Affective Font Selection: The Hybrid of Japanese and Latin Typefaces

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Abstract: Typeface is a ubiquitous component in graphic design and multilingualism. It has increasingly become a common need in design works for people in different language systems. In this paper, we propose an affective font selection approach for exploring the juxtaposition of different languages. Japanese and English fonts are the targets. First, some evaluation experiments are conducted to gain the affective data for selected fonts. Second, these fonts are classified into several clusters proposed with similar affective propensity by hierarchical cluster analysis. Third, we analyze the relationships between type clusters and impressions by quantification theory type I. We propose to select and combine Latin and Japanese fonts in the clusters which have the closest relations with a specified impression. It is verified that the combination of Latin and Japanese type clusters could have a better effect than using original Latin letters designed with similar shape features in Japanese font packages.

Keywords: *Font selection, Type hybrid, Affective design*

1. INTRODUCTION

Typography plays a fundamental role in graphic design. Selecting appropriate typefaces is an essential work to make texts readable and appealing on display. By the increasingly globalized world, the needs for multilingualism are growing, from corporate branding to event communications and digital publishing [1]. Some multilingual design cases employ a hybrid of different languages to reconcile different cultures for the sake of communication, such as multilingual signage, website, etc. The texts of different languages could be shown in the same page or different pages. There are also some products that have used a typography from a different language system as an appealing graphic device.

The design of typefaces had developed independently among different languages in the nascent stages, and the origins of alphabetic scripts are completely different from alphabetic scripts. Nowadays, the digital fonts of some alphabetic writing systems as Japanese, Chinese and Korean, have originally designed Latin alphabets in their font packages. It is found that there is some affective disharmony between Japanese and Latin alphabets in some well-designed Japanese font packages [2]. Type hybrid means the combination and juxtaposition of different typefaces that text characters of different languages are shown separately. For this case, graphic designers tend to use external Latin typefaces during their design works with the supporting of empiricism.

While for the cases of type mixture that mixing different fonts in a same sentence or paragraph, different fonts may cause some uncontrollable disharmony by their different settlement of design elements in typography, such as the difference in five lines of ascender line, capital line, mean line, base line, and descender line. The multilingual mixture cases are not concerned in this work.

In the globalized society, even normal office workers are facing more multilingual works. Type selection is not an easy work for non-designers, and the vast amount of types even confuses designers to use a good type in their works. Considering that it has been widely proved that typefaces have significant impacts on human feelings, we aim to offer the affective knowledge of typefaces for designers and amateurs to help narrow down the selection of the appropriate typeface and make multilingual works intelligent.

As we know, Latin type as an alphabetic script, is the most widely adopted writing system in the world. The modern Japanese writing system is often considered to be the most complicated in use. In this work, we explore the method of affective font selection for the juxtaposition of Japanese and English. We propose an approach that select different language scripts with similar impressions. First, we extract some typical typefaces of Japanese and English, and conduct the evaluation experiments to gain the affective evaluation data for these fonts. Second, we classify the fonts into several type clusters with similar affective propensity

separately. Third, we analyze the relations between these clusters and kansei words. The analysis results are used as the recommendation for type selection. The types for headings and body text are separated because of their different roles in design. We implement a prototype system of automatic type selection and conduct some experiments to verify the affective effect. It is assumed that the combination of external Latin fonts which have the closest relations with a specified impression could have a better performance than using original Latin letters in Japanese font packages. Our proposed method is verified to be applicable for headings rather than body text in document design.

2. RELATED WORK

2.1 Typeface persona

Many researchers have gradually recognized the importance of personality traits of certain typefaces and have studied the persona of Latin alphabets and Japanese characters individually. For Latin typefaces, Henderson [3] selected 210 typefaces that nearly represented the full range of typefaces, and measured these fonts by 12 impression variables to gain guidelines for impression management. In the same way, Grohman [4] provided guidelines of type selection related to consumers' perceptions in the field of brand management. Not only the personality of fonts, the text personas also took into consideration simultaneously in some researches. Brumberger [5,6] investigated that readers are aware of appropriateness in typeface and provided evidence that readers do consistently ascribe particular personality attributes to particular typefaces and text passages. The selected 15 typefaces referring to serif, sans-serif, script, and several design types, and 20 attributes were grouped as elegance, directness, and friendliness. Subsequently, Juni [7] showed the interaction of fonts with emotional qualities of text by the comparison of Times New Roman and Arial.

For Japanese typefaces, Mukai [8-10] has conducted several evaluation experiments for Japanese fonts and analyzed the impressions between fonts and package designs. 36 pairs of impression items were classified into 4 factors as familiarity, activity, stability, and comfortableness. Caldwell [11] had referred to 46 Japanese typefaces which had more comprehensive coverage for calligraphic and design styles. These researches show that affective response to typefaces is generally consistent across Japanese and English. Based on them, we did a subdivision in the choice of types.

2.2 Type hybrid of multilingual

Japanese is complicated with 3 sets of characters, kanji, hiragana, and katakana. Hiragana and katakana are syllabic scripts with only 48 characters each. They are simply called kana together. Kanji is logographic script which is close to the traditional Chinese writing and have thousands of characters. Latin alphabets have increasingly used in horizontal type setting in Japanese typography [12]. In Japanese font package, Latin alphabets are originally designed for their exclusive use with kanji and kana characters. Researchers and designers have devoted to improving the appearance of the Latin alphabets in Japanese fonts focused on the formative aspects [13]. In Yamamoto's research [2], 4 widely used Japanese fonts of Mincho style were extracted and found that there is an affective gap between Japanese characters and its original Latin alphabets. The harmony of kanji, kana, and Latin alphabets is still a challenging problem in typography design. We assume that the combination with external well-designed Latin typefaces is helpful to improve design quality, especially for creating creative designs and reducing the workload of multilingual workers.

2.3 Recommendation system

Recommending appropriate fonts in a generated multilingual design for users is another contribution of this paper. In the recommendation system for automatic design of magazine covers [14], there was a limitation that they did not consider the typefaces, and this problem tied close with the impressions of magazine. O'Donovan [15] proposed an interface for Latin font selection based on personality attributes. It offered vast amounts of fonts for choice that could be used in his interactive layout system [16] or the mentioned magazine design system. These researches are related to alphabetic writing system that have not taken multilingualism into account. A name card creating system [17] was built based on the procedure of Kansei Engineering (KE). This research proved that font has a significant impact on the human feelings. Only 7 Japanese fonts were involved in that system. In our work, we also use the analysis methods introduced in KE and build a prototype recommendation system with affective font selection.

3. AFFECTIVE EVALUATION OF TYPES

3.1 Font selection for evaluation

In graphic design, typefaces are generally used to compose either continuous text as body text or non-continuous text

such as headings, subheadings, or titles. Headings standing at the top or beginning, or playing as solo titles are used to grab readers' attention, and a variety of typefaces should be effectively used. Body text forming the main content should be easy and comfortable to read at small sizes, and it is better to use the basic styles. The basic styles of typography are serif and sans-serif types for Latin alphabets, likewise, Mincho and Gothic types for Japanese characters.

For Latin types, there are thousands of different fonts available and no one font classification system to rule them all. In general, Latin fonts can be classified into 5 groups, as serif, sans-serif, script, blackletter, and display types. Furthermore, serif types contain 4 or 5 traditional sub-classifications, as old-roman, transitional, modern, slab-serif and wedge-serif styles, and sans-serif types contain 3 or 4 sub-classifications, as humanist, geometric, grotesque, and neo-grotesque styles. Script type is created from handwriting. Blackletter, also known as Gothic script, is a highly ornamental type. Display type is a general concept that many fonts can be defined as display faces with associative and decorative values. We extracted 36 fonts which are widely used in DTP and cover these 5 traditional classifications and their sub-classifications simultaneously. The classification for Japanese types is more ambiguous. We divide them into 5 groups, as Mincho, Gothic, round Gothic, calligraphic and display types. The Mincho types are the equivalent of serif types. The triangles at the end of single horizontal strokes, are called *uroko* in Japanese, comparable to serifs. The Gothic types are the equivalent of sans-serif types that the strokes are lack of decorations. The round Gothic type, also called as round sans, has rounded ends and corners to the lines of characters. The calligraphic types are ancient Chinese writing styles, as semi-cursive script (行書 *gyōsho*), clerical script (隸書 *reisho*). Display types refer to some modern styles for specific purposes as newspaper script (新聞書体 *shinbunshotai*), handwriting types of pop and other design styles. We extracted 20 typical Japanese fonts in this study. All these fonts can be found in Figure 2 and 3 and they are available for headings.

Moreover, 3 serif types as Caslon, Bodoni, Clarendon, 3 sans-serif types as Helvetica, Gill Sans, Avenir, and 3 Mincho types as Kozuka-Mincho (小塚明朝), Hon-Mincho (本明朝), Shuei-Mincho (秀英明朝), 3 Gothic types as Shin-Gothic (新ゴ), Yu-Gothic (游ゴ), Typos (タイポス), were chosen as an additional study for body text. These 12 fonts were evaluated in an experiment with the

Boys, be ambitious!

Be ambitious not for money or for selfish
aggrandizement, not for that evanescent thing
which men call fame.

Be ambitious for the attainment of all that a man
ought to be.

少年よ大志を抱け！

お金のためではなく、私欲のためでもなく
名声という空虚な志のためでもなく
人はいかにあるべきか、その道を全うするために、
大志を抱け。

Figure 1: Evaluation samples of Caslon and Kozuka-Mincho

difference of weight and italic. Each Japanese font and Western font has 3 grades of weights as light, regular, or medium, and bold or black. Each of them have normal and italic versions.

3.2 Affective evaluation experiments

We extracted 18 kansei words including 16 images based on Kobayashi's Color Image Scale [18] and 2 words of readable and like as basic evaluation items. All these words can be found in Table 1 in Section 4. The words in color image scale allow also the classification and correlation of images for various objects. It is used as a practical tool to evaluate the images of objects relatively and it has been input into practice for evaluation of name card design [19]. The evaluation samples were created with simple contents for each selected font. Other design elements, such as line length, line spacing and text alignment which are mainly for the legibility and comprehension of text contents, were settled with relatively appropriate values in our study. Figure 1 shows 2 evaluation samples with Caslon and Kozuka-Mincho in regular type. The evaluation experiments for Latin and Japanese types were conducted separately for 88 graphic and editorial designers in Japan. The investigation was executed through online questionnaire survey by 5-scale method and entrusted to a research company, Macromill. The age of these respondents have a distribution in twenties, thirties, forties, fifties, and sixties.

4. RELATIONS BETWEEN IMPRESSIONS AND TYPE CLUSTERS

4.1 Cluster analysis

A cluster C_i is defined as a group of typefaces that have similar images to each other. To get the type clusters, Ward's method is used, since it tends to join with small numbers of observations and produces clusters with roughly equal numbers of observations.

We execute cluster analysis for the fonts of headings. The results for Latin types are shown in Figure 2 that 36 western fonts were divided into 8 clusters. The results for Japanese types are shown in Figure 3 that 20 Japanese fonts were divided into 11 clusters.

It is found that Latin clusters roughly correspond to traditional classifications, and several particular cases are found be separated from their original classifications. For example, in Latin clusters, C6 mainly includes old-roman and transitional serif types with the images of elegant, formal, feminine, and romantic. Optima, generally

Figure 2: Ward clustering for Latin typefaces

classified as a humanist sans type, is a particular case of this cluster. It is inspired and created by Roman stone carving with a subtle swelling at the terminals and it is evaluated with a strong image of feminine and romantic.

The forms for Japanese characters are more abundant, and almost have individual impressions. Hence, we have a finer division for Japanese types. Some archaic styles of calligraphy as semi-cursive script, clerical script and some modern styles as newspaper script own separate clusters. The weight is different in these fonts. We can see that the weight has obvious influence on affective evaluation which may be the reason for disrupting the original classifications. The detailed impact of weight on impressions will be analyzed in the part of body text later.

4.2 Estimation precision

We used Quantification Theory Type I (QT1) to analyze direct and quantitative relationships between an kansei word and design elements. Here, we have 3 parts of analysis works. In the analysis of 36 Latin fonts, the

Figure 3: Ward clustering for Japanese typefaces

Table 1: Multiple correlation coefficients for the evaluation data of headings and body text

Kansei words	Multiple correlation coefficient		
	Japanese clusters for headings	Latin clusters for headings	Japanese and Latin fonts for body text
Pretty	0.777	0.633	0.759
Casual	0.717	0.921	0.896
Dynamic	0.862	0.606	0.905
Natural	0.885	0.861	0.846
Elegant	0.897	0.881	0.845
Gorgeous	0.895	0.868	0.754
Wild	0.915	0.907	0.843
Classic	0.912	0.848	0.890
Formal	0.936	0.656	0.862
Dandy	0.869	0.833	0.776
Chic	0.918	0.928	0.838
Fresh	0.868	0.741	0.804
Clear	0.877	0.905	0.861
Romantic	0.791	0.869	0.815
Modern	0.805	0.917	0.629
Pop	0.914	0.791	0.874
Readable	0.872	0.891	0.694
Like	0.914	0.857	0.592

explanatory variables are type cluster and with serif or not. For 20 Japanese fonts, the variables are type cluster and font weight. In the additional study of body text, the variables are typeface, font weight and italic style.

The multiple correlation coefficient R determines how well the estimation model fits the observed data. In the long experience of KE, R should be more than 0.8 and must be more than 0.6 [18]. From the results of R shown in Table 1, we can see that the relationship for most kansei words are reliable. While for evaluation item “like”, the performance is not good for body text.

4.3 Recommendation for type selection

According to the results of QT1, the set of multilingual typefaces for a specified impression S_m is proposed to extract the type clusters with the largest positive category scores for the impression m from each language l and it is assumed that the combination also have the strongest expression for the specified impression.

$$S_m = \bigcup ((c_i, l, m) | a_{c_i} \geq a_{c_k}) \quad (1)$$

Where $k=1,2,\dots,I$ and I denotes the number of type clusters for language l .

The design item with serif or without, is found having a relatively weak influence on impressions. We speculate

that though serif is an important element in font design, its influence is weakened by other design elements which are contained in type clusters. The relationship between typeface anatomy and images is another subject of our research and will not be discussed in this paper. It is also found that the influence of weight is significant, while italic does not have a strong influence. It recommends to follow some design principles, as using italic to emphasize key points without affective consideration.

We have made the recommendations of type selection for 18 kansei words based on the results of QT1. Other impressions which are not included should find their locations in image scale [19], and select corresponding type clusters. It is noted that sometimes there are more than two clusters having strong correlations with the specified impression. These optional clusters are picked up as alternative recommendations for type selection. In this study, the threshold value of category score for alternative recommendation is set as 0.4. If the category scores for an item are all less than the threshold value, we only choose the largest one. If the category score is less than 0.1, it indicates that all evaluated typefaces do not have a good performance for the specified impression.

Here, we use the kansei word dynamic as an example. The combined results of QT1 for dynamic headings is shown in Figure 4. The results contain the items of Japanese and Latin type clusters. If it is requested to create dynamic headings, it recommends to choose the fonts in C2 of Japanese types and C2 of Latin types. In this case, HG_Soeikakupop (HG創英角ポップ) and DF_Kanteiryu (DF勘亭流) are available for Japanese characters, and Rockwell, Clarendon, Copperplate Gothic, and DIN are available for Latin alphabets. In addition, C1 of Latin types also have a large category score which is regarded to have a strong correlation. Hence, the fonts of Old English, American Text and Onyx in this cluster could be alternative for Latin alphabets.

Figure 5 shows the results of QT1 for dynamic body text. If it is requested to create dynamic body text, it is suggested to choose Shin-Gothic for Japanese characters and Bodoni for Latin alphabets. It is also suggested to use a bold font weight. Overall, bold font weight has strong impressions of dynamic, wild, and dandy. Light weight has strong impressions of romantic, natural, elegant, and clear. To create more variations, other fonts in the same sub-classifications are proposed to act as alternative choices. The effect of these recommendations will be verified in the next section.

Figure 4: Combined results of QT1 for dynamic headings

Figure 5: Results of QT1 for dynamic body text

5. SYSTEM FOR FONT SELECTION AND VERIFICATION

5.1 Interface for affective type selection

Based on the results of analysis for Japanese and Latin types, we implemented a type selection engine in our automatic design system. Considering that some kansei words have ambiguous meanings, users sometimes feel confused when facing a lot of adjectives arranged line by line as the interface in paper [11]. We offer an image selection menu for users to stimulate a more intuitive feeling. The selection menu shown in Figure 6 settles kansei words in an image scale. This image scale shown in Japanese is a recreated word image scale cooperating with Nippon Color & Design Institute [20]. Once the user selects a word, the fonts for headings and body text in the design will be reset corresponding to the selected impression. Since the

Figure 6: Image selection menu of automatic design system

Figure 7: Output samples of font selection system for dynamic, formal, clear, and elegant

character widths of different fonts are a little different, the font size will be adjusted to fit the fixed text area.

There are some output samples of posters shown in Figure 7. The design contents, layout, and color scheme in these designs, are same. The fonts for text contents

are changed automatically corresponding to the selected impressions, as dynamic, formal, clear, and elegant.

Besides document design, the type selection engine is available for various kinds of design areas with multilingual, such as package design, web design, etc. For some design objects, the multilingual affective database is very practical.

5.2 Verification experiments

To verify the effect of our proposal, we compare the external samples of Japanese and external Latin type clusters with the original samples of Japanese and its original Latin letters. The verification experiments are divided into 2 parts. One is for headings with 20 Japanese types and 36 Latin types. The other is for body text with 6 Japanese types and 6 Latin types. To avoid the effect of other design elements, the text of Japanese and English in these experiments are set with same font size and similar line count.

6 design tastes are extracted which are scattered in the image scale, as pretty, dynamic, elegant, formal, dandy, and clear.

For headings, the Japanese type in type optional cluster is chosen related to each specified impression. Each Japanese type is conducted with 2 cases. One is made with original Latin letters (original sample) and the other is made with a Latin type (external sample). The Latin type is selected from the alternative type clusters. Figure 8 shows the samples for dynamic headings with Japanese font HG_Soeikakupop and English font Copperplate Gothic.

Original

External

Figure 8: Verification samples for dynamic headings

For body text, there are 3 cases for each impression. The Japanese font is same in these samples. Case 1 is made with original Latin letters (original sample). Case 2 is made with the specified Latin font in the former evaluation experiment (external1 sample). Case 3 is made with an alternative Latin font which is in the same classification of specified Latin type randomly (external2 sample). A simple content about Olympic is used for headings and body text with Japanese-English typesetting. Figure 9 shows the samples for dynamic body text. Here, Shin-Gothic is used for Japanese characters. For Latin alphabets,

Original

External1

External2

Figure 9: Verification samples for dynamic body text

Figure 10: Verification results of external samples and original samples for headings

Bodoni is used for external1 sample and Didot is used for external2 sample.

The evaluation items include its own taste and 3 words as beautiful, high-grade, and like, which are related to the quality of design. These experiments are conducted by 5-scale evaluation method. 16 and 14 Japanese office workers with distribution in twenties, thirties, forties, and fifties, participated in these experiments for headings and body text.

For headings, the evaluation data of original and external samples is analyzed by Paired *t*-test. The results are shown in Figure 10. Overall, the average value for 6 design tastes is larger than 2.5 which implies that these samples can express the specified impressions more or less. More than half of evaluators have the evaluation that the external samples had stronger impressions of 6 design tastes than the original ones, while there is no significant difference statistically [$t(15)=-0.628$, n.s.]. It is found that most people like the external samples more than the original ones [$t(15)=-3.028$, $p<.01$]. For design quality as beautiful and high-grade, the external samples have a higher value than the original ones with significant difference [Beautiful: $t(15)=-4.017$, $p<.01$; High-grade: $t(15)=-5.173$, $p<.001$].

For body text, the evaluation data of original, external1 and external2 samples is analyzed by ANOVA. The results

Figure 11: Verification results of external samples and original samples for body text

are shown in Figure 11. For the average value of 6 design tastes, significant differences emerged [$F(2,26)=8.476$, $p<.01$]. To find means that are significantly different from each other, multiple comparison procedure is used. Tukey HSD post hoc tests indicate that the original samples have the relatively stronger impression than the external1 samples ($p<.01$) and external2 samples ($p<.01$). And there is no significant difference between external1 and external2 ($p=0.991$), that is, the fonts in the same classification have similar performance. Other evaluation items of like, beautiful, and high-grade are evaluated without significant difference among these samples [Like: $F(2,26)=0.759$, n.s.; Beautiful: $F(2,26)=0.552$, n.s.; High-grade: $F(2,26)=0.942$, n.s.].

5.3 Discussion of results

From the results, we can see that the proposed recommendations are confirmed to be effective for typeface selection for headings. In the verification samples, there are few number of words and the font size is large enough to show the design details clearly. The external Latin types are delicate and widely used by designers. They are evaluated with higher quality than original Latin characters in Japanese font packages, and have much better performance for the items of beautiful, high-grade, and like. Hence, it is suggested to use well-designed external Latin types with Japanese characters for multilingual cases when the texts are set in a large size and used for drawing attention. This method is speculated to be able to bring more creative variations in the design for headings.

While the external samples have no good performance over the original ones for body text. As we see, body text has vast number of words and it is set in a small font size. The difference of design characteristics in typography are difficult to be recognized when skimming the whole contents. Hence, the difference of affective effect is very little. Moreover, for the same font size, serif and sans-serif Latin types have smaller character size than Japanese types. That may make the external samples more illegible and cause poor performance on impressions. Since the readability and legibility are relatively more important for body text, it is suggested to juxtapose multilingual texts in a similar character size and weight. Using the original Latin letters in Japanese font package which share similar glyph in the design of all characters would be a good choice for body text.

6. CONCLUSION

Researchers and designers are increasingly aware of the importance of user's preferences in the design works, and have been devoted to the fuzzy things like feelings and impressions in human's mind. Many researchers have set out to explore the persona of typefaces, but all of them focus on a single writing system. The key contribution of our work is to break the barrier of different writing systems and build an experimental bridge between them for practical use. We propose an affective font selection method for different writing scripts, and put into practice for combining Japanese characters and Latin Alphabets. The evaluation experiments for some typical fonts are conducted and the relations between fonts and impressions are analyzed. The proposed method is verified to have good performance for headings to gain creative designs, while not so much for body text.

The main application scenario in this study is for bilingual reading of Japanese and English in the juxtaposition cases. The samples in our work are set with same font size and appropriate word count for Japanese and English. As we know, Latin characters have unequal sizes that could be larger or smaller than kana and kanji characters in same font size. The visual balance is also a puzzling issue in design work. In the next work, we will explore the effect of font size and word count. Furthermore, we would like to apply the approach to type mixture, considering with the effect of other design characteristics. Certainly, this approach is applicable to other writing systems. In the future, we will extend to the typefaces of other languages. As a fundamental element for graphic design, the affective knowledge of multilingual is available for different design

areas, such as web design, package design, cloth design, etc. More verification experiments will be conducted to explore the effect in other application fields.

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