliver strong usability characteristics have become competitive differentiators in a market filled with product options. Furthermore, due to the changing expectations and orientation of users, products that exhibit poor usability characteristics not only subvert the efforts of designers and engineers, but also create negative perceptions about a company or organization.
Thus far, usability's orientation has been linear. It is focused on the completion of task, i.e., going from point A to point B. However, when dealing with more experiential applications, ones that are not task driven and non-linear in nature, a new set of issues emerges. In the context of experiential usability, we can not predict when, where, what and how long a user may be engaged in an application, however the end goal still remains to make the interaction easy.
Considering these issues, it has become important that design education in collaboration with engineering take a leadership position in defining the heuristics and characteristics of strong experiential usability. These ideas have been incorporated in our teaching with measurable success, and the realization of a repository of principles and patterns is now required.

Keywords: Usability, Interaction, Interface Design, Multimedia, Experience Design

1 INTRODUCTION

The most widely recognized definitions of usability have similarities that help us visualize clearly it's core meaning. Usable interactive products have to comprise specific qualitative and quantitative goals and should also, according to Mayhew [1], define minimal acceptable user performance and satisfaction criteria based on a subset of high-priority qualitative goals. When specifying these heuristics, Nielsen [2] stated that usability has multiple components and is traditionally associated with the attributes of learnability, efficiency, memorability, errors, and satisfaction.

Different methodologies were developed and are currently applied to evaluate usability based on these widely used heuristics. According to Nielsen [2], user performance is determined, in most cases, by having a group of test users perform a predefined set of tasks while collecting the time to achieve a goal and the number of errors occurred during the interaction. The results obtained during these tests are converted into different parameters, ranked and utilized to recommend modifications and make the products more usable.
Since most of the methodologies available to evaluate traditional usability are based on time to completion and number of errors, they are only effective when the product has exemplary predefined sets of tasks. Products of this nature offer a more linear interaction and a defined number of straightforward task sequences.

2 SITUATIONS WHERE LINEAR USABILITY IS NOT APPLICABLE

Difficulties arise when dealing with designing interactive media that are experience-driven. "ConnectSpace" was a project developed by a group of students at the Interaction Design program at [2]Pontifícia Universidade Católica de Minas Gerais (PUC Minas), in Brazil. The apparatus consists of a computational system containing the users' personal information, RFID wristbands and RFID sensors mounted on a large translucent floor. As the users navigate the environment, social compatibility among them is calculated and visual interactions are projected around them on the translucent floor. This application clearly exemplifies a situation where time and error are not adequate metrics to evaluate the usability.

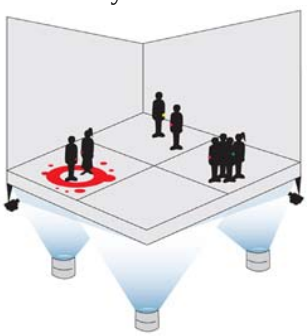

Figure 1 ConnectSpace seeks to link people who will have social compatibility

Presenting the students with sets of traditional usability heuristics [1], [3], [4] does not provide them with sufficient tools to systematically evaluate the apparatus they have designed. To overcome this limitation, they were encouraged to start by following one basic principle of user-centered design process, as described by Hackos [5]: building easy to use interfaces involves knowing the users and their goals. By understanding the users' true goals, students were able to identify that the participants were not interested in fast, streamlining and objective interaction, but in the experience derived from the interaction itself. It became clear for the students that to efficiently evaluate their artifact's usability they would have to adopt the heuristics centered on the user experience, and develop metrics based on those heuristics.

3 METHOD AND RESULTS OF TEACHING

Our results of teaching at [1]The Ohio State University and PUC Minas have yielded a variety of solutions that are intriguing in their interaction, structured in their communication, and demonstrative of the concept of non-linear usability. Student projects highlighted in this paper in some way challenge current conventions in linear, static communication processes. These dynamic programs explore how complex information or systems can be made accessible by engaging the user through a non-linear, interactive experience.

The "Carnival Interactive" project was completed over a two-year period with the goal being to develop a multimedia experience that promoted the history, heritage and practice of carnival arts in London, UK. Developed by a team of students, the application enables users to interact with an on-screen presentation that creates the illusion of a 3 dimensional cityscape or environment. The application's mix of textual content, imagery, audio, video, and interactivity allow visitors to become immersed in the experience of Carnival. And due to its non-linear presentation, it offers something new to discover each time it is used.

The application works on the concept of a horizontal panoramic streetscape. The application is exploratory in nature, and reacts the moment a user touches the mouse. The interface controls are transparent spirals, which are placed over key visual elements. When a user clicks on one of the spirals a small module of text is revealed that illuminates a different aspects of carnival. There are 5 different modules and each is accompanied by a different audio track in the genre of carnival.

Figure 2 Users interact with yellow pulsating spirals to reveal text morsels contained in transparent rectangles. As users explore each spiral, content, video, and progressively displayed information are discovered. The principles of 'Engagement' and 'Explorable Interfaces' are applied.

Figure 3 As users move the mouse, the panorama horizontally moves back and forth, increasing and decreasing in speed according to input from the user. The primary goal of the interaction is exploratory. The principle of 'Cause and Effect' are applied.

"Urban Patterns" deals with the evolution of cities and presents a fictitious city that shows causal effects of the city's growth over time. The application works in two modalities; a 'Watch' mode in which users may view the application chronologically via a time-based sequence, and the 'Explore' mode where users may interact in a non-linear and investigative fashion. The 'Watch' mode is a passive but self-teaching experience (with respect to the application's interface) while the 'Explore' mode is active and allows deeper discovery of the content.

"Urban Patterns" takes advantage of progressive disclosure [6] to no only manage the amount of content, but also to present an approachable interface to the user. Additionally, progressive disclosure helps focus the attention of the user on the hierarchy and timeline of the application, while delivering an application that requires less cognitive load.

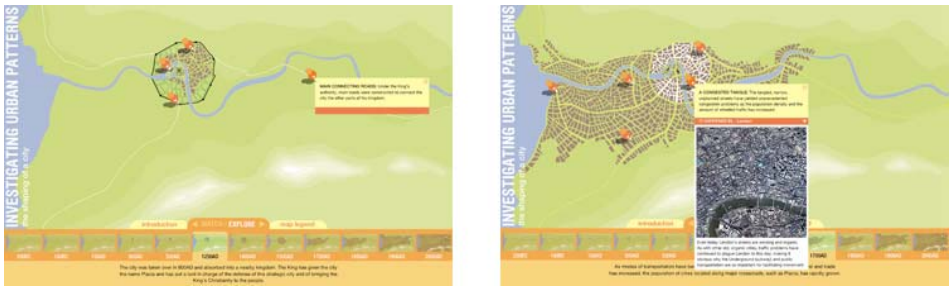

Figure 4 In the active "Explore" mode, users may engage each section by selecting a snap shot in the lower menu bar. In the passive "Watch" mode, users may view the application in a time-based sequence. The city gradually evolves in sync with interface and textual descriptions below.

Figure 5 Selections from the menu may be linear or non-linear. Once in a particular module, clicking a pushpin activates an expanding window revealing content. 'Learnability' principle is evident.

Both projects were developed as a part of Professor Stone's Interactive Media Design course. The focus of this course is to provide students with an opportunity to learn about the important principles of interface design and the significance of integrating it with effective interaction design. Students address issues concerning the innovation of screen-based communication and its relationship to user experience. All projects resulting from this course must consider change, dynamics, and cause and effect relationships. Experiential heuristics are applied throughout each project's development. As experience driven products become more and more prevalent, it has become of increasing importance to articulate principles or heuristics for our students. By defining the characteristics of strong experiential usability in the classroom setting, project results placed emphasis on 'interaction' with the goal to enhance the richness, resolution, dimensionality, and clarity of content for the user. Furthermore, the interaction supports a non-linear, exploratory engagement to the material.

4 REPRESENTATIONS OF NON-LINEAR USABILITY METRICS

To further support the growth of experience driven interactive applications, a repository of heuristics is required and under development at our institutions. Heuristics are used as a form of usability inspection, and serve as guiding principles in the evaluation of the usefulness and usability a given application or product interface. The following principles are applied in our respective courses[1,2] at appropriate levels relevant to a design problem. They have proven useful to our student designers when developing and planning experiential applications. Additionally, they may be considerations when creating a framework for interactive multimedia or experience design curriculum.

Relevant Predications: Designers must go through a predictive exercise with the goal of anticipating the needs, expectations, behaviours, and legacy issues of users. In the case of "Carnival Interactive" users were from a broad range of experience levels regarding

the interaction with multimedia applications and web sites. The interaction had to be simple with easily learned affordances to the interface. Due to the context of use, a public exhibition space, it was assumed that distractions would be prevalent, thus, very small amounts of content are presented at any given time. [7]

Reduce Cognitive Processing: As a user group explores a particular application, any reduction in cognitive load will give the system the appearance of efficiency and ease of use. By reducing the amount of decisions required, the user is encouraged to explore in a random (exploratory) or purposeful (task driven) manner.

Engage: The system should present information and interfaces that encourage interaction. Users will respond to certain change stimuli. This may take on the form of color change, motion, animations, narrative, or music. These elements will potentially draw your intended user into the system. At the same time, these elements may facilitate the efficient learning of a particular interface. The "Urban Patterns" project cycles through a progression of details. It becomes the introduction and teaching element to engage the application in an active mode.

Explorable and Stable Interfaces [7]: Interface controls should be self evident or easily learned. An experiential application will require interfaces that are direct, especially in the case of first time or infrequent users. The use of metaphor may be an appropriate strategy, or an immediate and clearly mapped response to a particular user input, i.e. the application responds by moving the mouse up and down or left to right. These interfaces must be supported by anchored visual elements that represent a sense of "home." These anchored elements will give your users a sense of dependability in the overall structure of the application. This can be seen in "Carnival Interactive" by the accessible and kinetic interface spirals that are complemented by the menu structure at the bottom of the screen.

Learnability: The application's interfaces, functionality, and structure must be very easily learned. In realty, all applications, no matter how elementary, will display a learning curve [7]. Reducing any learning curves where possible will facilitate this principle. Users should be able to gain quick mastery of any and all controls upon their initial interaction. Leverage conventions where appropriate or use a self-teaching component to your application. This is demonstrated in the "Urban Patterns" project by use of pushpins as metaphorical interfaces and in the 'Watch' mode, which demonstrated the applications behavior.

Cause and Effect: Each input by the user or change in the behavior of the program should be accompanied by a corresponding change of its representation within the interface. The 'current selection' (active field or object) should be indicated with some visual contrast. The current state of the product should be displayed in a consistent, clear, and unambiguous manner.

Context: The context of use must be carefully considered and defined. An experiential application residing in a public space or exhibition will have different psychological influences in terms of user behaviors then an application used in isolation. The interaction and user experience should be accommodating to the user's environment.

Emotion: 'Experiences' by definition involve the accumulation of knowledge or skill from direct participation in events or activities. This is accompanied by an emotional attachment through the senses or mind. This being the case, building in elements that evoke emotional response or resonant with your users will make the application more engaging and memorable. Maeda writes [8], form follows function and feeling follows form.

5 CONCLUSION

We are all trying to deeply understand the nature of experience design and its relationship to media; where its strengths lie, its appropriate application, best practices, and how to integrate it into design education curriculum. A combination of tools such as physiological evaluations, self-assessment, and observations might hold the key to multifaceted, accurate, non-linear usability. For the authors, we have found a growing number of heuristics to be useful in the educational process. As the complexity of experience driven applications rise; technically, functionally, cognitively, and aesthetically, principles in non-linear usability will be central in defining a more holistic approach to its design. When using them as a guide, the identification of potential weaknesses in an application can be corrected during design and implementation.

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[1]R Brian STONE
The Ohio State University
Department of Design
375b Hopkins Hall
128 N. Oval Mall
Columbus, OH 43210 USA
stone.158@osu.edu

[2] Daniel P ALENQUER
Pontifícia Universidade Católica
de Minas Gerais.
Av. Brasil, 2023, 7º andar
Belo Horizonte, Minas Gerais
Brazil 30140-002
alenquer@latitude14.com