Designing Text for the Screen: Setting Out the Criteria for the Legibility of Type Designed to be Read From the Computer Screen.

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The legibility of text on the computer screen appears to be one of the most important problems that designers, or any communicators, currently have to deal with. It may be that the paperless office has not come about largely because of the difficulty of reading text on the screen. More forests of paper than ever seem to be being consumed just so that people can read the vastly increased amount of information that their computers give them access to. Nor are high tech solutions such as greater screen resolution or non-screen presentations a solution for the majority of users, and may further preclude many who are not yet users, because of cost and technical complexity. Therefore the design of typeforms, forms of presentation and formats appropriate to the character and quality of the computer screen is very important.

During previous research into the legibility of type (not specifically for the screen), I found that this area had been the subject of very little research, particularly in reference to how specific typographic factors affect legibility. It appears that even less investigation is being done into the legibility of text on the computer screen despite the importance its widespread presence might warrant.

Do we mean readability, though, rather than legibility? Although definitions vary, it appears to be that legibility refers to the individual letter and how easily it is recognized, while readability appears to refer to how effective is the unconscious process we use to get meaning from the pattern of letters as we scan it. While the two obviously affect each other, readability is seen as the more important in practical terms.

One of my students set a short paragraph in an alphabet which had been put through a distortion filter which made it appear unreadable. However, after being told what the first few words were, we were slowly able to read a few more and by the end of the paragraph, we were able to read it quite fluently. From this we might conclude that reading, like designing, is a learning process. Other students who were asked recently to do a little ‘testing’ into the legibility of text discovered that a test group of middle aged readers stated a preference for reading text set in serif type, but actually read sans serif faster. Perhaps the adage learned at undergraduate design school might be correct – that we read most easily what we are most familiar with.

If so, it seems probable that a generation brought up reading from the screen may already read differently to those of the previous generation who learned to read from type printed on paper, who may find more difficulty reading from the screen. Indeed neurological research suggests that we may read these different forms of the written word in different ways!

Designing Text for the Screen; Setting out the criteria for the legibility of type designed to be read from the computer screen

Stuart Gluth

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The legibility of text on the computer screen appears to be one of the most important problems that designers have currently, or any communicators perhaps. It may be that the paperless office has not come about largely because of the difficulty of reading text on the screen. More forests of paper than ever seem to be being consumed just so that people can read the vastly increased amount of information that their computers give them access to. Nor are high tech solutions such as greater screen resolution or non-screen presentations a solution for the majority of users because of cost and technical complexity. For instance Xerox' proposal for screen systems capable of 300 dots per inch (Staples 2000) will not make a difference for the majority of existing users for quite a few years at least, nor for the huge numbers of potential users in low income groups and poorer countries. Such technological advances may further preclude many who are not yet users. Therefore the design of typeforms, forms of presentation and formats which are appropriate to the character and quality of the **existing** computer screen is important.

During the authors previous research into the legibility of type (not specifically for the screen), it was found that this area had been the subject of very little research, particularly about how the specific factors present in a typeface affect legibility. Now it appears that very little investigation is being done into the legibility of text on the computer screen despite the importance its widespread presence might warrant.

A recent call for references on the PhD Design email forum arrived at the relatively trivial, vague and sometimes inaccurate 'Use fonts designed for screen reading sized to at least 10-point. Such fonts are wide with a large counter (the open space in a letter), have generous kerning and a large x-height' (George 2003).

Herbert Spencer (1969) has documented the history of 'machine readable' type up to that time. Most of the emphasis was on making the type readable by the machine, and very little on its 'legibility' by human readers. Since then 'machines' have become much more powerful, particularly in their ability to read the same type that humans can read, but little attention has been paid to how the humans read the text produced by the machine. The unquestioning adoption of type evolved from five hundred years of reading from type printed on paper, particularly the ubiquitous Helvetica, which is especially poorly defined by the screen, is indicative of the lack of thought as to just what is involved with reading text from the screen.

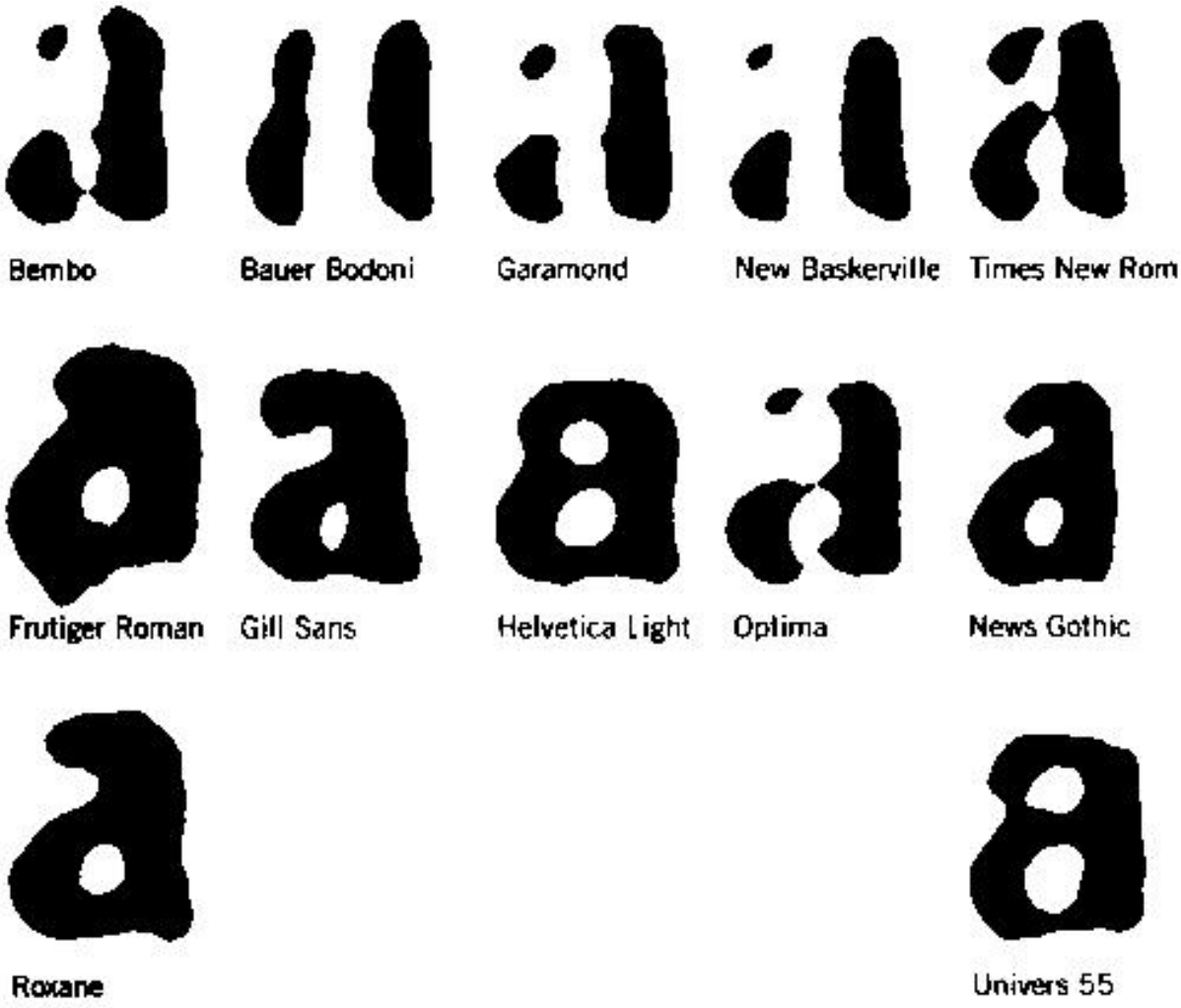
Do we mean readability, though, rather than legibility? Although definitions vary, it appears to be that legibility refers to the individual letter and how easily it is recognized, while readability appears to refer to how effective is the unconscious process we use to get meaning from the pattern of type as we scan it. While the legibility obviously affects the readability, the latter is seen as the more useful in practical terms, that is to say, in measurable terms. Tinker (1955) was able to establish that 'legibility' was directly related to speed at which a typeface could be read – in our terms – readability. To avoid controversy, because it is not the point of this paper to argue about these terms, I intend to use the term legibility/readability.

It is the purpose of this paper to determine what factors need to be taken into account when designing type for the computer screen, concerning how the screen defines the letter, how the eye 'sees' it, and how the brain perceives it.

This paper takes as a starting point the authors previous work on factors that affect the legibility/readability of type in print, which found that contrast, particularly in the negative spaces, was critical (Gluth 1999). This work found that contrast between left and right and between top and bottom in the shape of the counter spaces considerably aided legibility/readability,

(from Gluth, S. 1999 Roxane: A Study in Visual Factors Effecting Legibility. *Visible Language* 33.3, 1999, page 246)

particularly 'for very small sizes' and low resolution produced by 'very fast printing processes or poor quality paper'.



(from Gluth, S. 1999 Roxane: A Study in Visual Factors Effecting Legibility. *Visible Language* 33.3, 1999, page 252)

What are the consequences of the way the computer screen is able to reproduce this?

Two factors are involved. Firstly the letters on a computer screen are defined by a relatively coarse grid comprising only 72 pixels per inch (for Macintosh – a few more

for Windows). At the size we would prefer to read text, approximately 9 point, (Tinker 1965) this leads to a fairly primitive rendition of the type –

(from Knuth, D. 1999, Digital Typography. *CSLI Publications*, Stanford CA, page 53)

of which most of us are familiar with. This has several consequences, for instance:

1 Commonly we make the letters bigger on the screen so that we get slightly better definition of the letters.

(from Knuth, D. 1999, Digital Typography. *CSLI Publications*, Stanford CA, page 53)

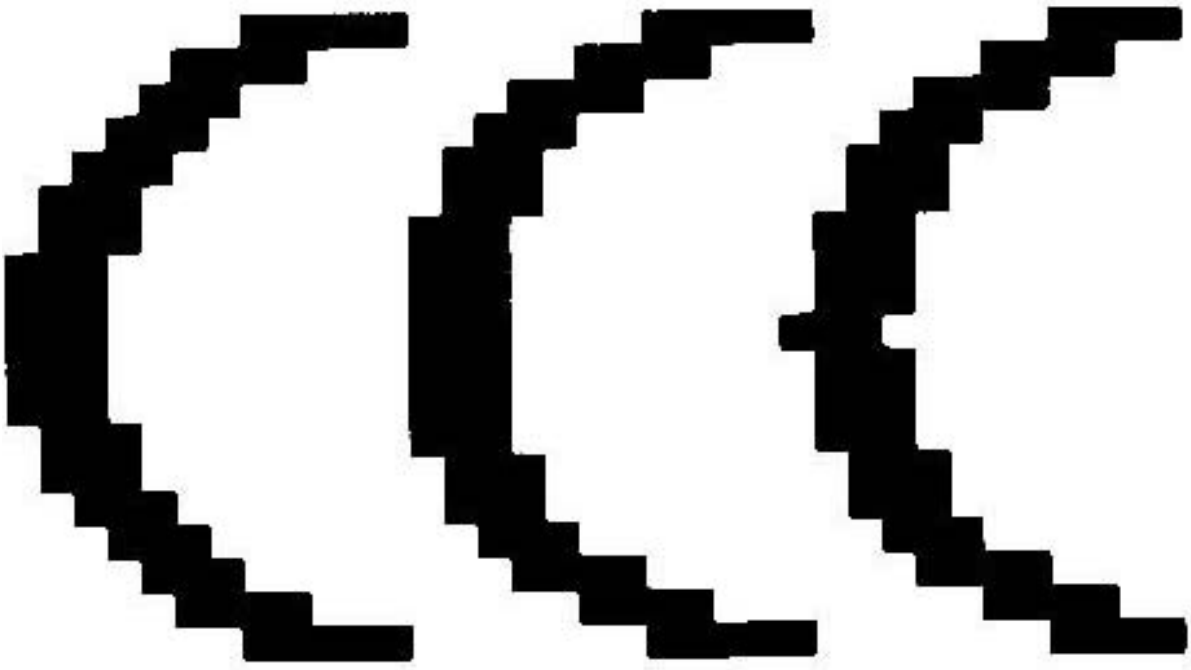
However this means that each saccadic jump that the eye makes along the line of type, covers less material, and to read the same amount of material takes more jumps, and takes longer. (Tinker 1963, Tinker 1965)

2 Or, having enlarged the type, we may sit further away from the screen adding stress to our eyes reading at an unaccustomed focal distance – and perhaps slumping, contributing to a sore back (anyone who has observed their students at a computer will be familiar with this)

3 Or, if we leave it at the optimal size – or similar, the perfect letterspacing which should be beautifully contrasting with both the counter spaces of the letter and the positive strokes of the letter

is not possible

The importance of excellent letterspacing should not be undervalued in setting type, although it often is, as it is crucial to ease of reading, however that must be the subject of another paper as there is not the time or space to discuss it further here. Knuth (1999) has also pointed out that different letterspacing will lead to characters being defined differently by the grid.

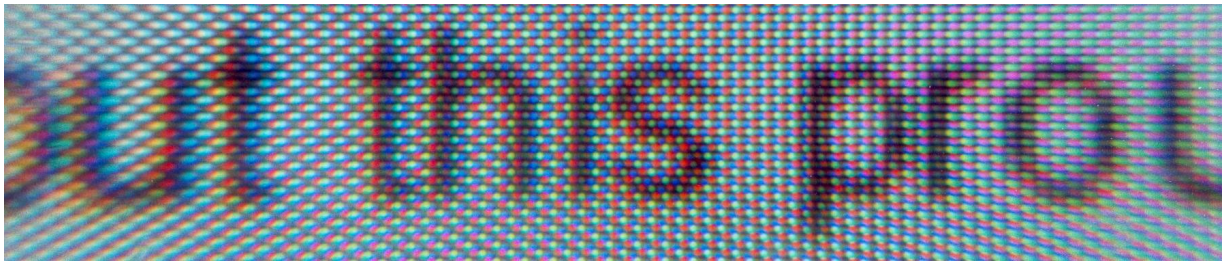


(from Knuth, D. 1999, Digital Typography. *CSLI Publications*, Stanford CA, page 54)

But this is **not** what it actually looks like!

mathematics

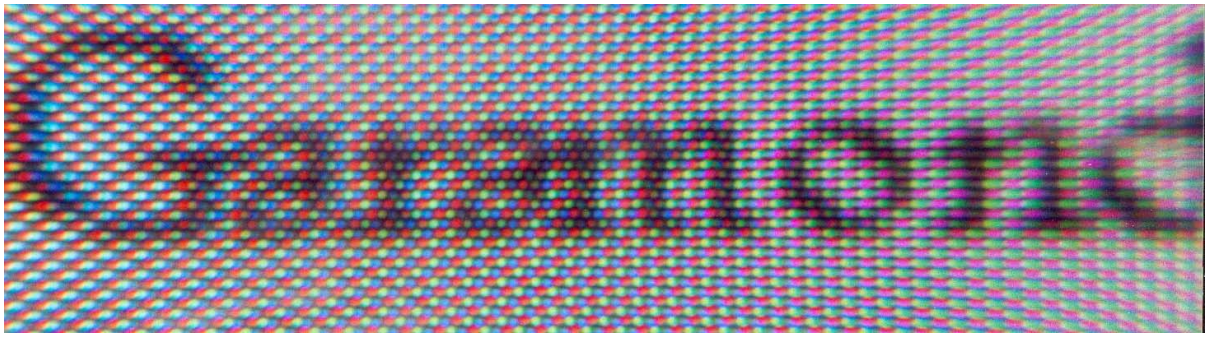
This is only what it looks like when it is printed on a page and the eye ‘sees’ the light reflected from the letter – or more properly it ‘sees’ the light reflected from the page and **doesn’t** ‘see’ the light which is **not** reflected by the letter. What it actually looks like on the screen is this.



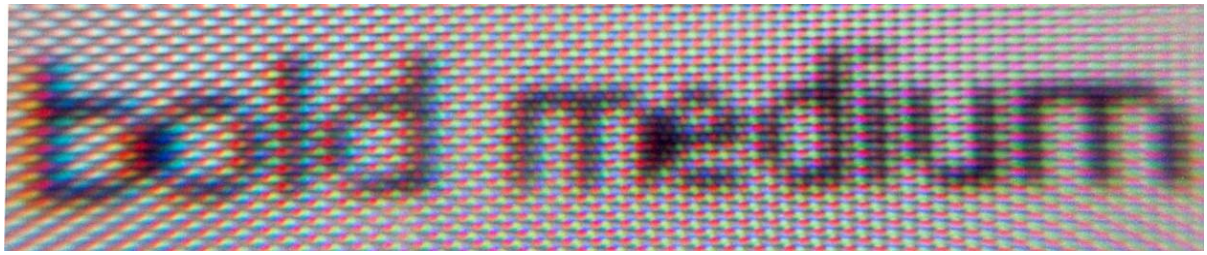
The letter – and the background – is generated by light emitted by the screen. We can see that the background is not white, and we can see that even black letters are not simply the absence of light, but that their edges are compromised and that they are mixes of colour. This is called ‘antialiasing’ and has actually been designed to remove the ‘steps’ that arise from the letters being defined by the grid.

We have the deliberate degrading of the letterform – supposedly to aid readability!

From this observation we can see that if we leave type on the screen at the optimal size – or similar, subtleties of the letter form such as thicks and thins and serifs, contrasts in the line which defines the letter form, are difficult to render, or are rendered clumsily and lose their contrasting character.

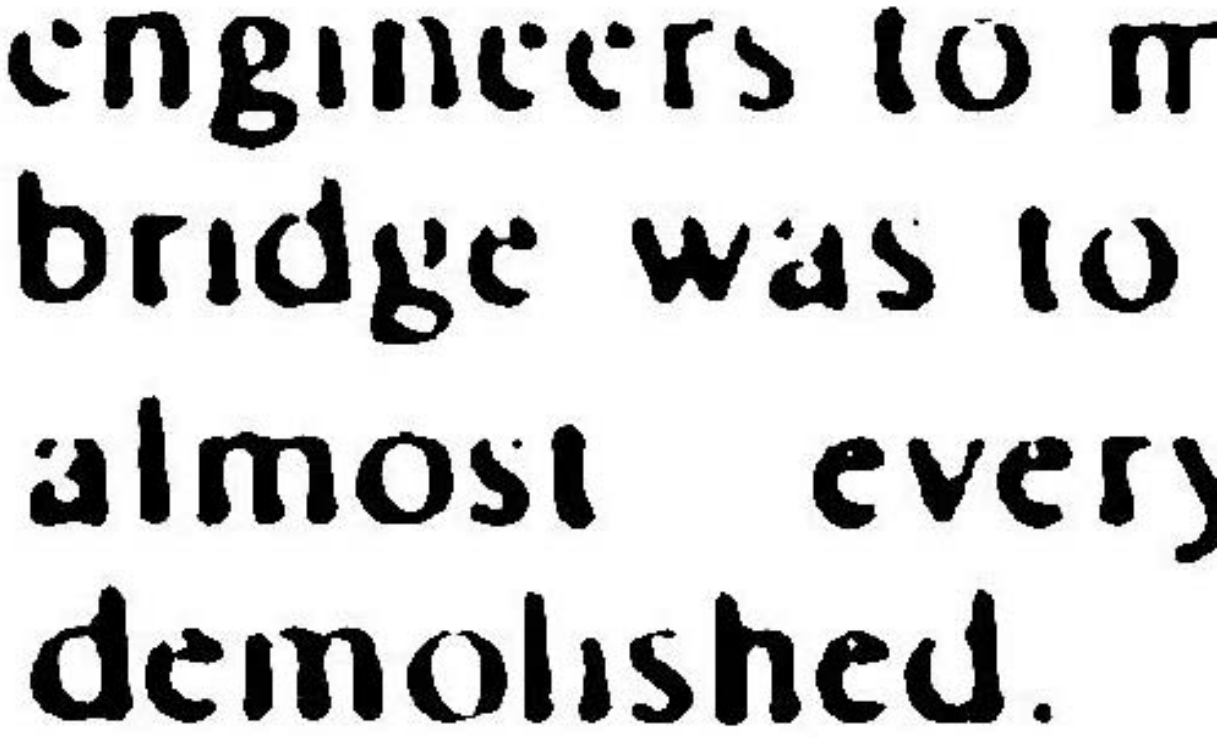


Or if we leave it at the optimal size – or similar, we cannot discriminate between medium and bold faces.

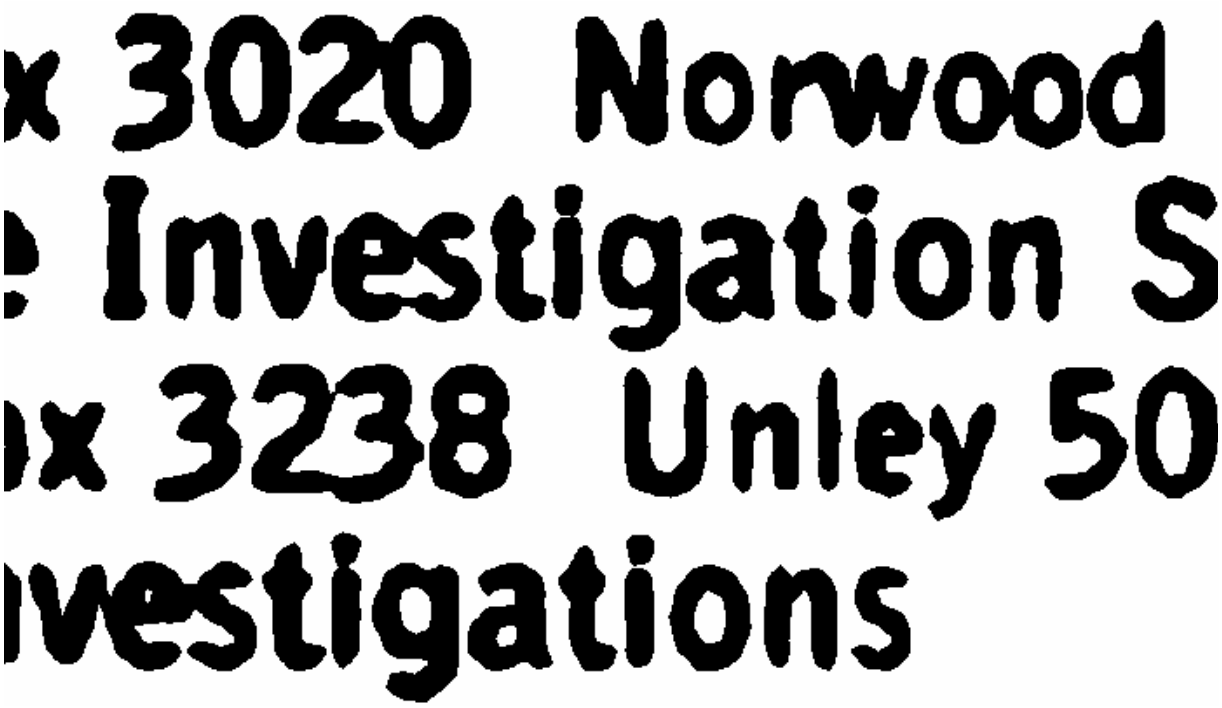


This lack of definition of the letter – while certainly important as a something we have to design with – is not something we are consciously aware of as we read text on the screen. On the other hand it might be more important than we may think as reading is mostly an automatic unconscious process, and therefore much more vulnerable to influence we may be unaware of. Poor legibility/readability may negatively affect our attitude to what we read.

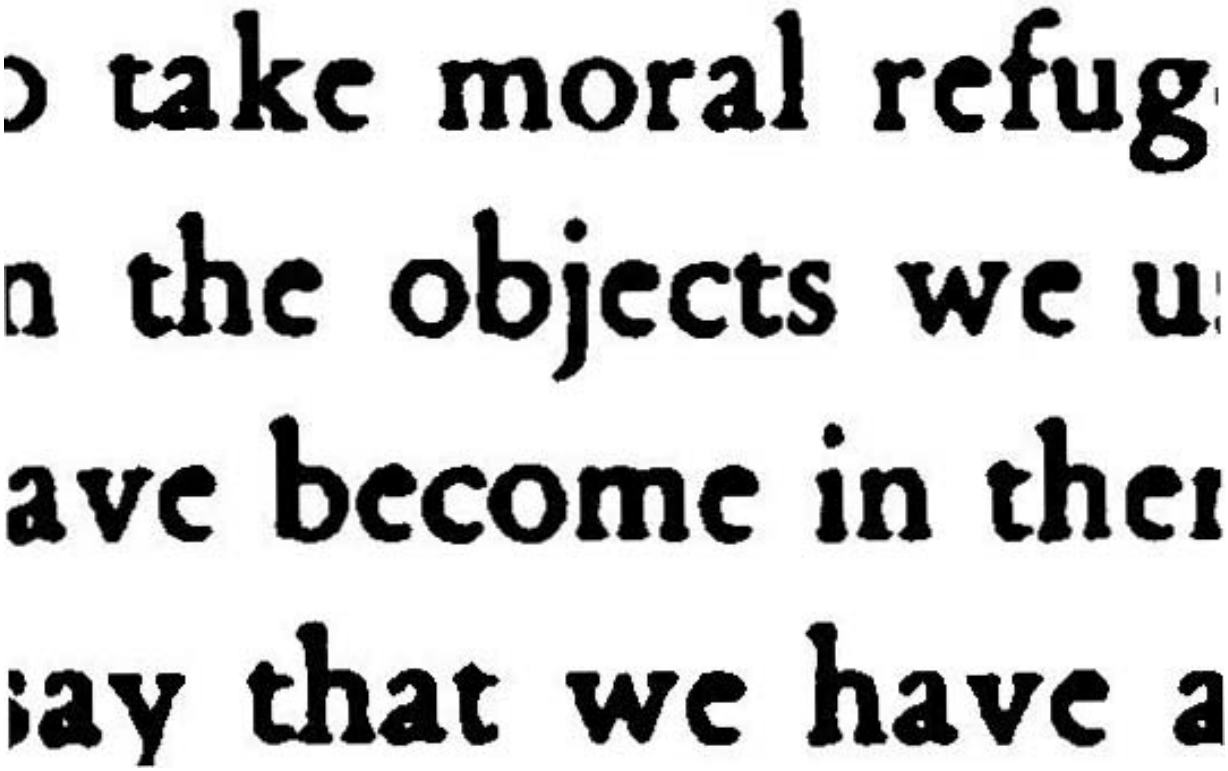
We are used to reading small type of poor definition, for example from the newspaper



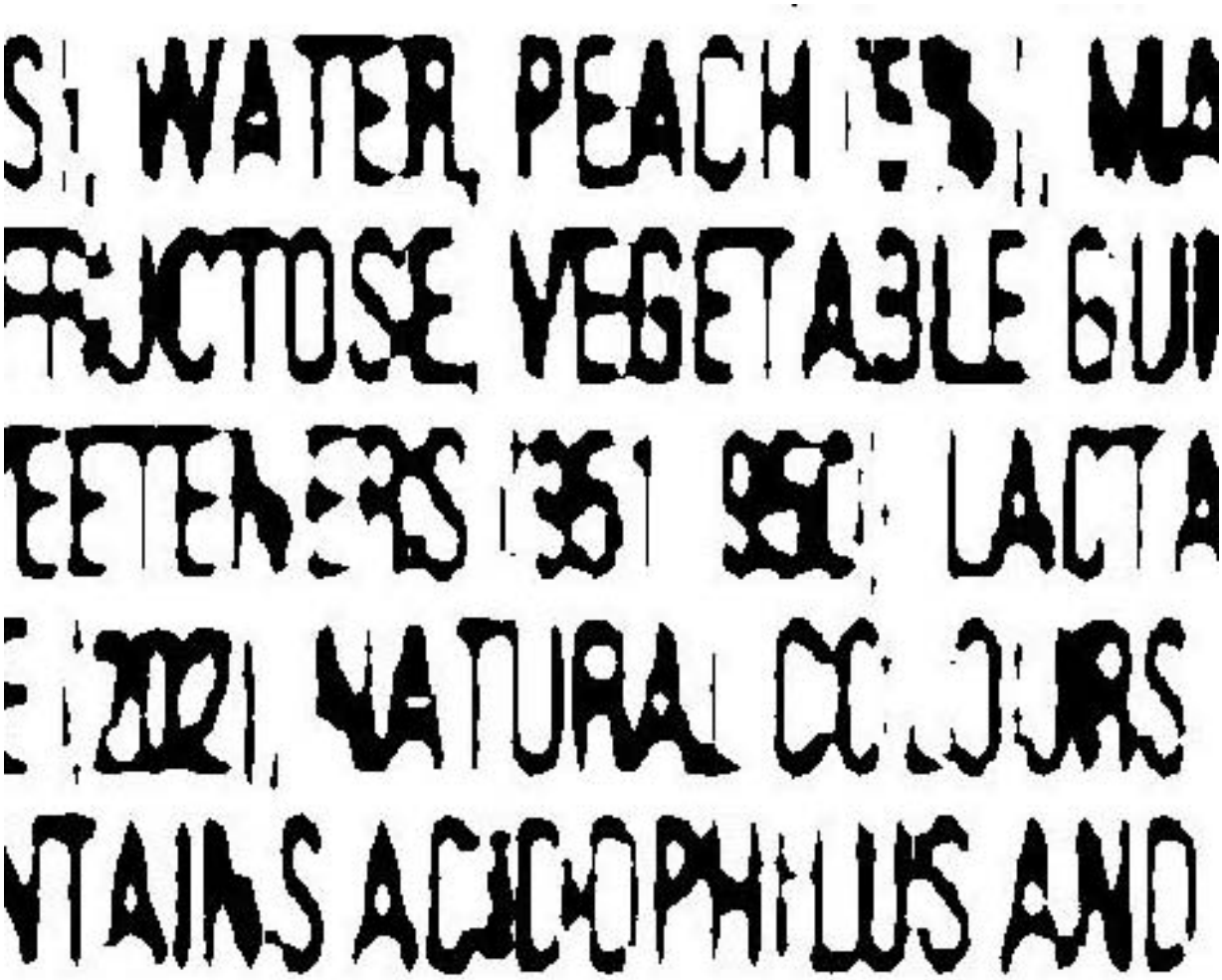
or from other examples of very fast printing on poor quality paper such as the telephone book,



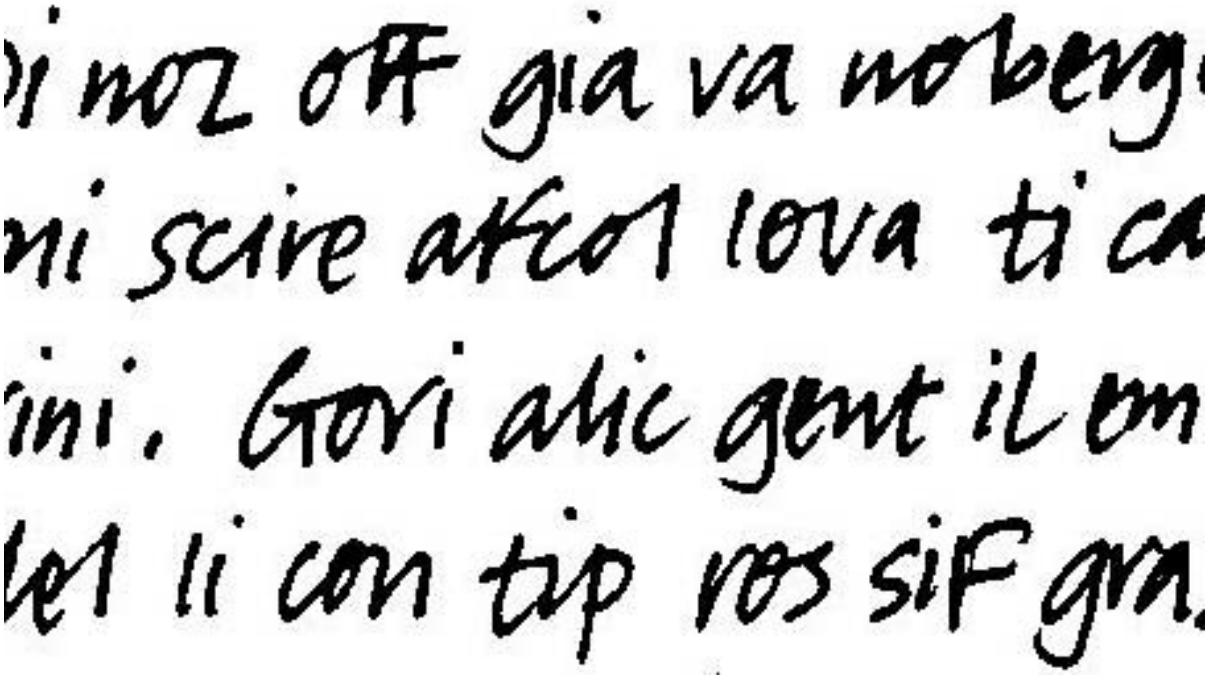
paperback novels



or packaging.



I am also amazed that anyone can read some people's handwriting with its infinite variability and poor definition



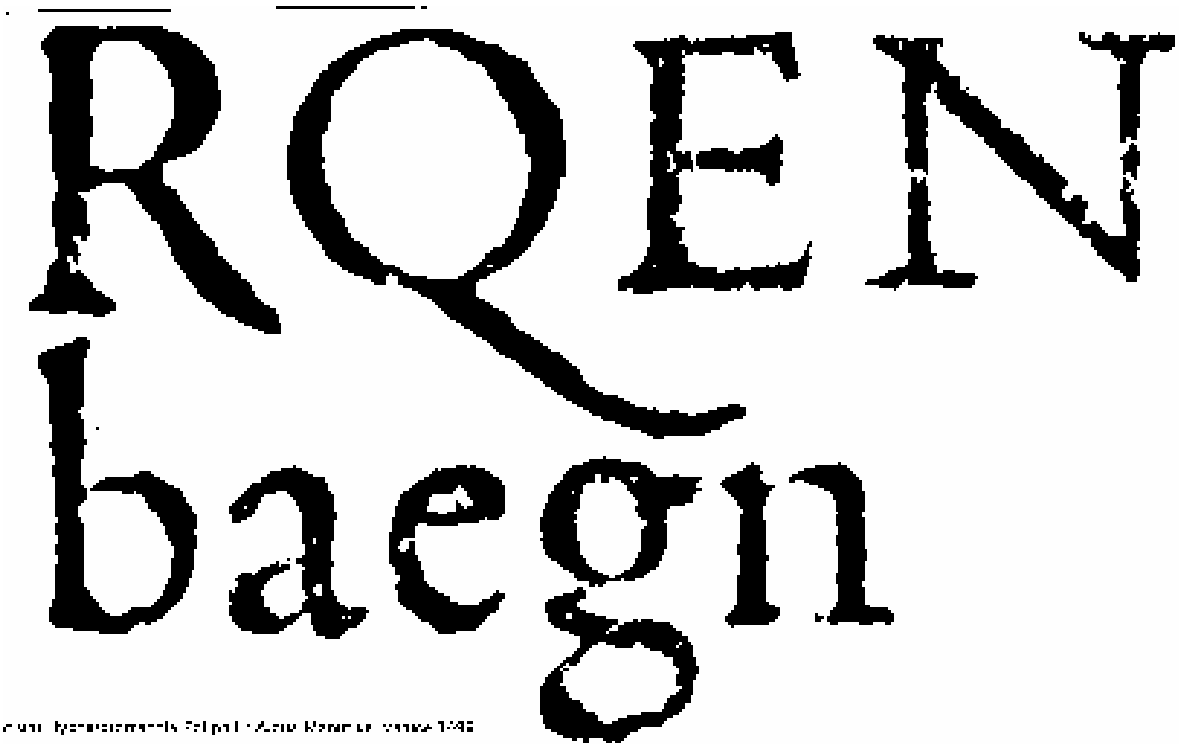
(from Swann, C. 1991, Language and Typography, *Lund Humphries.* London)
This, for example, is an eminent graphic designer's handwriting (Swann, 1991)

However, as we can see from the work by Gluth, (1999) referred to above, the legibility/readability of poorly defined type, such as the above examples, and, as we

have found, on the computer screen, depends even more on contrasts between the letterforms, ‘particularly in the negative spaces inside the letters and generated by the profiles between the letters’

I wear glasses, as do more than 50 percent of the population, almost everyone over the age of 45, particularly for reading, and about 30 percent of younger people. But not in the shower – I personally am continually amazed and frustrated by the tiny, low-contrast type used for instructions for shampoo

Historically also it appears –those of us who could read – were able to read type of low definition.



(from Sutton, J and Bartram, A. 1968, An Atlas of Typeforms, *Lund Humphries.* London, page 32)

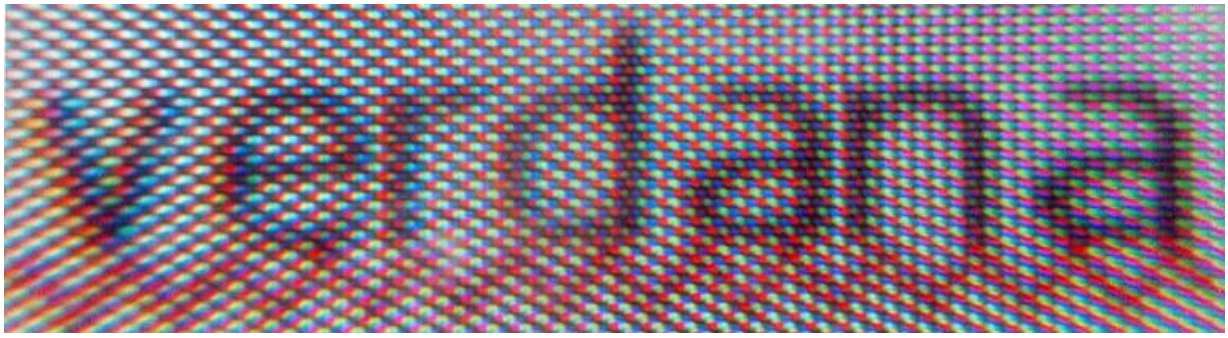
For most of its history type was hand generated, and produced and printed by low technology. Paper also was rough and took the printed letter very unevenly. There are two things we need to be aware of about this.

(from Sutton, J and Bartram, A. 1968, An Atlas of Typeforms, *Lund Humphries.* London)

Secondly, most of the printed material was printed in relatively large type sizes, round about 12 point, to cope with the poor definition. Ironically this is what we find ourselves doing again today so that we can adequately read poorly defined type on the computer screen. But, as we have noted earlier, this is at some cost to ease of reading.

We need to ask then how the relatively crude screen font grid is able to provide this contrast?

It is apparent that typefaces supposedly designed for the screen have not considered in their design either these factors which are needed for good legibility and readability, nor how the screen defines the letterform. Such an example is Verdana.



You can see that the letterspacing in particular, is inconsistent and that there is very little contrast between the different counterspaces because of their size and openness. Another is tiresias Screenfont, a particularly poor example developed by the royal national institute for the blind in England which seems entirely unsuited to the computer screen let alone for partially sighted people because of its lack of contrast between the letterforms and its apparent ignorance of the grid which will define it.

Tiresias Screenfont

(from ‘Tiresias; A family of typefaces designed for legibility on screens, signs and labels [brochure] *RNIB Scientific unit,* London, 2000).

There are many other examples.

But that’s only half the equation. We also need to know how we read; how the eye senses the type; how the brain perceives what is detected; and how the brain then makes sense out of its input.

The following examples might give us some indication.

Some years ago, during his second year, one of my students set a short paragraph in an alphabet that had been put through a distortion filter which made it appear unreadable. However, after being told what the first few words were, we were slowly able to read a few more and by the end of the paragraph, we were able to read it

quite fluently. Some years later the same person, by then a professional designer, gradually degraded the type over the course of a longer piece.

> ‘About 7 years ago I did some legibility research in which I created a booklet featuring text that gradually degraded and became illegible over time. It began with a clean sans serif face, and by the end of the 20 pages it had morphed into an illegible font. When reading through it the eye actually 'learns' the font and by the end of it is actually quite legible. The purpose of the exercise was to explore how “illegibility” is something the eye/brain can “learn”.’
> (Mahdavi 2004).

More recently, other students who were asked to do a little ‘testing’ into the legibility of text discovered that a group of middle aged readers, whom I suspect consisted mostly of their parents and their parents’ friends, stated a preference for reading text set in serif type, but actually read sans serif faster.

More recently still it seems that several hundred people sent me the following email:

“Aoccdrnig to a rscheearch at an Elingsh uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer is at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae we do not raed ervey lteter by it slef but the wrod as a wlohe.
chieero
Rsoe”

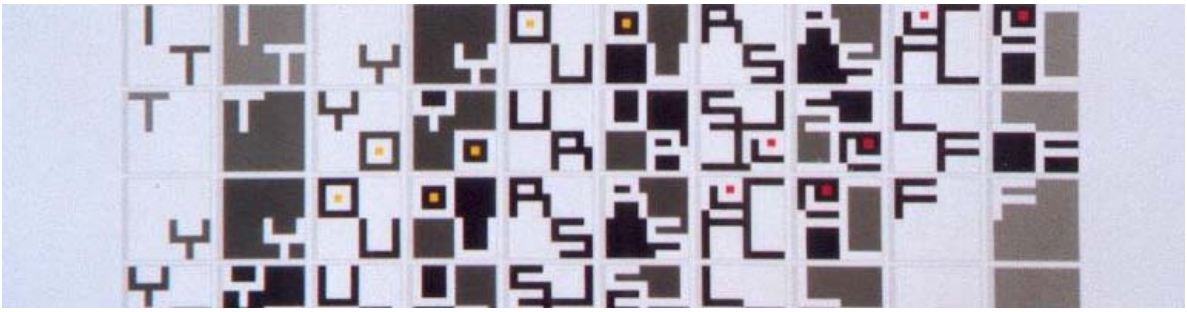
While this ‘research’ is not in any way rigorous, it does indicate strongly that reading, like designing, is a learning process.

Magnetic resonance brain scanning indicates that a bilingual person uses different parts of the brain for each language, which suggests the possibility that we may read different forms of the written word in different ways. (de Kerckhove 1986)

It is interesting to note that a great deal of typography in so-called ‘youth culture’ magazines, advertising and other publicity material such as dance party or club posters, uses letterforms which are at least inspired by pixilated type and at the extreme indicate a familiarity with and an ability to easily read this ‘new type’.

This is a caption from IdN graphic design magazine.

These are examples of graphics which may indicate great familiarity and perhaps comfort with reading type inspired by computer generation, even though they are printed . The Japanese graphic design and music group Delaware have been able to take the computer generated letterform to an art form. This may be because they do not take the letterforms for granted as might a native ‘reader’, and because of their stated aims for achieving graphic simplicity of form and language (Delaware 2004).



If so, it seems to indicate that a generation brought up reading from the screen may already read differently than those of us of the previous generation who learned to read from type printed on paper, who may find more difficulty reading from the screen simply because we do not have as much familiarity with it.

On the other hand it may not!

All it may indicate is that there is a generation out there that does not read at all, or very little, but gets its information from the ‘identity’ of the type. Famously David Carson, as art director of the Californian “Beach Culture’ and ‘Ray Gun’ Magazines set his type in increasingly illegible settings, until ultimately he set an entire article in Zapf Dingbats, an alphabet entirely of symbols, and waited for the complaints – but none were forthcoming! (Carson 2000).

Perhaps this is because ‘this’ generation has been ‘trained’;
by advertising, where the text is almost designed not to be read, but to give its message across by its style or its form,
by television, where almost every word displayed on the screen is repeated by the voice over, and of course, or
by the computer.

Perhaps the computer literate younger generation ‘read’ the screen differently. To watch them proceeding on the internet, for instance, one is immediately aware that they don’t ‘read’ the words so much as the colour codes, shapes and positions of the rollovers and buttons, etc.

These observations raise many more questions than they answer, of course, and really only indicate how little research has been done, and perhaps how much remains to be done, concerning how we design for this pervasive new medium. But what kind of research?

Reading is one of the most complex of human behaviours, which, according to most theories of vision, depends mostly on ‘seeing’ in terms of what we expect to see (Brady 1981, Rayner 1981). Even if we could amass all the relevant research from psychology, perception, physiology, neurology, history, culture, etc., etc., and try to ‘design’ taking them all into consideration, we would probably end up with an Edsel

If we wish to establish criteria for designing typeforms, forms of presentation and formats to improve reading text from the screen, we need to use the design process as a research tool, appropriately for a research area where possibilities may be the most relevant outcome. This is what designers are good at (Swann, 2002) (Dilnot 1998) – taking a whole ‘soup’ of demands, requirements, considerations, analysis, research, human factors, history and culture, and through a mixture of formal and informal methodology, coming up with possibilities which can be verified – or not.

A design analysis will be needed which takes into account a knowledge of the way we read and close study of the peculiarities of the medium as it is, not as it might be.

However, what this investigation does make clear is that typefaces should be designed specially for the screen, not adapted from existing typefaces. The best the screen can do is 'hint' at the typeface because of the way that it uses the grid and the antialiasing. The quality of this 'hinting' can vary enormously from different foundries or vendors (Will-Harris 2001).Such faces would need to be individually designed for each point size, in the way that monotype used to have different designs for different sizes of metal type.

This is not rocket science – it is just a little bit of careful observation and analysis. If we need to design typefaces for a medium with a limited definition and if there are processes that necessarily degrade this type, it is apparent that basic design principles are the most important starting point, and I'm filled with joy at the prospect

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