出國報告 (出國類別：國際會議)

參加 IEEM2013 學術研討會心得報告

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摘要

2013 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM2013)是由 IEEE 組所主辦，日期爲 12/11 - 13,/2013，於泰國曼谷所舉辦。會議題目涵蓋所有工業工程的主題，包括人本人研究領域人因工程。

本次參加 IEEM2013 主要目的有三個。首先是發表本人之國科會計畫研究成果。第二、IEEM2013 研討會是由 IEEE 組織所主辦的學術活動，其論文皆被收錄於 EI 資料庫，等同於論文出版，所以本人投稿於 IEEM2013 等於是再增加一篇本人之學術著作。最後，就是希望能找到同好，能當面討論，尋找合作契機。前面二個目的皆有達到，但最後一個目的並不理想，沒有見到想見的人，也沒找到跨國合作機會，下次若再有類似的機會，我應先邀請這些同好參加我的發表，才可能有機會和國際大師共同合作。

目次

本文

一、目的

本次參加 2013 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM2013)的主要目的有三個。

首先因爲本人之國科會計畫已執行完畢且有一些研究發現，所以想找個適當的場合發表本人最新的研究發現。所以第一個目的就是在於發表本人之國科會計畫研究成果。

此次本人發表的論文主題屬人因工程領域，是 IEEM2013 研討主題之一，所以報名參加之，並前往發表。

第二、IEEM2013 研討會是由 IEEE 組織所主辦的學術活動，其論文皆被收錄於 EI 資料庫，等同於論文出版，所以本人投稿於 IEEM2013 等於是再增加一篇本人之學術著作。

最後，本人的研究題目是屬於產品介面情感語意的研究，若能有跨文化的合作，將使本研究主題更爲精彩。因此，本人參加此次研討會的目的就是希望能找到同好，能當面討論，尋找合作契機。

另外，雖然，跨文化研究的對象當然是西方文化最好，但參與歐美的研討會所費之交通費太高，而考量本人結餘款和管理費之餘額有限，所以只好找東南亞附近的國家。因爲此次 IEEM2013 在曼谷舉行，離台灣不遠，可節省出國費用，所以選擇這個研討會發表論文。

二、過程

甲、會議議程

IEEM2013研討會是工業工程與管理相關領域的研討會，會議內容包括

E-Business and E-Commerce
Engineering Economy and Cost Analysis
Engineering Education and Training
Global Manufacturing and Management
Healthcare Systems and Management
Human Factors
Information Processing and Engineering
Intelligent Systems
Manufacturing Systems
Project Management
Quality Control and Management

Reliability and Maintenance Engineering
Safety, Security and Risk Management
Service Innovation and Management
Supply Chain Management
Systems Modeling and Simulation
Technology and Knowledge Management

本人主要參加發表論文的議題是屬於人因工程(human factors)。會議的第一天(12 月 10 日)是辦理註冊報到、城市導覽和歡迎酒會。除了報到外，其它活動皆要自己付費，所以我並沒有準備參加，所以從台灣搭乘晚班飛機，沒有參加。

第二天(12 月 11 日)早上 8:30 報到註冊，接著是 keynote speech，下午則有二個時段的 technique presentation，中間有 30 分鐘的中場休息。每個時段 90 分鐘，共有九場發表會，每場發表會約有六位學者發表，每位發表人有 15 分鐘的發表時間。人因工程相關之論文安排在第一個段發表，有 6 位學者參與發表。

第三天(12 月 120 日)早上和下午各有二個時段的 technique presentation，中間各有 30 分鐘的中場休息，每個時段 90 分鐘。早上的二個時段的發表會有九場，下午二個段則各自共有九場發表會，每場發表會約有六位學者發表，每位發表人有 15 分鐘的發表時間。人因工程相關之論文安排在早上第一個段發表，本人即在此時段發表，並兼做會議主席，有 6 位學者參與發表。晚上 7:300-9:30 則有會議宴會，但因要自費，且費用很高，所以放棄沒有參加。

乙、議場主題

Keynote Speech 場次，共有三位學者發表看法，第一位學者提出如何建立成爲名私校的見解，及建議馬來西亞大學的發展方向。所提到的治校理念不外是如何與業界現實結合，並無太多突破的見解。

第二位是泰國公司研發創新部門的總監，Sainamthip 先生。他的演講題目是有關永續性的創新。他認爲，公司優秀的製造能力已不再能支撐公司的永續經營。他提出公司應藉由研發和創新創造高價值的製程、服務和解沫方案。並且，公司應和政府和永續發展配合，如此才能平衡商和社會環境。

第三位講者是美國喬治亞理工學院的教授，則是由汽車工業到奈米生物科技談論品質改進。他認爲傳統的品質技術不外是工程和統計技術。但由於科技的進步，以致少量、多樣和高附加價值的產品模式挑戰品管技術。他認爲未來應有先的品質技術的產生，他亦嚐試的由過去品質工程

的典型產品，汽車和晶片爲例子，談到現在最夯的奈米和生物科技的品質改進技術。但其說明仍不脫離工程和統計的範籌。

由這二位專家的演講內容，我有深沈的感觸。目前的知識的交流是透明的，因此，即使沒有現場聆聽他們的演講，其知識背景也相差不遠。但重點是，我們如何以創新創意的方式，活用這些新知。另外，即使當某公司已真正應用這些知識，而且得到不錯的創新，這些公司會將之視爲公司內部的 know how 也不會輕易向外說明。

12 月 11 日下午 13:30-15:00 是人因工程發表場次，共有六篇文章。其中一位篇是由馬來西亞的大學所發表，其內是有關使用者經驗，與本人的研究主題較爲接近，所以本人用力聆聽。但因口音太重，所以不是很可解他的內容。所幸，此次會議附有各論文的電子的全文。所以了下全文，才知他的研究是植基在 NFC-enabled 的技術上，設計智慧型手機介面，討論 NFC 技術的方便性。這個技術我到是沒用過，倒是可以思考在未來的應用中，將之考慮進去。其他五篇論文，分別討論：(1)人體計測和採肌力的量測 ，(2)步態和地板磨擦系數間的關係 (3)有關滑倒的研究，三篇皆由台灣中華大學發表。台灣的論文還是偏重在較傳統的人工因工程研究。這可能是和國科會審查計畫的方式有關。因爲。在國內，具有前瞻性的研究計畫很不容易過，因爲這個主題全世界沒人做, 所以國科會的審查者就覺的這個計畫是有必要的。這也是國內研究的一大迷思，只要是世界上沒有出現似的研究，國科會是不會給予支持。學界和產業界不同。我認爲，學界更應該投入於沒有人做的領域，因爲他不像業界，有時間和成本及成敗的壓力。如此，台灣才能展現學的活力和創造力。

丙、與會報告議題

本人發表的場次是 12 月 12 日上午 9:00-10:30 是人因工程發表場次，共有六篇文章，由本人和另一位印度教授共同主持。本人發表其中一篇論文，內容留到下一章節介紹。另外五篇說明如下：

第二篇是探討影響工具機廠效率的因素。作者是亞洲大學老師，以台中工業區的工具機場爲對象，利用因素分析法，發現組織學習和工作績效是影響的主因。

第三篇是比較 AHP 和 fuzzy AHP 做爲評估績效的優劣，由東海大學研究生報告，因主題和我研究領差太大，所以不很懂。

第四和六篇是韓國人發表的論文很相近，分別由二位韓國的研究生報告。皆有利用專利地圖的方法找出動感介面的研究分佈及尚未研究的區塊。雖然方法不是很嚴謹，但整體的創意很足，可做爲台灣學者的參考。

第五篇是由德國人報告 emotional 的心智模型。這個研究內容很精彩，但並不是科學研究，倒像是設計的心得報告。發表者宣稱他提出一個經驗設計的模式，且能有運用。我相當質疑。因爲經驗設計是一種創造力的過程和設計一樣，很難有一標準模式可完全適用。我有和他交換意見，他說要提供他的模式給我看，結果爽約。德國人也會說話不算話。真是改變我對德國人的看法。

丁、個人發表內容摘要、現場報告台討論交流情形

我此次報告的題目是"可預測媒體介面美感的情感語意"。我首先介紹目前有關美感喜好的理論或研究有那些。並且說明這些理論或研究的弱點，並推論情感語意是美感喜好的中間變數。接著本人以 media player 的介面皮爲材料，討論美感和情感語意的關係，然後以迴歸分析法找出能預測美感的情感語意。最終我將情感語意分成二類：可穩定預測美感的怠語意和不能穩定預測的語意。前者就是外觀設計的必備因素，即不論使用者是誰，或是具有什麼樣的背景，外觀設計皆必須具備這類的語意。而後則是做爲市場區隔用的情感語意。即不同的受測者喜好的情感語意型會不一致。

大部分參加這場的觀眾大都不是研究這方面的專家，所以沒有給予建設性的建議，而只是針對他們不懂或好奇的部份交流。發問的內容都集中在受測者的選擇和迴歸方法的應用。討論場面熱絡，但這次並沒有符合我的預期。我的預期是希望藉由相關學者的參與討論，引起他們的興趣進而邀他們一起從事情感語意和美感的研究，擴大這個研究主題的基礎。在會議前，大會就寄給每位參加者一份大會資料，其中包括參與大會的人員。參加名單中包括多位與本人研究方向相似的學者，分別來自新加坡、香港和馬來西亞，預期他們將討論本人的相關議題。這些人我都不認識。我原本預期他們會出席我的發表，結果令人惋惜，他們不但沒參加，而參加我發表的人並不做這方面的人，有點可惜。

三、心得與建議

首先，與自己研究領域相關的同好一同討論、批評是人間的一大享受。國內學者數量有限，懂的人不多，一直沒有對話的人。但這次研討會，雖然有看到這些論文上常見到的作者名字，但他們都沒出席我論文發表。我的論文題目和他們相近，但我的看法和他們不一致，原本預期他們會參與，結果却是他們並沒有參加本人論文發表。以致失去一次和他們辯論學術見解機會。我想，他們都自認自己是大師，可能不認爲我們的內容有什麼突破。所以，下次若再有這種研討會的機會，我一要先 MAIL 邀他們來聽我的發表，並請他們指教。我認爲我的研究主題對外觀設計很重要。下次一定要好好握發表的機會。

其次，看到國內的論文題目是追隨別人的研究，很難突破。這可能是和國科會審查計畫的方式有關。因爲。在國內，具有前瞻性的研究計畫很不容易過，因爲這個主題全世界沒人做, 所以國科會的審查者就覺的這個計畫是有必要的。這也是國內研究的一大迷思，只要是世界上沒有出現相似的研究，國科會是不會給予支持。學界和產業界不同。我認爲，學界更應該投入於沒有人做的領域，因爲他不像業界，有時間和成本及成敗的壓力。如此，台灣才能展現學的活力和創造力。

最後，雖然能上台做 keynote 演講的人都是學有專精的人，但此次研討會中，他們的演講並沒有很大的突破。因此，我深刻體會到，目前的知識的交流是透明的，因此，即使沒有現場聆聽他們的演講，其知識背景也相差不遠。但重點是，我們如何以創新創意的方式，活用這些新知。另外，即使'當某公司已真正應用這些知識，而且得到不錯的創新，這些公司會將之視爲公司內部的 know how 也不會輕易向外說明。

附件

報告論文： A study of affective meanings predicting aesthetic preferences of interactive skins

A Study of Affective Meanings Predicting Aesthetic Preferences of Interactive Skins

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Abstract - **The purpose of this study was to explore the affective qualities which influence subjects' aesthetic preferences. The Stepwise Regression Analysis was performed to explore what affective meanings influenced subjects' aesthetic preferences. The aesthetic preference was regarded as a dependent variable; the 11 affective meanings found in previous study were independent variables. The result showed that 6 adjective pairs: "exquisite", "original", "strong", "childlike", "intense" and "pure" entered the model. Besides, "exquisite", was the most important affective quality in judgment of aesthetic preferences. It implied that designers had to create the interactive interfaces with an "exquisite" affective quality to please users' aesthetic affects. Furthermore, the other five affective meanings which were not selected into the model were called LoSPA affective meanings. It implied that designers had to create a specific skin with LoSPA to satisfy specific target users. Finally, the outcome also showed that rating consistency of aesthetic preferences was significant lower than most of affective meanings with feeling qualities.**

Keywords – **Aesthetics, affective meaning, skin**

I. INTRODUCTION

An aesthetically pleasing design can be more influential in affecting user preferences than conventional operational usability in interactive systems [1]. Several studies tried to find aesthetic factors, such as physical features, aesthetic prototypes, audience arousal…etc. However, these can not completely explain why aesthetic preferences are various for different audiences, or in different occasions. The author argues that the affective meanings evoked from an object as mediator variables sway human judgment of aesthetics. However, it was found that there was little literature to explore what affective meanings influence aesthetic judgment. Therefore, this paper tried to find the affective meanings affecting the aesthetic preferences of interactive interfaces. The outcomes of this paper would suggest designers to create skins with these affective meanings.

II. LITERATURE REVIEW

A. Physical Features

Physical features of objects might be critical factors of human aesthetic preferences. Empiricism in the philosophy of science emphasizes evidence, especially as discovered in experiments. Aesthetic empiricism believed that aesthetic pleasure was occasioned simply by "formal quality" of objects, such as colors, shapes, lines and the relationships between these [2]. However, in the studies of aesthetic preferences of color combinations in computer displays, the authors' recommendations about subjects' aesthetic ratings for color combinations were not always consistent with each other [1]. Hence, the object configurations themselves might not be a key factor to affect one's aesthetic judgment.

B. Prototypes

Aesthetic prototypes might be used to explain why physical features were not the key factors of aesthetic judgment. Aesthetic prototypes are the typical forms of the categories the audiences prefer [3]. The degree close to aesthetic prototypic exemplars of the preferred categories decided the degree of human aesthetic preferences. However, human aesthetic prototypes might be different due to diversities of cultures [4]. Besides, an audience's aesthetic prototypes would be changed when he was educated, or trained, to learn more the contents of the works [5]. Numerous studies demonstrated profound differences in the aesthetic preferences of novices and experts. In general, people without art training preferred simple and symmetric visual elements, whereas people with art training preferred complex and asymmetric visual elements [6].

C. Arousal Theory

Arousal theory might be used to explain why one's aesthetic prototypes were changed by way of training. Cupchik believed that the judgment of aesthetic preferences was decided by object configurations that evoked pleasure or arousal [6]. Human preferred the objects eliciting their certain middle degree of arousal [6, 7]. Winston & Cupchik explained that naïve audiences who had no experience on complex arts preferred middle complex arts which elicited their middle arousals [6]. Thus naïve audiences had a "middle complication" prototype. However, the "middle complication" prototype was replaced with a "more complication" prototype when they were trained with complex High Art and became experienced audiences. Consequently, middle complex arts did not elicit enough their middle arousals for experienced audiences. Only more complex

arts could elicit their middle arousals because they had a "more complication" prototype, no more a "middle complication" one.

D. Affective Meanings

However, in some situations, some objects whose appearances were proximal to one's aesthetic prototypes were not preferred although his aesthetic prototypes were not changed. For example, Meegeren's painting, *Disciples at Emmaus*, imitated the painting style of Vermeer realistically and claimed that the fake was Vermeer's work. Art critics gave it high appraisals. However, when the painting, *Disciples at Emmaus*, was found to be by Meegeren and not by Vermeer, the world's estimation of its value fell dramatically [2]. In this situation, the aesthetic prototypes in audiences' mind were not changed and their arousal levels were not changed either because the recognized complexity of the fake work was the same as the original work. However, their aesthetic preferences for the fake were degraded. Hence, the arousal theory and aesthetic prototypes did not properly explain why audiences rejected fakes.

Affective qualities of objects might explain why audiences degraded the aesthetic appraisals for a fake work. Affective qualities of objects were commonly described with affective meanings, such as simple, vivacious, or elegance [8]. They were human affective impression of the object a human perceived. When the *Disciples at Emmaus* was found to be a fake work, the affective quality, "original", audiences felt, or perceived, from the work was changed into "fake", or "plagiarizing" which evoked audiences' negative feelings. Therefore, the work's affective qualities presenting negative affective meanings elicited audiences' negative affective responses and resulted in detriment of aesthetic ratings. Hence, people tended to depreciate a fake work and gave it low ratings of aesthetic preferences even though the fake work was almost the same as the original one.

E. Context

Besides, Contextualist believes that most works are not to be considered in isolation; and each of them has a history and a context [2]. The affective quality of the objects might change when the context in which the objects were was changed. For example, the form of "Fountain", one of the works of Marcel Duchamp (1887-1968), was a ready-made urinal. It was deemed as an aesthetic work, but it was not an admirable work when being put in the restroom. It was because that the affective quality of the "Fountain" might include affective meanings, "original", "masculine" and "amazing" when exhibited in a museum, but it might include "foul", or "disgusting" when set in a restroom. The affective meanings, "original", "masculine" and "amazing", elicited positive affective responses; but "foul", or "disgusting", negative. Therefore, audiences preferred "Fountain" in a museum to "Urinal" in a restroom. Therefore, for an object (i.e. "urinal" here), the different contexts where it exists would change its affective quality.

Furthermore, audiences' prototypes did not change when an object was put in different situations, but audiences did prefer the object in a museum to that in a restroom. Therefore, it seems that aesthetic preference judgment might not depend on aesthetic prototypes, but on an object's affective quality. That is, when an object is presented, one perceives not only its feature qualities, but also the affective meanings where it presents in some specific situations. The affective meanings serve as affective prototypes which would provide essential reference points to permit people to judge objects quickly.

F. Perceived Usability and Beauty

Previous research suggested that aesthetic perceptions of an interface were highly correlated with perceived usability of the interface [9]. Huang [10] also found that color combinations with bad quality in both legibility and comfortability degraded subjects' aesthetic preference. Huang [11] extended the idea of "halo effect" to explain why aesthetic perceptions were highly correlated with perceived usability. He believed that a positive feeling about an interface with high perceived usability was extended to the aesthetic rating dimension. Therefore, aesthetic perceptions were highly correlated with perceived usability.

Affective meanings could be used to explain why aesthetic perceptions were highly correlated with perceived usability. When an object was perceived with "good usability", the affective quality would present a positive affective meaning, "good", resulting in a positive affective response. Therefore, the object with high perceived usability was rated at a high aesthetic preference.

G. Perceived affective meanings without contextual cue

In some situations, objects' affective qualities still existed even though we did not know the content, or knowledge, of the object. For example, one admired the beauty of a sunset scene not because of the knowledge of the scene, but the scene itself elicited his affective meaning "glory". He liked the scene because he liked the feeling of glory. Therefore, the affective meanings could explain why the aesthetic objective views believed that the object's intrinsic properties would sway the judgment of beauty even when the viewers did not have any information about the object. These properties could evoke audiences' feelings, or affective meanings. This affective meaning of the object properties would sway their judgment of beauty for the object.

However, the sunset scene may become not so beautiful after he quarreled with his friend because the quarrel (i.e., context) playing a role on the priming task changed the affective quality of the sunset scene. In this situation, he did not like the sunset scene because the affective meaning of sunset scene might become vile at

that moment. Audiences' bad emotion, or core affect, changed objects' affective qualities. That is, physical prototypes did not decide audiences' aesthetic preferences, but the affective quality played as a mediator variable in influencing audiences' judgment of beauty.

In summary, Affective meanings are the critical factor influencing human judgment of beauty.

III. METHODOLOGY

Therefore, the purpose of this paper was to find the affective meanings affecting the aesthetic preferences of interactive interfaces. First, subjects were recruited to rate the affective meanings and an adjective pair, "Ugly-Beautiful" (called "Beautiful pair" in this paper) with semantic differential methods for interactive skins. The rating score of Beautiful pair stands for subjects' judgment of beauty for the skins; the rating score of affective meaning stands for subjects' opinions about the intensity of the affective meaning evoked from the skins. Next, the rating scores of the Beautiful pair were regarded as a dependent variable; the others as independent variables. Regression analysis with stepwise were used to construct a predict model of aesthetic preference for interactive interfaces. By regression analysis, the independent variables which did not significantly predict aesthetic preference would be eliminated. Finally, the affective meanings which can predict aesthetics are found.

A. Collecting Affective meanings

Previous studies related to Kansei engineering collected affective meanings from various specialized journals, catalogues and websites. In order to reduce the amount of adjectives and find the typical affective meanings, Factor analysis was conducted to categorize these affective meanings. These categories were named and represented al the collected affective meanings.

However, these previous studies did not discriminate affective meanings from low to high level product attributes. For example, when compared with "cheerful", "colorful" is a low level attribute to objects. The judgment of a low level attribute (e.g. colorful) is clear and predictable for most of all audiences; however, the judgment of a high level attribute (e.g. cheerful) is varied from different audiences.

To avoid the pitfalls, my colleagues and I [12] classified 628 affective meanings (collected from master theses, PhD dissertations, journals, catalogues, books and websites) into six categories in light of their attribute levels. First level, "Form elements" referred to the affective meanings related to visual elements of forms; second, "Form organization" referred to the affective meanings related to the construction of visual elements; third, "Interactive features" referred to the affective meanings related to usability attribute; fourth, "Stylistic quality" referred to the affective meanings related to style description; fifth, "Feeling quality" referred to the affective meanings related to feelings evoked from the interfaces, such as gorgeous, vivacious, cheerful…etc.; sixth, "Emotional quality" referred to the affective meanings related to the emotions evoked from interfaces. We adopted "Feeling quality" as affective meanings to express interactive interface's affective quality. There were 75 adjective pairs of affective meanings related to "Feeling quality". Then, Semantic differential approaches were used to rate 16 windows media player skins (showed in Fig. 1) and factorize the 75 adjective pairs randomly arranged. Finally, eleven factors were generated to represent all the 75 affective meanings. They were named as "exquisite", "original", "vigorous", "Hi-tech", "strong", "childlike", "intense", "supernatural", "exaggerated", "formal" and "pure", respectively. Because the eleven factors were qualified to express all 75 affective meanings with "feeling quality", the present paper would deem these adjectives as typical affective meanings and use them to predict the aesthetic preference of interfaces.

Fig. 1. 16 windows media player skins used in the questionnaire.

B. Procedures

Subjects evaluated 16 windows media player skins (shown in Fig. 1) selected from Ms-office official website with 12 pairs of affective meanings. Forty-six subjects recruited from National Formosa University rated the skins with a 7-point Likert scale. The test was programmed with Director 8.0 and performed on a 20" TFT LCD screen. Each test screen only showed a skin and an adjective pair with 7 buttons scoring -3 to 3 from left to right between the adjective pair shown on Fig. 2. If subjects believed that their feelings evoked from the presented skin were closer to the adjective on the right side, they chose a button closer to the right adjective, and got higher positive score, vise versa. The combination of skins and adjective pairs was random to avoid the priming effect.

Fig. 2. A test interface in the experiment.

IV. RESULTS AND DISCUSSIONS

In this study, the rating score of a specific affective meaning for a specific skin reflected the strength of the

affective meaning evoked from the skin. The author argued that not all affective meanings could be used to predict aesthetics. Stepwise Regression analysis was used to select the affective meanings which could predict judgment of aesthetic preferences. By Stepwise regression analysis, the six adjective pairs enter into the model where R-square is 0.527. These adjective pairs that could predict the "Beautiful-Ugly" pair (i.e. aesthetic preference of the skins) are listed on Table 1. They are "exquisite", "original", "strong", "childlike", "intense" and "pure". Among these 6 affective meanings, the standardized coefficient (β) of "exquisite" (0.560) is larger then the others. Therefore, the affective meaning, "exquisite", is the most important affective quality influencing subjects' judgment of aesthetic preferences. The outcome implies that designers have to create the interactive interfaces with an "exquisite" affective quality to please users' aesthetic affects. Following-on studies might explore the product features which evoke user "exquisite" feelings. Besides, the affective meaning, "intense" has an inverse effect on beauty judgment because the β value (-0.158) is negative. That is, the interface with high "intense" has a low aesthetic preference.

TABLE I
THE REGRESSION MODEL FOR PREDICTING AESTHETIC SKINS

Model	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Sd. Err	Beta (β)	t	Sig.	Tolerance	VIF
(Constant)	-0.173	0.056		-3.084	0.002		
Exquisite	0.558	0.031	0.560	17.878	0.000	0.661	1.513
Childlike	0.155	0.029	0.155	5.415	0.000	0.791	1.265
Intense	-0.159	0.032	-0.158	-4.973	0.000	0.640	1.561
Original	0.145	0.029	0.161	5.083	0.000	0.649	1.541
Pure	0.101	0.032	0.096	3.152	0.002	0.704	1.420
Strong	0.085	0.039	0.068	2.199	0.028	0.687	1.456

*Dependent Variable: Beauty

Besides, the collinearity diagnostics show the independent variables do not depend linearly on each other. Tolerance, gives a value between zero and one, which is the proportion of a variable's variance not accounted for by the other independent variables in the regression. All our values are close to one, so these variables do not depend linearly on each other. In fact, the possibility of high collinear correlation among the independent variables should be low because these independent variables are main factors extracted by factor analysis with varimax rotation in Huang et al. [12]. These variables should be orthogonal with each other.

A. Rating Consistency for Each Affective Meaning

Rating Consistency refers to the extent of the agreement on intensity ratings of a specific affective meaning among judges for a specific interactive interface in this paper. For example, a system interface would get high rating Consistency if all judges rate the aesthetic preference of a specific system interface with similar scores; otherwise, it gets low rating Consistency. The intra-class correlation coefficient (ICC) is used as an index of estimating inter-rater reliability, or called rating consistency here. ICC was performed to explore rating consistency by using SPSS. The Single Measure Intra-class correlation (0.305) shows a low correlation among these subjects. That is, the rating consistencies were low among subjects.

Huang [1] used the Standard Deviation (SD) as a criterion to evaluate the rating consistency of subject aesthetic preferences. Likewise, in this paper, a skin's affective meaning with a large SD has a low rating consistency among all the recruited subjects for the skins. To explore the rating consistency of 12 adjective pairs (11 affective meanings plus a Beautiful pair), two-factor factorial design (12 affective qualities $\times$ 16 skins) was performed. The outcomes show that the effect of the affective qualities is significant ($F(11, 165)=7.024$, $p<0.01$). Table 2 shows the SD for each affective meaning. It shows that the "strong" has the less SD (1.2751) than the others; that is, the "strong" has higher rating consistency. Besides, all the values of SD of affective meanings are significantly smaller than "beautiful" (1.8008) excerpt "super-natural (1.7351)", "formal (1.7946)" and "original (1.8441)" which do not significantly differ from "beautiful". As mentioned above, all the collected affective meanings were classified into six categories from low to high level construct attribute. The affective meanings used in this study were belonged to the category of "feeling qualities" in this paper; aesthetic preferences (i.e. "beautiful") are a kind of "Emotional quality" whose construct level is higher that "feeling quality" because they are personally emotional (pleasure) responses to an interface skin. The judgment of a low level product attribute is more consistent among audiences than that of a high level product attribute. The result agrees this argument.

TABLE II
THE SD FOR EACH AFFECTIVE MEANING

Affective quality	N	Mean of SD	Duncan Group			
strong*	16	1.2751	A			
vigorous	16	1.4836	B			
childlike*	16	1.4968	B			
exaggerated	16	1.5198	B			
pure*	16	1.5318	B			
intense*	16	1.5487	B	C		
Hi-tech	16	1.5666	B	C		
exquisite*	16	1.6482	B	C	D	
super-natural	16	1.7351		C	D	E
formal	16	1.7946			D	E
beautiful	16	1.8008			D	E
original*	16	1.8441				E

* The affective meaning selected in the Regression Model

B. Affective Meanings with HiSPA

The Stepwise Regression analysis divides the 11 affective meanings into two parts. 6 affective meanings are kept in the regression model. They are "exquisite",

"original", "strong", "childlike", "intense" and "pure". Excerpt "intense", the β scores of all the others are positive; it means that the rating scores of aesthetic preferences would be high for all subjects when the affective qualities of any skins present these affective meanings intensely, vice versa. Inversely, for the "intense", which β score is negative, it means that the rating scores of aesthetic preferences for all subjects would be low when the affective qualities of any skins present these affective meanings intensely, vice versa. This kind of affective meanings is called Affective meanings with High Stable Prediction of Aesthetic preferences (HiSPA). That is, the intensity of the affective meanings with HiSPA decides the subjects' aesthetic preferences. The outcome implies that designers have to create skins with these 6 affective meanings with HiSPA. The following-on studies could focus on exploration of the skin physical features to satisfy these 6 HiSPA affective meanings.

C. Affective Meanings with LoSPA

The other 5 affective meanings do not enter the Regression model due to the low correlations with aesthetic preferences. They are "vigorous", "Hi-tech", "supernatural", "exaggerated" and "formal". It indicates that subjects who rate the skin affective qualities of the LoSPA affective meanings could rate the skins with any levels of aesthetic preference scores. That is, it is impossible to predict aesthetic preferences with these affective meanings. Therefore, these affective meanings are called Affective meanings with Low Stable Prediction of Aesthetic preferences (LoSPA) because they cannot stably predict subjects' aesthetic preference. The LoSPA affective meanings could explain why an object presenting identical affective meanings is accepted by one audience, but not accepted by the others. It implies that designers have to create a skin with LoSPA to satisfy specific target users.

D. Limitations

The Semantic Differential scale, used in this study, is the most prominent types of verbal scales. Verbal measures are language-dependent. The measure quality is dependent on subject's language proficiency. The subjects recruited in this study are Taiwanese students who can speak mandarin well. The outcomes might be hard to generalize to the other subjects who do not speak mandarin. It needs more studies to recruit subjects who do not speak mandarin.

V. CONCLUSION

This study has demonstrated that six affective meaning would influence subject judgment of beauty for interactive skins. Among the six affective meanings, "exquisite" is the most important affective quality influencing subjects' judgment of aesthetic preferences. Beside, the finding agrees with Huang's argument [12] that the judgment of la low level product attribute among audiences is more consistent than that of a high level product attribute. Next, the outcomes imply that designers had to create the interactive interfaces with HiSPA affective meanings to satisfy most of Chinese speakers; and create a specific skin with LoSPA to satisfy specific target users.

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