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AN ASSOCIATION EXPERIMENT FOR FINDING EMOTIONAL EXPRESSION BETWEEN DESIGN AND MUSIC

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ABSTRACT

Our research revolves around developing a web-based platform to explorer the relationship between music and image. It is a pervasive belief that music can often produce emotion in listeners. Image, at the other hand, also arouse viewers sensation. Three steps of an association experiment are conducted: 1) finding the possible adjectives, 2) unleashing the alternative represented images, and 3) finding the appropriate associations. One of Substantial findings is that music-background subjects have stronger and superior perception of emotional expression than design-background subjects.

Keywords: *music, image, emotional expression, adjectives, association*

1. BACKGROUND AND MOTIVATION

1.1. Background

How to represent the emotional expression of design is often a challenging issue in learning design. The shape and structure of design may reflect its contextual culture, aesthetics, or designer's background additionally. These all together create the emotional expression of design, and the expression itself might induce users to communicate with the product intuitively. The ways in which designs of different style interact with users are special but unique through their individual emotional expressions. Such unique means arouses users' affection and sensation, and therefore users are willing to spend more time with these emotional expressive artifacts.

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On the other hand, music as an artifact on its own has also emotional expression, and with its emotional expression both performers and listeners communicate with each other. Music not only speaks in its own semiotics but also reflects concept and human desires in a more general fashion. When listening to music, combination of abstractness with concrete emotional experience such as a happy moment in the past, the feeling of long for future might flash within listeners' minds. The emotional expressive abstractness could be in any kind of form, such as smell, image, or even temperature of specific circumstance. Emotional expression in music may even further involve the awareness of tensions, fulfillments, and resistance of a piece (of music).

Furthermore, design, especially the element of design—color, and music are highly related since Ancient Greek time. Aristotle developed a color-music theory by transferring consonances of tonal intervals into colors. Also, many composers often take pictures as inspiration for their compositions. For example, Liszt's Lo spozalizio from Années de Pèlerinage at 1839 was based on a painting by Raphael. Conversely, painters have derived inspiration from musical compositions or the abstract idea of music. Vasily Kandinsky and Paul Klee were best examples. All this proved that design (or visual elements) and music are interrelated with each other artistically. In addition, music is also an influential factor for motion pictures' perception. Since audio-film invented in the 1930s, music and movie have been all bit inseparable. Furthermore, music highlights some of the most emotionally charged moment in film.

Besides the general association of music and color/visual elements as well as music and motion pictures, music and design are very similar in many regards. First, they communicate with its ultimate consumers (or listeners in music) in a similar pattern. The design can be better understood if one realizes the design process. Music as well can be thoroughly appreciated if one comprehends the creative process of music. Secondly, both musicians and designers need to develop a special way to communicate with the appreciators without the assistance of verbal or written signs. Furthermore, the way to appreciate its artifact, or composition, is intimate, subjective, and personal. For example, one design may be regarded as significant in one particular country, but inappropriate in another one. This is applicable in music, too. The same piece of music may be perceived differently depends on listeners' background and tastes.

Since music and design are two different domains but highly interrelated in the representation of both creating and evaluating process, how to integrate these two together, become an interesting but demanding task. Imagining we make design sounds more musically, or in reverse make music visuals fashionably, how intellectual and fascinating it would be? Artifacts may become more attractive and appealing due to the musical stimuli in the design process, reflecting creators intimate expressive feelings.

1.2. Motivation

Cross-disciplinary study of music and design is deficient because of their diversity and complexity. Here we hypothesize that music by nature may arouse conscious connotation or unconscious visual process. If it is true, reversely we may assume that designers with sketches in the initial design process may also have a melody accompanying the will-become-artifacts. Evidences are shown in Louis Kahn and Frank Lloyd Wright's design

behaviors. A good example is Frank Lloyed Wright's famous anecdote of the design for Fallingwater. There he indicates that before committing ideas to the drafting board he was able to: "Conceive the building in the imagination, not on paper but in the mind, thoroughly…" (Tafel 1979). The mapping between design artifacts and music are illustrated in Figure 1.

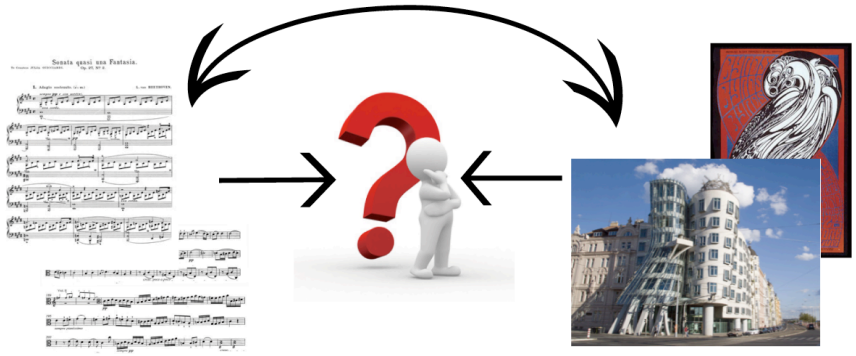


Figure 1: the emotional expression between music and design artifact

By verifying this hypothesis, we try to map the musical connotations in listeners' minds with images. In other words, we will explore the emotional expression between images and music.

Although sonic materials have proved for contributions to industrial design as for perception of a brand or a product, no sonic design was discussed in this research. Here we focused on how music may relate to image and provided a possible direction to link music and design with a connecting bridge—keyword or adjectives. As the nature of pilot study in this research, no attempt, for example, is made yet to deal with the scientific measurement of emotional expression—to examine whether this music is more related to that image, or how close music and images are interrelated.

2. LITERATURE REVIEWS

Association (Ball and Christensen 2009, Dahl and Moreau 2002) is a common method to link two different domains. People in one domain may use analogies to stimulate and explore new ideas from another domain. Among those researches, reasoning analogy (Christensen and Schunn 2007) is a frequent approach deployed by a team, and usually served as three primary functions or purposes: problem identification, problem solving, and explaining, within which between-domain analogies prevailed during explanation of solution. This provides the base for our between-domain association method.

Another perspective (Dahl and Moreau 2002) also suggests that distant analogies have a positive effect on the estimated originality of resulting product designs. Recent study by Ball and Christensen further discovered that analogies and mental simulations are strategies deployed to resolve uncertainty (2009), which proposes that the designer's imagination is used to test out ideas and concrete solution concepts. Both findings prompt this research to examine the impact of distant analogy between music and design, and whether mental simulations exist.

The appeal of music is believed to lie in its ability to induce and represent emotions (Davies 1994, Budd 1985, Meyer 1956). Music is usually viewed as an effective means of communicating emotions. Not only has the implied structure of music represented emotions, but also the way the composition is performed conveyed emotions. Both empirical research (Gabrielsson and Diana 1999, Persson 1995, Woody 2000) and biographical accounts (Schumacher 1995, Kennedy 1990, Blum 1977, Seckerson 1991) have suggested that performers conceive performance in terms of emotions, moods, and scenarios. In terms of music perception and music cognition, (Peretz, et al. 1998) claimed that decoding of emotion from music is quick. (Konishi, et al. 2000) revealed that listeners are able to decode basic emotions better than chance even from single voice tomes. Additionally, several studies in psychology (Juslin and Laukka 2003, Zentner and Scherer 1998) dealt with communication of emotion through music, such as how an emotional state can be expressed through music or inferred from music, and what formal and acoustic patterns are responsible for emotion attribution and emotion induction.

In design, emotion represents a different dimension of perception between users and the products. The interest of emotional design is widespread for both research and practice in this decade. (Pine and Gilmore 1999) predicted that the development towards an economy driven by experiences, foreseeing that the world of goods and service was diminishing. (Jordon 2000) proposed a pleasure-based approach to human factors by addressing the relationship between human and products. As a matter of fact, neutral products never exist. Any design will elicit emotions from users, or convey emotions from its designers, regardless of designers' conciseness or intention.

With reviews on analogy reasoning, music emotional expression characteristics and emotional design above, the triplets of music/association/design (image) via emotional expression characteristics are the approach conducted in this research, the relation of triplets is shown in Figure 1.

3. THE ASSOCIATION EXPERIMENT

One of the most common ways to associate music and design is through adjectives. To view adjective as a middle bridge between design and music, these adjectives must be similar in some degree and can be categorized. Three research steps are planned and executed: 1) finding the possible adjectives, 2) unleashing the alternative represented images, and 3) finding the appropriate associations between music and images. Each step is described in details in the following sessions.

Since connotations and associations are interpersonal, the subjects must have the same cultural background. Therefore the concept of the images may have the same significance and impact for the members of the group. Chinese-speaking people are selected due to the location this experiment is conducted. Also, as a language, Chinese itself has strong association with graphics and visualization, which serves best for this experiment. A small group of 16 subjects are selected for conducting in-depth and frequent interviews, for incrementally uncovering the obstacles within this research.

3.1. First step: Finding the adjectives—the view of musicians

First of all, we need to find the possible adjectives appealing as the description of emotional expression specific for music. For our purpose, abstract musical expression can be transformed into illuminating adjectives. Since many performers conceive of performance in terms of emotions, moods, or scenarios, they might have a more precise or faithful intuition for music. Thus the basic requirement for describing possible emotional expression that is suitable for music-visual association should be within the knowledge of musicians than designers. Therefore, musicians are requested in the first stage to provide adjectives related to music.

The collection of adjectives is based on the inputs from twelve musicians from classical music and film music background. The purpose of choosing subjects from different profession is to have a differentiation over the abilities in terms of musicianship. Musicians are more sensible to the adjectives than others, while soundtrack composers due to their association abstraction abilities on both music and visual are sharp to images, and thus act as a mean to adjust the bias.

Both musicians and original soundtrack composers are requested to provide ten adjectives described of emotional expression of music. Firstly, the analysis and evaluation method of the deduction is based on professional selection of experts. Secondly, one central adjective is selected within each group for identification. Then surrounded by this central adjective, other similar adjectives of adjacent emotional expression are grouped into fourteen groups and each group contains two parts: part A and part B, for illuminating the differentiation based on their different emotional characteristics over the similar emotional expression (shown in table 1).

Table 1: Table 1 Fourteen groups of adjectives based on their characteristics

#	Leftmost adjective						Rightmost adjective					
1	sorrowful	mournful	melancholy				Happy	comfortable	rhythmic	lively		
2	imaginable	diverse	colorful	rich			Bored					
3	passionate	expressive					sentimental	personal	Noble	elegant	delicate	graceful
4	solemn	deeply earnest	sacred	unlimited			quasi ugly	quirky	deceptive			
5	soft	gentle	harmonized	Corresponding			Nervous	restless				
6	energetic	lively	vigorous	exiting	sparkling	melodious	desperate	fraught				
7	pleasant	enjoyable	cheerful	lovely			emotional	dramatic	powerful	strong contrast		
8	humorous	witty					Serious	ironic				
9	enchanted	cantabile	sweet	flowing	smooth		mysterious					
10	unified	healing	moving	warm	contented		Lamented	grieved				
11	dreamy	poetic	ideal	artistic	abstract		Clear	precise	Direct			
12	tranquil	peaceful	deep				Agitated	motivated	thrilled			
13	reserved	deep-rooted	spiritual	conscious			multifaceted					
14	brilliant	virtuoso					Simple					

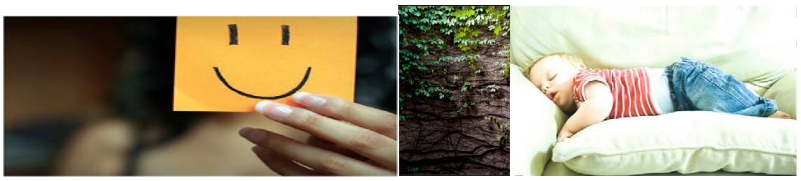
3.2. Second step: Finding the images—the view of designers

The objective at this stage is to find possible related images based on the analyzed adjectives provided by the musicians. The subjects are graduate students of computational design from National Yunlin University of Science and Technology (NYUST) in Taiwan. Graduate students are chosen because graduate students are sharper in many regards than novice designers, and may provide more appropriate visual responses. Furthermore, these design students are visual-based, and may offer images from designer's perspective.

Three procedures are conducted in the second step. First of all, the grouped adjectives are translated from Chinese into English for effective image-searching. Second, using search engine such as google/flickr to find twelve images from online database for each grouped adjectives. Third, in order to achieve data cleaning purpose, professional experts are brought in for removing the unassociated images that deduces the total images further from twelve to seven for each group. The reason for choosing seven images is based upon (Miller 1956)'s theory where working memory has a limited capacity of "7 plus or minus 2".

In terms of outcome, each column has two sections: Part A and Part B, with 7 images in each section. One adjective symbolizing the nature of each group is chosen and listed on the front of each column. According to the images offered from visual-based designers, some images are contradictory within one group. Therefore, in-depth interviews are required. Outcome of group 1a (happy) is shown in Table 2. The conclusion will be summarized in the discussion session.

Table 2: Table 2: Group 1A: Happy

Adjective	**Images**
Happy comfortable rhythmic Lively	 

3.3. Third step: Association—verification by cross-disciplinary experts

The objective of this step is to verify the relationship between music and image, examining whether the adjectives the subjects provided are identical to that of the first step. The experiment is conducted by cross-disciplinary experts. Eight subjects in this stage are either design professionals with a long history of music study or musicians with design-appreciation.

Based upon the collected adjectives from step one, 14 soundtrack excerpts are selected by a group of musicians. The reason for selecting original soundtrack music is that it is simple, direct, clear, and theme-matched. Unlike classical music with many layers in the structure, original soundtrack music has relatively few layers, thus provides listeners an easy access. Also, classical music with its sophisticated texture, takes more time to accumulate the emotion. Soundtrack music in contrast is supposed to capture the emotion in an instant, and therefore better suited for this experiment.

A web-based experiment platform is implemented, and seven images from step two for each group are shown on the screen with the soundtrack excerpts as background music. Subjects are requested to listen to the music and watch the images simultaneously, meanwhile input at least three adjectives that match both the excerpts and images. Analysis is conducted after collecting the adjectives, verifying whether the adjectives retrieved from the third step are identical with that in the first step.

In terms of outcomes, the results have confirmed that: (a) the relationship between music and image exists, and the association is reliable regardless of false case; (b) musically trained subjects were highly successful at recognizing the intended emotional expression, whereas design-trained subjects had a lower accuracy (with the 89 % accuracy for musically trained subjects and 72 % for design-trained subjects); and (c) the categories of basic emotion could be associated easily. The result of sample group 1a (happy) is shown in table 3.

Table 3: Table 3: Group 1a (happy)

Music#	Images	Subject #	Adjective 1	Adjective 2	Adjective 3
1a happy		Music A	active	Hopeful	vital
		Music B	new-born	Fresh	rising
		Music C	vibrant	Hopeful	proceeding
		Music D	pleasant	with hope	dazzling
		Design A	fantastic tour	Colorful	blue-black background
		Design B	light	Growing	happy
		Design C	energetic	Happy	fresh
		Design D	new-born	pleasant	energetic

4. LESSONS LEARNED

Following the experiments, the mapping (adjectives) between music and images are found and the associations reflecting the mapping are also verified. During the research process,

eleven lessons are revealed for more effective results. Among those, Seven major lessons are described as below:

1. The percentage of positive description is over weighted than negatives ones. This suggests music within musicians' mind might carry an optimistic quality.

2. Images selections need further constraints to reduce the complex factors between adjectives and represented images. Although most designers picked easy related images to present the adjectives, such as sarcastic posters for the adjectives ironic, some considered specific parameters such as emphasis on color, form or scenarios in the process of selecting an image (according to the interviews afterwards). Since the subjects of the third step did not know which parameter is applied to the image, they might associate the meaning using another parameter and then come up with unexpected results.

3. Scenario-based method is often applied for finding associated adjectives when indirect association appears. Scenario-based method here refers as a method of using synthetic description of events or series of actions and events, to find images. For example, "bored" is one of the unimaginable adjectives, and to find an image represents "bored" is difficult. Therefore, one interviewed designer said that she has to picture herself in a bored condition and see under which situation she senses bored. Sitting stuck in traffic is a possibility while driving alone on an endless path in the country is another alternative.

4. Subjects of music background tended to ignore the perceptual details, and focus on the concept for better integrating details into generalizations. Many subjects with music background reported that the images within same group occasionally seem contradictory to them, for example in group 2a. In that case, subjects disregard the differences among the different images and extracted what is common among them.

5. The adjectives selected by the subjects sometime are strongly influenced by the music due to the implicit representation of selected images in a particular group. This creates a need for selecting the weight for either music or images. For example, Group 11b is a false case since none of the results match the supplied adjectives. However, all adjectives provided are very similar and pointed to the same direction. Thus a further examination of the interrelation and validity of images and music is required.

6. Thematic music had greater impacts than images. Take the false case 11b of the third experiment for example; further investigation is conducted for exploring why the subjects provided similar adjectives. After interviews, the thematic characteristic of music of group 11b was too strong and could not present the accurate emotional expression of the adjectives.

7. Adjectives provided that are not emotional expressions will have the problems for selecting appropriate music. An assumption for the false case is that the bridged adjectives gathered and grouped in the first experiment "clear", "precise" and "direct"

are not emotional descriptive words, and therefore is difficult to find appropriate music. However, further experiment for verifying this assumption is needed.

5. CONCLUSION

Music and images can be related with adjectives as middle bridge. People with same cultural background have similar feelings toward music and image. Substantial finding of this paper is that music-background subjects have stronger and superior perception of emotional expression than design-background subjects. As the result shown in the third experiment, musically trained subjects have a high accuracy for emotional expression of 89 percentages than design-trained subjects of 72 percentages. If design-background subjects are taught to sense music, or add musical elements in the creating process, they might be able to create artifacts of emotional expression which is friendlier and more pleasurable for users. Eleven lessons learned and refinements of experiments from this research can towards a further investigation on this subject that can provide a better understanding on how and what kind of adjectives can associate music and design, and further provide a useful and powerful platform for learning design with emotional expression capability. Furthermore, with the support of scenario-based method, the accuracy of recognizing the emotional expression and experiment can provide a better reflection on the association and their impacts.

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