



**UNIVERSITI PUTRA MALAYSIA**

**CLASSIFICATION OF THE AESTHETICS FORMULA AND  
GENERATING THE SCREEN DESIGNS FOR BALANCE PRINCIPLE**

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**CLASSIFICATION OF THE AESTHETICS FORMULA AND  
GENERATING THE SCREEN DESIGNS FOR BALANCE PRINCIPLE**

MASTER OF SCIENCE (COMPUTER SCIENCE)

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OCTOBER, 2002




## **DEDICATION**

To my beloved parents, madam Wan Patimah binti Wan Endut  
and Mr. Ismail bin Jamal, and to all my brothers and sisters.

## DECLARATIONS

I declare that the material contained in this project is the end result of my own work and that due acknowledgement has been given in the references to ALL sources be they printed, electronic or personal.

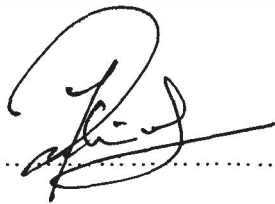
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## APPROVAL SHEET

This report is submitted to the Faculty of Computer Science and Information Technology, Universiti Putra Malaysia and was accepted as fulfillment of the requirement for the degree of Master of Science.

SIGNED

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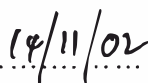
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**Classification of the Aesthetics Formula and Generating the Screen Designs  
for Balance Principle**

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October, 2002

**Abstracts**

An important aspect of screen design is aesthetic evaluation of screen layouts. Screen designs aesthetic plays a greater role in Human-Computer Interaction (HCI). It is important to understand what characteristics of screens that influence user acceptance. Therefore, we required tools and principles for evaluating aesthetic of screen designs. However, no one knows how to measure aesthetic value of screen designs accurately. Ngo et al.'s [D. C. L. Ngo et al, 1998-2001] has been proposed an interface aesthetics evaluation model and derived fourteen aesthetical measures for graphical screen design: *Balance*, *Equilibrium*,

*Symmetry, Sequence, Cohesion, Unity, Proportion, Simplicity, Density, Regularity, Economy, Homogeneity, Rhythm, Order and Complexity.* Based on the related work in field of screen design aesthetic, we were classified these fourteen aesthetic characteristics into three basic principles design in screen appearance (screen aesthetic): *Balance, Unity and Movement.* The end of this study, we transfer the mathematical theory for balance principle into a screen layout. The reason we carried out this study is there are none classification on aesthetic characteristic of screen design has been done before.

**Pengelasan bagi *Aesthetics* Formula dan Penghasilan Rekabentuk Skrin bagi**

***Balance Principle***

**Oleh**

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**Abstrak**

Penilaian rekabentuk skrin *aesthetic* merupakan salah satu aspek yang penting dalam rekabentuk sesebuah skrin. Rekabentuk skrin *aesthetic* juga memainkan peranan yang besar di dalam Interaksi Manusia-Komputer (*Human-Computer Interaction*). Di sini adalah mustahak bagi kita memahami apakah ciri-ciri rekabentuk skrin yang akan mempengaruhi penerimaan seseorang pengguna. Oleh yang demikian, kita memerlukan perkakasan dan prinsip-prinsip bagi menilai nilai *aesthetic* pada sesebuah rekabentuk skrin. Walaubagaimanapun, tiada seorang pun yang tahu bagaimana untuk mengukur nilai *aesthetic* pada sesebuah



rekabentuk skrin secara tepat. Ngo serta rakan-rakannya, telah memperkenalkan satu model iaitu *Interface aesthetic evaluation model* bagi mengukur nilai *aesthetic* yang terdapat pada sebuah rekabentuk skrin bagi antaramuka bergrafik: *Balance, Equilibrium, Symmetry, Sequence, Cohesion, Unity, Proportion, Simplicity, Density, Regularity, Economy, Homogeneity, Rhythm, Order and Complexity*. Berdasarkan kepada kajian-kajian yang berkaitan dengan rekabentuk skrin *aesthetic*, kami telah mengelaskan ciri-ciri tersebut kepada tiga prinsip asas rekabentuk penampilan skrin iaitu *Balance, Unity and Movement*. Di akhir penyelidikan ini, kami telah menterjemahkan teori matematik bagi *Balance principle* ke dalam bentuk skrin. Faktor yang mendorong kepada penyelidikan ini ialah tiada pengelasan terhadap ciri-ciri *aesthetic* pada rekabentuk skrin dilakukan oleh mana-mana penyelidik sebelumnya.

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# **CHAPTER I**

## **INTRODUCTION**

# CHAPTER I

## INTRODUCTION

### 1.0 INTRODUCTION

During Human-Computer Interaction (HCI), most information conveyed by the computer is presented visually, typically by means of a dynamic display device. Today, the majority of these devices are Cathode Ray Tubes (CRTs), although other devices such as large-scale liquid-crystal displays or electro luminescent panels may be more common. No matter what display technology is used, the content and format of the information presented will always have a substantial impact on the usefulness and efficiency of the interaction. If the system does not present the information that the user needs, or presents it in an unusable or confusing manner, the user may decide not to use the system at all. The user ability to perform the necessary task may be sharply degraded.

Donald A Norman in '*The Design of Everyday Things*' provides a psychological perspective of poor designs we tolerate on daily life. Norman describes many of the everyday situations where something goes wrong our interactions with poorly designed object around us. Users are frustrated with many unusable products they





have to deal with in their day to-day lives. Newsmagazines, newspapers, and books report growing dissatisfaction with unusable products [D.A. Norman, 1990]. Users frustrating because almost every product today's present us with a problem in screen design. What the aspects of poor screen design can be distracting the user?

Barnett has listed factors that when poorly designed hinder the use of paper forms [R. Barnett, 1993]. The factors certainly apply for electronic forms or screens as well are included:

- i. Unclear captions and badly worded questions. These cause hesitation, and rereading in order to determine what is needed or must be provided. They may also be interpreted incorrectly, causing errors.
- ii. Improper type and graphic emphasis. Important elements are hidden. Emphasis is drawn away from what is important to that which is not emphasis.
- iii. Misleading headings. These also create confusion and inhibit one's ability to see existing relationships.

- iv. Information requests perceived to be irrelevant or unnecessary. The value of what one is doing is questioned, as is the value of the system.
- v. Information requests that require one to backtrack and rethink a previous answer, or look ahead to determine possible context. Inefficiency result and mistakes increase.
- vi. Cluttered, cramped layout. Poor layouts create a bad initial impact and leads to more errors. May easily cause system rejection.
- vii. Poor quality of presentation, legibility, appearance and arrangement. Again, degrades performance, slowing the user down and causing more errors.

Howlett based upon her experiences at Microsoft suggests the most common problems in visual interface design are [V. Howlett, 1995]:

- i. Visual inconsistency in screen detail presentation and with the operating system.
- ii. Lack of restraint in the use of design features and elements.
- iii. Overuse of three-dimensional presentations

- iv. Overuse of too many bright colors
- v. Poor designed icons
- vi. Bad typography
- vii. Metaphor that is either overbearing or too cute or too literal thereby restricting design options.

These kinds of problems, she concludes leads to screens that can be chaotic, confusing, disorganized, distracting or just plain ugly. However, with today's technology, today's tools and our motivation help to create really effective and usable interfaces design. But why do they (the interface designers) continue to produce so many that are inefficient and confusing or at worst, just plain unusable interfaces design? It is because the interface designers still don't know:

- i. What really makes good screen design?
- ii. What exactly is good appearance in screen design?
- iii. What is characteristic for a screen that making it beautiful?
- iv. What are the characteristics of screens influence users acceptance?
- v. How to produce a better screen design?

But other than that, some of them create almost identical screen solutions based on the same requirement, without follow the design guidelines or standard design.

Actually, use of a screen, and a system, is affected by a variety of factors. Included are how much information is presented on the screen, how the screen is organized, the language used on the screen, the distinctiveness of the screen's components, provision of proper feedback and its aesthetics. Among these factors, one very essential component of graphical user interface design concerns the actual layout of elements on the screen. This is a realm of graphical design that has been missed by today's HCI researchers. To achieve the ultimate goal of designing an acceptable system, a more balanced approach may be needed. An approach is needed to achieve this goal and to avoid users frustrating during they deal with a screen is the interface designers should be improves the usability of the products. One way to enhance the usability of products is by improving the appearance (beauty) of the user interface design. The word "*beauty*" here refers to how the screen element is look like. This allows more attention to be focused on the organization and structure of interfaces, areas where design expertise should be focused.

## **1.1 BACKGROUND OF SCREEN DESIGNS AESTHETIC (INTERFACE AESTHETIC)**

Paying attention to aesthetics is important in making interfaces easy to learn and use. Aesthetics affect people's perceptions of the usability of a computer system, which may in turn, influence their attitudes towards the system. If the system

presents the information in a confusing manner, the user may decide not to use the system at all.

In this situation, aesthetics particularly play an important role in user interface design. Aesthetics may not be only solution, but it definitely plays a significant role in the overall value of screen design. It is related to our appreciation of computer system as well. However, some researchers [A. Marcus, 1992, J. D. Foley et al, 1990] have warns a tendency among designer to emphasize the aesthetic elements of the screen design, because these might degrade usability. In fact, interface aesthetics play a greater role in system usability and acceptability than we might be willing to admit. Obviously, here we can see how important the aesthetics in screen design, which is critical to its user acceptance and success.

Aesthetics design refers to how the screen is look like. Sometime aesthetic design, we call design appearance which is referring to how we create our interface design in a good appearance. The important thing in design appearance is how to arrange the object in a good visual composition. A visually pleasing composition in screen design is important because it is attractive to the viewer eye. It draws attention subliminally, conveying a message clearly and quickly. Visual appeal makes a computer system accessible and inviting. A lack of visually pleasing composition is disorienting, obscures the intent and meaning, slows down and confuses the user. Without designing the composition of the screens consistency, the problems arise among many others and the system will not have a holistic appearance. The aesthetics screen design is also important today because most



human-computer communication occurs in the visual real. Otherwise, it's important to prospective viewers and may help gain attention and build confidence in using computer systems.

Therefore, there should be a system of methods and principles for evaluating interface aesthetics. However, today's techniques account only for usability measurement. Very few know how to measure aesthetic value. Early examples of tools that analyses alphanumeric screens are Tullis's Display Analysis Program [Tullis, 1998] and Streveler and Wasserman [D. J. Streveler and A. I. Wasserman, 1984]. Tullis investigated predicting user performance for static alphanumeric displays. He explored the relationship between several metric including overall density of the screen, local density of the screen, grouping of objects and layout complexity. Streveler and Wasserman proposed of 'balance' as one of their objective techniques for assessing the spatial properties of alphanumeric screens. They also describe three basic techniques for analyzing screen formats which is "boxing", "hot-spot" and "alignment" analysis.

However, the principles that these measures use are extremely rudimentary and often vastly oversimplified and impracticality. Otherwise, these measures do not account for graphic interfaces but the studies have focused on alphanumeric screens. The movement toward Graphic User Interfaces (GUIs) with richer fonts and layout possibilities has reduced interest in these measures, but better analyses of layout seem possible [B. Shneiderman, 1998]. *"While it is conceivable to define a set of variables that characterize the key attributes of many alphanumeric*



*display formats, such a task seems difficult for graphics displays because of their much greater complexity,*” wrote Tullis [Tullis, 1998] and *utilisation*, they cannot measure aesthetic value.

No one knows how to measure aesthetic value. Here, we carried out a study on aesthetics screen design in computer systems. In general, our study focused on aesthetic evaluation of screen layouts design, which is important aspect of screen design that missed by most the HCI expertise today's. We explored and tried to understand a mathematical theoretical approach to measures the aesthetic elements for graphic screen designs (refer to Chapter II for the detail explanation of screen design). This theoretical known as a computational theory of interface aesthetics evaluation model. This aesthetics evaluation model proposed by Ngo et al.'s [Ngo et al, 1998-2001] who is involved research in the areas of interface aesthetics and automatic design of screen layouts. In this model, Ngo et al.'s present a set of screen characteristics that appears to be determined for aesthetically pleasing object. They derived fourteen aesthetical measures for graphical screen design. The formalized measures included *Balance, Equilibrium, Symmetry, Sequence, Cohesion, Unity, Proportion, Simplicity, Density, Regularity, Economy, Homogeneity, Rhythm, Order and Complexity*. The formalizing showed that the aesthetics of screen layouts could be measured objectively.

## 1.2 PROBLEM STATEMENT

There are two problems that we tried to solve in this study:

- i. There a none classification of the aesthetic characteristic have been done by the previous research.
- ii. There are none direct relationship of the formulizing (mathematical formula) aesthetic measures with a screen layouts.

We have to investigate several things to achieve this mission. This study can be done by answering the questions below:

- i. What is an aesthetic and why it is important in screen design?
- ii. What are the aesthetic characteristics measures for a screen design?
- iii. What are the basic principles designs for a screen appearance?
- iv. What are the important characteristics in screen design to respect the user interface design as well as to insure an aesthetically pleasing object?

All the questions above will be discussed deeply in Chapter II and Chapter III.



### 1.3 RESEARCH AIMS

The aims of this research is to study and looking into an interface aesthetic evaluation model for screen layout designs that have been proposed by Ngo et al.'s [Ngo et al, 1998-2001]. In general, we explored how to use the model to measure and evaluate the aesthetic elements of a screen design. For the information, in this study, no experiments were conducted to evaluate or to proof and validate the measurement model, but what we have to do is:

- i. We classified the fourteen characteristics of aesthetically pleasing objects for graphic screen design (*Balance, Equilibrium, Symmetry, Sequence, Cohesion, Unity, Proportion, Simplicity, Density, Regularity, Economy, Homogeneity, Rhythm, Order and Complexity*) into three basic principles design in screen appearance: *Balance, Unity and Movement*.
- ii Convert the theory into a screen layout. Here, we try to relate and transfer the theory (mathematical formula) of interface aesthetic evaluation model into a screen layout. We produce a drawing of a screen layout that contains the mathematic formula.