

October 1983

# An Investigation of the Interdependency of Paper Surface, Printing Process, and Printing Types

by MAX CAFLISCH

This paper is based on a lecture given at a symposium of book publishers sponsored by the Albert Ziegler Paper Company in Grellingen, Switzerland in 1973. The lecture derived from a study in which sixteen typefaces in three sizes were reproduced on nineteen different kinds of paper by the three most commonly used printing processes: letterpress, offset, and gravure. A collection of proofs was produced which allowed one to determine which method of printing reproduces best on a particular paper, the subtle refinements of a particular typeface, and what influence paper tints have on legibility. Copyright ©1974 by Max Caflich; this English translation by Inga Wennik published with permission of the author.

## *The Choice of Type and Paper—Yesterday and Today*

Just as the most "beautiful," or rather, the most suitable piece of paper can be deprived of its effect by the choice of an unsuitable typeface, so can reading turn into torture when a typeface is reproduced on the wrong paper.

When designing a book, the first step, other than deciding on the format of the book, is always to select a readable typeface that also harmonizes with the contents of the book. The early printers had a considerable advantage: they generally had at their disposal just one typeface which was printed on a handpress with heavy ink on moistened paper, a process which certainly differs greatly from printing on our fast modern printing presses. The proof was pulled by hand and a strong impression was created on the backside of the paper. This relief impression is still the characteristic sign of letterpress printing, but it is often so slight that one can hardly discern it; nowadays, letterpress is really just a "light touch." The paper is much smoother and more even; it is no longer moistened, and we print with considerably less ink. Papers with low ink absorption qualities can tolerate a much smaller amount of ink used in high-speed printing.

In contrast to his colleague of yesteryear, the modern printer has a large number of typefaces at his disposal. If, however, one disregards the poor or unsuitable types, one is left with just a dozen or two well-designed, easily readable typefaces, so the present assortment is hardly excessive, especially in view of the fact that many typefaces are designed only for certain manufacturing systems and thus are not readily available to every printer or publisher. Today's printer *does* have at his disposal a rich assortment of papers with different surfaces especially made to accommodate the various printing techniques. If the early printer was familiar with a variety of

more or less rough handmade papers, he could not have imagined today's coated and glossy paper finishes, nor the bright white papers we know today. Yet this very abundance of choices poses the threat that the publisher or printer will use the wrong combination of type, paper, printing process, and ink.

## *Glossy Paper—A Legitimate Need of the Printer*

Rough paper has always been a thankless surface both for writing and printing, and this is especially true for printing letterpress. Thus, it is understandable that calligraphers and printers were forever hoping to write and print on smoother surfaces in order to produce more even and crisp letters, and to reduce the amount of ink required. Originally papers were smoothed manually by means of an agate stone, but by the mid-sixteenth century smoother paper surfaces were achieved in Germany through the process of *schlagstampfen* (strike-stamping). Though still somewhat more porous than today's glossy papers, these surfaces were much better suited for reproduction since they no longer showed gross structural irregularities as did the unfinished papers.

In the eighteenth century several famous printers tried to produce printing paper with smoother surfaces. In Holland, a method was developed by which sheets of paper were pressed between wooden rollers made from logs, the forerunners of modern satinizing calenders. The English typefounder and printer John Baskerville, creator of the charming baroque types named after him, possessed a secret method for smoothing and evening paper. His books distinguish themselves by both the silky sheen of their paper surface and the excellent reproduction quality of his types. The German philosopher and physicist Georg Christoph Lichtenberg visited his house and shop shortly before Baskerville's death. He was shown punches and matrices but was unable to discover the secret behind the smoothing of the papers. Certain experts believe that the paper was pressed between hot plates made of copper. Albert Kapr writes that Baskerville's sheets (whether printed or unprinted he does not mention) were smoothed between polished steel rollers. The Italian master printer Giambattista Bodoni also used smoothed, handmade paper on which the subtleties of his neoclassical types were shown to their best advantage. The end of the eighteenth century brought the introduction of vellum paper, and most important for us, glossy or coated papers came in the nineteenth century, a development that has its culmination in the mirror-finish papers so highly regarded currently. Today's

*Carole Herfort*

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A photographic enlargement (approximately  $4\frac{1}{2} \times$ ) of type printed letterpress on handmade, moistened paper in the sixteenth century (from the *Hypnerotomachia Poliphili*, Paris, Jacques Kerver, 1546), clearly showing how ink-spread distorts a typeface.

text setting in 8· to 12·, especially if the small type sizes are printed on paper with a rough surface. Under these circumstances strong sans serif typefaces, for instance the regular or medium weights of Helvetica, often produce unsatisfactory results, whereas they hold up considerably better if printed on glossy paper with a stronger impression, with increased effectiveness produced by the white color of the paper.

#### *Sharpness as a Standard for Judging Printing Methods*

If one judges the quality of a printing method by the sharpness with which it reproduces type, one finds that letterpress does not work as well as offset printing, since the edges of the typeface appear heavier than they really are due to the ink-squeeze, and the contours of the metal types tend to lose some of their sharpness depending in degree on the structure of the paper surface. In offset printing, however, the sharpness of typographic reproduction is unsurpassed. The ink-spread disappears from the letter's edges and only its surface appears in print; the impression becomes crisper, sometimes even absolutely razor sharp. Technically speaking, offset printing provides a maximum of sharpness and is, therefore, superior to letterpress. Since, however, most of the types used in offset were originally designed for reproduction by letterpress, they appear unnaturally "pointy" and bloodless in offset.

In gravure printing many of the subtleties of a type are lost in the screen; the finer the typeface, the greater and more apparent the loss of resolution, a real disadvantage when using finely cut types in gravure printing. Regular weights of sans serif typefaces will not show as large a loss of resolution as would romans. Typefaces with counters too tightly cut or with too little letter space or width of the body are not desirable for gravure printing as they will tend to produce "fly specks."

#### *Printing Methods and Paper as Criteria for the Design of Type*

Generally speaking, historical type designs do not lend themselves easily to offset or gravure printing unless their image is particularly heavy. As a rule, they appear too fine, too thin.

Each method of printing demands its own designs. It is desirable that typefaces are now being designed especially for offset and gravure (or photogravure) printing processes with stronger hairlines and serifs. In other words, typefaces in which the edge definition of a letter, as it appeared in letter press, is taken into consideration.

These ideas have been scientifically examined in the United States and in England, where they have been incorporated into the typeface development program of the Monotype Corporation. Monotype developed special typefaces designed for the specific requirements of different printing method and paper, for example their Plantin, Erhardt, Emerson, and Times. Times Roman (1931) was an especially promising beginning because it was created for newsprint and newspaper printing. Times Roman is, however, not too well suited for printing on rough antique wove papers, especially the version that contains the stronger capitals. Typefaces designed especially for optimum reproduction quality include, among others, Monophoto Photina, Linotype Rotation (for rotary letterpress) as well as Hermann Zapf's Optima (letterpress and offset), Matthew Carter's Olympian (newspapers), and Adrian Frutiger's Iridium (offset) and Gerard Unger's Demos.

#### *Times New Roman and Italic, Serie 327*

Die Times New Roman ist wohl eine der weitestverbreiteten Antiqua-Schriften. Ursprünglich für *The Times* unter der Aufsicht von Stanley Morison in den Ateliers der Zeitung 1931 geschaffen—die erste Nummer der Zeitung im neuen Kleid erschien am 3. Oktober 1932—, wurde sie bereits 1933 der Fachwelt zur Verfügung gestellt. Nach dem Schnitt der Schrift durch die englische Monotype Corporation folgten Linotype und Intertype mit analogen Schnitten. Damit begann der eigentliche Siegeszug der Times New Roman: die Zeitungsschrift fand bald Eingang im Bereich von Zeitschriften und sogar Büchern. Die kräftige

#### *Bembo Roman and Italic, Serie 270*

Die von Aldus Manutius im Druck *De Aetna* von Pietro Bembo 1495 in Venedig verwendete Antiqua wurde von der englischen Monotype Corporation 1929 nachgeschnitten und der Fachwelt vorgestellt. Die zugehörige *Kursiv* geht auf eine von Giovantonio Tagliente 1524 gezeichnete Type zurück, ausserdem existiert noch die von Alfred Fairbank gezeichnete *Bembo Condensed Italic* 294, von der Stanley Morison sagt, 'it looked happier alone than in association with the Bembo roman'. Obwohl die Bembo als *Buchdrucktype* geschaffen ist, hat sie dank ihrer ausgeglichenen kräftigen Zeichnung auch für die Wiedergabe in Offset gerade noch genügend Substanz. Vorteil-

printer can choose from a large complement of more or less satin-finished natural papers as well as from matte, glossy, or high-gloss paper.

### *Paper Surface and Printing Results*

In due course the demands for improved paper surfaces also affected the design of typefaces. The much-desired glossiness of paper required different conditions for the reproduction, and, therefore, the cut of printing types. The early printing technique, hand letterpress on handmade moistened paper, demanded that the typefounder take the inking conditions (the inking of the form and the spreading of the ink over the edges of the letters) into consideration when cutting punches for type. The type image had to be reduced to allow for the ink that would be squeezed around the letters during the printing process, making inked letters on the printed sheet appear heavier and stronger than the metal type in direct proportion to the amount of ink squeezed out by the impression. If, today, we were to cast letters from existing matrices of the incunabular period, such as the roman of Jenson, and print them on glossy paper, the types would be too fine and too thin, but also too crisp, and their legibility would be correspondingly poor. The early types needed a lot of ink and much pressure, even on moistened papers. It is important to take this into account if one wants to re-cut historical types: the modern versions of Bembo or Garamond are designed to produce a more or less heavy effect when printed on today's glossy paper in order to replicate the impression the original types made when printed on early handmade papers.

An especially beautiful example of this adaption can be found in the Garamond roman. The Linotype as well as the Monotype Garamond roman recuts were based on old specimens of printing. Therefore, the hairlines and serifs of these true-to-the-original cuttings are relatively heavy. In reality, however, the cut of the historical Garamond was much finer as we can see on the first printer's proofs of this face, which Jeanne Veyrin-Forrier found in the Bibliothèque Nationale. Further evidence that early types were cut more finely than they appear in print are the types cut by the excellent typefounder Robert Granjon, who was a younger follower of Claude Garamond. Both the Musée Plantin in Antwerp and the Oxford University Press own punches and matrices of types cut by both typefounders. This makes it possible to compare punches and proofs. (Incidentally, this is the very manner in which typefaces for the IBM Composer were designed. In order to prevent the types from producing too heavy an imprint on the paper after striking the keys, the letters were reduced by a carefully measured percentage.)

### *The Influence of Copperplate Engraving on Type Design*

While the printing techniques of the sixteenth and seventeenth centuries differed but little from those of the incunabular printers, a major change occurred in the techniques for the reproduction of pictures, and consequently, of letterforms, toward the end of the eighteenth century: the development of copperplate engraving. Fine-line titles and texts, engraved by hand in copper, increasingly defined the type styles of that period; sharpness and fineness in letterforms were elevated to an ideal to be imitated by calligraphers and



Type design was influenced by letterforms created by pointed pen and copperplate engraving, as for example, these elaborate engraved letters from the lettering book of Joseph de Casanova, 1630.

the punchcutters. And as they turned away from the natural, form-giving effects of the broad pen, they gradually turned toward the unnatural pressure demanded by the pointed pen which corresponded to the techniques of copperplate engraving. In order to give printing types the delicate appearance that the engraver's burin makes possible in copperplate, the punches had to be cut even finer, impairing the durability of steel punches and cast letters. When printed on very glossy papers, these neoclassical types appear still finer and sharper, and their hairlines are barely visible; their legibility diminishes correspondingly. Therefore, it stands to reason that when using most types designed between 1780 and 1810, for instance Didot or Walbaum Antiqua, it is best to select a rather smooth book paper in order to show them to their best advantage, but under no circumstances can coated paper be recommended.

### *Width or Letterspacing of Types*

Letterspacing is important to legibility because the rhythm of a word image depends on the size of the counters<sup>1</sup> and on the width of the body or the spaces between the individual letters (the side-bearing measurement). Even the smallest width variation can have an irritating effect on the reader. Faulty letter width or letterspacing produces uneven and spotty word images, especially if the type has been set too tightly—a practice far too often embraced today by phototypographers. Tight letterspacing that may be quite acceptable for larger sizes is only rarely, or not at all, suitable for

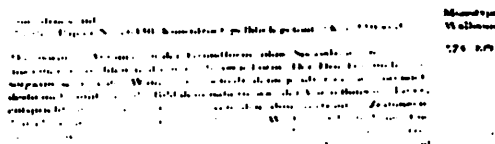
1. The counter is empty space inside the letterform; e.g., the bowl of the *b*.



(left) The sober letters of classical type design: Bodoni Antiqua: (right) Linofilm Iridium, designed for photo typesetting by Adrian Frutiger, based on a classical design but with stronger hairlines, and larger x-height and counters.



In order to obtain the image desired for photo typesetting, the drawing has to be corrected, as shown in the third letter "i." The second "i" shows how the first "i" would reproduce if uncorrected.



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The blinding effect of light on print on coated high-gloss paper

A comparison of two text types originally designed for letterpress printing from metal types and converted for film typesetting and offset printing: (left page) set by Monotype and printed letterpress on uncoated paper; (this page, left) set by Linotron

(digital typesetting). All of these faces are examples of attempts to clarify the technical requirements of the method of reproduction before the new typeface is designed.

Photo-typesetting offers the opportunity to create special types for offset and gravure reproduction. Letterpress printers can get along with fewer faces than general printers who also produce offset and gravure printing. The latter need to offer a number of typefaces to accommodate the specific requirements of various printing methods if they want to do justice to the task. There are hardly any faces that are equally suitable for all three printing methods, and none that can be used on all kinds of paper. However, this statement applies only to text type sizes from 6· to 12·; the larger sizes are far less susceptible to the specific disadvantages of a particular paper surface or printing method. Therefore, this discussion is limited primarily to text typefaces.

#### *Influence of Paper Surface on Typographic Reproduction*

A number of typefaces which were designed for printing on handmade paper (for instance Centaur or Caslon) undergo such a change in appearance when printed on coated paper that even an expert has to look twice in order to recognize them. Such is the extent to which a well-known typeface can be distorted when used on a different (or wrong) kind of paper.

The almost structureless surfaces of glossy, satinized, and coated papers demand typefaces designed to suit their idiosyncrasies. As these coated papers have a much higher blinding effect than do machine-finished natural papers, the eye has difficulty in distinguishing the fine subtleties of a typeface—the hairlines and very fine serifs; these get lost in the glare. The result is reduced legibility and, consequently, eye fatigue. It is absolutely necessary to use a face with a strong design for printing on finished or glossy paper. Some faces that are completely unsuitable for printing on coated papers are Caslon, Didot, and certain delicate versions of Bodoni and Walbaum. Nor does a fine sans serif face, if used in text typesetting, belong on coated paper. The reader has great difficulty in prolonged reading of small sizes of these faces when printed on coated paper. Machine-finished papers tend to produce less fatigue since the dazzling effect is slight or absent.

#### *Influence of Paper Tint on Legibility*

Legibility is also greatly influenced by the tinting of papers. During the last thirty years, unfortunately, it has become fashionable to artificially brighten and bleach bookpapers. This has more effect on legibility than even experts are willing to admit. Moreover these optical brighteners add to the cost of the paper.

Publishers and readers have by now become so spoiled that they judge the quality and value of a paper according to its whiteness, even paper used in publications with no halftone illustrations. White, bright white, and ultra white papers are fashionable. The gentle, slightly yellow tint which is much better suited to the human eye and necessary for optimum legibility is not much in demand, often even taboo. Though our eyes are suffering from the excessive use of bright white papers with their blinding effect, this undesirable trend continues. In textbooks there is the danger of creating two image

levels: one level formed by the printed lines, the other by the very cold, shimmering paper whose glare swallows the fine hairlines and serifs, subtracting substance from letters, and making it difficult to recognize them. The type and paper no longer become one homogeneous unit, as occurs with gently tinted papers; instead the type stands alone and unconnected on the paper. Pure white paper can certainly be recommended for the printing of multi-colored or black and white halftones in order to heighten the brilliance and luminescence of the images. However, bright whiteness is not necessarily a sign of quality or durability in paper.

#### *Structure and Opacity*

Book papers should not be transparent; their surfaces may well be of fine structure or sometimes even have a matte, velvet sheen. It is, however, barbarous for the eye to have to read long texts printed on shiny coated paper. Paper that may be appropriate for a science or art volume, requiring optimum reproduction of pictures with some text, is not advantageous for the printing of a book with substantial amounts of text whose reader demands quite different qualities from the paper.

Normally speaking, offset papers are manufactured with a tighter surface structure than machine-finished book papers, increasing the impression of glossiness and coldness, especially if unsuitable light typefaces have been used and the paper has been bleached. Weight, volume, and opacity of paper have to be taken into consideration when a typeface is chosen. Typefaces which tend to print rather heavily (Times Roman or Plantin) should be avoided on more transparent paper, yet they reproduce perfectly well on coated or glossy paper.

#### *Ink and Inking*

It is important also to take into consideration the appropriate choice of ink. Not every shade of black is right for every kind of paper; it is up to the printer to choose the proper color and, if necessary, experiment with it. There are printers who mix some gray into their book inks. When large type sizes are used, this gray tone may be desirable; however, for smaller sizes the color may turn out to be too weak and the contours of the characters may lose their sharpness. The most experienced book designers insist on pure black ink for text printing. At the same time, they look for perfect printing pressure and even color. Stanley Morison hit the nail on the head when he said: "I think black is a good color." Well-balanced color is of the utmost importance: too much ink will smudge the print, filling in small counters and creating blotches and fattening the finer strokes of the type. The image of the typeface can be so distorted that one can no longer recognize it. On the other hand, if too little ink is used, the print becomes faint, legibility is impaired, and, in some cases, irregularities in the paper structure become visible and cause spotty printing quality. Whether too much or too little ink has been used, legibility is diminished in either case. The inking of machine-finished paper is an art which has to be learned. Truly, it is the beginning and end of perfection in printing.

Continued on page 158.

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ON TYPE, from page 142.

Conclusion

The book as "fine printing" requires not only—as is generally acknowledged—the right typographic layout of lines and paragraphs, but also that components be selected to form a well-balanced entity: an appropriate typeface—legibility has to be a primary consideration; a paper that will give optimum reproduction quality with the printing process selected; the printing process most appropriate to the reproduction of the type; an ink appropriate for the paper selected; and, a paper tint easy on the eye.

A printed work that fulfills these five criteria can surely be considered perfect by the producer/designer as well as the reader. This, in the end, is the theme of this essay: neither type nor paper can be an end in itself. Both serve the whole: the printed work.

BIBLIOGRAPHY

Barthel, Gustav, Rahmer, Albert, and Stähle, Walter: *Gestalt und Ausdruck der Antiqua*. Stuttgart, Staatliche Ingenieurschule für Druck, 1970.

Caßisch, Max: *Fakten zur Schriftgeschichte*. Privately printed, 1972.

Frutiger, Adrian: The evolution of composition technology. In *IBM journal of research and development*, Volume 12, Number 1: The IBM selectric composer. New York 1968.

Jammes, André: *La réforme de la typographie royale sous Louis XIV: Le Grandjean*. Paris, Librairie Paul Jammes, 1961.

Kapr, Albert: *Schriftkunst*. Geschichte, Anatomie und Schönheit der lateinischen Buchstaben. Dresden, Verlag der Kunst, 1971.

Morison, Stanley: *First Principles of Typography*. New York, Macmillan, 1936; 2nd edition, Cambridge, University Press, 1967.

Simon, Oliver: *Introduction to Typography*. London, Faber and Faber, 1945, 1953 (revised); Penguin Books, 1954.

Tschan, André: *William Morris*. Berne, The Monotype Corporation Limited, 1962.

Tschichold, Jan: *Im Dienste des Buches*. St. Gallen, SGM-Bücherei, 1951.

—"Die Leserlichkeit verschiedener Schriftschnitte auf verschiedenen Papieroberflächen in Buchdruck, Offsetdruck und Tiefdruck." Basel, *Kupferschmid-Blätter* 10, 1953.

Vervliet, Hendrik D. L.: "The Garamond Types of Christopher Plantin." In *Journal of the Printing Historical Society*, Number 1. London, 1965.

Vervliet, Hendrik D. L., and Carter, Harry: *Type Specimen Facsimiles II*. London, The Bodley Head, 1972.

Veyrin-Forrer, Jeanne, and Jammes, André: *Les premiers caractères de l'Imprimerie Royale. Etude sur un spécimen inconnu de 1643*. Documents Typographiques Français. II. Paris, André Jammes, 1958.

Warde, Beatrice: *Type should have "Fitness for Paper."* An Experiment and Comment. London, The Monotype Corporation Limited (no date).

