1. INTRODUCTION

Typeface is fundamental to document designs. As a visual element of the document, type affects the reader’s initial impression and reading experience [1]. It is proved that typefaces have significant impacts on human emotions in the research of document design [2]. Nowadays, the needs of multilingual design are growing for multilingual signage, website, etc. There are some researches on affective design of Latin type [3], Japanese type [4, 5], and Chinese type [6-8]. The affective knowledge of typeface is proved helpful to font selection in design works, even for document designers and graphic artists. While there are less researches about the emotional response across different typefaces among the people with different cultures.

Chinese characters are among the most widely adopted writing systems in the world by numbers of users. It is used not only in mainland China, Taiwan, and Hong Kong, but Japan, North Korea, South Korea, and Vietnam, although Mongolia and parts of Central Asia. The standard of Chinese characters in these areas are settled independently. The so-called Chinese typeface contains simplified Chinese (SC) used in mainland China and traditional Chinese (TC) used in Taiwan. In Japanese typefaces, Chinese characters remain a key component known as kanji. As we know, there are differences in the perception of typeface personalities between varying cultures, gender, and expertise-level. To our knowledge, there are less research about the affective differences between SC, TC, and Japanese types. In other words, there are less knowledge about the affective differences for typography between the people in mainland China, Taiwan, and Japan.

Our research aims to evaluate the affective performance of Chinese characters in typical typefaces by quantitative methods and compare the different impressions for typefaces among the people with different cultures. We extracted some typical typefaces of SC and TC fonts, and conducted the kansei evaluation experiments to gain the affective evaluation data for these fonts. The preliminary results for the people living in mainland China and Taiwan have been analyzed in [9]. Furthermore, we collected the emotional evaluation data of Japanese typefaces to explore the emotional difference between Chinese and Japanese. Particularly, it is found that for the widely used types Heiti, Songti, and Kaiti, the people in mainland China and Taiwan have opposite feelings of classic and contemporary. The emotional response for these types is generally consistent between the people in Taiwan and the people in Japan.

2. AFFECTIVE EVALUATION FOR TYPEFACES

2.1 Brief history of Chinese characters

Chinese characters constitute the oldest continuously used writing system in the world. They have various script styles as art forms known as Chinese calligraphy. Figure 1 shows a brief history of Chinese characters with some different scripts of 馬 (horse) along history. We mainly
emphasize the evolution of main Chinese and Japanese typefaces. We classify them into four stages in consideration of technical development, as legendary origins, development stage, age of letterpress printing, and digital age. The ancient logographic scripts are called hieroglyph. The earliest known form of Chinese writing is oracle bone script and followed with bronze inscriptions. The earliest standard and adopted script is the variant of Seal script (篆书) during the Qin dynasty [10]. Since then, the Chinese types come to the development stage, typically as Clerical script (隶书), Cursive script (草书), Semi-cursive script (行书), and Wei inscriptions (魏碑). Chinese Calligraphy started a vibrant development in the meantime, especially for Regular script (楷书) which forms the basis of common Chinese typefaces. With the development of letterpress printing techniques in China, the appearance of typography had been more important and popular. From the letterpress printing age to digital age, the typical type during Song dynasty is adopted as Fangsong in Chinese and Socho in Japanese. The Ming type is adopted as Songti in Chinese and Mincho in Japanese. There is no clearly unique type in the Qing dynasty. The Kaiti in Chinese, Kaisho and Kyokasho in Japanese are mainly based on Regular script.

The modern Weibei type is a variant of Kaiti. Moreover, under the influence of sans-serif type in Latin typefaces, Gothic types for Japanese were designed for legibility. It should be noted that the meaning of Gothic in East Asian typography has no relationship with the gothic style in Western typography. The form is based on Clerical script that has high legibility for reading and characterized by strokes of even thickness and lack of decorations. It mainly has two widely used classifications, square sans called kaku gothic and round sans called maru gothic. Thereafter, Gothic type was input into China in the early 20th century, and then Heiti type for Chinese came out.

The standard of Chinese characters in East Asian cultural sphere are settled independently, and some of them share the same glyphs and some have subtle differences. Simplified Chinese character forms were created by reducing the number of strokes and simplifying the forms of a sizable proportion of Chinese characters since 1950s. Traditional Chinese characters follow the shapes that first appeared with the emergence of Clerical script and do not contain newly created characters after 1950s. The Japanese term kanji is written based on the forms of traditional Chinese, while some characters share the same glyphs and some have subtle differences. Nowadays, common ideographs are used for utilizing the Han characters in writing Chinese, Japanese and Korean (CJK) languages for internationalization. Occasionally, Vietnamese is included, as CJKV. The Unicode encoding scheme is used as a common encoding platform to deal with the multilingual collection in a uniform manner [11].

2.2 Font selection

Although there are thousands of Chinese fonts, they can be basically classified into several groups, as Heiti, Yuanti, Songti, Fangsong, Kaiti, other calligraphy types and Decorative types in digital age. In this work, 20 SC fonts and 20 TC fonts are selected shown as Table 1. Among them, 19 fonts are belonging with the same types, and 1 font is different. These fonts are from some famous Chinese font companies, as Sino Type (ST), Dyna Font (DF), etc. Among them, 6 fonts of Heiti, 2 fonts for Yuanti, Songti, and Fangsong which are commonly used in digital devices are selected.
For Japanese typefaces, 20 fonts with similar classifications of Chinese fonts as Kaku Gothic, Maru Gothic, Mincho, Kaisho, Kgyosho, Reisho, and decorative types were extracted shown in Table 1. Each font name or company name is either a registered trademark or trademark of each company.

### 2.3 Kansei evaluation data

For SC and TC types, one chapter of the Analects of Confucius is selected as the content of evaluation target which is widely known in China. Leading is set to 1.6 em. 20 SC samples and 20 TC samples were made for each SC and TC fonts shown as Figure 2. 30 kansei words based on Kobayashi’s color image scale [12] were extracted to express design tastes of typography, as pretty (漂亮), casual (随性), dynamic (动感), romantic (浪漫), mild (温和), feminine (女人味), natural (自然), elegant (优雅), gorgeous (华丽), wild (豪放), classic (古典), formal (正式), chic (别致), fresh (清新), clear (清晰), cool (帅气), modern (时尚), pop (流行), retro (怀旧), noble (高贵), friendly (亲切), contemporary (现代), standard (标准), stylish (时尚), expressive (生动), readable (易读), like (喜欢), reliable (可靠), attractive (醒目), beautiful (美丽). The experiments for SC and TC were conducted separately and all these kansei words are shown by their SC and TC samples. The investigation was executed by 1-5 rating method and conducted for 82 people in mainland China to evaluate SC samples and 82 people in Taiwan to evaluate TC samples in January, 2017.

For the emotional comparison of Chinese and Japanese types, we extract the affective evaluation data of 20 Japanese fonts with 19 kansei words that are common with SC and TC evaluation data, as pretty (プリティ), casual (カジュアル), dynamic (ダイナミック), romantic (ロマンチック), natural (ナチュラル), elegant (エレガント), gorgeous (ゴージャス), wild (ワイルド), classic (クラシック), formal (フォーマル), dandy (ダンディ), chic (シック), fresh (フレッシュ), clear (クリア), modern (モダン), pop (ポップ), readable (読みやすい),

| Classification          | SC fonts          | Sample  | TC fonts          | Sample  |
|------------------------|-------------------|---------|-------------------|---------|
| Heiti / Kaku Gothic    | Heiti             | 纸语    | Heiti             | 纸语    |
|                        | SimHei            | 纸语    | SimHei            | 纸语    |
|                        | Hiragino Sans GB  | 纸语    | Hiragino Sans GB  | 纸语    |
|                        | MS Yaei           | 纸语    | MS Yaei           | 纸语    |
|                        | LantingHei        | 纸语    | LantingHei        | 纸语    |
|                        | Source Han Sans   | 纸语    | Source Han Sans   | 纸语    |
| Yuanti / Maru Gothic   | Yuanti            | 纸语    | Yuanti            | 纸语    |
|                        | DFYuanti          | 纸语    | DF Yuanti         | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
| Songti / Mincho        | Songti            | 纸语    | Songti            | 纸语    |
|                        | SimSun            | 纸语    | SimSun            | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
| Fangsong / Socho       | STFangsong        | 纸语    | STFangsong        | 纸语    |
|                        | Adobe Fangsong    | 纸语    | Adobe Fangsong    | 纸语    |
| Kaiti / Kaisho         | Kaiti             | 纸语    | Kaiti             | 纸语    |
|                        | Weihei            | 纸语    | Weihei            | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
| Seal script            | DFJPinWen         | 纸语    | DFJPinWen         | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
| Semi-cursive script    | -                 | 纸语    | DFGxinshu         | 纸语    |
|                        |                   | 纸语    | HG Gyoshuu        | 纸语    |
| Clerical script        | DFPTanLi          | 纸语    | DF Reisho         | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
| Decorative type        | DFPPop            | 纸语    | HG Soei Kaku Pop  | 纸语    |
|                        | DFPSaslNv         | 纸语    | Elmer (えるまー)   | 纸语    |
|                        | Wawati            | 纸语    | Kirieji (切り絵字)| 纸语    |
|                        | HanziPen          | 纸语    | DF Gagei W6 (DF 風雅体 W6）| 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
|                        | -                 | 纸语    | -                 | 纸语    |
|                        | -                 | 纸语    | HG Soei Presence EB (HG 創英プレゼンス EB)| 纸语    |

Figure 2: Evaluation samples of SC and TC in Adobe Fangsong
like (好き), attractive (目を引く). The evaluation target is designed as a name card shown in Figure 3. The investigation was also executed by 1-5 rating scales method and conducted for 503 Japanese people in 2012.

Though the evaluation samples of Japanese typefaces are different from the samples of Chinese typefaces, we aim to have a preliminary emotional comparison.

3. ANALYSIS AND RESULTS

3.1 Analysis for Chinese types

Ward method is used for hierarchical cluster analysis. As the results, 20 SC fonts can be divided into 3 groups which are close to the classifications of Latin types, as serif, sans-serif, and design type. Here, it is intuitive to use serif and sans-serif for naming font classifications and the design type class includes Calligraphy and decorative types. The details are as follows, where ‘[]’ denotes sub-classifications that have close images.

• Serif: [Adobe Fangsong, SimSun, STFangsong, Kaiti], [DF Yuanti, Songti]
• Sans-serif: [Heiti, LantingHei, SimHei, Source Han Sans, Yanzi], [Hiragino Sans, MS YaHei]
• Design type: [DFPPOP], [Weibei, DFPTanLi], [DFP simsung, DFPShaoNv], [Wawati]

20 TC fonts have different classifications from SC fonts that Fangsong and Kaiti are evaluated with closer tastes of calligraphy, and Heiti, Songti, Yuanti have close tastes which are widely used in the modern digital world. They are divided into 3 groups denoted as calligraphy type, design type, and practical modern type. The details are as follows, where ‘[]’ denotes sub-classifications that have close images.

• Calligraphy type: [Adobe Fangsong, Kaiti, Weibei], [DFP simsung, DFPXingshu]
• Design type: [DFP simsung, DFPPOP], [Hanzizhen, Wawati, DFPShaoNv]
• Practical modern type: [DFP Yuanti, Yuanti], [Heiti, MS YaHei, SimHei, Hiragino Sans, Source Han Sans, LantingHei], [SimSun, Songti, STFangsong]

In these two evaluation experiments, 19 fonts for SC and TC types are same. To get the main kansei factors of Chinese typeface, the affective evaluation data of these 19 fonts from the subjects of mainland China and Taiwan is integrated. The results of factor analysis by promax rotation method are shown in Table 2. Factor 1 is interpreted as Informality with opposing meaning of casual and formal. Factor 2 is interpreted as Practicality denoting the word is readable or not. Factor 3 is interpreted as Times that classic, retro, and contemporary imply epochal meanings. In addition, from the correlation coefficients among these kansei words we found that the people in mainland China and Taiwan have relatively close impressions of standard, formal, reliable, readable, clear, dandy, casual, contemporary, attractive, dynamic, elegant, romantic, and mild. Some of these feelings to fonts have human commonality. For example, the people with same eyesight may have similar feelings of readable. On the other hand, some more feelings which are effected by culture, life environment and experience as classic, pretty, natural, chic, fresh, like, noble, retro, etc.

| Kansei words | Factor1 | Factor2 | Factor3 |
|--------------|---------|---------|---------|
| Informality  |         |         |         |
| casual       | 1.0707  | -0.1672 | -0.2233 |
| dynamic      | 1.0547  | -0.2776 | -0.0280 |
| dandy        | 1.0182  | -0.4133 | -0.0665 |
| modern       | 0.9836  | 0.0225  | -0.0189 |
| expressive   | 0.9760  | -0.0895 | 0.0355  |
| pop          | 0.8727  | 0.2954  | -0.1090 |
| romantic     | 0.8398  | -0.0071 | 0.2140  |
| stylish      | 0.8148  | 0.2577  | 0.0622  |
| wild         | 0.7629  | 0.1832  | 0.1205  |
| chic         | 0.7532  | -0.1487 | 0.3511  |
| feminine     | 0.7527  | 0.2374  | 0.1441  |
| beautiful    | 0.4800  | 0.2711  | 0.4552  |
| practicality |         |         |         |
| readable     | -0.1929 | 1.1010  | -0.1524 |
| standard     | -0.4485 | 1.0469  | 0.0315  |
| contemporary | 0.3434  | 0.9763  | -0.3378 |
| clear        | -0.0219 | 0.9585  | 0.0265  |
| formal       | -0.4324 | 0.9267  | 0.2034  |
| reliable     | -0.1193 | 0.8676  | 0.2449  |
| attractive   | 0.1648  | 0.7403  | 0.0792  |
| natural      | 0.4431  | 0.6546  | 0.0757  |
| friendly     | 0.5945  | 0.6407  | -0.1227 |
| like         | 0.3901  | 0.6390  | 0.1676  |
| mild         | 0.5345  | 0.5818  | -0.0141 |
| fresh        | 0.4685  | 0.5078  | 0.2123  |
| pretty       | 0.3568  | 0.4163  | 0.4011  |
| times        |         |         |         |
| classic      | -0.1566 | -0.1587 | 1.1043  |
| retro        | -0.0186 | -0.0235 | 0.9800  |
| noble        | 0.1041  | 0.2690  | 0.7511  |
| elegant      | 0.2740  | 0.2580  | 0.6079  |
| gorgeous     | 0.5228  | 0.0895  | 0.5634  |
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friendly, gorgeous, beautiful, expressive, modern, stylish, feminine, wild, and pop, are not significant correlated between the people in mainland China and Taiwan.

For details, the ranking of factor scores for 19 fonts for three factors are shown in Figure 4. For factor informality, the people in mainland China and Taiwan have different impressions about HanziPen and Wawati that have cute handwriting style. The people in Taiwan have the impressions of casual and dynamic for these two fonts, while the people in mainland China do not. Moreover, the people in mainland China think that STFangsong and SimSun are a little casual and dynamic, while the people in Taiwan do not think so. For factor practicality, mostly the people in mainland China and Taiwan have similar feelings of readable and standard for fonts. However, some Heiti and Yuanti as Source Hans, SimHei, and DFYuanti are found with affective difference between the mainland China and Taiwan. For factor times, the people in Taiwan have strong impressions of classic and retro for Kaiti, Fangsong, and Songti, while the people in mainland China think Heiti is more classic. The separated analysis results for mainland China and Taiwan are shown in the next section.

3.2 Emotional difference between Chinese and Japanese

To compare the feelings for typefaces between the people in mainland China, Taiwan, and Japan, correspondence analysis was executed to map all fonts and emotions. Optimal weights were calculated using the cross table containing the evaluation value of each kansei word to each font. After weighting to reflect the relative contribution of the dimensions, 2 dimensions are extracted and the mapping results for SC and TC fonts are shown in Figures 5 and 6 with all 30 kansei words. In these two figures, the distribution of serif types and sans-serif types of SC and TC fonts have opposite distributions. In our results, the people in Taiwan thought serif Chinese typefaces generally generate a classical, elegant feelings. For the people in mainland China, they were found to have very different emotional responses that they thought sans-serif types as Heiti types are more classic, and serif types as Songti, Fangsong, Kaiti are more contemporary. In addition, the mapping results for Japanese fonts are shown in Figure 7 with 19 common kansei words. It shows that Japanese people thought serif types as Mincho and Kyokasho are more classic, and sans-serif types as Gothic types are more natural and readable. It could be inferred that the people in Taiwan have closer emotional responses for typefaces with Japanese than the people in mainland China.

As we know, some Chinese characters in SC, TC, and Japanese are different. SC were created by reducing the number of strokes, while the modern shapes of TC and Japanese mostly retain the complex strokes. These decoration of the characters may be one of the reasons affecting the impression evaluation. From a historical perspective, despite the overwhelming traditional Chinese influence, Japan has a deep cultural influence on Taiwan and it continues to the present in the fields of art and design. In addition, linguistics also believes that the formation of language families represents an important direction for cultural change. Considering of these influencing factors, it needs further exploration.

Moreover, we extract the common 19 kansei words in the evaluation data, and get each kansei cluster based on their factor loadings by promax rotation. The results are shown in Figure 8. There is an interesting founding for the kansei word like. Overall the people in mainland China like the clear and readable types, the people in Taiwan like the chic and elegant types, and Japanese people like the clear and natural types. That is, the people in mainland China prefer serif types that they feel clear and readable from...
these types, and the people in Taiwan prefer serif types that they feel elegant from these types. Though the typeface preference is same between the people in mainland China and Taiwan, their emotional preference is different.

For Japanese people, they prefer sans-serif types that they feel clear and readable from these types. The emotional preference is same between Japanese and the people in mainland China, while their typeface preference is different.
4. CONCLUSION

This research is a beginning of exploring the affective differences of typeface across cultures. The key contribution of our work is to find out that there are significant differences of typographic feelings between the Chinese people in mainland China and Taiwan, and there are some consistent responses between the Japanese and the Chinese people in Taiwan. For a same design objective, it is suggested to use different types to meet the affective needs of people from different cultures and life environments. The affective knowledge of typefaces is used as a guideline for font selection in multilingual design works.

However, the evaluation targets and evaluation items for the experiments of Chinese and Japanese typefaces are different and the fonts are not identical in current research. The kansei words for Japanese evaluation experiments are transliteration in the katakana script from English origins, while it is translated as Chinese adjective words for Chinese evaluation experiments. There may have some ambiguity of different languages. In the future, the evaluation experiments could be executed for some fonts with same design and further research will go to have a deeper exploration about the historical reasons among different cultures for emotional responses for typography.

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