Roxane is an original typeface designed by the author in response to a design analysis of visual attributes that enhance the legibility of font characteristics. The author takes issue with scientific legibility studies which focus on isolating variables to obtain verifiable results, but which are not useful in the more complex and holistic design of specific type faces. Visual analysis of type form attributes and visual principles provide the framework for this more holistic enterprise. The principles and attributes are demonstrated visually throughout the article, ending with *Roxane*, a typeface developed with these principles in mind.

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R O X a N E

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A Study in Visual Factors Effecting Legibility

The legibility of typefaces has often been measured by means which have included distance, speed, both short term and long term comprehension, blink rates, saccadic jump regression, heart beats and even shaking tables. However, apart from the major class differences, such as sans serif and serif, bold and medium, italic or roman, there seems to be little or no research into which of the many different factors in a typestyle or class contribute to legibility.

Many believe that it doesn't really matter because as long as a typeface is reasonably readable, it doesn't make much difference as the reader compensates for ambiguous characteristics. I argue that legibility matters for two reasons. Excellent legibility is critical for the large proportion of the population who see with less than optimum vision. There are many who need glasses, particularly reading glasses, who may not have access to them. Even those who wear them may use glasses that are out of date or scratched. Under some conditions they also collect dust or moisture further interferring with vision. Further, once mastered, reading is an automatic process, susceptible to good or bad influence unknown to the reader. Legibility may effect our attitude toward what we read. The best legibility would minimize this negativity or lack of positive response to reading material.

But how do we test for the bewildering number of factors which may influence legibility? Although we can see that it is important, it would be prohibitive to test them all against each other, one at a time, using any of the methods mentioned at the beginning of this article.

As a designer, I approached legibility as a design problem. Design analysis, which is used to establish the parameters for a problem, to establish what the problem is, can establish which qualities we might expect to effect legibility. If we examine type in terms of design principles, we may increase legibility by increasing the degree to which these principles are used. So analysis of where contrast and unity lie within existing typefaces, might allow us to see which factors effect legibility, and by maximizing their contrast or unity respectively, allow us to create more legible type (*see figure* 1).

In terms of basic design principles, an examination of an alphabet set in a typical typeface (in this case *Verdana*) shows that the contrast, the variety that we depend on to create the pattern by which we recognize words and phrases, occurs primarily within the negative space, while the linear skeleton remains rather uniform, unifying the system to maintain contrast (*see figures* 2 *and* 3).

In terms of creating contrast, the spaces inside the letters are visually the most important (*see figure* 4). But the spaces between the letters, defined by their profiles, although they appear to have less contrast than the spaces inside the letters, also contribute importantly to pattern recognition. (With contrasting shapes but repetitive size, they are like the bass line in a piece of music, where there is variation in tone with a strong repetition in time, creating both variation and visual rhythm. This, however, is developed differently in different typefaces.)

figure 1

figure 2

figure 3

figure 4

A serif alphabet, in this case *Bembo*, an old style face which maintains many of the characteristics of the handwriting on which it was modeled (*see figure* 5), is seen to be very different from a modern sans serif typeface (*see figure* 6), in this case Helvetica, where the lack of serifs and the unity of graphic form have a dramatic effect on the negative space. This is much more enclosed in letters such as a, c, e, g and s, but much more open in the vertical direction in letters such as h, k, m, n, r, v, w, x, y and z, where the spaces are more repetitive in shape and size.

figure 5

figure 6

Upper case letters are a much different matter again; their uniform height, volume and often width, create a dramatic decrease in the variety of form they generate in a serif alphabet and in a sans serif alphabet, perhaps even more so (*see figures* 7 *and* 8).

figure 7

figure 8

In the spaces inside the letters, in a serif typeface, the serifs enclose the space much more in some letters, particularly in the vertical direction, creating a big difference between top and bottom and left and right (*see figures* 9 *and* 10).

figure 9

figure 10

In a modern sans serif typeface, the forms generated are more uniform in shape and size, and depend significantly on the square ends of the letters and uniformity of size and shape to control space in the vertical direction.

In the capitals, a serif typeface can be seen to be less different than a sans serif typeface, and the forms generated are much more uniform, particularly in size and proportion in the spaces between the letters (*see figures* 11 *and* 12).

figure 11

figure 12

In a lowercase serif typeface, the serifs both enclose the spaces more, and accentuate the difference between left and right and top and bottom (*see figures* 13 *and* 14).

figure 13

figure 14

In a sans serif typeface there is a uniformity, particularly of volume, and between left and right and top and bottom.

In the capital letters (*see figure* 15), much greater variety can be seen between the letters, than in the shapes inside the letters in both size and shape. This is also the case in the sans serif (*see figure* 16).

figure 15

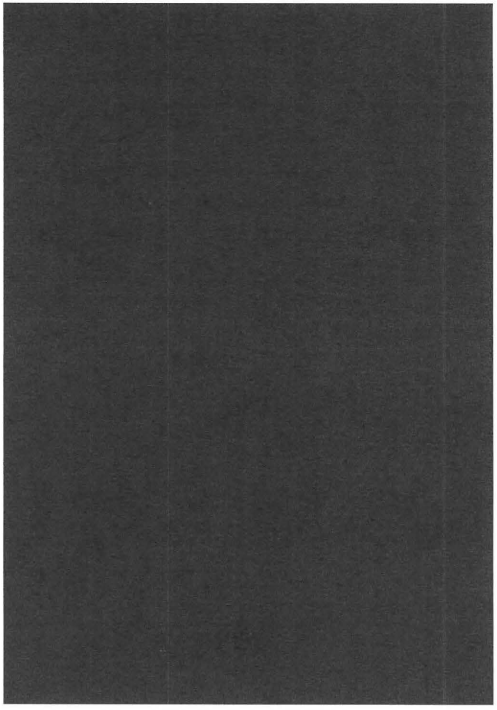
figure 16

As a result of these observations, the profiles of the capital letters are seen to be critical to their recognition and that they need sufficient letterspacing to define them. This reinforces Tschichold's idea that type set in all caps needs extra spacing. It also lends credence to the argument put forth here, that it is the space that establishes the recognizable pattern of letters.

Another indication of how important the negative spaces are in reading is that negative space is what the eye "sees." The eye detects light. When light hits the retina, a nerve is excited and sends a signal to the brain. When no light is "seen," or the eye "sees" black, no signal is sent (*see figure* 17).

When a page is viewed in the dark the letters cannot be "seen." When the light is turned on, the letters remain the same, but it is the white space that is "seen."

As a further indication of its importance, most of what we see on a page is white space (*see figure* 18). Even after we remove the margins, paragraph spaces, indenting leading and word spaces, the black of the letters still only occupy about fifteen percent of the remaining "full" space.



Use full points sparingly, and omit after these abbreviations: MR, MRS, Messrs, Dr, St, WC2, 8vo and others containing the last letter of the abbreviated word.

Use single quotes for a first quotation and double quotes for quotations within quotations. If there is still another quotation within the second, return to single quotes. Punctuation belonging to a quotation comes within the quotes, otherwise outside.

Opening quotes should be followed by a hair space except before A and J. Closing quotes should be preceded by a hair space except after a comma or a full point. If this cannot be done on the keyboard, omit these hairspaces, but try to get the necessary attatchment.

When long extracts are set in small type do not use quotes.

Use parentheses ( ) for explanation and interpolation; brackets [ ] for notes.

For all other queries on spelling, consult the *Rules for Compositors and Readers at the University Press, Oxford, or Collin's Author's and Printers' Dictionary*

CAPITALS, SMALL CAPITALS, AND ITALICS

Words in capitals must always be letterspaced. The spacing of the capitals in the lines of importance should be very carefully optically equalised. The word spaces in lines either of capitals or small capitals should not exceed an n quad.

All display lines set in the same font should be given the same spacing throughout the book.

Use small capitals for ruynning headlines and in contents pages. They must always be slightly letterspaced to make the words legible.

Running headlines, unless otherwise stated, should consist of the titlr of the book on the left hand page, and the contents of the chapter on the right.

Italics are to be used for emphasis, for foreign words and phrases, and for the titles of books, newspapers, and plays which appear in the text. In such cases the definite article 'The' should be printed in roman, unless it is part of the title itself.

In bibliographical and related matter, as a rule, the author's names should be given in small capitals with capitals, and the titles in italics

FIGURES

Do not mix old style text compositions with modern face figures. Either hanging or ranging figures may be used if they are cut in the font used for the text.

In text matter, numbers under 100 should be composed in letters. Use figures when the matter consists of a sequence of stated

figure 17

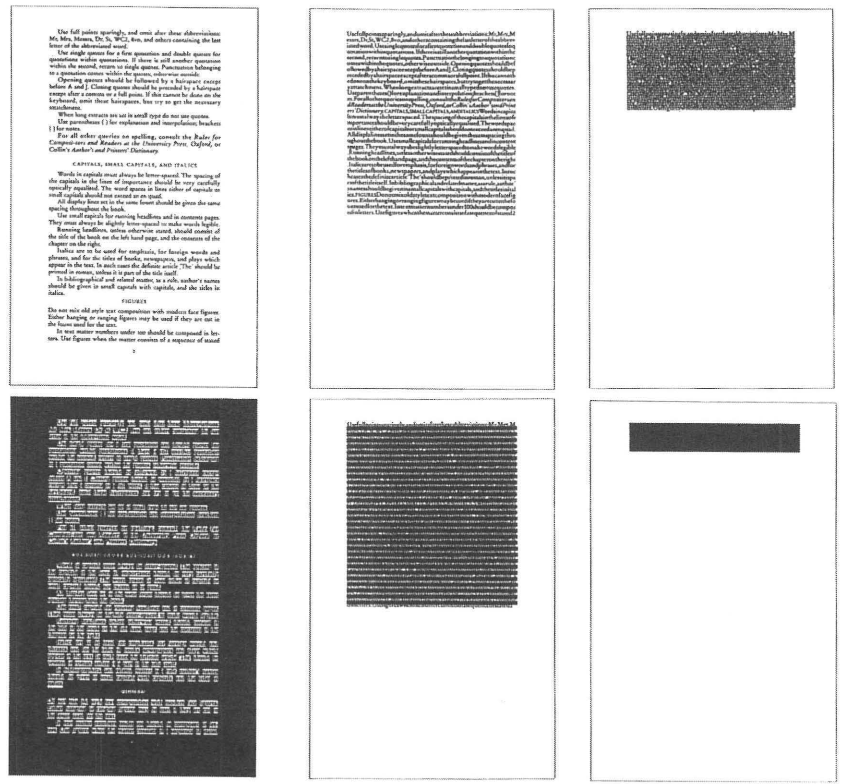


figure 18

Roxane was designed to maximize legibility by giving considerable attention to the way the space is controlled by the letters (*see figure* 19).

figure 19

By making the differences in the negative spaces as great as possible in the spaces inside the letters, (*see figure* 20), maximizing the differences in size and shape, between left and right, between top and bottom and between open and closed spaces (*see figure* 21), enhance legibility.

figure 20

figure 21

The spaces between the letters strengthen the characteristic profiles of the letters to maximize their difference in shape (*see figure* 22).

figure 22

In the capital letters, the significant features of their profiles are investigated and emphasized, while superfluous features are diminished or removed (*see figure* 23).

The capital letters are designed to be used with the lower case in text, rather than in settings of all caps. Therefore they are narrow, the letter often being only as wide as is necessary to carry the profile, and light, barely stronger than the lower case, so as not to interrupt the reader's eye, with either large black or white areas in the line of type (*see figures* 24 *and* 25).

The spaces inside the letters are open and clear with as much variety as possible, particularly in size (*see figure* 26). (Reference has been made to the Roman letters on the Trajan column, where there is a lot of variety, particularly in the width of the letters, the width often being determined by what is necessary to carry the profile.)

The profiles of the letters have been made as different as possible, to emphasize the difference in shape in the spaces between the letters. This has led to the openness of the C and S, the much nearer vertical angle of the center portion of the S, the straight and sharply angled stroke of the R and the slightly angled end strokes of the M.

figure 23

figure 24

figure 25

figure 26

The following examples of different typefaces were compared. When their presentation was effected by the deterioration caused by different reproduction processes, their legibility was demonstrably altered (*see figure* 27).

figure 27

Soft focus, caused by reproduction (or by the viewer) can have a dramatic effect, both in this example where it has caused the letters to fatten (*see figure* 28) and in this example where it has caused them to thin out with parts of them disappearing (*see figure* 29).

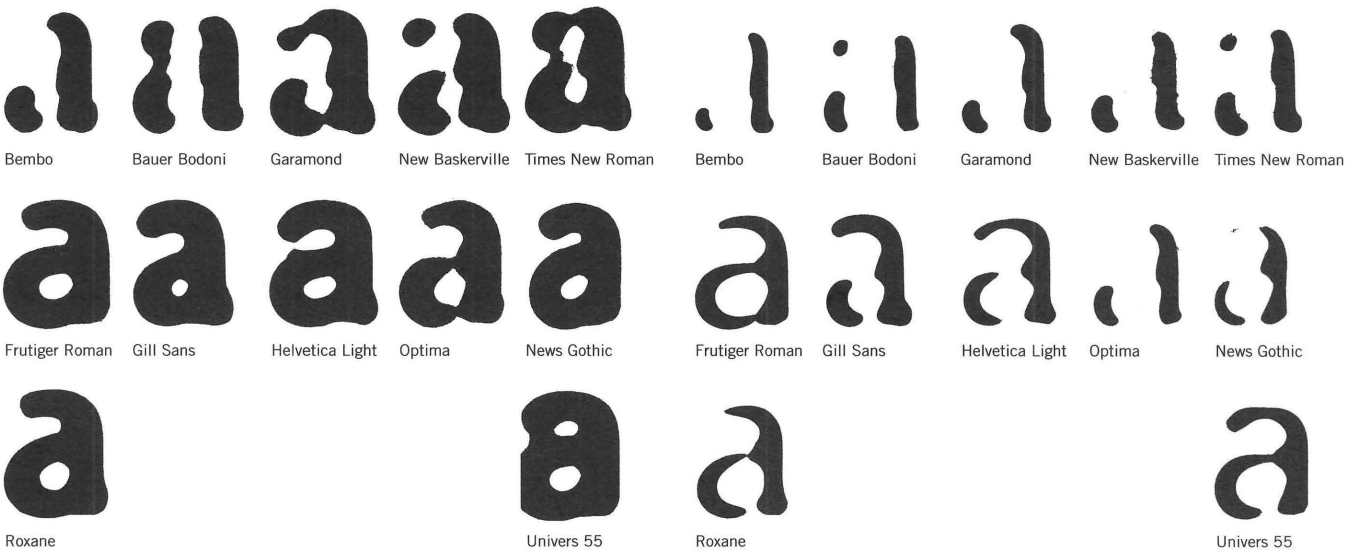


figure 28

figure 29

While overexposure is not usually itself a problem, the combined effects of plates, film, reproduction artwork, etc., can have a dramatic effect, particularly on very small letters (*see figure* 30).

Similarly, the combined effect of underexposure can change the presentation of the letters in the opposite direction, again in particular for very small letters (*see figure* 31).

figure 30

figure 31

The combined effects of these factors, plus those contributed by rough paper, over- or under-inking, very fast printing processes, digital typesetting, photocopying or low quality computer printing and so on, are simulated here (*see figures* 32 *and* 33) to show what the outcome might be, particularly for very small sizes, very fast printing processes or poor quality paper.

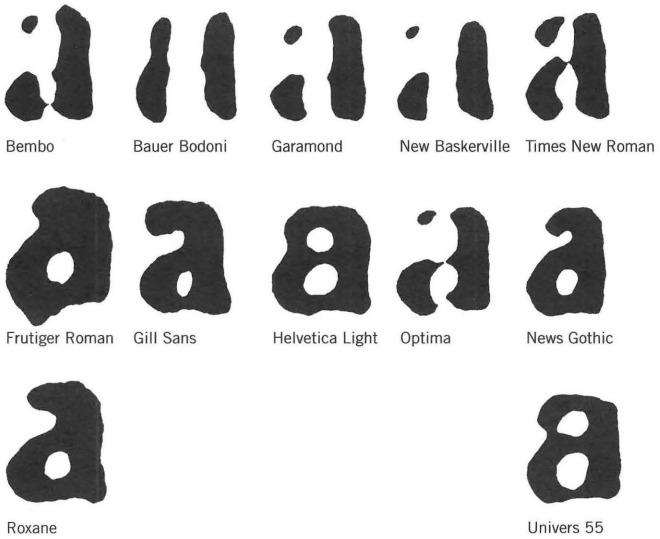


figure 32

They could also be seen as the result of different processes, such as screen printing on different surfaces such as are commonly used in packaging or other applications.

figure 33

6 When attatching or removing lenses never touch anything inside
the camera especially the lens contacts or mirror. To protect lens
contacts and lens elements always attatch body and rear caps
5 whenever a lens is not in place. Never touch lens elements or
eyepieces with your fingers; if the lens becomes dirty, clean it
gently with a lens brush. Only if necessary moisten a sheet of lens
4 cleaning fluid. Then starting at the centre and using a circular
motion lightly wipe the glass surface. Never lift the mirror or touch
its surface as this may impair its alignment. Dust specks on the
3 surface of the mirror will not affect meter readings or picture
quality. If they are annoying have the camera cleaned at an
authorised service facility

figure 34

In conclusion, we have discovered and been able to verify the importance of negative space for ease of reading, the importance of basic design principles to function, as well as visual interest in one of the most demanding sub-disciplines in graphic design, that of type design. The usefulness of design, and in particular design analysis as a research instrument is also suggested by the method and results contained within this paper.

Stuart Gluth teaches graphic design, leads the Design Research Group at the University of South Australia and is a partner in the design consultancy interDesign. The breadth of his interests is indicated by his passion for typography, which has led to a masters degree from the ANCT in Paris, following initial studies in industrial design. He is currently campaigning for Ph.D. degrees in design practice and for the acceptance of designing as researching.