Affective Engineering: What Is It Actually?

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ABSTRACT

Current scenarios in product design are stepping from functional towards emotional appeal of users. Emotional aspect is seen crucial in product design to ensure user acceptance and thus the successfulness of the product. The base of affective engineering concerns the approach for consideration of design elements that map the feeling of users. This paper introduces and discusses affective engineering in terms of its definition, underlying theory, and methods. Affective engineering, strongly related to interaction design or IxD, supports in the elicitation of user requirements and specification as well as design and development of a product. In order to understand affective engineering better, this paper presents an example of design innovation of a blog layout, which is user-focused. It is promising that affective engineering can be used for designing satisfying user-focused product.

Keywords
Affective engineering, emotional aspect, IxD.

1.0 INTRODUCTION

Affective engineering (AE) is currently the new focus in product design where it provides a platform to include emotional features into the designs for a user appealing product. Emotional aspect is seen crucial in product design to ensure user acceptance and thus the successfulness of the product. The product could either be industrial product such as a car, a bottle, and a bag; or interactive product such as a mobile phone and a computer. This paper however, is targeting at interactive product design using AE. Figure 1 illustrates the comparison of previous and current approach in designing any products.

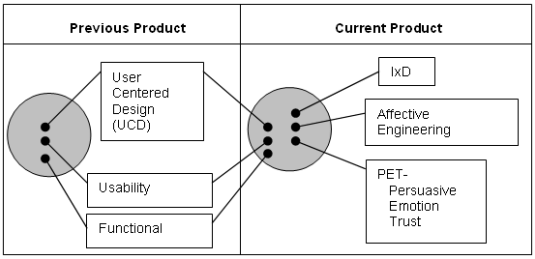

Figure 1: The comparison of the previous and current product design approach, adapted from Schaffer (2008).

The obvious difference between the two product designs is the inclusion of interaction design (IxD), AE, and PET. Previous approach in product design only focuses on user centered design (UCD) and the product's usability highlighting its functional features. Even now, the three elements are still incorporated into but concentrate more towards the inclusion of emotional appeal by focusing on:

- IxD – a branch of user experience design, which focuses more on complex dialogue between users and peripherals (e.g. computer, mobile communication tools, and digital electrical appliances such as a microwave and washing machine) of interactive product only (Schaffer, 2008).
- AE – is a research field to investigate subjective user requirements, which includes emotional aspect towards designing a product or a system.
- PET – also an approach that integrates persuasion, emotion, and trust into designing a product to ensure that the product is appealing to the users.

Aiming at introducing AE in the context of interactive product design this paper presents, in Section 2, its definition and underlying theory, which further highlights the important relationship that AE and IxD has in designing an interactive product. Section 3 presents affective engineering method by example. The example concerns the design of blog layout for bloggers. Finally, section 4 concludes the paper.

2.0 AFFECTIVE ENGINEERING

AE is seen important as the design approach moves from UCD to the incorporation of emotions as the key for successful product designs. Emotion is regarded as essential for the creation of an appealing product with high acceptance on its functionality and usability. The need to also include emotion is a spotlight in any current product design.

With the many labels put forward to represent AE, it is therefore important to define it with accordance to designing interactive products. Some of the proposed name for AE includes (Schütte, 2005):

- Affective design
- Affective ergonomics
- Design for experience
- Kansei engineering
- Emotional engineering
- Pleasure with products
- Design of metaqualities
- Design for human senses
- Sensorial engineering

Whatever labels used, the terms come to somewhat similar definition to refer to product design, be it physical, industrial product or interactive product, which take into significant amount of consideration the emotion portrays by human when using the product.

2.1 Definition and Underlying Theory

The theory behind AE strongly relates successful product design with the emotion of its users or consumers. It connects users and design where it provides useful subjective information to be regarded as key elements towards designing successful products. Without AE, the designed product shall not meet the emotional needs of users and therefore resulting in design failure. Figure 2 depicts the connection between user and design with AE as an approach to connect the two.

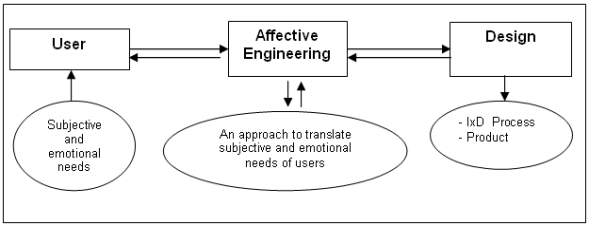

Figure 2: Affective engineering as an approach to connect users and designs.

AE can be defined as aiming "… at incorporating customer's affective needs into design elements that deliver customers' affective satisfaction" (Jiao, Zhang, & Helander, 2006). Affective needs refer to subjective and emotional needs where transferring or mapping the needs into design elements is a challenge. The success rates of new products are reported to be around 10% to 20% only and thus regarded as very low (Engineering Design Center, 2009). That is why AE is used to elicit the subjective requirements from potential users or consumers in order to boost up the success rates.

In Japan, AE or more popularly known as Kansei engineering has been deployed as a useful tool to map the subjective and emotional user needs into useful perceptual design elements. Kansei engineering "… refers to the translation of consumers' psychological feeling about a product into perceptual design elements…This technique involves determining which sensory attributes elicit particular subjective responses from people, and then designing a product using the attributes which elicit the desired responses" (Ergosoft Laboratories, 2009). Kansei engineering is focusing on designing consumer-oriented products which is expressed by using Kansei words that refers to words that reflects human's psychological feeling (Nagamachi, 2008) such as 'helpful', 'easy operation', 'assistive', and 'comfortable'.

Thus, it can be shown that regardless of the type of products, the definition of AE resorted to highlights the need to map human's affections or subjective and emotional needs into perceptual design elements so that the product designed is able to satisfy its users or consumers at cognitive and emotional level and therefore able to engage with them.

2.2 Core Affect

Targeting at arriving to users' affective satisfaction, Figure 3 illustrates the core affect circle that shows two dimensions of neuro-psychological state: pleasure-displeasure and activated-non-activated (Russell, 2003). Based on the two dimensions, another dimension can be plotted that shows positive effect at one end and negative affect at the other.

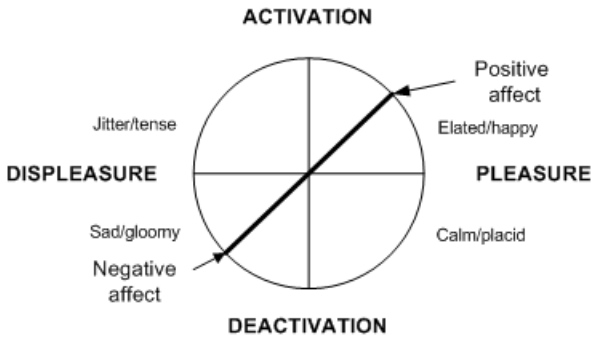

Figure 3: Core affect circle (source: Russell, 2003).

Referring to the neuro-psychological states as illustrated in Figure 3, the reason AE is introduced is to elicit requirements that can create pleasure and activation and thus bring out positive affect when user use a product. With AE a better, user-appealed product can be designed. Hence, the product that has been designed using AE is supposed to move the emotional affective state of its user towards the positive affect state. When in this state,

pleasure and activation is integrated into one creating an emotionally positive feeling.

2.3 Affective Engineering and IxD

Since the aim of this paper is to design an interactive product, incorporating AE is parallel with the current need. When designing interactive products, interactions between users and computers are essential. This is strongly related to human computer interaction (HCI), of which IxD is a sub, and AE where it is regarded as a new research area where the affect concerns with four important roles to play in HCI design as such (Te'eni, Carey, & Zhang, 2007):

- Modeling affect in the user and the computer
- Sensing and recognizing the user's affective state
- Adapting the computer's state to fit the user's affective state
- Generating artificial affective expressions on computers

To design the product features that can instill positive feeling when using them requires the need to use AE towards eliciting the emotional and subjective requirements. However, applying affective design into a product has some issues (Helander, Peng, & Khalid, 2007):

- Designers need to understand and know how to utilized the components of affective design
- There is a need to establish valid measures to users' affective responses to design
- There is a need to understand the sources of user affect and predict user affect to proposed designed solution

Thus, AE plays a significant role in that it offers subjective information that can be utilized to better understand the users in terms of their emotional requirements for an affective product. Consequently, applying AE approach towards gathering the information needed can lead to the establishment of valid measures of users' affective responses to design. For example in designing an interactive product, interface is a must and this includes colours, buttons, and menus to name a few. These features can affect the users' emotion. For example, being able to choose a suitable background colour of a website creates comfort for user. To obtain such affective features, AE approach is therefore used to generate certain measures so that only features with maximum effect towards human affections are being used in designing a product. Figure 4, adopted from (Te'eni et al., 2007), demonstrates an example relation between a product's features and affective qualities, which lead to emotional state of a user.

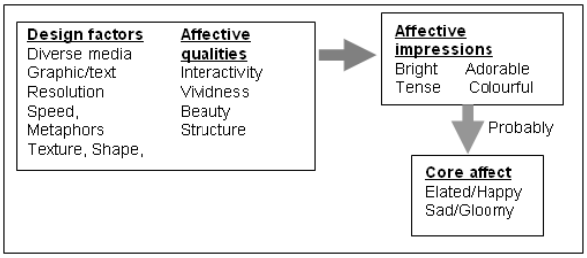

Figure 4: Design factors and affective qualities that lead to affective impressions and core affect.

The design factors are factors of IxD, which can be grouped into three dimensions (see Figure 5) – content (diverse media, graphic/text), behaviour (speed) and format (metaphors, texture, shape).

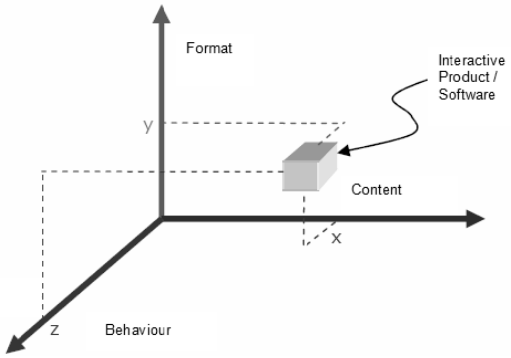

Figure 5: The three dimensions of IxD (source: Zulikha & Sabariah, in press).

Affective qualities such as interactivity, vividness, beauty, and structure are qualities elicited from AE process. The design factors and affective qualities when combined together create affective impressions that probably will generate core affect of either elated/happy or sad/gloomy.

3.0 METHOD: AN EXAMPLE

To illustrate the AE process, an example is therefore presented. The example is concerned with blog layout design. AE is suitable for eliciting the subjective and emotional needs through its processes. Figure 6 presents the process flow of AE in the context of the example.

The first step is to collect and observe user (in this case the bloggers) information. The more information obtained about the users, the better. Richer information provides knowledge to more understand the users' profiles that offer useful information of their preferences. The information collected and observed includes their personal backgrounds – age, gender, and marital status to name a few, hobbies or likes/dislikes, and any information that could lead to the discovery of the users' profiles.

Once they are identified, personification process begins. In this step, personas are created. A persona is a fictional individual that represents collective needs and requirements of specific users for a particular computer

application. Creating personas involve creative synthesis process and an in depth analysis of profiles created to represent users (Cooper, Reinman, & Cronin, 2007). The personas contain narrative information about the fictional individual's character that represents the collective profiles in one group.

Next, the features that shall be incorporated into the product, in this case the blog layout design, have to be elicited from the personas using certain scenarios. Detail descriptions of elicitation process are discussed in (Fakhrul, Husniza, & Zulikha, 2008).

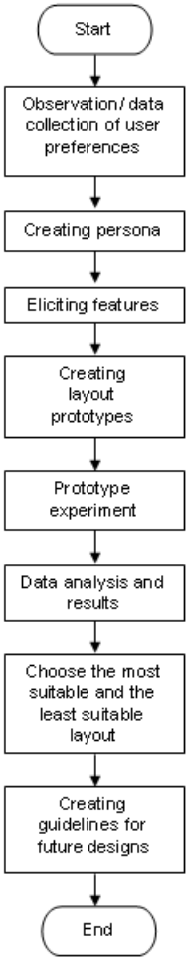

Figure 6: The AE process flow with regards to the example of blog layout design.

Based on the features are elicited, a number of blog layout are designed to include the features. Figure 7 illustrates the layout designs. The prototypes of blog layout designs are based on user preferences as elicited from the personas. Since a persona represents a group of users with similar profiles, the design for features represented in that persona is considered general but still within the scope of the particular persona.

The prototypes then are put in series of experiments targeting on potential users/bloggers. Their responses towards the designs can be obtained either by using questionnaires with certain predetermined scales or through observation. Of course, observation takes longer time but can possibly educe certain behaviours towards using the prototypes.

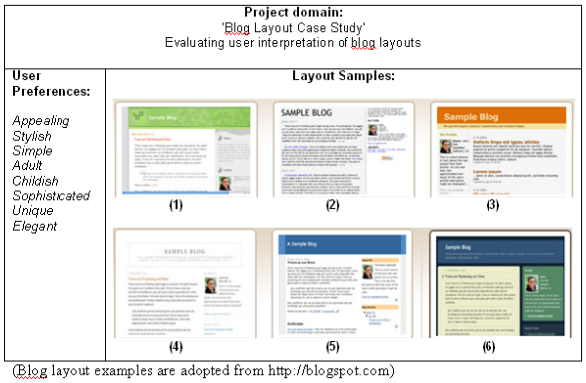

Figure 7: Examples of layout designs and user preferences.

Data obtained from the experiment are analysed and used as useful information towards future blog layout design. Figure 8 shows a sample of the data gathered during the experiment (the scale and the user preferences are adopted from http://www.engineeringdesigncentre.co.uk). Figure 9 illustrates the examples analysis results.

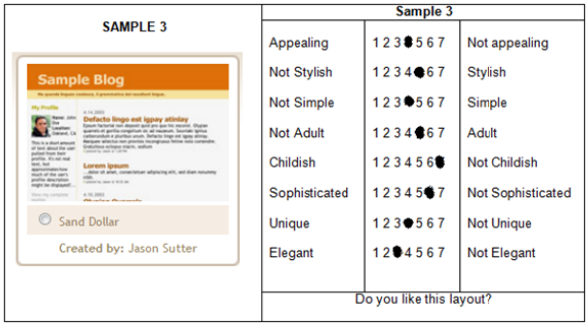

Figure 8: An example of data gathered during the experiment process using a scale.

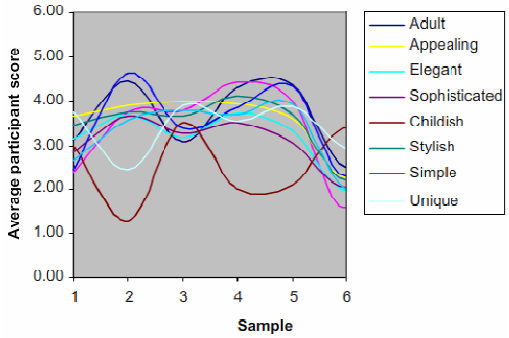

Figure 9: An example of analysis results plotted in line graph.

From the results, the most favourite layout design can be identified as well as the least favourite one. Figure 10

depicts the most and least favourites among the layouts presented in the experiment.

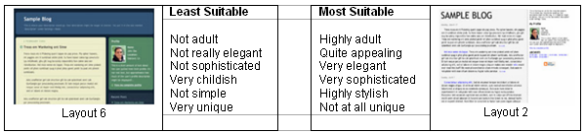

Figure 10: The least and most suitable blog layout design with their preferences results.

In addition, a guideline can be prepared for future references. The guideline contains all the necessary information and finding of the experiment, as well as the design principles in designing layout for blogs. Finally, the underlying links between interpretation and pack attributes can also be identified, according to the following process:

(1) Design the stimuli from a range of key attributes
(2) Statistical evaluation of stimuli response changes
(3) Regression analysis to relate to individual attributes

In this case, the link could be for example: 'layout with too many colours and big buttons has a high childish affect'.

4.0 CONCLUSION

AE is proven to be effective as it has been use and currently gaining attention worldwide. Kansei engineering has now transfered to western world which is now refer to the many names of AE. Even though AE is known by many terms and labels, it still refers to the same key 'ingredient' of successful product design – emotion. The target of AE is straightforward in that emotion needs to be mapped and incorporated into design elements to create appealing products, be it physical or interactive products, and thus increase product success rates. AE is seen to be very closely related to IxD especially in designing interactive products due to its key property that includes emotion and directly map it to design principles. Method of using AE in designing interactive product is thus discussed to highlight how AE is used, or more or less how emotion is used, to be included as design elements and guarantee user satisfaction.

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