

Digital typography with Hermann Zapf

Peter Karow

Hermann Zapf was involved in many of the demands for digital typefaces which came into existence from 1972 through 1997. These issues included formats, variations, interpolation, rasterizing, hinting, and grayscaleing.

Within modern text composition, digital text is a special part that should proceed without manual assistance and human layout. Up to now, the milestones were these: kerning, optical scaling, paragraph composition (*Hz*-program), and chapter composition (chapter fit).

Digital typefaces

In 1972, creative typesetting professionals produced variations manually using their photographic experience and a phototypesetting machine to make fonts with contours and shadows. Naturally, shadowing as well as contouring were my next features, which I started on 26 February 1973. This date might be regarded as the birth of “digital typefaces”: new forms were generated automatically (see Figure 1).

My programs crashed quite often and generated substandard looking results. But anyhow, I got it flying further and further. That influenced my decision to call the software **Ikarus** [6] in 1974.

The first time I met Hermann Zapf was in the summer of 1975. I had just completed the basic parts of the Ikarus program which could already generate “digital typefaces” in the form of contoured, slanted and shadowed versions based on hand-digitized outlines.

Zapf was amazed to see what I could present to him (see Figures 1 and 2). He decided to include me with a presentation of Ikarus in his general presentation which he had to give at the next ATypI conference in the fall of 1975 in Warsaw.

It began a close relationship between us. This had a very decisive influence on the future development of our company URW Software & Type GmbH.

These days, everyone regards all fonts on computers as digital fonts since they are stored in digital formats such as **OpenType**. In the early seventies, we had long discussions with famous designers. They argued that pure mapping from analogue to digital is not changing the basic quality of a typeface (old properties), namely its type, appearance, effect, expression and congeniality. Therefore they asserted that the typefaces only had digital images and were therefore still analogue. “Digital” at that time was regarded as a pseudo-property.

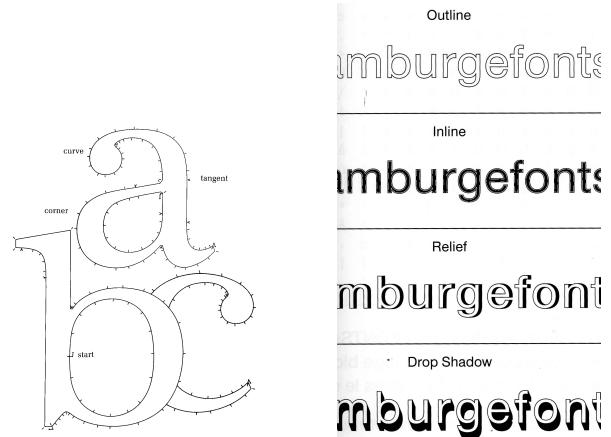


Figure 1: The first version of Ikarus-Format as started in 1972 (left). Contouring used to make Outline and Inline versions, shadowing and contouring used to make Relief and Drop Shadow (right).



Figure 2: Typical desktop in 1972 with digitizer tablet, “mouse”, keyboard (below), direct VDT, alphanumeric terminal, electronic digitizer.

Never did I hear such arguments from Hermann Zapf; he was already very familiar with computers and always very eager and demanding to see the next innovation.

Today, the property “digital” is not only accepted but also embraced. It serves as an additional characteristic which doesn’t interfere with the old properties and holds an extremely high significance regarding a font. It allows and creates new and important functions which did not exist before.

With the invention of the Digiset by Rudolf Hell in 1965, typefaces were digitized for the first time. No additional ideas were put into place other than using them 1:1 for typesetting on the Digiset, scaled linearly and displayed at resolutions between 1,000 and 2,400 dpi. Hermann Zapf was engaged by Hell to consult on typesetting and to design new typefaces.

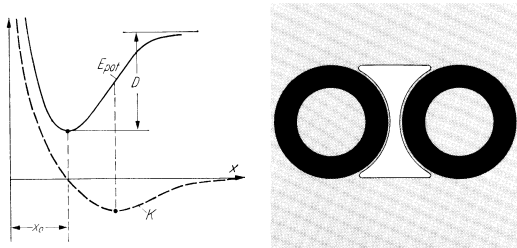


Figure 3: Kerning can be regarded as a power that repulses characters the nearer they come to each other, and that attracts characters the farther they get from each other (left). Kerning can be used also to calculate character positions for overlapping and touching of text.

In 1985 during the yearly ATypI conference (this time sponsored by Hell in Kiel) Hermann Zapf discussed with me the problem that too many people were talking about digital typefaces and unfortunately not knowing what they are really all about. So, I decided to write a book with the title “Digital Formats for Typefaces” which he kindly corrected as a co-editor. Finally, we could present it in 1986 during the next ATypI conference in New York. Later I changed the title: it became “Digital Typefaces” [3].

Digital text

Being pushed by Hermann Zapf, I started automatic **kerning** [4, 7] in 1980 together with Margret Albrecht. We wanted to save money because the generation of kerning tables along with left and right side bearings took a lot of time in our typeface production. As in other cases of artificial intelligence, we had to go through several approaches throughout the years until 1987. Finally, we mixed programmed ideas and heuristic parameters gained by processing a lot of existing kerning tables manufactured by different companies. We expanded kerning to get overlapping and blending of characters in tightly composed words [9] (see Figure 3).

In hot metal printing, **optical scaling** was usual [2]. In any case one had to cut the point sizes individually, so it was a matter of knowledge, but not of money. This changed when phototype-setting came up and the possibility of linear scaling came into existence. Optical scaling didn’t play a role at the beginning of DTP, however, a lot of people

wrote about it [1]. Hermann Zapf urged me to “do something”.

In 1991 at URW, we adopted the following approach for text fonts. First, the smaller the type size:

- 1) the wider the composition,
- 2) the thicker the strokes,
- 3) the broader the characters, especially the lowercase.

And second, the larger the type size in titles:

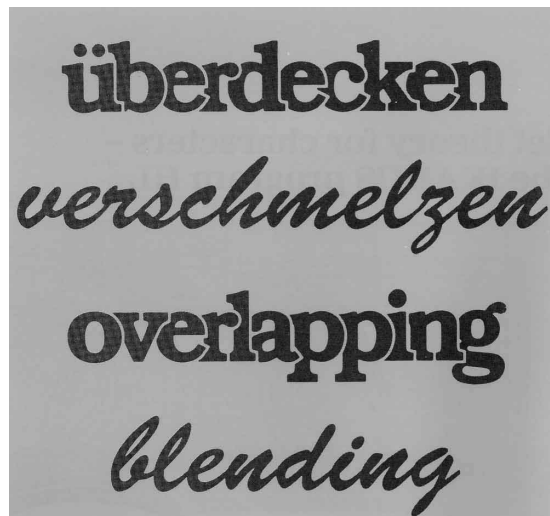
- 1) the more compact the composition,
- 2) the thinner the strokes, especially the hairlines,
- 3) the narrower the characters, especially the lowercase.

Simplified, one applies the rule that space and stroke width of light fonts (text fonts) are reduced or enlarged by 7% on the average if the point size is enlarged or reduced by a factor of 2 [8] (see Figure 4). For bold fonts the opposite is true.

To my knowledge, optical scaling was not employed for bold fonts in the past because they weren’t (and still aren’t) used very often, and if so, they were cut just for these special cases in certain point sizes as a special effort.

Paragraph composition was our next project in 1990 and it became the favorite of both of us.

We called the program *hz-engine*. Developed with and named after Hermann Zapf [5, 12] — it uses a justification per paragraph system — as described by Donald E. Knuth [10, 11], along with “kerning



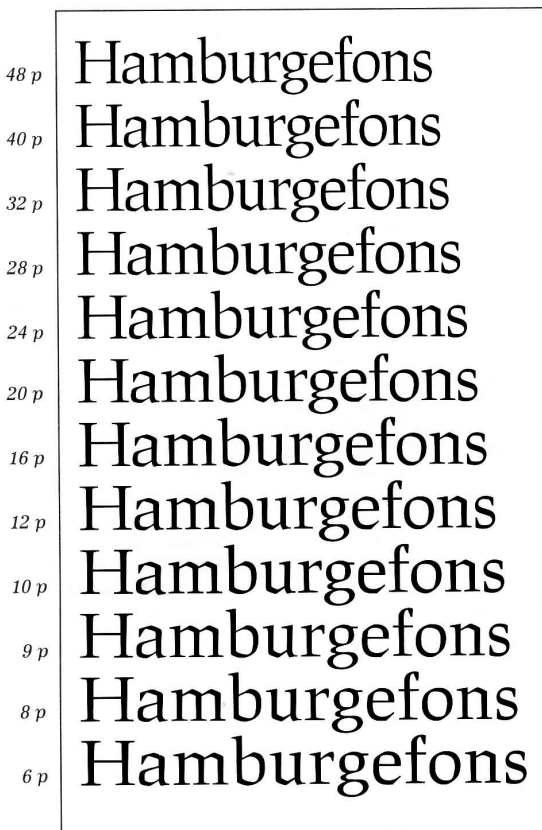


Figure 4: Different point sizes, which have been generated at the same size for the purpose of comparison.

on the fly” and expanding/condensing of characters in order to obtain margin lines for a column that are optically straight (optical margins), and achieve typeset spaces among words within lines of text that are fairly constant in order to avoid rivers and creeks.

Rivers run vertically through poorly spaced words in consecutive lines of text when the spaces between the words have the same space or a greater space than the distance between the baselines of the text. In contrast, a creek is a less severe form where the spaces between words are accidentally too wide within one line.

The basic feature of the *hZ*-engine, which was programmed by Margret Albrecht, is to regard all lines of a given paragraph at once — making the **justification per paragraph**. At first, all words or syllables are distributed to the lines together in a manner where each line gets a line length nearest to its given individually parametrized width (as default there is usually column width). The following optimization is controlled by minimizing the typographi-

cal demerits, which are obtained from a function of the actual line lengths, given line lengths, given line widths and tolerances of the layout parameters.

If hyphenation is turned on, words are replaced by syllables. The *hZ*-engine has to follow a lot of exceptions and to provide solutions for them, e.g. ligature substitution, consecutive hyphens and good or bad locations for hyphenation within a word. This level of text/typographic detail promotes a better fit and contributes to the reader’s comfort (see Figure 5).

A comparison between the *hZ*-engine and today’s typical composition tools demonstrates the superiority of the *hZ*-engine (see Figure 6). In 1995, the “*hZ*-engine” was implemented in **InDesign** by Adobe. This has been a big step in digital text composition.

I believe that not too many people learned that much about the “digital side” of Hermann Zapf as Don Knuth and me. I learned a lot from him and thank him.

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His Secret

*Hyphenation
turned off.*

*To the left
the hz -program:
38 lines,
last lines of
paragraphs ok.*

*To the right
today's software:
40 lines,
short last lines,
larger spaces.*

What makes the Gutenberg Bible the unattainable masterpiece of the art of printing? The printing on his handpress? Can't be really, because of today's standards, the inking was not of extraordinary quality. We could order hand made rag paper also in our day. Maybe the secret of his beautiful pages is in the proportions of the columns on the paper. But this we are also able to copy. Therefore only the composition is to be considered closely.

How could Gutenberg get those even gray areas of columns without disturbing or unsightly holes between words? His secret: the master achieved this perfection by applying several characters of different width combined with many ligatures and abbreviations out of his type case. He finally created 290 characters for the composition of the 42-line Bible. An enormous time consuming job to realize his idea of good typographic lines: the justified lines of even length, compared to the flush-left lines of the works of the famous mediaeval scribes.

But with Johannes Gutenberg's unusual ligatures and abbreviations, today we can't apply this old principle for contemporary composition. Now we can get help through the versatility of modern electronic software and formats like the Multiple Masters to receive a perfect type setting in our production, to achieve Gutenberg's standards of quality: The hz -program, named after Hermann Zapf.

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← *too short*

← *a creek*

← *too short*

Figure 5: Comparison between hz -engine and standard composition, without hyphenation.

Magazine Composition

left two columns:

*hz-program (most left)
compared with
today's software,*

*narrow columns,
hyphenation on.*

right two columns:

*hz-program
compared with
today's software
(most right),*

*narrow columns,
hyphenation off
which is unusual
and used as a test.*

Hermann Zapf 1986:

Writing is the visual reproduction of the spoken word, its primary objective being to convey a text to the reader without difficulties, or distraction, and without disturbing the flow of reading with unnecessary embellishments. The letters have no self-fulfilling purpose, neither are they a medium for self-presentation of a designer. Everything which makes reading difficult or time-consuming, or is detrimental because of its unusual form, has to be avoided. The new technical possibilities of type composition - with all its limitations - also determined the form of the letters. The infinite possibilities provided by today's electronics are used for example to develop types of our time, without historical hangovers. Ideally, the *hz*-program comprises (1) kerning on the fly, (2) optical spacing, (3) expanding and condensing plus optical scaling from Multiple Master fonts and (4) justification per paragraph. It is the non-plus-ultra in typography.

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*hz: 10 hyphens,
3 lines less*
*Today's software:
12 hyphens,
3 more lines,
bad in line 11 and 12*

*Today's software:
spaced out words are
worst typography,
line 14 has a ligature!*

Figure 6: Comparison between *hz*-engine and standard composition, narrow columns, with and without hyphenation.