

The Journal of Typographic Research
Volume III, Number 3, July 1969

- 219—240 Mallarmé: The Transcendence of Language and the
Aesthetics of the Book
Gerald L. Bruns
- 241—248 O or 0?
Dirk Wendt
- 249—258 A Proposed Fontstyle for the Graphic Representation
of the Oh and Zero
Allen G. Vartabedian
- 259—276 The Use of Type Damage as Evidence in Bibliograph-
ical Description
G. Thomas Tanselle
- 277—286 A Report Generator Approach to Automated Page
Composition
J. R. Burns
- 287—292 Letterforms in the Arts
- 293—300 Comment: Marshall McLuhan and Italic
Handwriting
Lloyd Reynolds
Comment: Publishing by Computer
R. J. Wakefield
- 301—305 Exhibition Review
- 306—308 Book Review
- 309—311 Abstracts of Journal Articles in French and German
- 312 The Authors

The Journal of Typographic Research, Volume III, Number 3, July 1969.
Published quarterly (January, April, July, and October) by the *Journal*, c/o The
Cleveland Museum of Art, Cleveland, Ohio, USA 44106. Copyright © 1969 by
The Journal of Typographic Research. Second-class postage paid at Cleveland, Ohio,
and at additional mailing offices.

EXCEPTÉ
à l'altitude
PEUT-ÊTRE
aussi loin qu'un endroit

fusionne avec au delà
hors l'intérêt
quant à lui signalé
en général
selon telle obliquité par telle déclivité
de feux

vers
se doit être
le Sépentrion aussi Nord

UNE CONSTELLATION

froide d'oubli et de dévétude
pas tant
qu'elle n'énumère
sur quelque surface vacante et supérieure
le heurt successif
idéalement
d'un compte total en formation

veillant
doutant
roulant
brillant et méditant
avant de s'arrêter
à quelque point dernier qui le sacre
Toute Pensée émet un Coup de Dés.

O or 0?

Dirk Wendt

There is a need for a universal and aesthetic solution to the current problem of distinguishing between the capital letter oh and the numeral zero on electronic data processing equipment. Practices leading to the present lack of understanding and differentiation are discussed and illustrated. A new proposal for distinguishing between the oh and the zero is advanced.

The printing and typing output devices of many data processing machines do not distinguish between the capital letter oh and the numeral zero. Internally, however, in the electronic cores of these machines the symbols are coded and handled quite differently. This is completely all right as long as there is no doubt about their identity. The problem arises as soon as you are debugging a program, and you cannot see from the computer output whether there is a letter oh or a numeral zero in a certain position. Mixing up these two symbols can be quite fatal to the computer program. Unfortunately, such errors happen frequently, especially when less skilled typists are typing the program—and in most cases the programmers are not very experienced typists since typing is not part of their education. I remember a programmer team which was working on the terminal of a time sharing computer and became quite desperate about the indiscriminability of oh and zero. Finally one of the team took a file and scratched the face of the oh so that it could be recognized on all further outputs (see Fig. 1 for an illustration).

This procedure solved the problem in that individual case—but there should be a general and more aesthetic solution. Some Teletypes have an additional stroke diagonally through the numeral zero: Ø (see Table I, 4th pair). This, again, solves the problem technically, but there are some objections to this solution. Frequently computer outputs are used directly (i.e., photographically reproduced) in

LOG

TIME USED

CPU: 00.01 MIN

CON: 00.06 HRS

Figure 1. Teletype output with originally identical oh and zero; the operators scratched the oh (see in "LOG" and "CON") to make a distinction possible.

TABLE 1: Numbers and Percentages of Subjects Considering the Symbol in the Top Line as Letter O.

Pair No.	1		2		3		4		5	
	O	0	0	0	O	o	O	Ø	O	⊙
16 staff members of the computing center	15 94%	1 6%	5 31%	11 69%	14 87%	2 13%	3 19%	13 81%	8 50%	8 50%
22 other computer users	21 96%	1 4%	11 50%	11 50%	15 68%	7 32%	17 77%	5 23%	15 68%	7 32%
68 students in a programming course	57 84%	11 16%	46 63%	22 37%	38 56%	30 44%	54 79%	14 21%	52 76%	16 24%
106 subjects (total)	93 88%	13 12%	62 59%	44 41%	67 63%	39 37%	74 70%	32 30%	75 71%	31 29%

tables, etc., for publications. And a table with zeros like this, Ø, would look rather strange in an article otherwise composed of normal typefaces (including numerals). Another objection to Ø as zero is that it equals a Danish letter, and the symbol technicians frequently use for "diameter," and the symbol mathematicians use for the empty set. To complete the confusion about this symbol, some earlier IBM manuals¹ used Ø for the letter oh, more recent ones use it for zero. SHARE, the IBM users organization, and IBM official practice now use Ø for zero, and O for oh uniformly.^{2, 3} Vartabedian,⁴ in an experimental investigation, found the virgule through the O to be an unsatisfactory means of differentiation between the two characters.

There are more solutions to the problem offered by the industry. The computer output "Anelex"⁵ uses very small circles for zero, and a regular O for the letter oh. But the little zero circle was so small that it was almost indistinguishable from the decimal point, and tables printed with this zero looked very strange and could not be used for direct photographic reproduction in publications. Therefore, a staff working on a computer equipped with this output device decided to change the wiring such that they avoided the small zero circle completely, and both the oh and the zero were printed by the same symbol O. (In any case, even scratching it would not be of any help!)

A German banking institute⁶ prints its customers' statements by a device which produces a zero with a small concentric circle within the regular O, as shown in pair 5 of Table I. This, however, will look more like oh rather than zero to those readers who are in the habit of writing their handwritten ohs with center dots to make them distinct from their zeros. Other people make small horizontal dashes through their zeros, like this: . Neither of these principles seems adoptable for computer outputs because they deviate too far from usual typography (like Ø). Additional trouble would rise if people center-dotting their ohs tried to communicate with people dashing their zeros; the problem would shift from guessing whether a circle stands for oh or zero to discriminating whether there is a dash or a dot in the circle.

In the standard alphabets for writing instructions in the schools of some countries the oh has a small hook in its top which is not the case with the zero.⁷

Vartabedian⁸ recommends adoption of this principle for computer outputs, too. Tait, in Bemer's article,⁹ proposed a similar solution for the matrix-type keypunch font.

German writing standards, as issued by the Arbeitsgemeinschaft Schreiberziehung,¹⁰ and obligatory for writing instructions in all public schools in West Germany, do not provide a distinction between zero and oh by means of the loop; both characters have small hooks in their tops. But all numerals are somewhat smaller (in height) than the capital letters, about halfway between the height of the capitals and the x-height. This tiny difference barely shows up in fluent writing, but its principle could be used for computer outputs, too: make the numerals somewhat lower, and/or the letters somewhat higher, just to give them a small but notable difference in height. This would not only conform to regular printing practice¹¹ but also make it easier to find a bug in a program or in a set of data. The somewhat larger (mistyped) letter oh would easily show up in a sequence of numerals, and so would the somewhat smaller mistyped zero in a string of letters (Fig. 2).

In many fonts of printing typefaces, and in lettering stencils, the zero is designed slightly narrower than the oh. This principle seems highly compatible with the previously mentioned distinction by designing numerals somewhat lower than capitals. It actually has been adopted by some IBM printouts which have a squared O for the letter oh, and an ellipse for zero¹² (Fig. 3).

Unfortunately, the recently designed typeface OCR-A uses a squared zero, and an ellipsoid diamond shaped character as letter oh.¹³ These are but just individual practices applied by some typeface designers. To my best knowledge, there do not exist any official guidelines on how to make the distinction.

For printing standards, the Fachnormenausschuß Graphisches Gewerbe (NAGRA), a subdivision of the German board for industrial standards (DIN), has issued a set of requirements which should be met in composing mathematical formulae.¹⁴ They recommend choosing typefaces which make sure that the lower-case l, the numeral 1, and the capitals I and J are easily and correctly understood, and that Greek and Roman letters, and capital and lower-case letters cannot get mixed up, especially as subscripts, but very little is said on how to distinguish between oh and zero. They only require that

26.13,28.40,27.04

10 FoRMAT(F9.3,F6.2,14)

Figure 2. A string of numerals with an erroneously typed oh in it which easily shows up by its size (in 28.40), and a string of letters where a mistyped zero (instead of an oh in "FORMAT") is easily found out. Proportion of sizes of letters : numerals is 7 : 6.

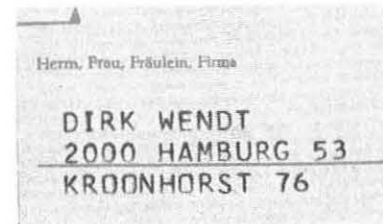


Figure 3. Output with oval zeros and squared ohs as in use on some IBM printing devices, and on the telephone statements by the Deutsche Bundespost (our example).

small grades as used for subscripts should print so clearly that lowercase o, capital O, zero, and ° (degree) can be distinguished—but without saying how the distinction should be made. In short, they merely give suggestions for the choice of a font but not for its design. For the manuscript, however, they recommend drawing zero narrower than oh.¹⁵ This is consistent with the use in many type fonts, and with standard lettering stencils. (The first pair of symbols in Table I is drawn by such a stencil; see also the heading of this article.)

Obviously, there is some practical need to distinguish clearly between the oh and zero—not only for computer programmers. The problem arises with license plates and telephone numbers, too, which start with three letters in some cities, and with two letters in others. Something should be done to introduce a generally accepted, and internationally understood distinction between these two symbols. If introduced officially, such a distinction should be the same in all nations, and it should be such that it can be understood by all readers, with as little unlearning as possible, to avoid unnecessary controversy and misunderstanding.

A couple of possible ways to make this distinction as suggested by different makers of computer output equipment have been mentioned. A very simple experiment was performed to test how these suggestions meet the above requirement of being unambiguously understood by readers. Staff members of the computing center at the University of Hamburg, students in a programming course, and other scientists frequently using the computing center of the University of Hamburg answered a questionnaire in which the problem was outlined, and five different possibilities of distinctions between oh and zero were displayed, as shown in Table I. The subjects' task was to indicate in each pair which of the two symbols they would, intuitively, understand as zero, and which as oh, without having further information than that in each pair one symbol had to be oh and the other, zero.

Table I shows the results of this investigation. In the total group, the distinction by adding a small hook to one of the symbols is most ambiguous, whereas making the zero somewhat narrower (as usual in many printing fonts) is most clearly understood. The symbol Ø is understood as oh by most of the computing center staff members, but as zero by most of the other subjects. This is clear since they are the

readers of a Fortran manual which uses Ø for oh. The same holds for the second pair of symbols where the staff members give different results from the other groups, too; this is due to the fact that there was in the computing center a typewriter which had a hook in the top of the zero rather than in the oh as in the American handwriting standard.

Since these results were obtained only with subjects around one computing center, they cannot be considered representative for mankind, and everybody who has such an opportunity should be encouraged to repeat the study in his own environment. At any rate, it seems as if the distinction by making the zero somewhat narrower than the oh, as actually made in many typefaces, is most clearly understood by the readers. An even better suggestion would be to make all numerals somewhat smaller, and/or all letters somewhat larger since this would make a typing mixup between the two characters still more obvious. However, this means of distinction was not tested in our experiment since we displayed only single characters. This could be changed in a further experiment which might display various strings of numerals and letters where it would be the task of the subject to find out which O is the oh and which is the zero.

At any rate, the designers of typefaces, especially for computer output devices, should be encouraged to emphasize these means of distinction rather than inventing new ones which will raise more confusion. Some (maybe rather desperate) computer programmers meanwhile solved the problem quite another way: they started writing compilers and programs which do not need a distinction between zero and oh.¹⁶

1. Daniel McCracken, *A Guide to FORTRAN Programming* (New York: Wiley, 1961).
2. Bemser, R. W., "Towards Standards for Handwritten Zero and Oh," *Communications of the ACM*, X (August 1967), 513–518.
3. Dr. William B. Kehl, Campus Computing Network, UCLA, Los Angeles; Private communication.
4. Vartabedian, A. G. "A Proposed Fontstyle for the Graphic Representation of the Oh and Zero," *Journal of Typographic Research*, III (July, 1969), 249–258.

5. Telefunken-Schnelldrucker with printing part made by the Anelex Corporation, in use in the Computing Center at the University of Hamburg.
6. Dr. Feldmann, Rechenzentrum der Universität Hamburg; private communication.
7. M. Reed and E. Osswald, *My First Golden Dictionary* (New York: Golden Press, 1963).
8. Vartabedian, *op. cit.*
9. Bemmer, *op. cit.*
10. Mr. Lämmel, Arbeitsgemeinschaft Schreiberziehung, Hannover; private communication.
11. Kehl, *op. cit.*
12. Bemmer and Kehl, *op. cit.*
13. Herbert Spencer, *The Visible Word* (London: Royal College of Art, 1969).
14. Normblatt 1338 DIN, Buchstaben, Ziffern und Zeichen im Formelsatz (Berlin: Beuth-Vertrieb, 1968).
15. *Ibid.*
16. Bemmer, *op. cit.*

A Proposed Fontstyle for the Graphic Representation of the Oh and Zero

Allen G. Vartabedian

A new fontstyle is proposed for the machine rendering of the graphic representation of the letter oh and the number zero. It prescribes placing a loop on the oh and drawing the zero as an oval. The new convention is intended for use in communication environments where the discriminability of graphic symbols is critical. These environments include use of devices such as teleprinters, computer line printers, keypunch machines, and cathode ray tube displays. The proposed new fontstyle does not draw upon previous conventions for distinguishing between these symbols and consequently avoids a current conflict in slashing either the oh or zero. A design criterion is also presented for distinguishing between the numbers and letters of a given font.

I. Introduction

In recent years the question of whether to slash the oh (alpha O) or the zero (numeric 0) in the machine rendering of the graphical representation of these symbols has been bandied about without resolution.¹ Proposed standards have oscillated between slashing the oh and slashing the zero with little agreement between the proponents of either of the two camps.

Historically the data communication community has adopted the convention of slashing the zero.² They reasoned that in teletypewriter environments the frequency of occurrence of zero is less than oh, and consequently the embellished character would appear least often with this convention. Moreover, numerics generally occur in a strictly defined format, and therefore an operator would be cued to expect the novel character and would not find it annoying.

More recently, the computer community has generally adopted the convention of slashing the oh based on the frequency of occurrence argument.³ As long as these two communities remained independent of each other there was little problem with the existence of these two conflicting conventions. However, when