TYPEFACE PERSONALITY TRAITS AND THEIR DESIGN CHARACTERISTICS

Ying Li

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ABSTRACT

Typeface Personality Traits and Their Design Characteristics

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Typography is a critical tool in visual communication. Selecting the appropriate typeface to express and communicate a message is very important. Since most studies on typeface design concentrate on typeface legibility and readability, this thesis focuses on the visual expression of typefaces and their design characteristics. The relationship between typefaces and their personality traits including legible, cheerful, fearful, creative, attractive, formal, sloppy, relaxed, friendly and confident are investigated.

A font survey about twenty four typefaces and ten personality traits is conducted and a series of statistical analyses are performed to discover the correlation between typefaces and their personality traits. As a result, the number of studied typefaces is reduced from twenty four to fifteen and these fifteen typefaces are categorized into four groups according to their personality traits and typographical features.

Typeface design characteristics, such as x-height proportion, ascender and descender proportion, font weight, stroke design, counter design as well as character space of these fifteen typefaces are studied in depth. Typeface design characteristics of four different groups are summarized.

In addition, the aesthetic design characteristics of studied typefaces are analyzed. The appropriate uses of each of the four groups are discussed.

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Chapter 1 Introduction

In this chapter, the motivation and objectives of this thesis are introduced. We also review typography terminologies and some typeface design characteristics. Lastly, we present the structure of this thesis.

1.1 Motivation and Objectives

In this thesis, we focus on the visual expression of typefaces and their design characteristics. The relationship between typefaces and their personas is investigated. By using statistical analyses on data collected from participants who filled out a survey, the correlation between fonts and personas is explored. Fonts used within this study are grouped according to their personas and typical characteristics of typefaces in these groups are examined in detail.

Typography is a critical tool in visual communication, because typeface can evoke human emotions. Due to different styles and a variety of proportions, weights, heights, etc., each typeface has its own aesthetic and expressive qualities, as evidenced by the visual attributes of its letterforms [1]. Some fonts can reinforce a chosen message, whereas others can detract from an intended meaning and have adverse effects. Therefore, selecting the appropriate typeface to express and communicate a message is very important.

Each typeface has its own individual identity. In a BBC audio program on February 11th, 2005, Ian Peacock [2] explores how the fonts we choose are sending secret subliminal messages about who we are. He argues that the fonts we use to dress our words are as much of a fashion statement as the clothes we wear. Within the program, fonts were also depicted as being feminine or masculine, as well as possessing other traits. Feminine fonts, for example, were described as fine, serif, sleek, and elegant, while masculine fonts were characterized as being blocky and bold.

Most research on fonts is related to legibility and readability. There are only a few studies on typefaces and their potential personas. In our study, we examine whether specific typefaces are perceived to have particular personality traits. First, we established ten different personas for twenty four typefaces. A survey was then created and administrated to individuals who voluntarily participated in the study. This survey was created to help determine whether or not participants think that the twenty four chosen fonts are associated with ten tangible personality traits, and to what degree fonts can convey these traits.

After obtaining sufficient data, our next step was to analyze how particular typefaces are associated with certain personality traits. In order to measure the relationship between typefaces and personas quantitatively, we used standard statistical methods to evaluate the relationship between studied typefaces and personality traits.

The relationship between typefaces and personality traits are thus examined. In this thesis, typeface design characteristics, such as x-height proportion, ascender and descender proportion, font weight as well as stroke design and so on are studied

further. We also analyze the aesthetic design characteristics of studied typefaces.

1.2 Typeface Terminology

In this section, we review typeface terminologies, including typeface and font, anatomy of typeface, typeface classification and typeface selection and usage.

1.2.1 Anatomy of Typeface

Letterforms are sets of letters, numbers and other symbols. A typeface is a set of one or more fonts, in one or more sizes. It is designed with stylistic unity as each typeface is comprised of a coordinated set of glyphs. Arial and Times New Roman are two examples of typefaces. A font is a particular example of a typeface, with a particular size, weight and angle. For example, 8-point Arial, 10-point Arial and 10-point Arial Italic are three different fonts but are all members of the Arial typeface. A glyph is a single representation of a typographic character in a typeface.

In Figures 1 and 2 below, the terms such as baseline and x-height, are included to help understand and describe the typeface anatomy.

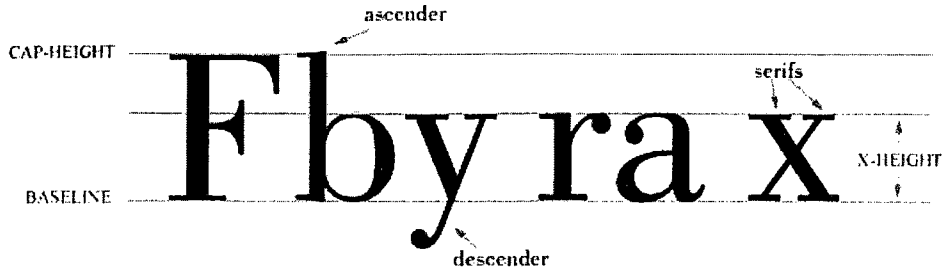


Figure 1 Anatomy of typeface

x- height: the basic height of the lowercase letter x. The x-height can vary greatly from typeface to typeface at the same point size.

Baseline: the line on which all letters rest.

Cap-height: the distance from baseline to cap line of an alphabet, this is the approximate height of the uppercase letters.

Ascender: the part of some lowercase letters (such as b, h or d) which ascends above the x-height.

Descender: the part of some lowercase letters (such as y, p or q) that descends below the baseline.

Serif: a stroke added to the beginning or end of one of the main strokes of a letter.

Contrast: the degree of difference between the thick and the thin strokes in a letterform.

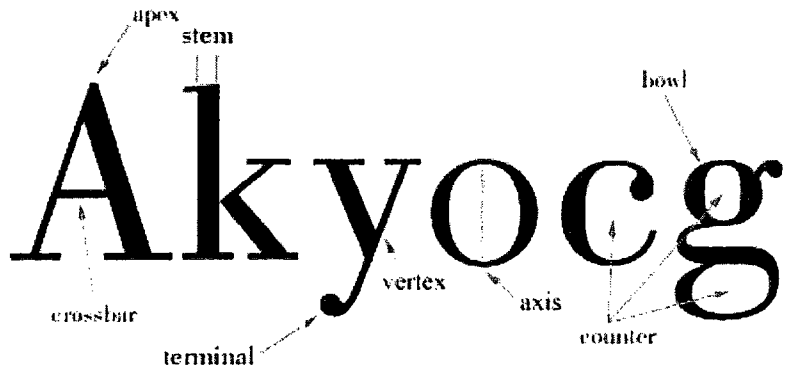


Figure 2 More anatomy of typeface

Axis: the axis of a letter means the axis of the stroke, which in turn reveals the axis of the pen or other tool used to make the letter.

Bowl: the round or elliptical forms which are the basic body shape of letters such as C, G, O in the upper case, and b, c, e, o, p in the lower case. It is also called *eye*.

Stem: a main stroke that is more or less straight, not part of a bowl. The letter o, for example, has no stem; the letter l consists of stem and serif alone.

Counter: the white space enclosed by a letterform, whether wholly enclosed, as in d or o, or partially, as in c or m.

Terminal: a curved stroke, which is usually apparent on the tail or stem of some letters (such as j, y, r and a). It is not a serif.

Apex: the uppermost point of a character where the vertical strokes meet.

Vertex: the bottom of a letter where two straight strokes or stems join and create an angle, such as in V, Y and W.

Crossbar: a horizontal stroke or arm that connect two stems (as in H or A).

1.2.2 Typeface Classifications

There are many scales to classify different typefaces. We introduce two typical scales, which include classification based on historical development and classification based on visual appearance.

1.2.2.1 Classification Based on Historical Development

According to the French typographic historian Maximilian Vox, typefaces can be classified within six main groups based on specific historical periods. These groups include pre-Venetian (before 1400), Venetian (1400-1500), Garalde which is also called Old Roman or Old Style (1600), Transitional (1700), Didone (1700-1900) and Display (1900-present) [3]. Some typeface examples classified based on historical development are shown in Figure 3.

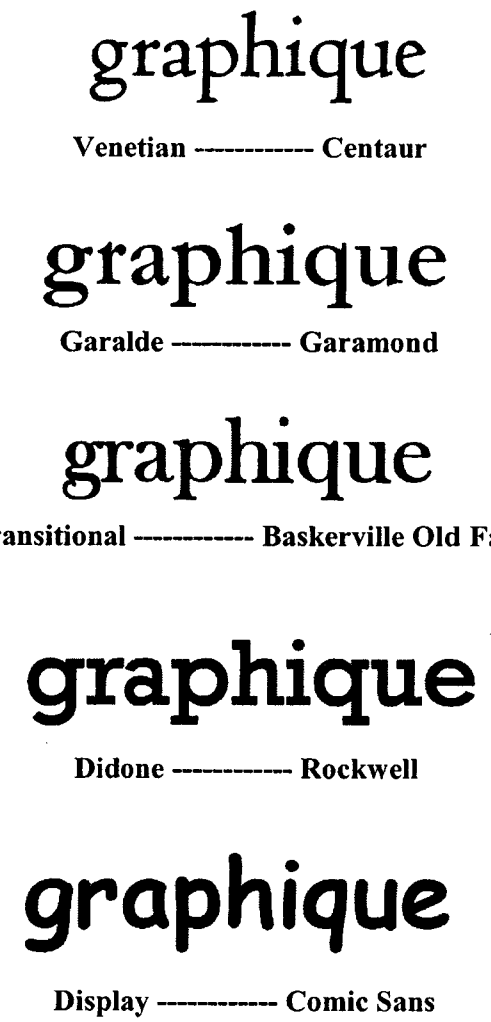


Figure 3 Examples of typeface classification based on the historical development

1.2.2.2 Classification Based on Visual Appearance

Typefaces can be classified into three categories based on their visual appearance. These categories are Sans Serif, Serif and decorative typefaces.

Serif is the typeface with small features at the end of strokes within letters. The typefaces without serifs are considered Sans Serif (from French sans, meaning without) (Figure 4).

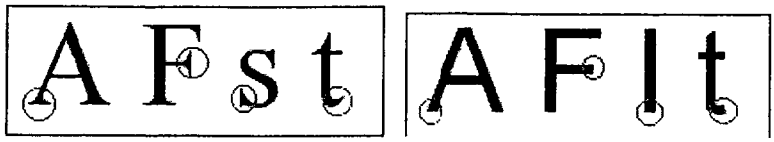


Figure 4 Examples of Serif and Sans Serif typefaces (from left to right: Serif and Sans Serif)

A decorative typeface differs as it involves a particular use of typeface. These typefaces may be used for headlines and not appropriate for text documents. The best appearance of decorative typefaces are at large display sizes, typically 36 points or larger.

1.2.3 Typeface Selection and Usage

There are many factors that influence the selection of a typeface. Type size measurement, legibility and readability, weight and space are all influential factors that are presented in this section.

1.2.3.1 Type Size Measurement

Standard type face sizes range from 4 up to 120 points, where a point is the smallest typographical unit of measurement. Each point measures 0.0138 of an inch, which is equivalent to 1/72 of an inch. There are approximately 72 points (0.9936 inch) to one inch. A pica is 12 points (0.1660 inch). There are approximately 6 picas (6.0230) to one inch.

1.2.3.2 Legibility and Readability

Legibility and readability are two important aspects of a typeface. Legibility means the quality of being easy to read, and it is the term used when discussing the clarity of single characters. Readability is the term which describes the quality of visual comfort, an important requirement in the comprehension of long stretches of text [4].

1.2.3.3 Typeface Weight

The weight of a typeface is reflected in the typeface's design or style. It is the visual lightness or darkness of form. A typeface family may offer a full range of weights from light (or thin) to extra bold.

1.2.3.4 Character Spacing

The interrelationship between the white space and the text in a typeface is also an important aspect. Roughly, there are two different scales of character spacing, mono-spaced typeface (Figure 5) and proportional typeface (Figure 6). Mono-spaced typeface means each character fits into the same character width, while proportional typeface means that each character width is different in order to accommodate the particular width of each character.

Figure 5 Example of mono-spaced typeface

Figure 6 Example of proportional typeface

1.3 Thesis Outline

This thesis consists of four additional chapters.

In the next chapter, we present a description of the study, which investigates typefaces and their personalities. This description includes an overview of the font survey that was used to investigate the relationship between twenty four typefaces and ten personalities. Research methodology, including a description of participants, materials, data collection and procedure of font survey are also outlined in this chapter.

Chapter 3 focuses on the statistical analysis. We used SPSS (version 17.0) to analyze the data collected from the font survey, including various methods of analysis such as Correlation, Factor Analysis, Multidimensional Scaling and one way Analysis of Variance, etc.

In Chapter 4, we examine the design characteristics of fifteen typefaces from typographical design and aesthetics. The measurement and analysis on typical design factors of these typefaces are presented.

Chapter 5 provides our conclusions and suggestions on topics for future exploration based on our research results.

Chapter 2 Typeface Personality Survey

In order to investigate whether or not viewers associate particular typefaces with emotional qualities, we developed and administrated a font survey on the relationship between twenty four fonts and ten personalities. This chapter begins with a literature review of different studies on typeface personalities. A description of the font survey and the methodology used within this study are then presented.

2.1 Literature Review of Typeface Personality Studies

Most research on typefaces is related to font legibility and readability. There are, however, a few studies on personalities that fonts may have, personalities that convey messages beyond what is expressed within the text. In the area of marketing and consumer psychology, typeface personality has been studied for a long time. The earliest study is by Proffenberger and Franken [5], who identified five atmosphere qualities for twenty nine typefaces. These qualities include cheapness, dignity, economy, luxury, and strength. Subsequently, Spencer [6] mentioned in his book that typefaces can be grouped under three headings of atmosphere value: luxury/refinement, economy/precision and strength. Some researchers assigned specific personas to specific typefaces. Kostelnick, Roberts and Dragga [7] depicted

Times New Roman as "booklish and traditional"; Bodoni as "dramatic and sophisticated" and Goudy as "corpulent and jolly". Shunshan and Wright [8] described Garamond as "graceful, refined and confident" and Century Schoolbook as "serious yet friendly". Some typographers also have perceived that particular typefaces are imbued with cultural and national characteristics. Laliberte [9] attributed several typefaces to represent several countries, Fraktur for Germany, Garamond for France, Bodoni for Italy, and Caslon for England.

There are however, discrepancies within these past studies on the topic of typefaces and their associated personalities. The personalities identified by the above stated researchers are not consistent. This may be due to the difference in participants based on gender, age or other demographic factors. Consequently there are discrepancies within findings from past studies.

2.2 Proposed Typeface Personality Study Method

In our study, a survey with twenty four different fonts in two sizes and ten personalities was developed to help determine whether or not viewers think that the chosen fonts are associated with tangible personality traits, and to what degree these fonts convey these traits.

2.2.1 Studied Typefaces

Figure 7 Twenty four typefaces used in the survey

Twenty four different typefaces were chosen as test typefaces (Figure 7). We selected these twenty four typefaces to represent a wide range of physical characteristics from Serif and Sans Serif to display typefaces (see Table 1 for a complete listing, classification refers to [10]). Each typeface exhibits variations in typeface design from x-height, ascender, descender and stroke weight, etc. Also, these twenty four typefaces are widely used in different applications. Some of them are standard and most frequently used in books and newspapers, such as Times New Roman and Arial. Others, such as Cooper Black, Impact and Broadway, are popular for advertising.

Serif	
1	Centaur
2	Garamond
3	Times New Roman
Sans Serif	
4	Arial
5	Helvetica
6	Berlin Sans FB
Slab Serif	
7	Rockwell
8	Playbill
Display Serif	
9	Cooper Black
10	Bernard MT Condensed
11	Onyx
12	Footlight Light
13	Poor Richard
14	Belwe Lt BT
Display Sans Serif	
15	Impact
16	Kabel
Display	
17	Bauhaus 93
18	Broadway
19	Harrington
20	Kino MT
21	Snap ITC
22	Jokerman
23	Chiller
24	Harry Potter

Table 1 Twenty four typefaces used in the study

2.2.2 Typeface Personality in Research

We selected ten typeface personality traits (Table 2) based on previous studies. These studies have frequently referred to such adjectives to describe typefaces within the literature.

Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

Table 2 Ten adjectives used to assess font personalities

2.2.3 Rating Scale

	Not at all	Slightly	Moderately	Highly	Extremely

Table 3 Five-point modified likert scale

We used a modified five point Likert Scale with the categories as shown in Table 3. The scale was used to reflect a range of different responses from participants to the twenty four typefaces.

2.2.4 Participants

The participants were Concordia University students and staff, as well as others who were interested in this topic. The respondents were recruited through e-mails and posters in Concordia University.

A total of 75 participants completed the survey, 37 females and 38 males. Approximately 58.7% of participants were between 20-29 years of age, and 22.7%

between 30-39 years. Only one participant was younger than 20 years and the remaining 17.3% participants were older than 40 years.

Approximately 40% of respondents reported having a bachelor degree, 42.7% a master's degree and 10.7% a doctorate. The education backgrounds of the remaining 6.6% participants include High School, Technical School and Junior College.

2.2.5 Materials and Procedure

For each typeface, the complete alphabet in 22 points was displayed in an image that included capitals, lower cases and numerals. Two pangrams, "The quick brown fox jumps over the lazy dog" and "Please complete the survey to your comfort level" were also displayed in 16 points in another corresponding image. Figure 8 illustrates a sample of the display participants were given for each of the twenty four typefaces. The text samples were converted to binary images at 200*200 dpi resolution.

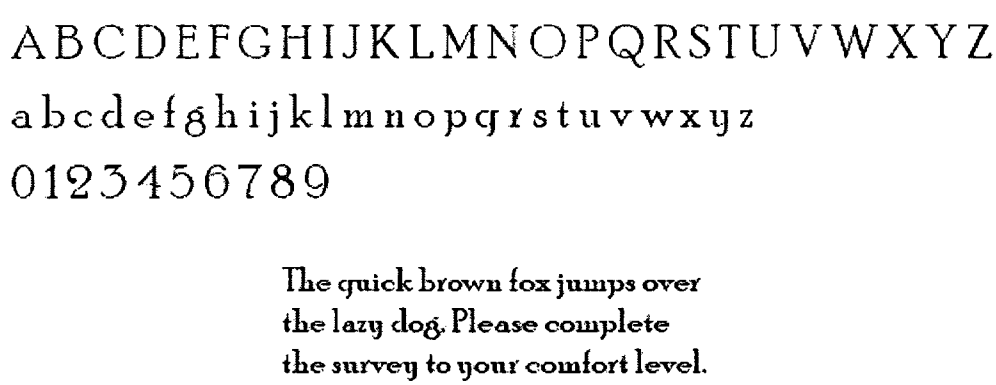


Figure 8 Sample of the alphabets and text displayed in the font survey. This sample shows the typeface Poor Richard

The twenty four typefaces were randomly distributed throughout the survey to avoid any effects due to order. The order of twenty four typefaces displayed in the font survey is provided in Appendix A. The two images were presented at the top of each page, followed by the rating scale.

The survey was provided as printed and online forms, with 27 questions. 24 questions addressed the twenty four fonts and ten personality traits, and 3 questions inquired about demographic information, including age, gender and education background. The survey took approximately 30-35 minutes to complete. Participation in the survey was voluntary and participants are able to discontinue the survey at any time, without consequence, in accordance with Concordia University's Office of Research Policies. Participants were provided written instructions at the beginning of the survey. They were asked to visually examine the computer or paper displays of the twenty four typefaces and rate them on ten personality traits, indicating how well the typeface suited each personality trait. A copy of the survey is provided in Appendix B.

2.2.6 Data Collection Methods

We used the online survey tool - freeonlinesurvey [11] to create the survey form. Two approaches were used to conduct the survey, the online version and the paper version. This online survey was administered by the survey tool, including data collection, data storage, etc. Participants of the online survey were recruited via inviting emails. They followed the survey link and completed the survey online.

The data for the paper survey were inputted by us and data storage was also administered by the survey tool. Participants were paid for completing the paper survey. We distributed the hard copy to prospective participants, and they returned the completed survey to get the monetary reward.

Chapter 3 Analysis of Survey Results

In this chapter, we describe the survey results, which were analyzed by using data with statistical software SPSS (version 17.0).

First, we performed univariate analysis on survey data and calculated the central tendency and dispersion of the rating scores of each typeface's personality traits.

Second, we performed correlation analysis on the survey data to determine the relationship between each of the twenty four typefaces related to every personality trait. We could then decide whether correlations exist between any of our studied typefaces.

Third, because the correlation analysis of twenty four typefaces and ten personality traits produced too numerous and detailed information for analysis and presentation, we removed several typefaces whose relationship strength were not statistically significant based on the correlation analysis results. We then conducted factor analysis on the remaining typefaces to group them into smaller sets and identify common underlying factors.

Fourth, we applied multidimensional scaling to survey data for the remaining typefaces related to every personality trait to validate the results of the factor analysis.

Lastly, we analyzed the survey's demographic data to examine its potential influence on participants' responses.

The following sections discuss these analyses in greater detail.

3.1 Univariate Analysis

In order to explore the characteristics of individual variables from our survey data and to prepare for further statistical procedures, we first applied univariate analysis on the rating scores for each typeface of the survey data.

3.1.1 Distributions of Typeface Rating Scores

We examined the histogram of rating scores of each typeface to explore the distributions of rating scores for each typeface related to each personality trait.

Through the analysis we found that, the histograms of rating scores exhibited two common shaped distributions: normal and slightly skewed. These two types of distributions are illustrated in Figure 9 (typeface Harrington related to personality trait "Cheerful"), Figure 10 (typeface Rockwell related to personality trait "Relaxed") and Figure 11 (typeface Times New Roman related to personality trait "Confident").

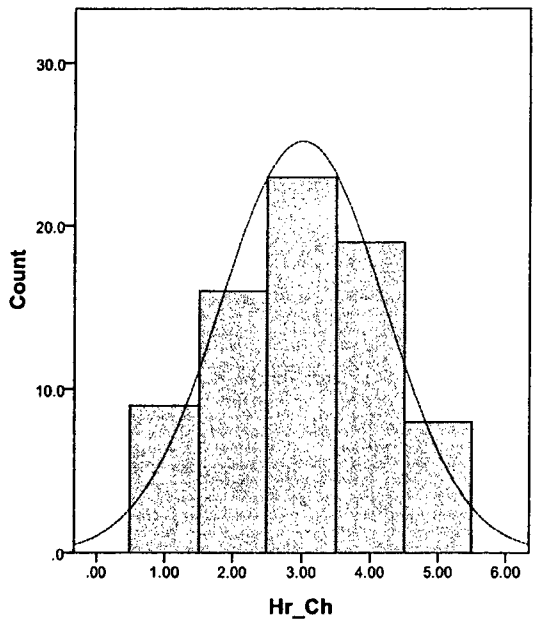


Figure 9 Normal distribution of rating scores of typeface Harrington related to personality trait "Cheerful"

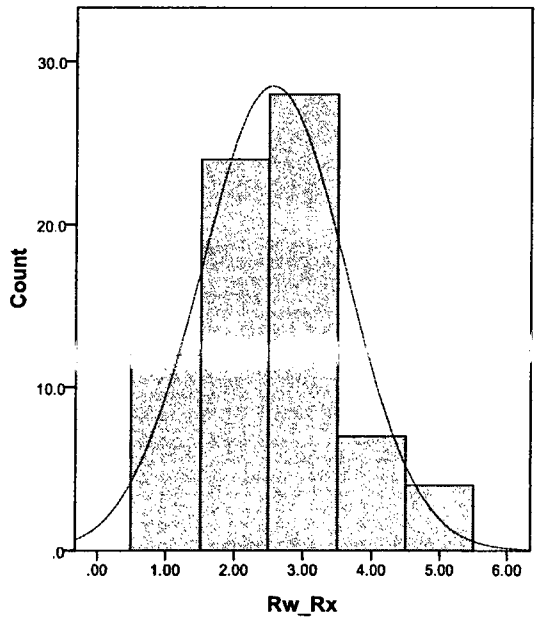


Figure 10 Slightly skewed distribution of rating scores of typeface Rockwell related to personality trait "Relaxed"

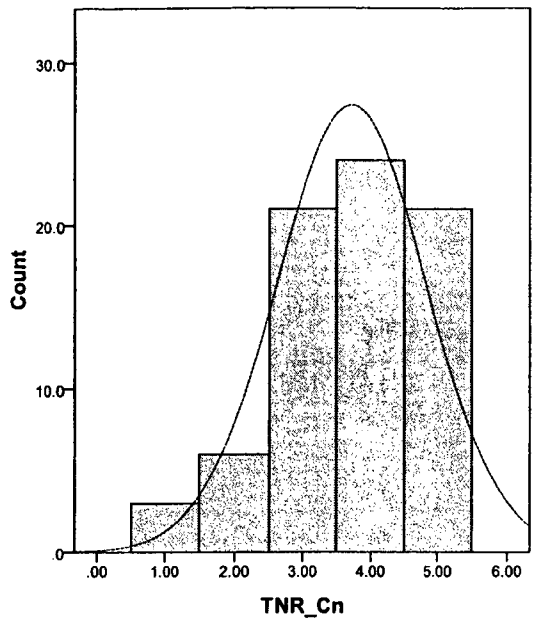


Figure 11 Slightly skewed distribution of rating scores of typeface Times New Roman related to personality trait "Confident"

3.1.2 Measures of Central Tendency and Spread

We examined the mean values, minimum values, maximum values and standard deviations of rating scores of each typeface based on each personality trait. Table 4 is the mean values of rating scores of twenty four typefaces related to ten personality traits. We summarized the five typefaces that were the most associated with each of the ten personality traits and their mean values in Table 5.

The abbreviations used for typefaces are shown in Appendix C and in the next page for easy reference, and the abbreviations used for personality traits is shown in Appendix D, similarly hereinafter.

	Cheerful	Fearful	Legible	Attractive	Creative	Formal	Sloppy	Relaxed	Friendly	Confident
CB	2.5733	1.6933	3.4133	2.7200	2.4533	2.4533	1.9733	2.8933	3.2400	3.2933
BSF	2.3467	1.5467	3.3067	2.6400	2.5200	2.5067	1.7467	2.6933	3.0533	2.9067
BMC	1.8133	2.1067	2.3733	2.0933	2.0800	2.5867	2.1333	1.7467	1.8933	2.7467
Ga	2.6000	1.4533	4.0267	3.1733	2.5200	3.8133	1.4800	2.7200	3.2267	3.5867
BLB	2.6533	1.5867	3.3867	2.7467	2.7200	2.7733	1.8133	2.8533	3.1333	3.1733
Pb	1.4000	2.4800	1.6000	1.4800	1.8533	1.5600	2.3467	1.6533	1.7200	2.0133
HP	2.1467	2.9067	2.0800	2.3867	3.1200	1.3467	2.8000	2.2400	2.3333	2.3333
Cr	2.5067	1.4267	3.9733	3.1200	2.4267	3.9733	1.5333	2.8533	3.2267	3.6000
PR	2.5733	1.6000	2.9467	2.7867	2.8933	2.5733	2.0133	2.5867	2.9067	2.9467
Jm	3.4533	1.9467	2.4667	2.9067	3.6400	1.2933	2.7867	3.2933	3.4933	2.6933
TNR	2.2533	1.4533	4.1067	2.8000	2.1867	4.1733	1.5733	2.5200	2.9067	3.7200
Al	2.1467	1.3867	4.0000	2.5867	2.0667	3.7600	1.5333	2.6267	2.8800	3.6667
Bw	2.5733	1.9467	2.4667	2.4000	2.7200	2.2533	2.2133	2.2667	2.5067	2.8667
KM	1.8933	2.0933	2.4133	2.1067	2.5867	2.1067	2.0267	2.0267	2.2000	2.4267
Ip	1.8667	1.9867	3.2533	2.4000	2.0133	2.9733	1.8533	1.8667	2.1067	3.4400
Cl	2.5600	2.3867	2.2667	2.5200	3.0400	1.3333	3.1200	2.9067	2.7600	2.0800
Ht	2.1733	1.3600	4.1467	2.7200	2.0533	3.8533	1.5333	2.4933	2.8933	3.8267
Bh93	2.5867	1.5467	2.4800	2.7333	3.0267	1.9200	2.1333	2.7200	2.9467	2.7600
Kb	2.5067	1.7600	3.2667	2.5333	2.3867	2.6133	1.9467	2.4133	2.6400	3.1067
Ox	1.7867	2.0800	1.9067	1.9333	1.9867	2.3200	2.0933	1.6533	1.8133	2.2533
Rw	2.4133	1.5333	3.7333	2.8667	2.4000	3.3733	1.5600	2.5600	3.1467	3.5200
SITC	3.2933	2.0133	2.4133	2.9067	3.4267	1.4800	2.7333	3.1067	3.3200	2.8267
Hr	3.0133	1.5867	2.7600	3.1333	3.3333	2.0000	2.2800	3.0000	3.1733	2.8000
FL	2.4133	1.5867	3.5467	2.8800	2.4400	3.2000	1.6667	2.7200	3.0133	3.3200

Table 4 Mean values of rating scores of twenty four typefaces related to ten personality traits

Name abbreviation of typeface

Typeface Name	Abbreviation
Cooper Black	CB
Berlin Sans FB	BSF
Bernard MT Condensed	BMC
Garamond	Ga
Belwe Lt BT	BLB
Playbill	Pb
Harry Potter	HP
Centaur	Cr
Poor Richard	PR
Jokerman	Jm
Times New Roman	TNR
Arial	Al
Broadway	Bw
Kino MT	KM
Impact	Ip
Chiller	Cl
Helvetica	Ht
Bauhaus 93	Bh93
Kabel	Kb
Onyx	Ox
Rockwell	Rw
Snap ITC	SITC
Harrington	Hr
Footlight MT Light	FL

Personality	Typeface				
Cheerful	Jm	SITC	Hr	BLB	Ga
	3.4533	3.2933	3.0133	2.6533	2.6000
Fearful	Hp	Pb	Cl	BMC	KM
	2.9067	2.4800	2.3867	2.1067	2.0933
Legible	Ht	TNR	Ga	Al	Cr
	4.1467	4.1067	4.0267	4.0000	3.9733
Attractive	Ga	Hr	Cr	Jm	SITC
	3.1733	3.1333	3.1200	2.9067	2.9067
Creative	Jm	SITC	Hr	HP	Cl
	3.6400	3.4267	3.3333	3.1200	3.0400
Formal	TNR	Cr	Ht	Ga	Al
	4.1733	3.9733	3.8533	3.8133	3.7600
Sloppy	Cl	HP	Jm	SITC	Pb
	3.1200	2.8000	2.7867	2.7333	2.3467
Relaxed	Jm	SITC	Hr	Cl	CB
	3.2933	3.1067	3.0000	2.9067	2.8933
Friendly	Jm	SITC	CB	Ga	Cr
	3.4933	3.3200	3.2400	3.2267	3.2267
Confident	Ht	TNR	Al	Cr	Ga
	3.8267	3.7200	3.6667	3.6000	3.5867

Table 5 Five typefaces that were the most associated with each of the ten personality traits and their means

3.2 Correlation Analysis

To investigate the relationship between the twenty four typefaces related to each of the ten personality traits, we performed correlation analysis on the survey data. Correlation analysis involves assessing the strength of the relationship between two interval or ratio variables. Based on [12], the aim of the correlation coefficient is to determine:

- whether there is a real relationship between two interval/ratio variables;
- the direction of the relationship and
- the strength of the relationship.

We used Pearson's Correlation coefficient to measure the strength of the linear relationship between each two typefaces. And our survey data satisfy the assumptions of calculating the Pearson's correlation coefficient, which include:

- linear relationship between two variables
- continuous random variables
- both variables must be normally distributed
- two variables must be independent of each other

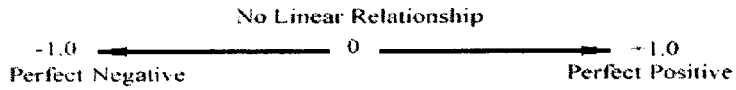


Figure 12 Pearson correlation coefficient

If Pearson's correlation coefficient value is near ± 1, then it is a perfect correlation. When Pearson's correlation coefficient value lies around zero, then there is no correlation.

By performing correlation analysis on the survey data, we obtained a series of correlation coefficients. In our study, a high positive correlation coefficient between two typefaces indicated that participants perceived these two typefaces have very similar personality traits; a high negative correlation coefficient between two

typefaces reflected that participants perceived these two typefaces have very dissimilar personality traits.

A number of relatively strong correlations are found in our calculations. Table 6 is an example and shows the Pearson's Correlation coefficients between each pair of twenty four typefaces related to personality trait "Legible". Pearson's Correlation coefficients between each pair of twenty four typefaces related to ten personality traits are shown in Appendix E.

By examining the correlation coefficients in the matrix of all the personality traits, we found some relatively significant correlations, which means there is a high degree of correlation between these two typefaces. In the social sciences, a correlation of 0.30 using individual level data is considered a "good" correlation; a correlation above 0.40 is considered "strong" [13]. In our study, in order to reduce the number of typefaces for further analysis, we set 0.60 or more as a "strong" correlation threshold. We highlighted all the correlation coefficients that equal or greater than 0.60 in the Table 6.

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.485	.396	.534	.566	.192	.255	.410	.519	.406	.483	.264	.391	.401	.266	.336	.239	.434	.358	.284	.366	.316	.433	.491
BSF_Ch		1	.513	.518	.308	.177	.234	.305	.352	.343	.355	.324	.265	.353	.325	.231	.324	.365	.400	.228	.332	.256	.458	.341
BMC_Ch			1	.330	.323	.396	.322	.245	.527	.401	.285	.271	.440	.416	.343	.399	.243	.520	.493	.427	.318	.508	.470	.422
Ga_Ch				1	.438	.058	.188	.639	.410	.309	.518	.413	.213	.240	.205	.201	.363	.232	.303	.133	.369	.160	.271	.423
BLB_Ch					1	.291	.286	.375	.497	.325	.368	.281	.506	.327	.415	.380	.270	.400	.319	.245	.412	.193	.266	.487
Pb_Ch						1	.353	.031	.315	.260	.042	-.060	.275	.315	.300	.310	.065	.351	.081	.472	.157	.334	.273	.185
HP_Ch							1	.259	.494	.497	.181	.263	.455	.452	.304	.469	.267	.355	.289	.502	.297	.451	.517	.464
Cr_Ch								1	.356	.349	.534	.558	.205	.211	.161	.251	.394	.283	.369	.231	.443	.094	.243	.496
PR_Ch									1	.438	.395	.432	.577	.495	.474	.381	.450	.541	.493	.504	.468	.460	.535	.534
Jm_Ch										1	.328	.324	.462	.447	.267	.512	.327	.590	.490	.319	.495	.582	.550	.567
TNR_Ch											1	.654	.154	.211	.414	.145	.613	.295	.530	.165	.597	.179	.376	.578
Al_Ch												1	.273	.304	.442	.070	.743	.284	.657	.107	.650	.312	.394	.546
Bw_Ch													1	.560	.390	.452	.225	.541	.418	.408	.319	.509	.411	.416
KM_Ch														1	.435	.402	.294	.489	.466	.369	.217	.531	.545	.535
Ip_Ch															1	.118	.475	.508	.575	.391	.534	.436	.453	.451
Cl_Ch																1	.195	.437	.159	.429	.112	.343	.396	.367
Ht_Ch																	1	.325	.577	.258	.656	.298	.376	.606
Bh93_Ch																		1	.520	.426	.366	.606	.655	.460
Kb_Ch																			1	.259	.569	.568	.525	.628
Ox_Ch																				1	.235	.321	.535	.470
Rw_Ch																					1	.399	.375	.588
SITC_Ch																						1	.662	.408
Hr_Ch																							1	.559
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Table 6 Correlation matrix of twenty four typefaces related to personality trait "Legible"

We summarized the fifteen typefaces that exhibited strong correlations with the ten personality traits. They are: Garamond, Belwe Lt BT, Harry Potter, Centaur, Jokerman, Times New Roman, Arial, Chiller, Helvetica, Bauhaus 93, Kabel, Rockwell, Snap ITC, Harrington and Footlight MT Light.

We compared results from the correlation and univariate analyses result from section 3.1. We found that most typefaces that appeared in the three typefaces that most associated with the ten personality traits (Table 5) also exhibited strong correlations with the ten personality traits. Only two typefaces, Cooper Black and Playbill, we found them did not produce statistically significant results after examining their correlation analysis results. Therefore these fifteen typefaces were used in further analyses. The other nine typefaces, Cooper Black, Berlin Sans FB, Bernard MT Condensed, Playbill, Poor Richard, Broadway, Kino MT, Impact and Onyx were not included in the next factor analysis because they were not found to be the most associated with the ten personality traits or they did not produce statistically significant results in the correlation analysis.

3.3 Factor Analysis

We performed factor analysis by using Principal Components Analysis with Varimax Rotation (Kaiser Normalization) to identify the common underlying factors between typefaces and personality traits. Factor analysis is similar in reasoning to cluster analysis. Generally, a factor analysis goes through two stages: deriving the factors,

then rotating them to enhance their interpretability.

3.3.1 Kaiser-Meyer-Olkin Measure of Sampling Adequacy

In order to detect whether or not a factor analysis was applicable with our survey data, first, we performed Kaiser-Meyer-Olkin Measure of Sampling Adequacy on the rating scores of the fifteen typefaces and ten personality traits to test if these typefaces could be grouped into a smaller set of underlying factors.

We found that the Kaiser-Meyer-Olkin values of each personality trait for the fifteen studied typefaces all produced values greater than 0.730. High Kaiser-Meyer-Olkin values (close to 1.0) generally indicate that a factor analysis may be useful. If the value is less than 0.50, the results of the factor analysis will not be very useful. Therefore our data clearly supported the use of factor analysis.

3.3.2 Deriving Principal Component

Principal Components Analysis (PCA) was used to combine multiple correlated variables into components. This method was used in the typeface persona studies conducted by Bartram [14]. Bartram describes PCA as follows:

> This is a technique for summarizing the inter-correlations between a large number of scales in terms of a smaller number of independent factors. If four scales ... all measure the same semantic property, principal components analysis should

produce one main factor which accounts for most of the variation in the correlations (i.e. the inter-relationships) between the four scales. This factor can be taken to represent the semantic dimension which each of these scales is measuring.

We used the correlation matrix of fifteen typefaces that we obtained from our previous correlation analysis. The initial component structure started with as many components as there were items in the analysis. In our case, we started with fifteen items. Next, we calculated the eigenvalues, which represent the amount of variance in the data, and explained the factor with which it was associated. The components were extracted in order of the amount of variance that they explained. Therefore, the first component had the highest eigenvalue, the second the next highest, etc. The first few components explained the majority of the variance with the last few explaining only a very small proportion of variance. We retained components whose eigenvalues exceed 1. Then, after the appropriate number of components have been determined, a component matrix was calculated. This matrix identified the relationship between variables and components.

As a general guideline, component loadings greater than 0.40 indicate that an item is related or associated with a given component. We sorted the matrix and suppressed values that were less than 0.40. We knew that if no relationship existed between the variables then each variable would make its own unique component.

3.3.3 Varimax Rotation

After obtaining the components, we used Varimax rotation to enhance the interpretability of each component and sort data until specific groups are indentified. Varimax rotation is a change of coordinates that maximizes the sum of the variance of the loading vectors. That is, it seeks such a basis that most economically represents each individual - that each individual can be well described by a linear combination of only a few basis functions. The rotation can aid in simplifying the factor interpretation. Table 7 is an example showing the rotated component matrix of these fifteen typefaces related to personality trait "Cheerful". Four components (factors) are identified in this factor analysis calculation. Rotated component matrix of fifteen typefaces related to the ten personality traits are shown in Appendix F.

Rotated Component Matrix				
	Component			
	1	2	3	4
TNR_Ch	.905			
FL_Ch	.859			
Cr_Ch	.852			
Ga_Ch	.756			
Rw_Ch	.682			
Ht_Ch	.654			
Al_Ch	.622			
SITC_Ch		.773		
Hr_Ch		.669		
Bh93_Ch		.640		.600
Cl_Ch			.753	
HP_Ch			.730	
Jm_Ch		.545	.623	
Kb_Ch				.826
BLB_Ch	.458			.508

Table 7 Rotated component matrix of fifteen typefaces related to the personality trait "Cheerful"

3.3.4 Interpretation of Factors

Our factor analysis results revealed that three or four independent factors both accounted for 50% of the total variance. We can thus categorize fifteen typefaces into three or four groups. On closer examination of the factor analysis results, the ratings of the fifteen typefaces and the values of their correlation, we finally decided on four groups. Typefaces within a group correlated highly with the other typefaces in that

group, and did not correlate highly with typefaces in other groups.

Group 1 – Garamond, Centaur, Times New Roman, Arial, Helvetica, Rockwell and Footlight MT Light

Group 2 – Belwe Lt BT, Bauhaus 93 and Kabel

Group 3 – Jokerman, Snap ITC and Harrington

Group 4 – Harry Potter and Chiller

Items that had higher factor loadings were being more representative of the factor than items with lower factor loadings. For example, all typefaces that correlated positively in the group 3 rated much higher than those in the other three groups; thus, cheerfulness was a common property of the typefaces in group 3 and was a characteristic that distinguished those typefaces from the typefaces in the other groups. Although typefaces in group 3 also rated highly on "Attractive", "Creative", "Relaxed" and "Friendly", the differences between the groups were not as great, so these characteristics were not considered to be the distinguishing characteristics. We incorporated, compared and combined the rating scores of each personality trait across the four groups and ranked them within each group. In summary, we labeled the four groups based on these rankings as (Table 8).

Group	Factor	Typeface
1	Directness	Garamond, Centaur, Times New Roman, Arial, Helvetica, Rockwell, Footlight MT Light
2	Gentleness	Belwe Lt BT, Bauhaus 93, Kabel
3	Cheerfulness	Jokerman, Snap ITC, Harrington
4	Fearfulness	Harry Potter, Chiller

Table 8 Four groups and their corresponding typefaces

3.4 Multidimensional Scaling (MDS) Analysis

Multidimensional scaling analysis was performed to validate the results from the factor analysis. MDS analyzes the dissimilarity of data in a way that displays the structure of the distance between data like a geometrical picture.

We performed MDS on rating scores of fifteen typefaces related to ten personality traits. Figure 13 is an example showing the MDS analysis of the fifteen typefaces related to the personality trait "Friendly". We found that typefaces that are similar are represented by points that are close together, and typefaces that are dissimilar are represented by points that are far apart. The fifteen typefaces can be combined into four groups in the Figure 13. Typefaces within a group were close together. There was no overlap between groups. Therefore, the MDS analysis revealed the fifteen typeface groupings results comparable to those from factor analysis and MDS analysis validated the results from factor analysis. MDS displayed the typeface groups by

dimensional descriptions and factor analysis generated the typeface groups by factor descriptions.

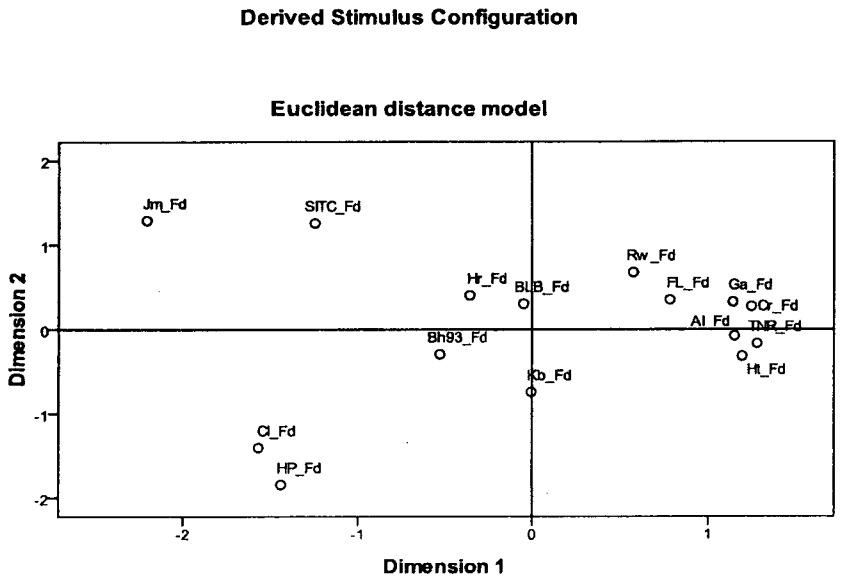


Figure 13 MDS analysis of fifteen typefaces related to the personality trait "Friendly"

3.5 Demographic Differences

We performed a one way Analysis of Variance (ANOVA) on the survey data to detect if there is a difference between demographic groups based on gender. A one way ANOVA can be used to determine if two or more independent random samples come from populations with different means. Gender serves as the independent variable in our analysis. Figure 14 is an example of the histogram of typeface Garamond concerning ten personality traits in terms of gender.

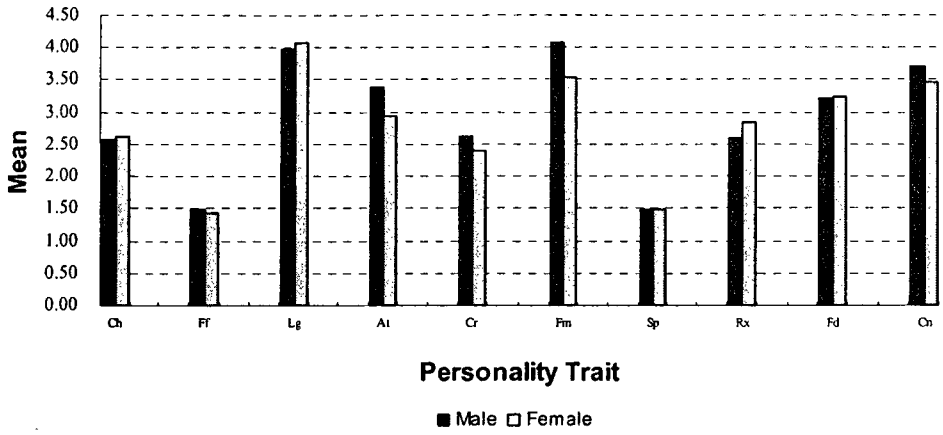


Figure 14 Histogram of typeface "Garamond" concerning ten personality traits in male and female groups

In Figure 14, the x axis indicates the ten personality traits while the y axis indicates the average values of rating scores of each personality trait in the two groups: male and female. We found no statistically significant difference between the responses of male and female participants for all fifteen typefaces and ten personality traits by calculating and comparing the rating scores' means of each typeface based on male and female participants. Moreover, we used the difference among means of each typeface related to ten personality traits and assessed them with a one-way ANOVA. The results were all insignificant ($p > 0.05$). Gender, thus does not have a significant and sizeable effect on perceptions of the fifteen typefaces' personality traits.

For the remaining demographic data (age and education background), the numbers of participants within these groups were not sufficient for a valid analysis. The majority of participants stated to be over 20 years of age and only several participants claimed having Technical School/Higher Vocational School and Junior College/Technical College education.

In short, our analysis revealed no statistically significant effects related to demographic factors.

3.6 Discussion

The results of our statistical analysis clearly supported that there is a clear and strong relationship between perceived typefaces and particular personality traits.

We removed nine typefaces after our statistical analysis. These typefaces were statistically insignificant. As a result and the total number of studied typefaces was thus reduced from twenty four to fifteen. Through series of statistical analyses on perceived personality traits, we categorized these fifteen studied typefaces into four groups. The four groups each contained typefaces that are related by typographic characteristics. These results can provide typeface designers with some use suggestions in terms of the typeface choices to suit different personality expressions.

We also detected that there is no significant difference for the participants' response influenced by the gender factor.

Participants in our study consistently described specific personality traits to certain typefaces, which was consistent with those results from previous research on typeface and their personality traits (see [15] and [16]).

In [15], Shaikh, Chaparro and Fox (2006) investigated the relationship between certain personalities and various fonts through an online survey. They concluded that users consistently attributed personalities to fonts. The twenty fonts chosen for their

survey are Cambria, Constantia, Corbel, Candara, Calibri, Consolas, Times New Roman, Arial, Verdana, Comic Sans, Century Gothic, Courier New, Impact, Gigi, Kristen, Rockwell Extra Bold, Rage Italic, Agency FB, Georgia and Monotype Corsiva. They used fifteen personality adjective pairs and semantic differential scales in the font survey. They analyzed the top three fonts of each personality traits and finally presented five groups (All purpose, traditional, happy creative, assertive bold and plain).

Compared with their survey, we found that:

1. Three commonly used fonts, Times New Roman, Arial and Impact were also chosen in our study.
2. We also used Creative, Attractive, Happy and Formal personalities in our survey as compared to Shaikh's.
3. However, due to the difference in specific typefaces, personality traits and rating scales used in our survey as compared to Shaikh's and former studies, we cannot directly compare our study results with theirs and others.

Tables 9 and 10 display the study method and results compared between Shaikh's (2006) and our studies.

Some issues that were not addressed in our study but need further investigation are whether (a) the participants' age and educational background, (b) reading of familiar or unfamiliar typefaces, (c) reading time, affect participants' responses.

	Typefaces	Personality Traits	Rating Scales
Shaikh (2006)	Times New Roman, Gigi, Cambria, Arial, Kristen, Constantia, Verdana, Rockwell Extra Bold, Corbel, Comic Sans, Rage Italic, Candara, Century Gothic, Agency FB, Calibri, Courier New, Georgia, Consolas, Impact, Monotype Corsiva	Stable vs. Unstable Flexible vs. Rigid Conformist vs. Rebel Creative vs. Unimaginative Sad vs. Happy Polite vs. Rude Exciting vs. Dull Attractive vs. Unattractive Elegant vs. Plain Youthful vs. Mature Formal vs. Casual Assertive vs. Passive Cuddly vs. Coarse Masculine vs. Feminine Practical vs. Impractical	Four point Likert scale
Our Studies	Cooper Black, Berlin Sans FB, Bernard MT Condensed, Garamond, Belwe Lt BT, Playbill, Harry Potter, Centaur, Poor Richard, Jokerman, Times New Roman, Arial, Broadway, Kino MT, Impact, Chiller, Helvetica, Bauhaus 93, Kabel, Onyx, Rockwell, Snap ITC, Harrington, Footlight MT Light	Cheerful Fearful Legible Attractive Creative Formal Sloppy Relaxed Friendly Confident	Five-point modified Likert Scale

Table 9 Comparisons of experimental method between Shaikh (2006) and our studies

	Group	Typeface
Shaikh (2006)	All Purpose	Calibri, Century Gothic, Arial, Verdana, Corbel, Candara
	Traditional	Constantia, Georgia, Times New Roman, Cambria
	Happy Creative	Gigi, Kristen, Rage Italic, Monotype Corsiva, Comic Sans
	Assertive Bold	Impact, Rockwell Xbold, Agency FB
	Plain	Courier New, Consolas
Our Studies	Directness	Garamond, Centaur, Times New Roman, Arial, Helvetica, Rockwell, Footlight MT Light
	Gentleness	Belwe Lt BT, Bauhaus 93, Kabel
	Cheerfulness	Jokerman, Snap ITC, Harrington
	Fearfulness	Harry Potter, Chiller

Table 10 Comparisons of study results between Shaikh (2006) and our studies

Chapter 4 Typeface Characteristics Analysis

In this chapter, we describe typeface characteristics based on typographical and aesthetics design of the fifteen typefaces, which have been divided into four groups (Table 11), and provide some suggestions on typefaces' uses. Typographical design characteristics are objective descriptions of typefaces, while aesthetic design characteristics are subjective descriptions of typefaces, which mostly rely on viewers' perception.

Group	Typeface
Directness	Garamond Centaur Times New Roman Arial Helvetica Rockwell Footlight MT Light
Gentleness	Belwe Lt BT Bauhaus 93 Kabel
Cheerfulness	Jokerman Snap ITC Harrington
Fearfulness	Harry Potter Chiller

Table 11 Fifteen studied typefaces in four groups

4.1 Typographical Design Characteristics

First, we analyzed typographical design characteristics of the four groups that include all fifteen typefaces. Typographical design characteristics include legibility, Serif and Sans Serif, x-height, ascender and descender, etc. We will now discuss these

characteristics individually in detail.

4.1.1 Legibility

Legibility is one of the primarily concerns of typeface designers and is an important part of typeface design. We examined the legibility of fifteen typefaces by analyzing the survey data of personality trait "Legible". We calculated the means of rating scores of personality trait "Legible" for all fifteen typefaces which have been categorized into four groups, Directness, Gentleness, Cheerfulness and Fearfulness.

Group	Typeface	Legibility
Directness	Garamond	4.0137
	Centaur	3.9726
	Times New Roman	4.0822
	Arial	3.9726
	Helvetica	4.1233
	Rockwell	3.7123
	Footlight MT Light	3.5342
Gentleness	Belwe Lt BT	3.3562
	Bauhaus 93	2.4521
	Kabel	3.2603
Cheerfulness	Jokerman	2.4658
	Snap ITC	2.3836
	Harrington	2.7397
Fearfulness	Harry Potter	2.0822
	Chiller	2.2466

Table 12 Mean values of rating scores of personality trait "Legible" for fifteen typefaces within their corresponding groups

No.	Group	Legibility
1	Directness	3.916
2	Confident	3.023
3	Cheerfulness	2.530
4	Fearfulness	2.164

Table 13 Legibility comparison of four groups

From the mean values of personality trait "Legible" of fifteen typefaces and four groups shown in Table 12 and 13, we have found that:

1) The most legible group is Directness, followed by the group Gentleness and Cheerfulness; the most illegible group is Fearfulness.
2) Typefaces in the Directness group all have high values (>3.5) for the personality trait "Legible".
3) The total value for the group Directness is much higher than the value of group Fearfulness.

4.1.2 x-height Proportion

The typographical structure of text lines is determined from the vertical projection profile, VP [17], as shown in Figure 15. Each component VP[i] represents the sum of black pixels of the scanline *i*. The *ul* and *bl* scanlines, which estimate the *upperline* and the *baseline*, correspond to the main peaks of VP, such that:

$$ul = i \text{ if } i \in [to, to + \frac{1}{2}|bo - to|] \,\&\, \max(VP[i+1] - VP[i]);$$

$$bl = i \text{ if } i \in [to + \frac{1}{2}|bo - to|, bo] \,\&\, \max(VP[i-1] - VP[i]).$$

$$x-height = bl - ul$$

$$wordheight = bo - to$$

$$x-height \Pr oportion = x-height / wordheight$$

Figure 15 Four typographical lines from vertical projection profiles

We examined the x-height proportion of fifteen typefaces included in the four groups (Table 14). The word test samples were set in 36 points and converted to binary images at 200*200 dpi resolution. The word test samples of fifteen typefaces are displayed in Appendix G. The same test samples were used in x-height proportion, ascender proportion, descender proportion and weight detection.

Directness		
No.	**Typeface**	**x-height/word height**
1	Garamond	0.4444
2	Centaur	0.3916
3	Times New Roman	0.5038
4	Arial	0.5571
5	Helvetica	0.5603
6	Rockwell	0.5145
7	Footlight MT Light	0.5036
Gentleness		
No.	**Typeface**	**x-height/word height**
8	Belwe Lt BT	0.5639
9	Bauhaus 93	0.5180
10	Kabel	0.5644
Cheerfulness		
No.	**Typeface**	**x-height/word height**
11	Jokerman	0.3736
12	Snap ITC	0.5347
13	Harrington	0.5180
Fearfulness		
No.	**Typeface**	**x-height/word height**
14	Harry Potter	0.4138
15	Chiller	0.2917

Table 14 x-height proportions of fifteen typefaces in 36 point

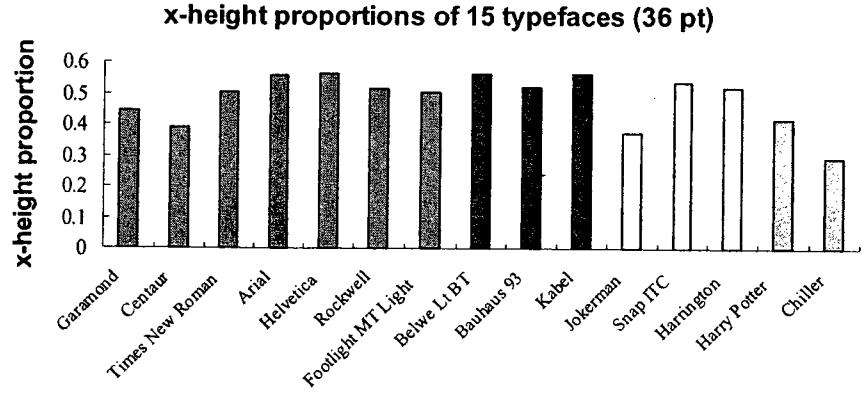


Figure 16 x-height proportion of fifteen typefaces in 36 point

For the x-height proportions of fifteen typefaces shown in Table 14 and Figure 16, we found that:

1. x-height ratios of the typefaces in group Directness are within the range of 0.40-0.56.
2. x-height ratios of the typefaces in group Gentleness are comparably larger (>0.50) than all other groups. Typeface Kabel has the largest x-height ratio of 0.5644 as compared to all other typefaces.
3. x-height ratios of typefaces in group Cheerfulness are within the range of 0.37-0.52.
4. x-height ratios of group Fearfulness are the smallest of the four groups. The typeface Chiller has the smallest x-height ratio of 0.2917 in fifteen typefaces.

4.1.3 Ascender Proportion

Based on Figure 15, we find that:

$$Ascender = ul - to$$

$$Ascender \text{ Pr } oportion = Ascender / wordheight$$

We examined the ascender proportion of all fifteen typefaces within their four groups (Table 15).

Directness		
No.	**Typeface**	**Ascender/height**
1	Garamond	0.2741
2	Centaur	0.3147
3	Times New Roman	0.2556
4	Arial	0.2143
5	Helvetica	0.2057
6	Rockwell	0.2391
7	Footlight MT Light	0.2555
Gentleness		
No.	**Typeface**	**Ascender/height**
8	Belwe Lt BT	0.2180
9	Bauhaus 93	0.2374
10	Kabel	0.2331
Cheerfulness		
No.	**Typeface**	**Ascender/height**
11	Jokerman	0.3516
12	Snap ITC	0.2292
13	Harrington	0.2518
Fearfulness		
No.	**Typeface**	**Ascender/height**
14	Harry Potter	0.3241
15	Chiller	0.3542

Table 15 Ascender proportions of fifteen typefaces in 36 point

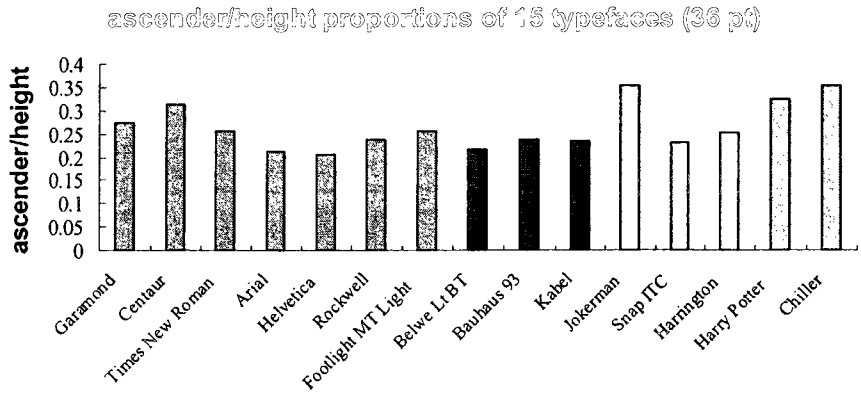


Figure 17 Ascender/height of fifteen typefaces in 36 point

From Table 15 and Figure 17 we find that:

1. The ascender ratios of typefaces in group Directness are within the range of 0.20-0.32. Typeface Arial has the smallest ascender ratio (0.2143) of all fifteen typefaces.
2. The ascender ratios of typefaces within the group Confident are very close to each other and are within the range of 0.21-0.23.
3. The ascender ratio range of typefaces in group Cheerfulness and Fearfulness are wide. Chiller, in group Fearfulness, has the largest ascender ratio of all fifteen typefaces at 0.3542.

4.1.4 Descender Proportion

Based on Figure 15, we find that:

$Descender = bo - bl$

$Descender\ \mathrm{Pr}\ oportion = Descender / wordheight$

We examined the descender proportion of fifteen typefaces within the four groups (Table 16).

Directness		
No.	**Typeface**	**Descender/height**
1	Garamond	0.2815
2	Centaur	0.2937
3	Times New Roman	0.2406
4	Arial	0.2286
5	Helvetica	0.2340
6	Rockwell	0.2464
7	Footlight MT Light	0.2409
Gentleness		
No.	**Typeface**	**Descender/height**
8	Belwe Lt BT	0.2180
9	Bauhaus 93	0.2446
10	Kabel	0.2025
Cheerfulness		
No.	**Typeface**	**Descender/height**
11	Jokerman	0.2747
12	Snap ITC	0.2361
13	Harrington	0.2302
Fearfulness		
No.	**Typeface**	**Descender/height**
14	Harry Potter	0.2621
15	Chiller	0.3542

Table 16 Descender proportions of fifteen typefaces in 36 point

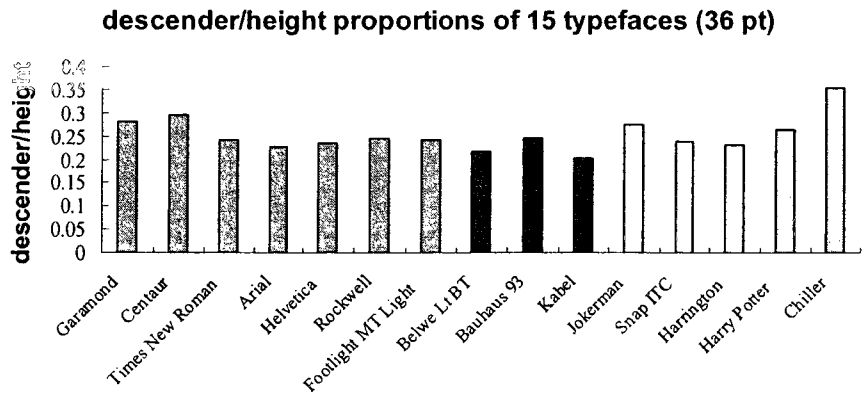


Figure 18 Descender/height of fifteen typefaces in 36 point

From Table 16 and Figure 18, we find that:

1. The descender ratios of typefaces in group Directness are close together and are within the range of 0.22-0.30.
2. The desender ratios of typefaces in group Confident are in the range of 0.20–0.25. Typeface Kabel has the smallest descender ratio of 0.2025 as compared to all fifteen typefaces.
3. The descender ratios of all typefaces in group Cheerful are around 0.24.
4. The descender ratios of group Fearfulness are the largest one of all four groups. Typeface Chiller in this group has the largest descender ratio (0.3542) of all fifteen typefaces.

4.1.5 Weight Detection

The weight of font is reflected by the density of black surfaces on the white background. This density (dn) is extracted from the horizontal profile P'_h.

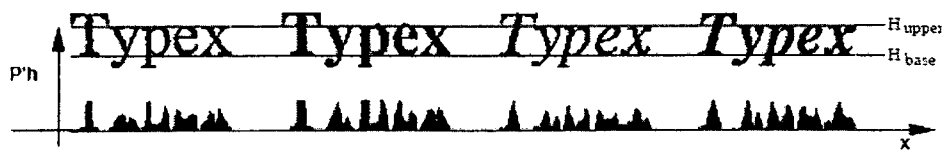


Figure 19 Horizontal projection profiles

The weight is computed on the central part of the line located between H_{upper} and H_{base}, in order to be independent of the text line structure [17]. dn is thus defined by:

$$dn = \frac{1}{n}\sum_{x=1}^{n} P'_h[x]$$

We examined the font weights of fifteen typefaces within the four groups (Table 17), in which the fifteen typefaces were set in 36 points in measurement.

Directness		
No.	**Typeface**	**Font weight**
1	Garamond	26.2734
2	Centaur	19.9271
3	Times New Roman	34.0139
4	Arial	42.8067
5	Helvetica	32.8545
6	Rockwell	34.9534
7	Footlight MT Light	24.6890
Gentleness		
No.	**Typeface**	**Font weight**
8	Belwe Lt BT	34.1732
9	Bauhaus 93	49.4027
10	Kabel	56.3408
Cheerfulness		
No.	**Typeface**	**Font weight**
11	Jokerman	33.7589
12	Snap ITC	53.4029
13	Harrington	20.8273
Fearfulness		
No.	**Typeface**	**Font weight**
15	Harry Potter	30.1218
16	Chiller	17.6524

Table 17 Font weight of fifteen typefaces in 36 point

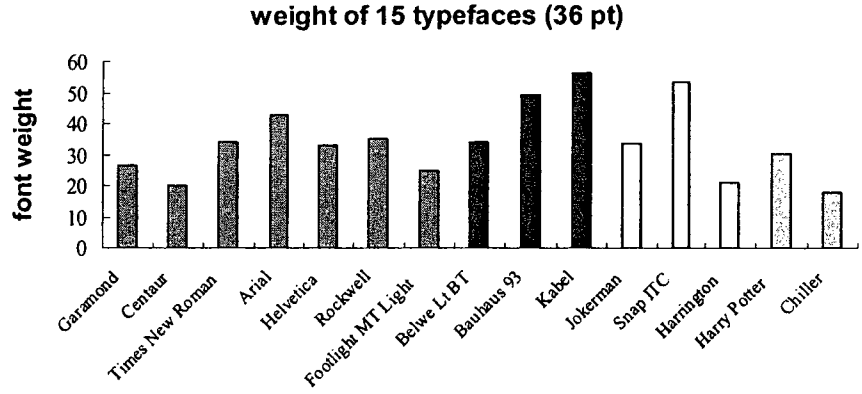


Figure 20 Weight of fifteen typefaces in 36 point

From Table 17 and Figure 20, we find that:

1. The weights of typefaces in group Directness are within the range of 20 to 43.
2. The weights of typefaces in group Gentleness vary from 34 to 56, in which typeface Kabel has the largest weight (56.34) of all fifteen typefaces.
3. The weights of typefaces in group Cheerfulness vary greatly from 20 to 53.
4. The weights of typefaces in group Fearfulness are comparably small. Typeface Chiller has the smallest weight (17.65) of the fifteen typefaces.

4.1.6 Serif and Sans Serif

We classified all fifteen typefaces based on typographical features. The classification is shown in Table 18.

No.	Group	Typeface	Classification
1	Directness	Garamond	Serif
2		Centaur	Serif
3		Times New Roman	Serif
4		Arial	Sans Serif
5		Helvetica	Sans Serif
6		Rockwell	Slab Serif
7		Footlight MT Light	Display Serif
8	Gentleness	Belwe Lt BT	Display Serif
9		Bauhaus 93	Display
10		Kabel	Display Sans Serif
11	Cheerfulness	Jokerman	Display
12		Snap ITC	Display
13		Harrington	Display
14	Fearfulness	Harry Potter	Display
15		Chiller	Display

Table 18 Fifteen typefaces classified based on typographical features, classification refers to [10]

From Table 18, we find that the typefaces in group Directness consist of Serif, Sans Serif, Slab Serif and Display Serif. The typefaces in group Gentleness are Display Serif, Display Sans Serif and Display. The typefaces in group Cheerfulness and Fearfulness are all the Display typefaces. Display Sans Serif and Display Serif are basic Sans Serif font and Serif font but some may be designed with only capital letters or work best in larger sizes.

Round-shaped characters were selected as the conspicuous character patterns. Conspicuous character patterns are special patterns designed for easier detection in scenery images. We compared our fifteen studied typefaces with those conspicuous character patterns defined in [18], and found some typefaces in the Gentleness and Cheerfulness groups such as Typeface Bauhaus 93, Kabel and Snap ITC are

round-shaped characters.

We use capital C to illustrate the differences between Serif, Sans Serif and Display typefaces of our fifteen studied typefaces. The Capital Cs of the fifteen typefaces are shown in Table 19. The order of typefaces in each group is the same as that in Table 11, similarly hereinafter.

Group	Capital "C"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 19 Capital "C" of fifteen typefaces in 36 point

4.1.6.1 Serif

For Serif capital C, there is a vertical or angled serif at the top and bottom of the bowl. These two serifs are not normally identical and symmetrical. The lower end of C could be a sharp point (see Times New Roman and Footlight MT Light in Table 19). The upper end of serif capital C is identified by an implied spur (Centaur), bracketed spur (Times New Roman) and slab serif (Rockwell), as shown in Figure 21.

Figure 21 Upper end of Capital "C", implied spur, bracketed spur and Slab Serif (from left to right: Centaur, Times New Roman and Rockwell)

4.1.6.2 Sans Serif

As displayed in Figure 22, for Sans Serif and Display Sans Serif typefaces, the end stroke of capital C could be at any angle, oblique (Arial), horizontal (Helvetica) or oblique and vertical (Kabel).

Figure 22 Ends of Capital C of Sans Serif (from left to right: Arial, Helvetica and Kabel)

4.1.6.3 Display

Capital Cs of Display typefaces do not have regular round forms as do those of Serifs' or Sans Serifs'. The arcs of Display typefaces are irregular and squeezed into the vertical axis, (see C of Harry Potter in Table 19). In addition, the stroke weight of capital C is not constant in most Display typefaces (Snap ITC, Jokerman and Chiller). There are many litter stickers along the bowl of C in Jokerman. The cut of C in Harrington even has flourished treatment (Figure 23).

Figure 23 Capital Cs (from left to right: Harry Potter, Snap ITC, Jokerman, Chiller and Harrington)

4.1.6.4 Legibility between Serif and Sans Serif

In the typographic literature [19], Serifs are generally believed to have a significant impact on readability. There are two main reasons cited to explain why Serifs should enhance legibility.

First, Serifs are believed to increase letter discrimination by making the spatial code of letter forms more complex. Mclean [20] wrote: "Sans Serif type is intrinsically less legible than seriffed type. . .because some of the letters are more like each other than letters that have serifs, and so the certainty of decipherment is diminished."

Second, Serifs are thought to increase the visibility of the ends of strokes, increasing the salience of the main strokes of the letters. Rubinstein [21] wrote: "Serifs have an important role in the readability of type, providing. . .accentuation to the ends of strokes that may help the reader read faster and avoid fatigue."

On the contrary, there are also some researchers who question if Serifs enhance legibility. Moriarty and Scheiner [22] showed that there is no difference between Serif and Sans Serif typefaces in terms of legibility. Also in [19], there are some reasons supporting that Serifs may have little effect on legibility. Serifs are generally ornamental rather than an essential part of the letter form. If they do affect legibility, it

might be reasonable to suppose that they interfere with letter recognition, since within a simple letter-form template, they might simply act as a form of noise.

From our font survey results, the three most legible typefaces include Helvetica, Times New Roman and Garamond with scores that are very close (Table 12), which shows there is not a big difference between Serif and Sans Serif on legibility issues within our present study. By contrast, the three most illegible typefaces include Harry Potter, Chiller and Snap ITC (Table 12). The most legible group is group Directness and the most illegible group is group Fearfulness. This may suggest that legibility is diminished by the use of exaggerated ornamental elements and prominent typographical features. Moderate typographical design characteristics increase typeface legibility. The simpler a typeface design is, the more legible it is.

4.1.7 Character Stroke Contrast Design

Stroke contrast of characters is an important issue in typeface design. We examined the ratio between left and right stem of capital "U" for all fifteen typefaces to illustrate the stroke contrast design. The left stem of U is thick, and the right one is thin, which is the tradition of Serif design. For Slab Serif and Sans Serif, the two stems are always thick and symmetric. Some examples of capital U in typefaces used in our studies are shown in Figure 24.

Figure 24 Examples of Capital U (from left to right: Centaur, Times New Roman, Arial, Rockwell, Bauhaus 93 and Harry Potter in 36pt)

Directness		
No.	**Typeface**	**Width ratio of left /right stem of U**
1	Garamond	2.8
2	Centaur	3.5
3	Times New Roman	2.5
4	Arial	1.0625
5	Helvetica	1.0625
6	Rockwell	1.0625
7	Footlight MT Light	1.5
Gentleness		
No.	**Typeface**	**Width ratio of left /right stem of U**
8	Belwe Lt BT	0.7667
9	Bauhaus 93	1.0303
10	Kabel	1
Cheerfulness		
No.	**Typeface**	**Width ratio of left /right stem of U**
11	Jokerman	0.5807
12	Snap ITC	1.3333
13	Harrington	0.7059
Fearfulness		
No.	**Typeface**	**Width ratio of left /right stem of U**
14	Harry Potter	1.1111
15	Chiller	4

Table 20 Ratios between the two stems of U for fifteen typefaces

From Table 20, we find that the ratios between the two vertical stems of U vary from 0.7 to 4 for the fifteen studied typefaces. Typeface Chiller has the strongest stroke contrast of 4, which is the most exaggerated contrast of all fifteen typefaces. The contrast of two stems in U for most Sans Serif typefaces is consistent and is not as

strong as Serif typefaces.

4.1.8 Character Width and Height Design

The ratio between width and height of characters is another important issue for typeface design. We use the capital "O" to illustrate this ratio for our fifteen studied typefaces. Capital Os of all fifteen typefaces are shown in Table 21.

Group	Capital "O"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 21 Capital "O" in fifteen typefaces in 36 point

The form of the O impacts the design of all other round letters, such as Q, C, etc. According to [3], the design of Serif O varied greatly over time. Early Serif O has thick and thin strokes with oblique emphasis. Later Serif O becomes more oval and upright, with both higher and lower contrasts. The Sans Serif O has fewer options compared to its Serif counterpart, since the stroke contrast is not high, even the letters are designed with equal stroke widths. This tradition is also present in other Sans Serif

character designs. For Display typefaces, the O is not in the traditional circular or oval form, but is in the rounded rectangle, square, or asymmetrical form. All kinds of random O forms, including rectangular, square, diamond, and triangular forms are present in Display typefaces. The capital Os of Display typefaces do not keep the traditional upright form. This characteristic also undermines the legibility and readability of Display typefaces. The O of typeface Snap ITC is flat, as extends by stretching and thus ruins the stroke weight and proportion. In contrast, capital O of typeface Harry Potter is narrow, as it is condensed by squeezing the letter, and the width of letter is not regular (Table 21). The capital Os' of Display typefaces are not symmetric and are not round forms at all. Even the O of typeface Chiller is not a close circle.

We calculated the ratios between width and height of capital O for the fifteen typefaces. These values are shown in Table 22.

Directness		
No.	**Typeface**	**Width/height of O**
1	Garamond	1.0625
2	Centaur	1.0103
3	Times New Roman	0.9314
4	Arial	0.9189
5	Helvetica	0.9204
6	Rockwell	1
7	Footlight MT Light	0.9897
Gentleness		
No.	**Typeface**	**Width/height of O**
8	Belwe Lt BT	1.019
9	Bauhaus 93	1.0097
10	Kabel	1.0317
Cheerfulness		
No.	**Typeface**	**Width/height of O**
11	Jokerman	0.8475
12	Snap ITC	1.0727
13	Harrington	0.8019
Fearfulness		
No.	**Typeface**	**Width/height of O**
14	Harry Potter	0.5688
15	Chiller	0.7403

Table 22 Ratio between width and height of O for all fifteen typefaces

From Table 22, we find that:

1. The capital O is not necessary a true circle in the typeface design, it is always in an elliptical form. Capital O in Rockwell is the only true circle, as its ratio is 1.
2. The ratios between width and height of capital O of typefaces in the Directness and Gentleness groups are within the range of 0.9-1.1, close to a true circle.
3. The width and height ratios of typefaces in group Cheerfulness vary slightly, more than those of typefaces in group Directness and Gentleness, as they are within the range of 0.8-1.1. The capital O of typeface Snap ITC has the largest width and

height ratio of 1.0727 of all fifteen typefaces.

4. The width and height ratios of typefaces in group Fearfulness are the smallest of all four groups. The Os of typefaces in this group are therefore greatly narrower than those in the other three groups. The O of typeface Harry Potter is the narrowest with the width and height ratio of 0.5688.

4.1.9 Stem and Cap Height Design

Capital Y has two diagonal strokes and a vertical stem (Figure 25). The capital Ys of the fifteen studied typefaces are shown in Table 23.

Figure 25 Stem height and Cap height of Capital "Y"

Group	Capital "Y"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 23 Capital "Y" for all fifteen typefaces in 36 point

Directness		
No.	**Typeface**	**Stem/Cap height of Y**
1	Garamond	0.3830
2	Centaur	0.4316
3	Times New Roman	0.3878
4	Arial	0.4112
5	Helvetica	0.3925
6	Rockwell	0.4455
7	Footlight MT Light	0.3763
Gentleness		
No.	**Typeface**	**Stem/Cap height of Y**
8	Belwe Lt BT	0.3333
9	Bauhaus 93	0.5455
10	Kabel	0.3609
Cheerfulness		
No.	**Typeface**	**Stem/Cap height of Y**
11	Jokerman	0.2941
12	Snap ITC	0.4018
13	Harrington	0.2891
Fearfulness		
No.	**Typeface**	**Stem/Cap height of Y**
15	Harry Potter	0.4183
16	Chiller	0.4862

Table 24 Ratios between stem and Cap height of Y of fifteen typefaces

Typeface designers are interested in the design of the stem height of Y. If the vertex is too low, the Y will be top heavy. However, if the vertex is too high, the space between the arms will be too small, and the gesture of the arms will look timid. According to [3], in general, the stem of a Serif capital Y should fall between 35-50% of the capital height.

We calculated the ratio between the stem and cap height of Y for the fifteen typefaces. These ratios are presented in Table 24. From this table, we find that:

1. The ratios between the stem and Cap height of typefaces in the group Directness are within the range of 0.38-0.45.
2. The ratios between the stem and Cap height for typefaces in the Gentleness group are within the range of 0.42-0.50, in which typeface Bauhaus 93 has the largest stem/height ratio of 0.5455 of all fifteen typefaces.
3. The ratios between the stem and Cap height of the typefaces in group Cheerfulness vary greatly. Typeface Harrington has the smallest stem height ratio of 0.2891.
4. The ratios between the stem and Cap height for typefaces in the group Fearfulness are within the range of 0.42-0.49.

4.1.10 Character Stroke Design

4.1.10.1 Stroke Length

Group	Capital "E"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 25 Capital "E" of fifteen typefaces in 36 point

We use capital E from all fifteen typefaces to demonstrate the stroke design characteristic. Table 25 shows capital E for the fifteen studied typefaces. For capital E, the lengths of the three arms in relation to the stem and to each other give the letter its character [3]. Based on our results, we found that:

1. The capital E of Sans Serif typefaces, such as Arial and Helvetica in group Directness and Gentleness, include three bars that are optically the same in length. However, the lengths of the horizontal bars of Serif typefaces, such as Times New Roman and Centaur in group Directness and Gentleness vary; the central bar is the shortest, and the bottom is the longest.
2. The lengths of the three horizontal strokes of E of typeface Chiller in group Fearfulness differ from each other and contrast greatly. Moreover, the lowest arm

is much shorter than the upper one.

3. The central bar of E of Harrington in group Cheerfulness is the longest one of the three bars, and all three bars are not horizontal and curvilinear.
4. The stress or bias of a roman font is the angle determined by the direction of the thicker stem strokes [3]. The main stem of E in group Directness and Gentleness is strictly perpendicular to the baseline.
5. By contrast, most typefaces in group Cheerfulness and Fearfulness are not perpendicular to the baseline. The vertical stems of E of typeface Jokerman and Chiller are slightly slanted to the right. The main stem of typeface Harrington is curvilinear.

Similar features can be found in other letters in these fifteen typefaces that have main upright strokes, such as B, D, K and R.

4.1.10.2 Stroke Form

Group	Capital "D"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 26 Capital "D" of fifteen typefaces in 36 point

We use capital D as an example to illustrate the stroke form's design characteristic. Table 26 shows the capital D for all fifteen studied typefaces. Based on our results, we found that:

1. The capital D of Sans Serif typefaces, such as Arial and Kabel in group Directness and Gentleness, includes arcs that are almost semi-circular and are in a half round shape.
2. The radian of the bowl of D of typeface Harry Potter in groups Fearfulness is flatter than the radian of the bowl of D of typeface Arial in group Directness, and it looks like a semi oval, squeezed in the horizontal axis.
3. The curvilinear stroke of D of typeface Snap ITC in group Cheerfulness is irregular and squeezed in the horizontal axis. In addition, the curvilinear stroke weight of D is not constant for typeface Snap ITC in group Cheerfulness and

typeface Chiller in group Fearfulness.

Similar features of the fifteen typefaces can be found in other letters that have round strokes, such as B, D, O and Q.

4.1.10.3 Stroke Joining Part Treatment

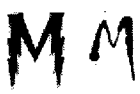
Group	Capital "M"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 27 Capital "M" of fifteen typefaces in 36 point

The treatment of the junction area where two strokes intersect in a letterform, such as the vertices of M and N, is of interest. We use capital M to illustrate this design characteristic. Table 27 shows the capital Ms for all fifteen studied typefaces.

1. The vertex of the two diagonal strokes of M for most typefaces in the groups Directness and Gentleness do not overshoot and are close to the baseline including Serif and Sans Serif typefaces, except the typeface Kabel in group Gentleness. In this case, the sharp point vertex of the two diagonal strokes of M is below the baseline.

2. The vertex of the two diagonal strokes of M of typefaces in groups Cheerfulness and Fearfulness protrude conspicuously above the baseline. The vertexes of M of typefaces in group Cheerfulness vary in form. The vertex of M of typeface Harrington is a loop circle.

4.1.11 Counter Design

Group	Lowercase "b"
Directness	
Gentleness	
Cheerfulness	
Fearfulness	

Table 28 Lowercase "b" of fifteen typefaces in 36 point

We chose lowercase "b" to illustrate the different counter designs of the fifteen typefaces we studied. Table 28 shows the different designs of lowercase "b" for all fifteen typefaces. We found the following results:

1. In typefaces in groups Directness and Gentleness, counters of character b appear even and in circular form.
2. In typeface Snap ITC of group Cheerfulness, lowercase b has a very small counter. Moreover, due to the inconsistent weight of the round stroke, the closed counter is

not in the center of the letter, but is in the upper part. In typeface Jokerman of group Fearfulness, lowercase b has a spiral counter. The counter of lowercase b of typefaces in group Fearfulness are not in a circle form and lowercase b of typeface Chiller does not have a closed counter.

4.1.12 Character Space

In [4], Walter wrote: "the success or failure of a type is very much a question of getting a good balance of white inside and outside the letters. The interior areas of letters are fixed by the shape of the letters, but the spaces at both sides of them are at will."

In order to examine whether the character space influenced participants' attitudes toward typefaces, we chose some standard characters, including capitals "H", "O", and lowercases "h" and "o" by using Fontlab 4 to detect the inter-letter space. Table 29 shows the left and right side bearings of these standard characters for all fifteen studied typefaces. We found that the inter-letter settings of the characters differ considerably from one typeface design to another. For typeface Kabel of group Gentleness, the side bearings of the four standard characters are much bigger than those of the other typefaces. On the contrary, for typeface Snap ITC of group Cheerfulness and typeface Harry Potter of group Fearfulness, the left side bearings have negative values and are smaller than others. From these values, we found negative values appear only in the typefaces belonging to groups Cheerfulness and

Fearfulness.

No.	Typeface	H (LSB,RSB)	O (LSB,RSB)	h (LSB,RSB)	o (LSB,RSB)
Directness					
1	Garamond	(39,53)	(94,98)	(30,27)	(73,74)
2	Centaur	(31,55)	(84,80)	(29,11)	(78,78)
3	Times New Roman	(35,42)	(72,79)	(13,13)	(69,71)
4	Arial	(164,165)	(99,92)	(135,139)	(68,76)
5	Helvetica	(158,156)	(80,80)	(133,133)	(72,72)
6	Rockwell	(55,53)	(102,101)	(42,12)	(78,78)
7	Footlight MT Light	(61,63)	(76,75)	(50,42)	(42,45)
Gentleness					
8	Belwe Lt BT	(102,103)	(72,72)	(94,93)	(68,67)
9	Bauhaus 93	(137,136)	(55,54)	(109,109)	(48,47)
10	Kabel	(209,184)	(242,197)	(217,242)	(242,176)
Cheerfulness					
11	Jokerman	(141,114)	(102,102)	(76,129)	(64,64)
12	Snap ITC	(-10,-10)	(47,47)	(-8,35)	(37,37)
13	Harrington	(12,124)	(90,90)	(83,152)	(74,82)
Fearfulness					
14	Harry Potter	(8,-57)	(33,31)	(12,12)	(12,7)
15	Chiller	(74,103)	(72,71)	(23,90)	(63,63)

Table 29 Left side bearings (LSB) and right side bearings (RSB) of characters "H", "O", "h" and "o" for fifteen typefaces

4.2 Aesthetic Design Characteristics

In addition to typographical design characteristics, we analyzed the aesthetic design characteristics of all fifteen typefaces in their four groups. According to some marketing research studies on logo design ([23] and [24]), three universal aesthetic dimensions of graphic logo design were proposed, elaborateness, naturalness and harmony. Since many of our studied typefaces are Display typefaces, we tried to use

these three aesthetic design dimensions to examine our four studied groups and their corresponding typefaces. These three dimensions were analyzed individually and will be discussed in detail.

4.2.1 Elaborateness

Elaborate is not simply intricate, but appears to capture the concept of design richness and the ability to use simple lines to capture the essence of something [23]. Elaborateness is composed of several design characteristics: ornament vs. briefness, depth vs. flatness and special use vs. common use.

4.2.1.1 Ornament vs. Briefness

The design of typefaces in group Directness is brief, simple, and is without any ornaments. The form of characters of typefaces in this group is standard and rigid. For example, the capital Os of group Directness are always circular or oval. Rectangular, square, diamond and some other random O forms do not appear in group Directness. Compared with the briefness of typeface design within the group Directness, some special ornaments were incorporated in Display typefaces within the groups Gentleness, Cheerfulness and Fearfulness. For example, the design of typeface Jokerman in group Cheerfulness, includes some little stickers, small circles or even star figures added deliberately to the main strokes of letters. These ornaments are distributed evenly on strokes (Figure 26).

Figure 26 Ornaments of typeface "Jokerman"

Stems and other strokes in the letterform of typeface Snap ITC of group Cheerfulness include slanted, convex, and concave lines (Figure 27). The special curly strokes communicate a feeling of cheerfulness.

Figure 27 Curvaceous strokes of typeface "Harrington"

4.2.1.2 Depth vs. Flatness

Depth gives the appearance of perspective or a three dimensional design [23].

Typefaces in group Directness are flat and seldom have structure variation; the strokes of these typefaces are always vertical and horizontal.

Typefaces in group Gentleness have a slight structural variation. For example, the serifs in typeface Belwe Lt BT in this group are slanted and are in a ribbon form (Figure 28).

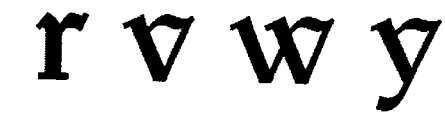


Figure 28 Curvaceous strokes of typeface "Belwe Lt BT"

Typefaces in group Cheerfulness and Fearfulness represent a wide range of structure

variation. These variations include stroke form, character size and proportion, etc., which add depth to the typeface and make it more distinctive.

4.2.1.3 Special Use and Common Use

Typefaces in group Directness are commonly and widely used in small sizes as text typefaces for newspaper, textbooks, magazines, etc. They can also be used in large sizes for Display typefaces, such as headings in advertisements. However, typefaces in group Gentleness, Cheerfulness and Fearfulness are only suitable for headings in large sizes.

4.2.2 Naturalness

Naturalness is composed of several design characteristics: organic vs. geometric and printed vs. handwritten appearance.

4.2.2.1 Organic vs. Geometric

Organic designs are those that are made up of natural shapes, such as irregular curves. Alternatively, geometric designs tend to represent less natural and more synthetic-looking objects [23].

Typefaces in groups Directness and Gentleness are more geometric while typefaces in groups Cheerfulness and Fearfulness are more organic in appearance. For example,

typeface Bauhaus 93 in group Gentleness, displays a rigid letterform style, which is geometric and even (Figure 29).

Figure 29 Geometric and even strokes of typeface "Bauhaus 93"

For typeface Harrington of group Cheerfulness, tight curlicues are added to the serifs, no matter if they are capital or lowercase letters (Figure 30). The tight loop on the terminal is the most identifying characteristic of typeface Harrington and makes it more casual and original. It creates visual interest and provides a fun and vivacious feeling.

Figure 30 Curly Serifs of typeface "Harrington"

4.2.2.2 Printed vs. Handwritten Appearance

For typefaces of groups Directness and Gentleness, their strokes are straight lines, and their structure is rigid. The characters rest on the same baseline.

However, typefaces in groups Cheerfulness and Fearfulness, include letterforms that look more handwritten and random. For the letterform of typeface Chiller of group Fearfulness, all strokes are in handwritten form and convey shivery chilled feelings

(Figure 31). The great effect creates visual interest and provides a fearful feeling. Moreover, there is no horizontal and perpendicular line in these two letterforms.

Figure 31 Shivery chilled strokes of typeface "Chiller"

4.2.3 Harmony

Harmony is composed of several design characteristics: symmetry vs. asymmetry, and balanced vs. unbalanced.

4.2.2.3 Symmetry vs. Asymmetry

Symmetric designs appear as reflections along one or more axes. That is, the elements on one side of the axis are identical to the elements on the other side [23].

The letterform design of typefaces in groups Directness and Gentleness exhibit symmetry everywhere, and the symmetrical design generally lends the letterform to a more formal appearance. On the contrary, asymmetry is a more common letterform design of typefaces in groups Cheerfulness and Fearfulness.

4.2.2.4 Balanced vs. Unbalanced

Balance is related to symmetry because symmetric designs are normally considered balanced. The reverse is not true, however (i.e., an asymmetric design is not

necessarily imbalanced) [23].

Letterforms of typefaces in groups Directness and Gentleness are well proportioned and balanced, as opposed to letterform designs of typefaces in groups Cheerfulness and Fearfulness, which are examples of unbalanced designs. They have different baselines, proportions and flexible ornaments.

4.3 Summary of Typeface Characteristics

By analyzing the typographical and aesthetic design characteristics of our four studied groups and their corresponding typefaces, we obtained some conclusions about typeface design and the personality traits they convey. These conclusions are summarized mainly from analyses of the individual characters.

4.3.1 Typographical Characteristics

We examined the typographical characteristics of our studied typefaces from two aspects, groups and their representative typefaces.

4.3.1.1 Typographical Characteristics of Four Groups

We analyzed some typographical characteristics of our fifteen typefaces including x-height, ascender and descender ratios, weight, serif design, character stroke contrast, character width and height, stem height and cap height, stroke form, stroke length,

stroke joining part treatment, character space, and counter design. Table 30 shows the mean values of four main typographical characteristics of our four study groups.

	x-height ratio	ascender ratio	descender ratio	font weight
Directness	0.4965	0.2513	0.2522	30.7883
Gentleness	0.5488	0.2295	0.2217	46.6389
Cheerfulness	0.4754	0.2775	0.247	35.9964
Fearfulness	0.3528	0.3392	0.3082	23.8871

Table 30 Mean values of four main typographical characteristics of our four study groups

From Table 30 and our analysis we found that:

1. The values of typographical characteristics of typefaces in group Directness are moderate compared with the other three groups and it is the most legible groups in four groups. It proved the balance between a moderately large x-height, ascender and descender ratios is very important for typeface legibility.
2. The typefaces in group Gentleness have largest ratios on x-height and font weight, while smallest ratios on ascender and descender ratios in four groups. Legibility of the Gentleness group ranks second out of the four groups. The typefaces in groups Directness and Gentleness are easy to read.
3. The values of typographical characteristics of typefaces in group Cheerfulness and Fearfulness vary in a wide range. Typefaces that have minimum or maximum values in our fifteen typefaces fall mainly within these two groups. Some typefaces in these two groups have very flexible and exaggerated values,

especially on ascender and descender ratios. This exaggeration creates visual interest, making typefaces prominent and provides readers with strong visual feelings. The typefaces of these two groups consist only of Display typefaces, and are easy to catch readers' eyes compared with Serif and Sans Serif typefaces from the Directness and Gentleness groups. Legibility of these two groups is worse than the Directness and Gentleness groups.

4. There are trade-offs between typeface legibility and strong visual feelings conveyed by typefaces. Specifically, moderate design increases the typeface legibility, but decreases prominent responses. For example, typeface Helvetica in group Directness scored very highly on legibility, low on creative and cheerful and average on relaxed in our font survey. Typeface Jokerman in the Cheerfulness group scored first on cheerful and creative and low on legible. The typefaces in group Gentleness are less prominent compared to the other three groups. They produced average scores on several typeface traits, such as cheerful, friendly, confident and relaxed.

4.3.1.2 Typographical Characteristics of Groups' Representative Typefaces

On the basis of the survey results and analysis of groups' typographical characteristics, we select four typefaces that represented the characteristics for each of the four

groups.

● Directness Group and Typeface Helvetica

This group includes common, highly legible typefaces. Closer examination of the ratings for each typeface within the Directness group, we found all typefaces in this group rated highest than those in other groups on personality traits "Legible", "Formal" and "Confident". Based on the ranking comparisons, we found five typefaces, Helvetica, Times New Roman, Garamond, Arial and Centaur are in the ranking of first five of all these three personality traits (Table 31).

Personality	**Typeface**				
Lg	Ht	TNR	Ga	Al	Cr
	4.1467	4.1067	4.0267	4.0000	3.9733
Fm	TNR	Cr	Ht	Ga	Al
	4.1733	3.9733	3.8533	3.8133	3.7600
Cn	Ht	TNR	Al	Cr	Ga
	3.8267	3.7200	3.6667	3.6000	3.5867

Table 31 Five typefaces that were the most associated with personality traits "Legible", "Formal" and "Confident"

Table 32 shows the mean values of four main typographical characteristics of these five typefaces of the Directness group.

	Typeface	x-height ratio	ascender ratio	descender ratio	font weight
Directness	Ht	0.5603	0.2057	0.2340	32.8545
	TNR	0.5038	0.2556	0.2406	34.0139
	Ga	0.4444	0.2741	0.2815	26.2734
	Al	0.5571	0.2143	0.2286	42.8067
	Cr	0.3916	0.3147	0.2937	19.9271

Table 32 Means of four main typographical characteristics of five typefaces in the Directness group

Among the five typefaces, the typeface Helvetica has the largest x-height ratio, smallest ascender ratio and scores first on personality traits "Legible" and "Formal". The descender ratio of typeface Helvetica is smaller compared with other three typefaces and only larger than typeface Arial. Therefore typeface Helvetica is a good example to represent the Directness group. As we noted, typeface Centaur has the smallest x-height ratio and font weight in five typefaces, and it scores fifth on personality trait "legible". The result also proved that a moderately large x-height and font weight are very important for a legible typeface.

● Gentleness Group and Typeface Belwe Lt BT

This group is unlikely to be a very prominent one as compared to other three groups because the typefaces in this group rated moderate on all the personality traits. After careful examination we found the typefaces of this group ranked comparably higher

on "Cheerful", "Legible", "Creative", "Relaxed" and "Friendly". Typeface Belwe Lt BT scored highest than other two typefaces on these personality traits. Therefore, we choose Belwe Lt BT to represent this group.

	Typeface	x-height ratio	ascender ratio	descender ratio	font weight
Gentleness	BLB	0.5639	0.2180	0.2180	34.1732
	Bh93	0.5180	0.2374	0.2446	49.4027
	Kb	0.5640	0.2331	0.2025	56.3408

Table 33 Means of four main typographical characteristics of typefaces in the Gentleness group

Compared the typographical characteristics of these three typefaces (Table 33) with typefaces in the Directness group, we found they all have larger x-height, smaller ascender, descender and thicker weight as compared to typefaces in other groups.

• Cheerfulness Group and Typeface Jokerman

Personality	Typeface				
Ch	Jm	SITC	Hr	BLB	Ga
	3.4533	3.2933	3.0133	2.6533	2.6000
At	Ga	Hr	Cr	Jm	SITC
	3.1733	3.1333	3.1200	2.9067	2.9067
Cr	Jm	SITC	Hr	HP	Cl
	3.6400	3.4267	3.3333	3.1200	3.0400
Rx	Jm	SITC	Hr	Cl	CB
	3.2933	3.1067	3.0000	2.9067	2.8933

Table 34 Five typefaces that were the most associated with personality traits "Cheerful", "Attractive", "Creative" and "Relaxed"

We found all typefaces that correlated in the Cheerfulness group rated highest than

those in other groups on personality traits "Cheerful", "Creative" and "Relaxed" (Table 34). In addition, the three typefaces scored high on personality trait "Attractive". Typeface Jokerman scored first among the three typefaces in these four personality traits. Therefore typeface Jokerman is a representative example of the Cheerfulness group.

	Typeface	x-height ratio	ascender ratio	descender ratio	font weight
Cheerfulness	Jm	0.3736	0.3516	0.2747	33.7589
	SITC	0.5347	0.2292	0.2361	53.4029
	Hr	0.5180	0.2518	0.2302	20.8273

Table 35 Means of four main typographical characteristics of typefaces in the Cheerfulness group

Careful examination of the four main typographical characteristics of these three typefaces (Table 35), we found their typographical ratios vary greatly. Typeface Jokerman has the smallest x-height ratio and largest ascender and descender ratios among three typefaces. It appears that special ornaments, unbalanced and asymmetrical design are the reasons that typeface Jokerman was chosen as the most creative and cheerful typeface.

● Fearfulness Group and Typeface Harry Potter

Personality	Typeface				
Ff	Hp	Pb	Cl	BMC	KM
	2.9067	2.4800	2.3867	2.1067	2.0933
Cr	Jm	SITC	Hr	HP	Cl
	3.6400	3.4267	3.3333	3.1200	3.0400
Sp	Cl	HP	Jm	SITC	Pb
	3.1200	2.8000	2.7867	2.7333	2.3467

Table 36 Five typefaces that were the most associated with personality traits "Fearful", "Creative" and "Sloppy"

We found that the typefaces in the Fearfulness group are rated as most fearful and sloppy (Table 36). In addition, the two typefaces in the Fearfulness group scored high on personality trait "Creative". Typeface Harry Potter scored first in the personality traits "Fearful". Therefore typeface Harry Potter is the representative example of the Fearfulness group.

Fearfulness	Typeface	x-height ratio	ascender ratio	descender ratio	font weight
	HP	0.4138	0.3241	0.2621	30.1218
	Cl	0.2917	0.3542	0.3542	17.6524

Table 37 Means of four main typographical characteristics of typefaces in the Fearfulness group

As we noted previously, the four main typographical characteristics of these two typefaces vary greatly (Table 37). Typeface Harry Potter has a comparably larger x-height and smaller descender ratio, while typeface Chiller has the smallest x-height

in our fifteen typefaces. These exaggerated values make them illegible, but might be effective in grabbing attention. The special ornaments used in these two typefaces make the typefaces overly unpleasant. That is the reason typeface Chiller was rated as the sloppiest one.

4.3.2 Aesthetic Characteristics

We evaluated aesthetic characteristics of the four groups based on three aspects: elaborateness, naturalness and harmony. In our analysis we found that:

1. The typefaces of groups Directness and Gentleness are less complex and more plain compared with those in the Cheerfulness and Fearfulness groups. Different ornaments are used in all the typefaces of group Cheerfulness and Fearfulness, while there are no ornaments in the typefaces of the Directness group, and some subtle ornaments in typefaces of the Gentleness group. The applications of typefaces in the Directness group are extensive while those in group Gentleness, Cheerfulness and Fearfulness are only suitable for headings in large sizes.
2. The letterform of typefaces in the Directness and Gentleness groups are more geometric and carefully set. Those of the Cheerfulness and Fearfulness groups are more flexible and natural. There are almost no horizontal and perpendicular strokes in typefaces of the Cheerfulness and Fearfulness groups.
3. The typefaces in the Cheerfulness and Fearfulness groups are asymmetrical and unbalanced, while those in the Directness and Gentleness groups are symmetrical

and balanced.

4. The most attractive groups are Directness and Cheerfulness, their typefaces ranked highest on personality trait "Attractive".
5. There are some trade offs in the aesthetic aspects of typeface design. Symmetrical and balanced designs increase friendly responses and typeface legibility but decrease attraction and prominent responses. The use of ornaments always influences and decreases typeface legibility.

Table 38 shows the different levels of aesthetic characteristics of our four study groups. The Directness group is highly harmony but not elaborate and natural. The typefaces in this group are all common and highly readable typefaces. The Cheerfulness and Fearfulness groups are high on elaborateness and naturalness but low on harmony. Such typefaces are mostly special used in the content of advertisements. While the Gentleness group is average on elaborateness and harmony compared with other three groups but low on naturalness.

	Elaborateness		**Naturalness**		**Harmony**	
	Ornament	Depth	Organic	Handwritten	Symmetry	Balanced
Directness	Low	Low	Low	Low	High	High
Gentleness	Average	Average	Low	Low	Average	Average
Cheerfulness	High	High	High	High	Low	Low
Fearfulness	High	High	High	High	Low	Low

Table 38 Different levels of aesthetic characteristics of four study groups

Compared with previous research on font and personality traits ([15] and [25]), we not only performed analyses of font survey results and obtained the font groups, also did further research on the typographical and aesthetic characteristics based on our study groups and their representative typefaces and suggested the potential association with typeface design and their personality traits.

4.3.3 Appropriate Uses

Since specific typefaces are associated with particular personality traits, we need to consider the responses that typefaces might create. Thus typefaces should be carefully selected to ensure appropriateness for the meanings and occasions. For example, Times New Roman is better than Harry Potter when we choose a typeface between them for a business document. With regard to the survey results, we derive the following conclusions on typeface uses:

- **Directness Group**

Typefaces in this group are legible, formal and confident, but unimaginative, unemotional and unrelaxed. Therefore such typefaces are commonly used, all purpose and especially appropriate for the content of official documents, reports and forms.

- **Gentleness Group**

Typefaces in this group are less prominent and scored average on all the personality traits. In addition, the typefaces of the Gentleness group are more legible than typefaces in the Cheerfulness and Fearfulness groups. However, with regard to the noticeable ornaments used in these typefaces, they are more appropriate used in the commercial advertising and headings than for textual contents. However, the feelings they evoked might not be as intense as typefaces in the Cheerfulness and Fearfulness groups.

- **Cheerfulness Group**

Typefaces in this group are rated as cheerful, attractive, creative and relaxed. Such typefaces are generally best for evoking a pleasant tone in the commercial advertisement and children's reading books.

- **Fearfulness Group**

Similar as typefaces in the Cheerfulness group, the typefaces in the Fearfulness group are also best for evoking intense emotional feelings. The difference is typefaces in this group are displeasing and cold. Such typefaces are generally used in the commercial advertising for special effects. In addition, typefaces in the Cheerfulness and

Fearfulness groups are not very legible, therefore they are often printed in large size and more appropriate for the headings than texts.

Chapter 5 Conclusion

In this chapter, we summarize the contributions of this thesis and present some future work in this research area. By conducting a designed font survey, the personalities of twenty four studied typefaces were identified. The twenty four typefaces were reduced to fifteen typefaces and four groups were clustered and defined through a series of statistical analyses. Typeface characteristics, including typographical and aesthetic aspects, for all fifteen typefaces were examined and analyzed in detail.

5.1 Summary

Since most studies on typeface design concentrate on typeface legibility and readability, the main purpose of this thesis is to provide a new point of view. We aimed to investigate the relationship between certain typefaces and particular personality traits. Then, based on the identified personality traits the typefaces conveyed, we analyzed their design characteristics.

Firstly, an investigation to address whether or not participants think that particular fonts are associated with tangible personality traits and to what degree fonts can convey personality traits was conducted. In our study, a designed font survey was used. The personality traits that twenty four typefaces conveyed were identified after comparison and examination.

Secondly, we conducted a series of statistical analyses on the survey data. The

statistical methods used include correlation matrix analysis, factor analysis, multidimensional scaling and one way analysis of variance. We reduced the number of studied typeface from twenty four to fifteen and categorized them into four different groups, typefaces within a group correlated highly with the other typefaces in this group. We labeled these four groups as Directness, Gentleness, Cheerfulness and Fearfulness for further typeface characteristic analysis.

We investigated and evaluated the typeface characteristics of all fifteen typefaces in the four groups for typographical and aesthetic design characteristics. Design features of each of the four groups were analyzed. Moreover, based on characteristic comparison of the four groups and their corresponding typefaces, conclusions and suggestions were made based on the design of typefaces and the potential association with personality traits.

5.2 Future Work

Based on research in the fields of psychology and typography design, our study offers a systematic method of typeface design analysis in terms of the particular personality traits the typefaces conveyed. Current work is an initial step, however, more research is required. Future work may take into account the following considerations:

1. In the future, the selection of personality traits that are used in research should be pilot tested and examined in more detail to help make studied personality traits more accurate and specific.

2. Due to the limitations based on our study's methodology, we must also address some issues which may have influenced the participants' responses, including factors such as participants' reading comprehension, reading time, familiarity with studied typefaces. All these factors need further investigation. The distribution of participants based on age and education background should also be taken into consideration in the future.
3. The analysis of typeface design characteristics should be more profound and characteristics used for analysis may be comprehensive, diverse and in greater detail.

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Appendix A Order of Typefaces in the Survey

Sample 1: Cooper Black

Sample 2: Berlin Sans FB

Sample 3: Bernard MT Condensed

Sample 4: Garamond

Sample 5: Belwe Lt BT

Sample 6: Playbill

Sample 7: Harry Potter

Sample 8: Centaur

Sample 9: Poor Richard

Sample 10: Jokerman

Sample 11: Times New Roman

Sample 12: Arial

Sample 13: Broadway

Sample 14: Kino MT

Sample 15: Impact

Sample 16: Chiller

Sample 17: Helvetica

Sample 18: Bauhaus 93

Sample 19: Kabel

Sample 20: Onyx

Sample 21: Rockwell

Sample 22: Snap ITC

Sample 23: Harrington

Sample 24: Footlight MT Light

Appendix B Sample of the Font Survey

Fonts and Their Personalities

Most research on fonts is related to legibility and readability, but there are still a few studies on the personalities that fonts may have, the personalities beyond the message conveyed by the text. Of more importance from a graphic designer's point of view is a characteristic of typefaces variously referred to as 'congeniality', 'typographic allusion', 'atmosphere value' or 'typeface personality' (Lewis & Walker, 1989). For this reason, designers must carefully select fonts that are appropriate for the occasion. The right fonts can reinforce the message, whereas the wrong ones can detract from the intended meaning and have the adverse influence.

This survey attempts to determine whether or not participants think that the 24 presented fonts, are associated with tangible personality traits, and to what degree that fonts can convey personality traits.

This survey is expected to take 30-35 minutes. Participants will be provided with 2 images for each font. One image includes the alphabet and numerals printed in the size of 22 points and another image shows two pangrams: "The quick brown fox jumps over the lazy dog" and "Please complete the survey to your comfort level", which are printed in the size of 16 points. Participants will be asked to rate these fonts with 10 adjectives representing 10 different personality traits, for example, cheerful, fearful, comfortable, etc. The scores are based on a 5-point modified Likert scale.

The following is an example:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	X				
Fearful	X				
Legible					X
Attractive	X				
Creative	X				
Formal					X
Sloppy	X				
Relaxed			X		
Friendly				X	
Confident					X

1)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over the lazy dog. Please complete the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

2)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

3)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

4)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	○	○	○	○	○
Fearful	○	○	○	○	○
Legible	○	○	○	○	○
Attractive	○	○	○	○	○
Creative	○	○	○	○	○
Formal	○	○	○	○	○
Sloppy	○	○	○	○	○
Relaxed	○	○	○	○	○
Friendly	○	○	○	○	○
Confident	○	○	○	○	○

5)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

6)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

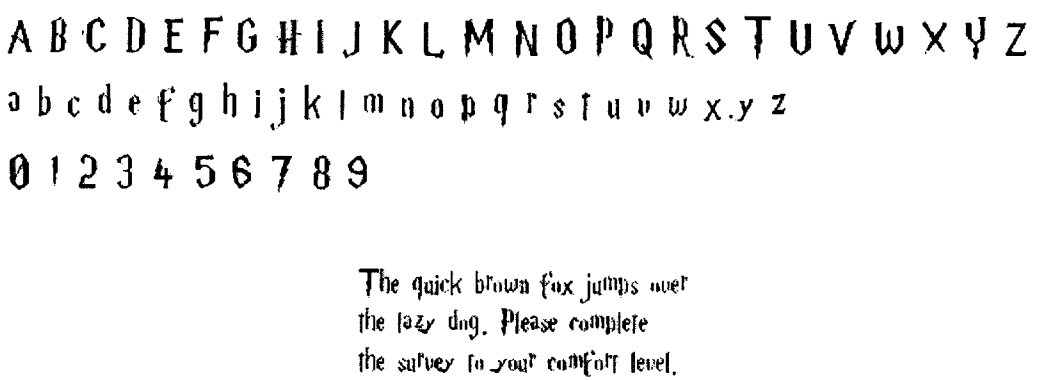
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

7)



Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

8)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	○	○	○	○	○
Fearful	○	○	○	○	○
Legible	○	○	○	○	○
Attractive	○	○	○	○	○
Creative	○	○	○	○	○
Formal	○	○	○	○	○
Sloppy	○	○	○	○	○
Relaxed	○	○	○	○	○
Friendly	○	○	○	○	○
Confident	○	○	○	○	○

9)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

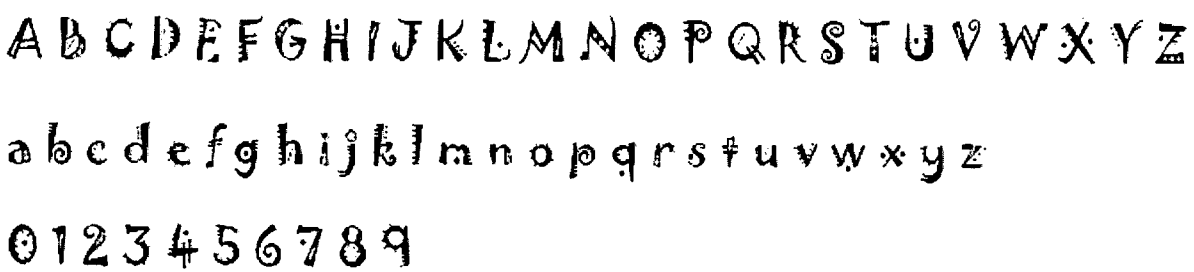
0123456789

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	○	○	○	○	○
Fearful	○	○	○	○	○
Legible	○	○	○	○	○
Attractive	○	○	○	○	○
Creative	○	○	○	○	○
Formal	○	○	○	○	○
Sloppy	○	○	○	○	○
Relaxed	○	○	○	○	○
Friendly	○	○	○	○	○
Confident	○	○	○	○	○

10)



The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

11)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

12)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

13)

The quick brown fox jumps over the lazy dog. Please complete the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

14)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

15)

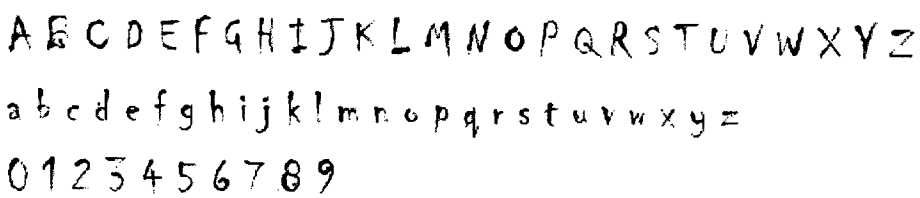
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over the lazy dog. Please complete the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

16)



The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	○	○	○	○	○
Fearful	○	○	○	○	○
Legible	○	○	○	○	○
Attractive	○	○	○	○	○
Creative	○	○	○	○	○
Formal	○	○	○	○	○
Sloppy	○	○	○	○	○
Relaxed	○	○	○	○	○
Friendly	○	○	○	○	○
Confident	○	○	○	○	○

17)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

18)

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

19)

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

20)

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

21)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

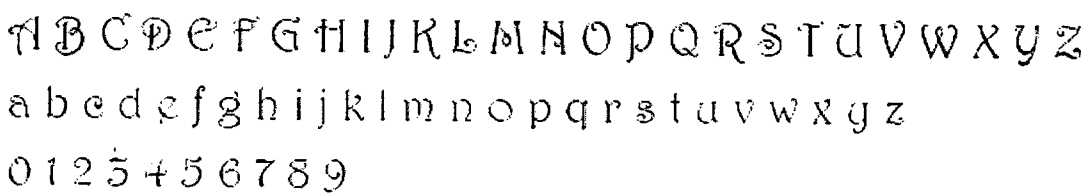
22)

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

23)



The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful					
Fearful					
Legible					
Attractive					
Creative					
Formal					
Sloppy					
Relaxed					
Friendly					
Confident					

24)

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

a b c d e f g h i j k l m n o p q r s t u v w x y z

0 1 2 3 4 5 6 7 8 9

The quick brown fox jumps over
the lazy dog. Please complete
the survey to your comfort level.

Please choose the answer that best represents to the extent you feel this font conveys the following personalities:

	Not at All	Slightly	Moderately	Highly	Extremely
Cheerful	○	○	○	○	○
Fearful	○	○	○	○	○
Legible	○	○	○	○	○
Attractive	○	○	○	○	○
Creative	○	○	○	○	○
Formal	○	○	○	○	○
Sloppy	○	○	○	○	○
Relaxed	○	○	○	○	○
Friendly	○	○	○	○	○
Confident	○	○	○	○	○

25)

Age of Participant:

- ○ <20
- ○ 20-29
- ○ 30-39
- ○ 40-49
- ○ >=50

26)

Gender of Participant:

- ○ Male
- ○ Female

27)

Education Level (Highest Degree) of Participant:

- ○ High School
- ○ Technical School/Higher Vocational School
- ○ Junior College/Technical College
- ○ Bachelor Degree
- ○ Master Degree
- ○ doctorate

Appendix C Name abbreviation of typeface

Typeface Name	Abbreviation
Cooper Black	CB
Berlin Sans FB	BSF
Bernard MT Condensed	BMC
Garamond	Ga
Belwe Lt BT	BLB
Playbill	Pb
Harry Potter	HP
Centaur	Cr
Poor Richard	PR
Jokerman	Jm
Times New Roman	TNR
Arial	Al
Broadway	Bw
Kino MT	KM
Impact	Ip
Chiller	Cl
Helvetica	Ht
Bauhaus 93	Bh93
Kabel	Kb
Onyx	Ox
Rockwell	Rw
Snap ITC	SITC
Harrington	Hr
Footlight MT Light	FL

Appendix D Name abbreviation of Personality Trait

Personality Trait	Abbreviation
Cheerful	Ch
Fearful	Ff
Legible	Lg
Attractive	At
Creative	Cr
Formal	Fm
Sloppy	Sp
Relaxed	Rx
Friendly	Fd
Confident	Cn

Appendix E
Pearson's Correlation Coefficients

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.356	.474	.175	.397	.410	.115	.160	.476	.217	.289	.296	.434	.364	.187	.218	.103	.392	.407	.206	.319	.269	.336	.200
BSF_Ch		1	.168	.353	.281	.248	.228	.292	.383	.168	.220	.247	.082	.217	.031	.264	.092	.199	.215	.157	.309	.182	.373	.450
BMC_Ch			1	.143	.274	.277	-.026	.220	.427	.004	.375	.322	.349	.255	.320	.081	.306	.228	.379	.406	.192	.212	.275	.363
Ga_Ch				1	.516	-.114	.121	.689	.290	.101	.632	.468	.043	.319	.440	.131	.395	.072	.356	.163	.402	-.011	.201	.606
BLB_Ch					1	.095	.158	.432	.513	.073	.433	.337	.267	.458	.352	.175	.245	.207	.456	.356	.313	-.024	.175	.408
Pb_Ch						1	.165	-.113	.247	.316	-.092	-.098	.431	.163	-.054	.298	-.143	.282	.171	.206	.041	.229	.249	.009
HP_Ch							1	.056	.225	.478	-.040	.104	.171	.254	.110	.436	-.121	.365	.118	.169	.128	.352	.301	.035
Cr_Ch								1	.321	.082	.697	.389	.122	.217	.373	.046	.477	.089	.288	.174	.576	-.019	.300	.707
PR_Ch									1	.103	.375	.397	.247	.253	.325	.084	.242	.357	.223	.277	.392	.205	.410	.382
Jm_Ch										1	.030	.017	.201	.117	.062	.480	-.099	.378	.203	.138	.227	.469	.433	.227
TNR_Ch											1	.595	.157	.156	.472	-.014	.549	.018	.221	.248	.569	-.137	.306	.726
Al_Ch												1	.270	.201	.588	.069	.446	.193	.310	.215	.574	-.081	.139	.473
Bw_Ch													1	.412	.280	.220	.153	.503	.389	.438	.252	.167	.278	.082
KM_Ch														1	.337	.317	.233	.352	.421	.503	.235	.057	.057	.248
Ip_Ch															1	.005	.440	.248	.556	.354	.450	.040	.142	.407
Cl_Ch																1	-.002	.291	.210	.414	.125	.144	.305	.117
Ht_Ch																	1	.130	.385	.254	.527	-.123	.225	.564
Bh93_Ch																		1	.484	.204	.383	.510	.441	.163
Kb_Ch																			1	.348	.378	.158	.217	.357
Ox_Ch																				1	.234	.007	.244	.255
Rw_Ch																					1	.126	.340	.614
SITC_Ch																						1	.410	.035
Hr_Ch																							1	.398
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Cheerful"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.306	.401	.413	.517	.090	.087	.284	.290	.296	.394	.438	.456	.312	.446	.061	.423	.238	.538	.219	.558	.112	.101	.305
BSF_Ch		1	.238	.362	.496	.250	.051	.497	.372	.380	.437	.428	.252	.254	.390	.129	.504	.285	.441	.220	.366	.233	.192	.422
BMC_Ch			1	.266	.354	.319	.182	.193	.206	.294	.265	.170	.356	.441	.335	.147	.147	.219	.427	.416	.183	.141	.074	.255
Ga_Ch				1	.503	-.004	.053	.382	.152	.260	.410	.194	.055	.300	.253	.151	.395	.132	.137	.163	.355	-.098	.040	.408
BLB_Ch					1	.276	.242	.645	.424	.455	.601	.492	.300	.341	.418	.187	.616	.408	.337	.211	.557	.174	.269	.564
Pb_Ch						1	.142	.210	.269	.277	.202	.228	.312	.308	.190	.162	.282	.420	.303	.283	.261	.222	.310	.233
HP_Ch							1	.078	.036	.334	.013	.030	.184	.277	.121	.447	.120	.174	.014	.302	.076	.283	.187	.094
Cr_Ch								1	.294	.322	.722	.562	.196	.265	.436	.197	.535	.460	.395	.283	.468	.178	.443	.555
PR_Ch									1	.214	.401	.380	.235	.466	.392	.178	.393	.394	.286	.387	.426	.367	.320	.465
Jm_Ch										1	.353	.346	.350	.396	.264	.428	.417	.434	.388	.227	.369	.467	.194	.317
TNR_Ch											1	.540	.378	.309	.484	.168	.548	.503	.358	.257	.545	.204	.275	.507
Al_Ch												1	.522	.284	.302	.076	.656	.511	.452	.246	.691	.352	.339	.536
Bw_Ch													1	.461	.372	.021	.361	.424	.462	.276	.433	.301	.066	.238
KM_Ch														1	.350	.293	.387	.428	.389	.556	.343	.352	.204	.519
Ip_Ch															1	.134	.387	.333	.585	.283	.471	.359	.325	.259
Cl_Ch																1	-.006	.342	.173	.429	-.005	.399	.362	.254
Ht_Ch																	1	.394	.312	.170	.742	.255	.310	.508
Bh93_Ch																		1	.313	.477	.296	.367	.248	.392
Kb_Ch																			1	.315	.518	.414	.190	.338
Ox_Ch																				1	.236	.313	.320	.294
Rw_Ch																					1	.330	.300	.497
SITC_Ch																						1	.354	.278
Hr_Ch																							1	.406
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Fearful"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.485	.396	.534	.566	.192	.255	.410	.519	.406	.483	.264	.391	.401	.266	.336	.239	.434	.358	.284	.366	.316	.433	.491
BSF_Ch		1	.513	.518	.308	.177	.234	.305	.352	.343	.355	.324	.265	.353	.325	.231	.324	.365	.400	.228	.332	.256	.458	.341
BMC_Ch			1	.330	.323	.396	.322	.245	.527	.401	.285	.271	.440	.416	.343	.399	.243	.520	.493	.427	.318	.508	.470	.422
Ga_Ch				1	.438	.058	.188	.639	.410	.309	.518	.413	.213	.240	.205	.201	.363	.232	.303	.133	.369	.160	.271	.423
BLB_Ch					1	.291	.286	.375	.497	.325	.368	.281	.506	.327	.415	.380	.270	.400	.319	.245	.412	.193	.266	.487
Pb_Ch						1	.353	-.031	.315	.260	.042	-.060	.275	.315	.300	.310	.065	.351	.081	.472	.157	.334	.273	.185
HP_Ch							1	.259	.494	.497	.181	.263	.455	.452	.304	.469	.267	.355	.289	.502	.297	.451	.517	.464
Cr_Ch								1	.356	.349	.534	.558	.205	.211	.161	.251	.394	.283	.369	.231	.443	.094	.243	.496
PR_Ch									1	.438	.395	.432	.577	.495	.474	.381	.450	.541	.493	.504	.468	.460	.535	.534
Jm_Ch										1	.328	.324	.462	.447	.267	.512	.327	.590	.490	.319	.495	.582	.550	.567
TNR_Ch											1	.654	.154	.211	.414	.145	.613	.295	.530	.165	.597	.179	.376	.578
Al_Ch												1	.273	.304	.442	.070	.743	.284	.657	.107	.650	.312	.394	.546
Bw_Ch													1	.560	.390	.452	.225	.541	.418	.408	.319	.509	.411	.416
KM_Ch														1	.435	.402	.294	.489	.466	.369	.217	.531	.545	.535
Ip_Ch															1	.118	.475	.508	.575	.391	.534	.436	.453	.451
Cl_Ch																1	.195	.437	.159	.429	.112	.343	.396	.367
Ht_Ch																	1	.325	.577	.258	.656	.298	.376	.606
Bh93_Ch																		1	.520	.426	.366	.606	.655	.460
Kb_Ch																			1	.259	.569	.568	.525	.628
Ox_Ch																				1	.235	.321	.535	.470
Rw_Ch																					1	.399	.375	.588
SITC_Ch																						1	.662	.408
Hr_Ch																							1	.559
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Legible"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.141	.308	.214	.270	.144	.153	.188	.342	.129	.119	-.017	.395	.243	.312	.206	.108	.287	.337	.295	.265	.188	.121	.145
BSF_Ch		1	.061	.418	.419	.097	.200	.316	.362	-.134	.352	.291	.060	.223	.204	.198	.205	.044	.104	.095	.255	-.022	.166	.414
BMC_Ch			1	.134	.311	.353	.151	.197	.424	.064	.173	.329	.341	.343	.562	.180	.244	.205	.327	.476	.130	.128	.095	.049
Ga_Ch				1	.362	.201	-.037	.635	.158	-.029	.515	.380	-.064	.256	.190	.076	.423	-.005	.042	.098	.551	-.080	-.006	.395
BLB_Ch					1	.100	.266	.237	.529	.262	.280	.308	.145	.352	.191	.297	.253	.267	.300	.222	.321	.173	.349	.454
Pb_Ch						1	.001	.127	-.005	-.216	.090	.225	.150	.034	.315	-.146	.392	-.108	.106	.056	.217	-.165	-.237	-.041
HP_Ch							1	-.131	.357	.477	-.156	.085	.306	.240	.248	.554	-.027	.260	.265	.110	-.022	.432	.498	.139
Cr_Ch								1	.218	-.092	.689	.431	.060	.258	.157	-.077	.443	.118	.091	.149	.687	-.089	.016	.408
PR_Ch									1	.206	.157	.183	.325	.367	.245	.405	.072	.318	.387	.286	.222	.279	.409	.378
Jm_Ch										1	-.077	.153	.175	.175	.171	.419	.032	.397	.174	.164	.063	.683	.478	.185
TNR_Ch											1	.448	-.044	.228	.258	-.011	.422	.031	.132	.164	.511	-.170	.053	.525
Al_Ch												1	.199	.329	.363	.113	.514	.239	.264	.182	.456	.117	.115	.366
Bw_Ch													1	.189	.326	.307	.100	.433	.332	.366	.168	.392	.260	.066
KM_Ch														1	.372	.370	.356	.291	.331	.362	.399	.282	.048	.248
Ip_Ch															1	.272	.472	.358	.545	.321	.281	.325	.103	.110
Cl_Ch																1	.033	.383	.247	.307	-.046	.549	.442	.287
Ht_Ch																	1	.093	.257	.255	.517	.077	-.019	.394
Bh93_Ch																		1	.438	.255	.239	.544	.374	.281
Kb_Ch																			1	.285	.267	.416	.227	.279
Ox_Ch																				1	.182	.232	.170	.305
Rw_Ch																					1	.087	.052	.437
SITC_Ch																						1	.525	.179
Hr_Ch																							1	.325
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Attractive"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.201	.130	.278	.144	.072	.000	.126	.034	-.100	.064	-.153	.176	.145	.219	.090	-.023	.082	.138	.169	.150	.036	-.038	.111
BSF_Ch		1	.153	.214	.404	.440	.301	.136	.330	.168	.071	.224	.255	.349	.205	.244	-.001	.305	.291	.186	.350	.151	.398	.359
BMC_Ch			1	.169	.262	.479	.222	.169	.456	.119	.219	.165	.353	.404	.342	.271	.245	.277	.429	.475	.204	.337	.260	.037
Ga_Ch				1	.297	.088	-.024	.619	.179	-.213	.530	.264	-.048	.067	.387	.032	.451	-.148	.024	.060	.480	-.090	-.031	.410
BLB_Ch					1	.158	.156	.448	.516	.311	.281	.315	.378	.479	.274	.258	.270	.412	.380	.335	.384	.185	.453	.443
Pb_Ch						1	.311	.020	.245	.130	.084	.049	.191	.281	.145	.323	.021	.163	.270	.216	.310	.139	.212	.128
HP_Ch							1	-.296	.276	.473	-.221	-.097	.310	.408	-.078	.721	-.211	.372	.303	.207	-.102	.402	.498	.010
Cr_Ch								1	.305	-.159	.695	.316	.135	.164	.378	-.110	.412	-.036	.052	.182	.493	-.055	.085	.493
PR_Ch									1	.321	.230	.254	.416	.419	.158	.378	.163	.442	.360	.320	.338	.318	.469	.398
Jm_Ch										1	-.227	-.048	.411	.342	-.108	.504	-.253	.482	.182	.183	-.021	.536	.608	.050
TNR_Ch											1	.462	-.033	.009	.467	-.116	.582	-.176	-.086	.282	.447	-.162	-.006	.406
Al_Ch												1	.170	.171	.325	-.077	.658	.093	.001	.188	.404	-.029	.137	.384
Bw_Ch													1	.414	.374	.334	.038	.523	.414	.346	.278	.470	.495	.251
KM_Ch														1	.211	.548	.183	.448	.368	.381	.129	.393	.504	.240
Ip_Ch															1	.034	.503	.241	.255	.468	.495	.278	.145	.369
Cl_Ch																1	-.137	.474	.317	.258	.028	.515	.559	.164
Ht_Ch																	1	-.055	.006	.180	.493	-.103	.039	.388
Bh93_Ch																		1	.477	.387	.224	.613	.502	.222
Kb_Ch																			1	.368	.300	.387	.340	.172
Ox_Ch																				1	.161	.205	.236	.140
Rw_Ch																					1	.091	.271	.588
SITC_Ch																						1	.524	.051
Hr_Ch																							1	.387
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Creative"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.343	.272	.059	.404	.285	.232	.134	.138	.101	.175	.200	.313	.258	.310	.158	.073	.354	.342	-.181	.372	.141	.091	.191
BSF_Ch		1	.141	.186	.234	.157	.069	.244	.218	.133	.211	.129	.250	.244	.217	.275	.227	.447	.455	-.045	.323	.198	.214	.397
BMC_Ch			1	-.028	.395	.471	.094	.002	.337	.109	.112	.219	.459	.277	.398	.181	.206	.279	.454	.352	.315	.240	.141	.253
Ga_Ch				1	.031	-.196	-.072	.548	.035	-.080	.077	.058	-.067	-.124	-.146	-.062	.106	.038	.051	-.088	.049	.056	.000	.275
BLB_Ch					1	.224	.197	.007	.384	.289	.220	.128	.392	.450	.284	.206	.068	.323	.283	.253	.333	.159	.287	.295
Pb_Ch						1	.352	-.071	.156	.255	.204	.064	.413	.381	.319	.274	.002	.393	.219	.211	.177	.404	.099	-.084
HP_Ch							1	-.200	.326	.655	.035	-.081	.280	.286	.184	.560	-.179	.433	.168	.131	.236	.582	.246	-.108
Cr_Ch								1	.093	-.190	.100	.178	.145	-.041	.127	-.235	.274	.173	.219	-.039	.153	-.118	-.103	.373
PR_Ch									1	.312	.086	.049	.320	.237	.243	.197	-.009	.237	.281	.310	.217	.204	.291	.159
Jm_Ch										1	-.040	-.123	.424	.318	.186	.479	-.142	.340	.193	.208	.141	.522	.356	-.125
TNR_Ch											1	.388	.190	.222	.337	.091	.379	.229	.235	.039	.409	.136	.092	.430
Al_Ch												1	.177	.127	.368	-.090	.673	.109	.423	-.114	.509	.083	-.224	.414
Bw_Ch													1	.361	.511	.231	.137	.406	.439	.254	.423	.249	.248	.189
KM_Ch														1	.371	.493	.165	.500	.426	.328	.421	.358	.200	.164
Ip_Ch															1	.212	.361	.460	.478	.109	.535	.380	.021	.336
Cl_Ch																1	-.069	.414	.157	.127	.239	.660	.323	.022
Ht_Ch																	1	.178	.443	-.075	.511	.055	-.219	.513
Bh93_Ch																		1	.546	.102	.438	.501	.200	.333
Kb_Ch																			1	.030	.621	.236	.000	.496
Ox_Ch																				1	.012	.125	.192	.027
Rw_Ch																					1	.358	.025	.565
SITC_Ch																						1	.196	.068
Hr_Ch																							1	-.014
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Formal"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.317	.170	.339	.330	.162	.229	.284	.350	.175	.234	.349	.322	.131	.244	.142	.266	.264	.203	.133	.222	.245	.282	.344
BSF_Ch		1	.307	.359	.251	.100	.102	.151	.198	.037	.159	.288	.227	.123	.207	.068	.242	.205	.361	.248	.325	.063	.164	.217
BMC_Ch			1	.336	.213	.290	.277	.133	.234	.053	.257	.302	.176	.369	.295	.041	.239	.270	.272	.209	.121	.091	.146	.104
Ga_Ch				1	.435	.145	.083	.510	.532	.124	.549	.519	.412	.432	.588	-.039	.424	.396	.432	.370	.403	.076	.326	.532
BLB_Ch					1	.023	.096	.195	.524	.271	.456	.293	.356	.374	.411	.033	.442	.285	.420	.153	.162	.147	.463	.490
Pb_Ch						1	.182	-.138	.019	.005	-.011	.079	-.063	.237	.243	.009	.129	.066	.117	.209	-.021	.058	.018	.035
HP_Ch							1	.060	.239	.115	.030	.049	.029	.244	.124	.054	.106	.228	.021	.156	-.020	.009	.031	.037
Cr_Ch								1	.597	.078	.466	.562	.503	.334	.236	.139	.473	.377	.466	.182	.346	.106	.356	.418
PR_Ch									1	.295	.524	.387	.577	.465	.356	.122	.376	.366	.466	.229	.249	.191	.436	.511
Jm_Ch										1	-.033	-.055	.132	.162	.028	.326	-.046	.107	.050	.033	-.178	.513	.342	.145
TNR_Ch											1	.521	.410	.269	.412	-.231	.536	.189	.380	.136	.244	-.137	.161	.550
Al_Ch												1	.412	.382	.382	-.086	.643	.358	.422	.185	.489	.170	.245	.475
Bw_Ch													1	.388	.387	.076	.343	.318	.322	.218	.345	.253	.317	.468
KM_Ch														1	.481	.095	.465	.342	.385	.432	.116	.241	.263	.269
Ip_Ch															1	-.084	.403	.295	.503	.392	.342	.054	.271	.526
Cl_Ch																1	-.066	.284	.135	.239	-.040	.488	.512	.013
Ht_Ch																	1	.434	.677	.202	.404	.145	.325	.446
Bh93_Ch																		1	.427	.194	.501	.192	.390	.333
Kb_Ch																			1	.261	.370	.098	.437	.516
Ox_Ch																				1	.082	.165	.297	.176
Rw_Ch																					1	.144	.165	.434
SITC_Ch																						1	.527	.131
Hr_Ch																							1	.371
FL_Ch																								1

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Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Sloppy"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.356	.474	.175	.397	.410	.115	.160	.476	.217	.289	.296	.434	.364	.187	.218	.103	.392	.407	.206	.319	.269	.336	.200
BSF_Ch	1	-.112	.142	-.254	-.073	.270	.120	.113	-.014	.118	.011	.000	.306	.145	.040	.047	-.168	.099	.122	.063	.113	.207	-.042	-.003
BMC_Ch		1	.057	.129	.077	.040	.144	-.178	.213	.088	-.033	.070	.141	.095	-.024	.128	.074	-.086	-.183	-.137	-.063	.042	.193	.067
Ga_Ch			1	-.118	-.010	.391	.338	.204	.273	.141	.010	.133	.285	.327	.372	.117	.116	.266	.224	.174	.228	.127	.161	.116
BLB_Ch				1	.423	-.373	-.089	-.057	.219	-.050	.405	.177	-.102	-.089	.071	-.014	.258	.040	-.198	.159	.101	-.134	.203	.335
Pb_Ch					1	-.087	-.014	.225	.460	-.007	.530	.461	-.056	.063	.219	.115	.399	.287	.202	.160	.403	.220	.242	.526
HP_Ch						1	.072	-.063	-.023	.018	-.285	-.080	.214	.119	.211	.071	-.111	.123	.233	.164	.021	.153	-.118	-.186
Cr_Ch							1	.236	.260	.341	-.078	-.041	.225	.268	.106	.276	.019	.202	-.029	.122	-.098	.166	.105	.042
PR_Ch								1	.314	.176	.259	.313	.323	.357	.085	.096	.221	.188	.100	.264	.206	-.003	.165	.167
Jm_Ch									1	.203	.354	.300	.223	.210	.198	.216	.294	.269	.011	.209	.127	.136	.530	.434
TNR_Ch										1	-.225	-.270	.318	.098	-.224	.428	-.099	.279	.033	.098	-.146	.312	.210	-.107
Al_Ch											1	.524	-.065	.087	.372	-.131	.482	.121	.094	.198	.412	-.160	.211	.608
Bw_Ch												1	.109	.199	.424	-.191	.612	.272	.300	.065	.527	.111	.152	.432
KM_Ch													1	.469	.141	.196	-.018	.161	.035	.325	.173	.234	.172	-.016
Ip_Ch														1	.268	.293	.175	.291	.169	.249	.074	.056	.222	.093
Cl_Ch															1	-.190	.531	.191	.433	.350	.386	-.063	.000	.359
Ht_Ch																1	.003	.245	-.097	.035	-.218	.247	.426	-.033
Bh93_Ch																	1	.270	.377	.201	.429	-.133	.258	.388
Kb_Ch																		1	.447	.178	.242	.291	.251	.104
Ox_Ch																			1	.149	.269	.060	.067	.196
Rw_Ch																				1	.201	-.109	.108	.238
SITC_Ch																					1	.168	.122	.360
Hr_Ch																						1	.225	.068
FL_Ch																							1	.426

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Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Relaxed"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.078	.055	.067	-.005	.273	-.194	.121	.148	.041	.100	-.052	.222	-.007	.286	-.143	-.019	.175	.199	.115	.262	.083	.088	.138
BSF_Ch		1	-.020	.222	.135	.037	.030	.290	.166	.173	.015	.066	.053	.204	-.162	.055	.015	.087	-.044	.060	.123	.173	.196	.034
BMC_Ch			1	-.053	-.014	.298	.021	-.121	.329	.031	.003	.058	.364	.299	.266	.159	.037	.200	.409	.238	-.011	.171	.173	.106
Ga_Ch				1	.202	-.146	-.106	.771	.389	-.103	.518	.273	-.017	.035	.106	.120	.448	.135	-.109	-.010	.182	-.261	.136	.441
BLB_Ch					1	-.059	-.043	.265	.330	.212	.274	.462	-.050	.047	.060	.155	.407	.350	.280	-.061	.241	.249	.280	.410
Pb_Ch						1	.084	-.153	.081	.229	-.150	-.082	.317	.205	.144	.130	-.125	.261	.245	.247	-.063	.231	-.041	-.034
HP_Ch							1	-.157	.177	.350	-.200	.020	.194	.427	.043	.480	.017	.266	.012	.374	-.079	.216	.109	-.118
Cr_Ch								1	.381	-.174	.610	.391	-.040	-.075	.016	.010	.501	.131	-.114	-.090	.289	-.187	.177	.461
PR_Ch									1	.197	.280	.206	.302	.305	.244	.354	.278	.302	.158	.221	.357	.095	.394	.384
Jm_Ch										1	-.207	-.220	.323	.346	-.202	.362	-.236	.198	.174	.133	-.052	.398	.292	-.005
TNR_Ch											1	.668	-.138	-.034	.338	-.033	.728	.139	.101	.021	.435	-.107	.254	.620
Al_Ch												1	-.082	.144	.286	-.086	.733	.246	.267	.061	.425	.112	.171	.586
Bw_Ch													1	.286	.099	.319	-.098	.373	.278	.291	.073	.264	.264	-.158
KM_Ch														1	.290	.419	.107	.188	.169	.424	-.003	.139	.278	.052
Ip_Ch															1	.021	.409	.055	.432	.335	.276	-.067	.048	.321
Cl_Ch																1	-.008	.185	-.046	.239	-.171	.127	.312	-.036
Ht_Ch																	1	.220	.138	.018	.396	.005	.255	.551
Bh93_Ch																		1	.217	.123	.209	.385	.212	.109
Kb_Ch																			1	.112	.196	.213	.222	.296
Ox_Ch																				1	.095	.076	-.033	.068
Rw_Ch																					1	.236	.218	.497
SITC_Ch																						1	.356	-.035
Hr_Ch																							1	.231
FL_Ch																								1

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Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Friendly"

	CB_Ch	BSF_Ch	BMC_Ch	Ga_Ch	BLB_Ch	Pb_Ch	HP_Ch	Cr_Ch	PR_Ch	Jm_Ch	TNR_Ch	Al_Ch	Bw_Ch	KM_Ch	Ip_Ch	Cl_Ch	Ht_Ch	Bh93_Ch	Kb_Ch	Ox_Ch	Rw_Ch	SITC_Ch	Hr_Ch	FL_Ch
CB_Ch	1	.368	.249	.458	.306	.065	.147	.313	.411	.276	.353	.089	.352	.130	.082	.230	.103	.284	.286	.213	.306	.195	.472	.344
BSF_Ch		1	.266	.419	.251	.154	.128	.461	.238	.358	.210	.263	.255	.152	.130	.263	.116	.194	.184	-.003	.218	.290	.397	.367
BMC_Ch			1	.164	.266	.256	.245	-.070	.204	.397	.072	.097	.385	.270	.279	.357	-.003	.440	.314	.341	.291	.334	.151	.114
Ga_Ch				1	.377	.187	.213	.645	.493	.442	.501	.468	.327	.310	.227	.209	.522	.242	.263	.331	.424	.202	.328	.540
BLB_Ch					1	.195	.436	.323	.392	.370	.287	.379	.417	.570	.329	.304	.487	.331	.507	.344	.388	.385	.408	.471
Pb_Ch						1	.425	.068	.173	.335	.283	.228	.400	.300	.362	.303	.220	.354	.160	.453	.210	.225	.182	.086
HP_Ch							1	.110	.130	.468	.089	.039	.437	.333	.293	.303	.150	.254	.293	.467	.112	.292	.230	.162
Cr_Ch								1	.495	.248	.470	.293	.139	.077	.213	.147	.398	.231	.172	.213	.460	.183	.322	.525
PR_Ch									1	.321	.345	.199	.365	.265	.136	.412	.300	.342	.265	.323	.468	.368	.365	.364
Jm_Ch										1	.128	.165	.398	.233	.330	.357	.146	.438	.436	.306	.376	.420	.309	.350
TNR_Ch											1	.537	.285	.217	.412	.164	.586	.287	.221	.324	.517	.152	.393	.391
Al_Ch												1	.132	.348	.355	.087	.734	.298	.378	.222	.490	.213	.246	.435
Bw_Ch													1	.403	.421	.237	.213	.374	.240	.446	.297	.464	.386	.309
KM_Ch														1	.253	.248	.406	.335	.388	.390	.304	.346	.192	.209
Ip_Ch															1	.096	.314	.530	.395	.316	.419	.377	.188	.086
Cl_Ch																1	.159	.358	.329	.410	.215	.333	.298	.226
Ht_Ch																	1	.290	.365	.294	.487	.259	.394	.535
Bh93_Ch																		1	.511	.499	.505	.559	.361	.348
Kb_Ch																			1	.320	.527	.430	.334	.340
Ox_Ch																				1	.300	.279	.259	.195
Rw_Ch																					1	.514	.360	.533
SITC_Ch																						1	.482	.280
Hr_Ch																							1	.409
FL_Ch																								1

* The cell of each row and each column represent one typeface, the bottom left portion of the table is left blank because it would simply duplicate the information already shown.

Correlation Matrix of Twenty Four Typefaces Related to Personality Trait "Confident"

Appendix F
Rotated Component Matrix

Cheerful

Rotated Component Matrix				
	Component			
	1	2	3	4
TNR_Ch	.905			
FL_Ch	.859			
Cr_Ch	.852			
Ga_Ch	.756			
Rw_Ch	.682			
Ht_Ch	.654			
Al_Ch	.622			
SITC_Ch		.773		
Hr_Ch		.669		
Bh93_Ch		.640		.600
Cl_Ch			.753	
HP_Ch			.730	
Jm_Ch		.545	.623	
Kb_Ch				.826
BLB_Ch	.458			.508

Fearful

Rotated Component Matrix			
	Component		
	1	2	3
BLB_Ff	.800		
Ga_Ff	.790		
TNR_Ff	.728		
Cr_Ff	.722		
Ht_Ff	.685	.454	
FL_Ff	.634		
SITC_Ff		.715	.463
AI_Ff	.499	.695	
Kb_Ff		.675	
Rw_Ff	.586	.599	
Bh93_Ff		.467	
Hr_Ff		.416	
CI_Ff			.857
HP_Ff			.750
Jm_Ff			.547

Legible

Rotated Component Matrix			
	Component		
	1	2	3
Al_Lg	.857		
Ht_Lg	.794		
Rw_Lg	.743		
Kb_Lg	.731	.445	
TNR_Lg	.715		.431
FL_Lg	.549	.474	
SITC_Lg		.799	
Hr_Lg		.762	
Bh93_Lg		.751	
Jm_Lg		.736	
HP_Lg		.665	
Cl_Lg		.658	.456
Ga_Lg			.735
Cr_Lg	.412		.722
BLB_Lg			.662

Attractive

Rotated Component Matrix			
	Component		
	1	2	3
Cr_At	.837		
TNR_At	.816		
Ga_At	.785		
Rw_At	.766		
FL_At	.653		
Ht_At	.648		
Al_At	.618		
Hr_At		.770	
Cl_At		.767	
HP_At		.756	
Jm_At		.678	
SITC_At		.614	.603
BLB_At	.487	.503	
Kb_At			.732
Bh93_At			.684

Creative

Rotated Component Matrix			
	Component		
	1	2	3
Cr_Cr	.812		
TNR_Cr	.803		
Ga_Cr	.761		
Rw_Cr	.723		
Ht_Cr	.722		
FL_Cr	.705		
Al_Cr	.603		
BLB_Cr	.544	.462	
Bh93_Cr		.833	
SITC_Cr		.642	
Kb_Cr		.641	
Hr_Cr		.603	.523
Jm_Cr		.531	.530
CI_Cr			.821
HP_Cr			.806

Formal

Rotated Component Matrix				
	Component			
	1	2	3	4
Ht_Fm	.813			
Al_Fm	.803			
Rw_Fm	.780			
FL_Fm	.705			
Kb_Fm	.684			
TNR_Fm	.588			
SITC_Fm		.842		
HP_Fm		.835		
Cl_Fm		.773		
Jm_Fm		.751		
Bh93_Fm		.612		
Ga_Fm			.866	
Cr_Fm			.840	
Hr_Fm				.752
BLB_Fm				.722

Sloppy

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
TNR_Sp	.798			
BLB_Sp	.770			
FL_Sp	.687			
Ga_Sp	.648			
Rw_Sp		.803		
Bh93_Sp		.670		
Al_Sp	.479	.630		
Ht_Sp	.552	.575		
Cr_Sp	.411	.563		
Kb_Sp	.498	.523		
SITC_Sp			.808	
Cl_Sp			.794	
Hr_Sp			.732	
Jm_Sp			.675	
HP_Sp				.956

Relaxed

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
Cr_Rx	.812			
TNR_Rx	.795			
Ga_Rx	.740			
FL_Rx	.718			
BLB_Rx	.696			
Kb_Rx		.840		
Bh93_Rx		.620	.457	
Ht_Rx	.512	.611		
Al_Rx	.510	.563		
Rw_Rx		.486		.410
CI_Rx			.777	
Jm_Rx			.739	
HP_Rx			.605	
Hr_Rx	.437		.473	
SITC_Rx				.876

Friendly

Rotated Component Matrix[a]				
	Component			
	1	2	3	4
TNR_Fd	.861			
Cr_Fd	.816			
Ht_Fd	.816			
Ga_Fd	.757			
FL_Fd	.730			
Al_Fd	.721	.413		
BLB_Fd	.434	.427		
Kb_Fd		.686		
SITC_Fd		.629		
Rw_Fd	.479	.495		
Jm_Fd			.749	
Hr_Fd			.631	
HP_Fd				.857
Cl_Fd			.556	.575
Bh93_Fd				.548

Confident

Rotated Component Matrix[a]			
	Component		
	1	2	3
Ga_Cn	.779		
Ht_Cn	.765		
TNR_Cn	.749		
Cr_Cn	.742		
Al_Cn	.692	.403	
FL_Cn	.674		
Bh93_Cn		.735	
SITC_Cn		.733	
Kb_Cn		.712	
Rw_Cn	.538	.606	
Hr_Cn		.420	
HP_Cn			.754
Jm_Cn			.718
Cl_Cn			.522
BLB_Cn	.402		.441

Appendix G Fifteen Examined Typefaces

Directness

Centaur

graphique

Garamond

graphique

Times New Roman

graphique

Arial

graphique

Helvetica

graphique

Rockwell

graphique

Footlight MT Light

graphique

Gentliness

Belwe Lt BT

graphique

Bauhaus 93

graphique

Kable

graphique

Cheerfulness

Jokerman

graphique

Snap ITC

graphique

Harrington

graphique

Fearfulness

Harry Potter

graphique

Chiller

graphique