Some Elements of Proportion and Optical Image Support in a Typeface

by Mark Jamra

The alphabet is a fundamental element of visual communication and represents a basic level of communication design. Therefore, the learning experience in the development of one of the most complex of visual systems – a typeface – can be evaluated and transposed into all other areas of graphic design. There is a lot to be learned from observing the design of a typeface family, not only towards working on letterforms but also with regards to our perception of two-dimensional shapes and the basic optical rules of graphic design – particularly in a situation such as type design where these virtually thrust themselves upon the designer. Since more attention is being given typefaces today by almost anyone with a computer, this essay is intended to provide a glimpse at some of the many aspects of form which were taken into account when developing a specific typeface (ITC Jamille) and which, in many cases, are applicable to letterforms in general.

When we learn about and work with two-dimensional forms, it becomes evident that we often perceive forms as being something other than what they really are. Working with a measuring stick and a rational impression of the goal in any project will lead a designer to create forms of an inferior visual quality. When dealing with such matters, a designer has to base his decisions upon what is actually perceived and not what he supposes a form to be. Amongst the simplest examples of this (also applicable in typefaces) is the difference between the optical middle and the exact middle of a vertical line: the optical middle is higher. A point or form element placed at the exact middle will always appear to sit too low. [Fig. 1]

Fig. 1
Right: the crossbar placed at the exact middle sits too low optically.

Generally, the traditional structure of the letterforms in the Latin alphabet were determined by the tools and writing instruments used in making them. These formed the letters with a certain anatomical structure which has remained present in typefaces up to this day. Competent descriptions of the traditional forms of each letter in the Latin alphabet can be found in the books *Letters of Credit* by Walter Tracy[1] and, in German, *Schriftkunst* by Albert Kapr.[2] The successful design of text typefaces depends on the creation of forms which correspond appropriately to those mental images of letterforms which have developed over the centuries and been passed on – impressed in the minds of literate persons and changing slightly with each generation. A correspondence to these images is required more in text typefaces (which must be read easily, quickly and painlessly) and comparatively less in fanciful display typefaces.

The letterform patterns in our minds dictate how we react to their various visual interpretations. For example, an uppercase U with a contrast in stroke thicknesses will look disproportionate if its sequence of thick-stroke/thin-stroke is reversed to thin-stroke/thick-stroke. The reversed form looks unnatural to us because the mental image which we have of this letter is structured otherwise. [Fig. 2] This image can influence our perception of this form under far more subtle circumstances: if both vertical strokes are given the same width, the right stroke will appear heavier. When the impression of equal stroke thicknesses is intended, an optical correction is required; the right stroke must be drawn slightly thinner so that both strokes will appear to have the same width. [Fig. 3]

Fig. 2
Right: reversing the contrast sequence creates an unconventional form.

Fig. 3
Giving both strokes the same width will cause the right stroke to look heavier.

Thus it comes as no surprise to find out that the letterforms of a text typeface are often not what they seem. Many letters require certain compensations or "optical corrections" which provide us with an image that best corresponds to the letterform image in our minds. The clearest example of this can be seen in the letter x. The average observer may claim that an x consists of two diagonal strokes which cross each other at the middle. This impression comes from our perception of this letter and from the way it's written by hand. However, the designer who draws an x based on this assumption *is not using his eyes*. In an optically correct x, the two strokes don't actually cross in the middle – indeed, they don't cross at all (as we shall see).

If and how much optical correction should be applied to letterforms depends upon the forms themselves as evaluated by the experienced type designer. If there is a rule, it might be: the higher the stroke contrast, the more letters require optical adjustments in order to maintain an aesthetic and perceptual quality. This is why the sample typeface chosen for the figures of this essay, ITC Jamille®, is particularly suited to this kind of documentation; its form is rooted in the historical tradition of the neo-classical typefaces of the late 18th and early 19th centuries. The most common characteristics of these typefaces – and of the typeface at hand – are a dominating vertical stress, sculpted forms and a high contrast in stroke thicknesses. The visual quality of a typeface, particularly one of this breed, can suffer greatly if it is not conceived and executed with the necessary allowance for optical perception.

Of course, it's important not to stop at the individual letterforms. The beauty and legibility of a typeface lie not only in the single letters but especially in how the letters work together in texts. Research into legibility and oculomotor behavior has shown that when we read, our eyes execute a series of rapid (saccadic) movements followed intermittently by pauses (fixations). During this process, we do not read letter by letter but rather segments of single or multiple word images. Each letter designed in this typeface had to have the clearness and integrity of form necessary to provide the best possible image elements, which could then be effectively arranged together in texts. They had to be like the instruments of an orchestra; each individually well-played and also working together as a whole. What follows is a brief look at a few of the elements of proportion and optical image support in some of the characters of this typeface.

Basic optical compensation for letterforms

The most basic principles of optical compensation in typefaces can be seen in an interesting test made by Peter Karow in his book *Digital Formats for Typefaces*[3] (p. 25). The reader is presented with a number of square-like forms with slightly varying dimensions and asked to select the form which he/she perceives as being the perfect square. The same is then done with circles. In the third test, the reader is shown circles of slightly varying sizes placed between a repeating square form and is asked to choose the circle which appears to be the same size as the square. The same is done with triangles. Karow's evaluations of the results from 130 test persons led to the following conclusions:

a) a square appears to be a square when it is 1% higher than it is wide,
the same applies to circles.

b) circles appear as large as squares when their diameter is 3% greater than the length of the square. This is important with reference to round letterforms in comparison to "straight" letterforms, particularly the straight capital letters.
c) triangles appear as large as squares when their height is 3% and their width 5% greater than the corresponding side length of the square, this with reference to such letterforms as A and V.

Then Karow concludes – quite correctly – with: "These percentages are mean values. The whole aim of this exercise is not to prescribe how one produces optically satisfying effects. We are merely trying to provide guidelines. Each particular typeface has, as might well be expected, its own individual effects and its own individual 'excesses'. These and other optical effects can only be properly and correctly considered by experienced type designers. In the future all technicians should bear this fact in mind [and] let us hope that we have seen the last of those 'computer typefaces in 3 hours'".4

Figure 4 illustrates how these basic principles are transferred onto letterforms so that they appear to have the same size or the same height and to stand equally on the baseline. The "straight" forms provide the eye with a clearer delineation of the plane division than diagonal or round forms which must protrude beyond the cap, mean or base line.

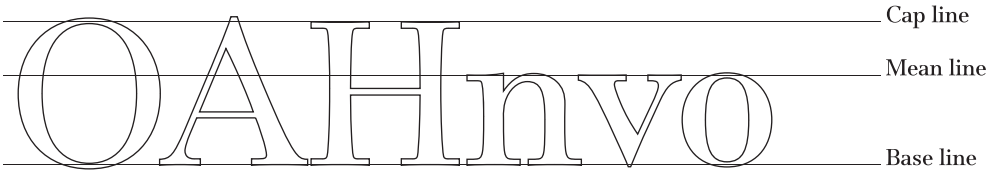

Fig. 4
Each letter is designed for a consistent base and optical height.

The exact middle vs. the optical middle

When the strokes of a typeface such as Optima® or ITC Jamille® have concave contours as an important characteristic element, the "run" of this concavity should be designed taking the optical middle into account. In our sample typeface, the narrowest point of the concave stroke lies optically central in the height of the letter. Were the contours to come closest at the exact middle, the stroke would appear top-heavy since we would perceive it as having more weight in its top half than in the bottom half. [Fig. 5] If a top-heavy effect is indeed desired, having the narrowest width in the exact middle of the height will cause the top-heaviness to flicker as an irritating optical trick. Top-heaviness – present in relatively few typefaces – must be drawn with more intent so that the result doesn't appear to be merely a mistake or faulty execution.

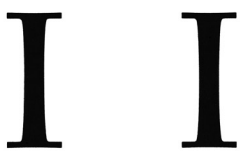

Fig. 5
Right: the stroke appears top-heavy when the contours come closest at the exact middle in the height of the letter.

Since letterforms are generally a division of two-dimensional space into positive and negative planes, this same principle of optical perception which applies to the positive planes of a typeface – the letterforms themselves – must also apply to the ground or negative forms. Where interior forms (counters) are divided into two parts in a letter, the upper forms have been kept smaller than the lower forms. An example of this can be seen in the design of the numerals 6 and 9 as well as the letters B and S. [Fig. 6]

Fig. 6
Turning the 9, B and S upside-down (right letterform in the second, third and fourth pairs from left) shows that the upper counters are smaller.

In a neo-classical typeface with its distinct vertical stress, it would seem correct to design all round character forms with a symmetry in the vertical stroke. In digital production, it would even be tempting to digitize only ¼ of the o and then, using a computer function, mirror it in all four directions of the compass. But this would have hardly resulted in the desired optical effect of a symmetrical round form; it would have appeared a bit top-heavy. To achieve this effect, a little more weight was given to the bottom half of the vertical stroke. Turning a character upside-down makes this compensation visible. [Fig. 7]

Fig. 7
Round forms also need slight adjustments in order to appear well-balanced (right letterform of each pair is upside-down)

Proportions of ascenders to descenders

In virtually all typefaces, the length of the descenders must be carefully adjusted with respect to the length of the ascenders. Generally, they must be kept somewhat shorter. If their measured length were the same, the descenders would appear to be far too long. [Fig. 8]

Fig.8
Left: proportionally adjusted descender. *Right: ascender and descender have the same length.*

Treatment of serifs

Sometimes it's practical to have a kind of "cupping" – or concave curve – in the base of a serif. This was especially true of our sample typeface and is also the case in most other neo-classical typefaces where the sudden change of movement from a thick stroke into a thin serif can cause an optical break or bend upwards in the serif. Most neo-classical typefaces have no bracketing (the rounded transition from the vertical stroke into the horizontal serif) and this undesired bend can be quite prominent. Therefore it is best to build in a slight curve to counteract this optical effect. Merely showing the same letterform with and without this correction clearly illustrates the effect of this curve. [Fig. 9] In some interpretations of old-style typefaces, this cupping is so prominent as to become a significant characteristic of the typeface image. The Schneidler® and Seneca® typefaces are good examples of this.

Fig. 9
Serifs with cupping (left in both examples) and without cupping (right).

Avoiding breaks

The kind of optical correction mentioned above in serifs is similar to the treatment of optical breaks or disturbances which can occur in the letterforms of a wide variety of typefaces and particularly in those with a prominent contrast in stroke weights.

Several characters with a high stroke contrast have such a fragile form that it becomes necessary to strengthen their appearance with various form adjustments. For example, slight curves are drawn into supposedly straight elements to prevent the junction of a thin stroke and a thick stroke from breaking optically. [Fig. 10] In large point sizes, this might add some liveliness to otherwise rigid forms. In small sizes, these compensations maintain the integrity of the forms when they are subjected to various reproduction processes.

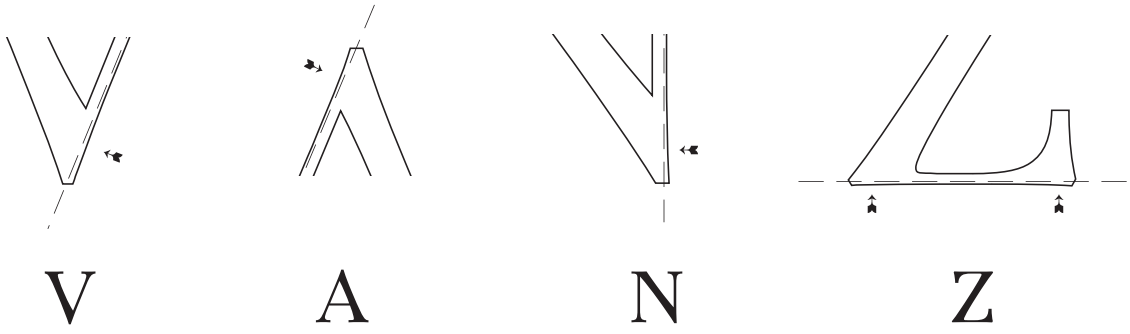

Fig. 10
Sensitive areas like these can be strengthened with curves.

Diagonal cross-strokes

Now, let's get back to the x! This character, along with related forms in a typeface complement, provides the designer with a problem which typically occurs when two diagonal strokes must cross each other optically. Again, this problem becomes more prominent as the contrast of the stroke weights is increased. In our sample typeface, the point at which the strokes cross is the optical middle. Placing the letter upside down illustrates this clearly. [Fig. 11] If the thin stroke is drawn straight through the thick stroke, the optical result will appear as a break in movement. Therefore, these two thin-stroke halves must be slightly staggered in order to create the image of an unbroken stroke. [Fig. 12]

There is no specific equation for the amount of staggering required; the distance depends on the formal characteristics of each individual typeface and must be determined by the designer's eye. Other similar forms require this same treatment and the so-called "Danish Ø" poses a special problem since the thin diagonal crosses over two opposing strokes in the same character. [Fig. 13]

Fig. 11
Right: character placed upside-down.

Fig. 12
Left: staggered thin stroke. Right: thin stroke drawn through.

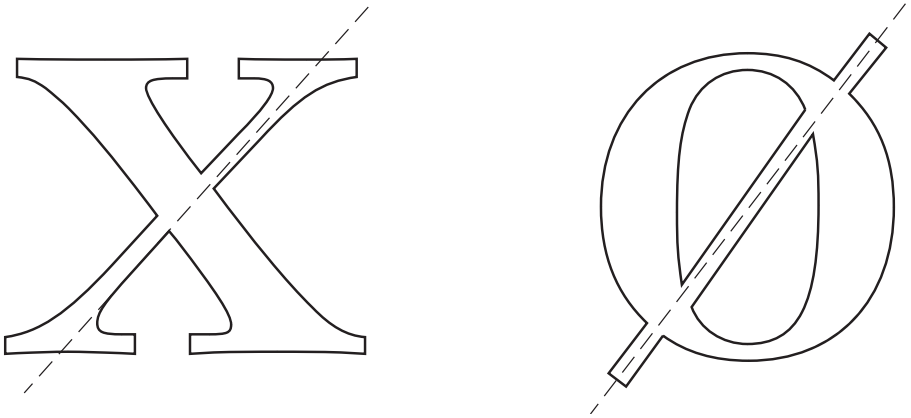

Fig. 13
A close look at the staggered diagonal stroke.

This essay has covered only a small portion of the considerations to be made when designing a typeface, but I hope to have given some food for thought to those who work with type and other elements of visual communications. Moreover, the indispensible aspect of craftsmanship can be observed and personal conclusions may be drawn which can enhance a designer's capabilities in many areas of graphic design. This can also increase the appreciation of type design and the sensitivity to type required for using it knowledgeably.

FOOTNOTES

1. Tracy, W. *Letters of Credit*. Gordon Fraser Gallery Ltd., London: 1986
2. Kapr, A. *Schriftkunst*. VEB Verlag der Kunst, Dresden: 1971
3. Karow, P. *Digital Formats for Typefaces*. URW Verlag, Hamburg: 1987
4. Ibid.

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