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A Computational Model to Predict Aesthetic Quality of Text Elements of GUI

Ranjan Maity*, Akshay Madrosiya, Samit Bhattacharya

Indian Institute of Technology, Guwahati, 781039, Assam, India

Abstract

The role of aesthetics in determining usability of interactive systems has come under focus in recent time. The issue is relevant for Graphical User Interfaces (GUI) containing elements of widely varying nature. It is important to evaluate GUI aesthetically to determine their acceptability to the users. Computational models have been reported in the literature to perform objective assessment of interface aesthetics. However, the existing models only consider geometric features at the highest level, without considering the *content* inside the geometry. To address this issue, we propose a computational model to evaluate aesthetics of textual contents present on a GUI. The proposed model is based on empirical data collected from user studies. The model is a weighted sum of six features characterizing text: chromatic contrast, luminance contrast, font size, letter spacing, line height and word spacing. A separate validation study demonstrates the feasibility and potential of the model (showing 87% accuracy in model prediction), which is expected to be useful in predicting usability of a web page in a more refined way. Such modeling has its obvious implications in the context of engineering interactive systems. The proposed model along with the user studies are presented in this paper.

Keywords: Aesthetics; web page; text elements; aesthetic score; categorization.

1. Introduction

In human-computer interaction (HCI), improving the usability of interactive systems is of primary concern. The standard definition of usability reveals its task-centric nature, i.e. how easily and efficiently user is able to carry out the tasks. In recent times, studies have shown the importance of aesthetics in shaping the overall user experience of an interactive system^{4, 17, 20, 29, 30, 31, 32}. It is argued that aesthetically designed interfaces increase user's efficiency and decrease perceived interface complexity, which in turn help in increasing usability, productivity and acceptability of the system¹⁶.

Graphical User Interface (GUI) is good examples to understand the importance of aesthetics in interactive system design. Most of the interfaces contain various types of information, put together using various design patterns.

* Corresponding author. Tel.: +91-3661277143; fax: +91-3661277143.
E-mail address: ranjan.maity@iitg.ernet.in

Consequently, the complexity of the interfaces in terms of information content and layout is usually high. Evidently, the aesthetics of the design determines to a great extent its acceptability (and therefore, usability) to the users. Several measures and guidelines were proposed for the evaluation of interface aesthetics^{12, 14, 18, 19, 23, 24}. Most of these works attempted to measure aesthetics primarily through empirical means. A parallel research effort also attempted to develop computational models to evaluate interface aesthetics¹⁶. The advantage of computational model is the ability to evaluate interface aesthetics *automatically*, thereby making it possible to integrate the model as a tool in a design environment so that the designer can check their design quickly. Such automation also makes it possible to automate the design process itself, as demonstrated in²⁶ with its obvious implications for engineering interactive systems.

A problem with the existing computational modelling approaches is their emphasis on the *layout geometry*. The objects present on the interface are treated as regular-shaped polygons. Aesthetics is assumed to be a function of the geometry alone, without considering the content. As we know, textual content forms a significant part of most GUIs including web pages. Those contents vary in style, size, font, colour and many such features. Such variations are expected to have a bearing on the overall interface aesthetics. Since the existing models are inadequate to account for the variation of textual content on overall aesthetics, we propose in this work a new computational model for interface text aesthetics. The model, which is a weighted sum of multiple features that characterize textual elements (chromatic contrast, luminance contrast, font size, letter spacing, line height and word spacing), is derived from empirical data. User studies were conducted to ascertain the efficacy of the model. The proposed model along with the user studies are reported in this paper.

2. Related Work

Aesthetics is considered as a branch of philosophy that deals with the nature of beauty, art, and taste, and with the creation and appreciation of beauty. Aesthetic design is a well-studied area in the field of fine and commercial arts^{1,8}. Maque¹⁵ elaborated the importance of aesthetics in human affairs. The contribution of aesthetics in determining usability of interactive systems was highlighted as early as 1984 by Heines¹⁰, who reported that a poorly designed computer screen can hinder communication. Aspillaga² found that good graphic design and attractive displays of a system contribute to the transfer of information. Elements of aesthetic considerations were present in other works as well^{22, 33, 34, 35}.

In spite of such early works, research in this direction picked up only in the later part of the '90s of the last century. These works included investigation of the role of aesthetics on interactive system design in general as well as on the effects of aesthetics in specific interaction domains. Researchers argued about the role of aesthetics in interactive system design²⁹. Set of guidelines for screen design, keeping in mind the aesthetic aspect, were proposed⁹. In the context of e-learning, the effect of aesthetically pleasing layouts on the student's motivation to learn has been reported²⁸. Szabo and Kanuka²⁷ found that subjects who used the lesson with *good design principles* completed the lesson in less time and had a higher completion rate than those who used the lesson with poor design principles.

A typical scenario where aesthetics play important role in the overall usability of the system is the design of web pages. Relationship between visual appeal and perceived usability of web pages was investigated by Lindgaard et al.¹⁴. Schmidt et al.²⁴ found correlation between usability and aesthetics in the context of subjective evaluation, depending on the user's background, goal, task, and application type. Several works concentrated on developing measures to assess aesthetic quality of web pages¹².

Aesthetic evaluation of interfaces poses problem due to its subjective nature: an aesthetically pleasing interface may not look so to a different person. Computational aesthetic modelling attempts to overcome this problem by proposing objective measure of aesthetics^{6, 11}. However, works related to web page aesthetics are rare and we found only three^{3, 16, 25}.

In¹⁶, an analytical expression was proposed to compute an aesthetic score of a web page based on 12 features, all of which are related to the geometry of the layout. The content of the geometry was not considered. Clearly, the nature of web page elements varies widely (image, text, and animation with their characteristic features) and it is necessary to consider their characteristics in any modelling approach. Works in this direction were reported in^{3, 25}, to computationally model aesthetics of short animations embedded in web pages.

In this work, we propose a model to compute aesthetics of textual contents of a GUI. This work is part of a larger goal of computational modeling of whole web page aesthetics. We base our work on the philosophy that modeling component aesthetics and then combining those models will lead to an overall web page aesthetics model. In

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