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The Journal of Typographic Research
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Index
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Psycholinguistic Universals in the Reading Process

Kenneth S. Goodman

Literate speakers in any language have two alternative surface language forms which are realizations of the same deep structure and which represent alternate encodings of the same meaning. For the proficient reader, written language becomes parallel to speech and not a secondary representation of it. Listening and reading are processes in which the language user may sample, select, and predict from the available signal. Readers are users of language who process graphic, syntactic, and semantic information simultaneously. Readers develop strategies for the efficient sampling of the graphic signal in relation to the syntax of their language and the concepts and experiences with which the passage is concerned. The essential characteristics of the reading process are universal.

Reading is a psycholinguistic process by which the reader (a language user) reconstructs, as best he can, a message which has been encoded by a writer as a graphic display.

Through research on children reading English who are native speakers of some dialect of American English, I have evolved a basic theoretical view of the reading process. It should be understood that some of what follows is an extension of and projection of a theoretical view into dimensions that go beyond the research on which it is based. In this sense, what follows is hypothetical; other scholars are invited to test and challenge the hypotheses in terms of languages and orthographies other than English.

Generative and Receptive Aspects of Language
It is ironic that although most researchers agree that receptive control of aspects of language precedes generative control, more attention has been given to the process of language production than to the process by which language is understood.

Many linguists have assumed that listening and reading are simply the mirror images of speaking and writing. They have

assumed that since generative processes begin with meaning and result in a fully-formed phonological or graphic display that receptive processes begin with the encoded display and reverse the process, step by step, to get back to meaning.

In this too simple view, not enough consideration has been given to the variant nature of the productive and receptive tasks that are involved in language use. *In producing language*, the language user has thoughts which he wishes to express. In a transformational view, he creates a deep language structure which represents his meaning, applies a set of compulsory and optional transformational rules, and generates a surface structure. If the language user is literate, this surface structure may utilize a phonological signal and require the application of a set of phonological rules, or it may utilize a graphic signal and require use of a set of orthographic rules. The choice will be dictated, of course, by the language user's purpose.

The *receptive* process does start with the phonological or graphic display as input, and it does end with meaning as output, but the efficient language user takes the most direct route and touches the fewest bases necessary to get to his goal. He accomplishes this by *sampling*, relying on the redundancy of language, and his knowledge of linguistic constraints. He *predicts* structures, *tests* them against the semantic context which he builds up from the situation and the on-going discourse, and then *confirms* or disconfirms as he processes further language.

Receptive language processes are cycles of *sampling*, *predicting*, *testing*, and *confirming*. The language user relies on strategies which yield the most reliable prediction with the minimum use of the information available.

Neither listening nor reading are precise processes and, in fact, even what the language user perceives is only partly what he sees or hears and partly what he expects to see or hear. This is necessarily so not only because of the prediction in which the language user engages but also because he has learned to organize his perceptions according to what is and is not significant in the language. The language user must not simply know what to pay attention to but what not to pay attention to.

The producer of language will be most successful if the signal

he produces is complete and well-formed. With such a signal, the receiver of language is free to utilize his sampling strategies.

The necessary concern for oral language which had been neglected for so long caused many scholars to dismiss written language—without adequate consideration—as a secondary representation of oral language. But written language in a literate culture is not simply a way of preserving and recording oral language. It designates streets, places, and directions; it labels and classifies. It makes communication possible over time and space.

A key difference between oral and written language is that speech is most commonly encountered within the situations in which it is most relevant. Speakers may rely on the situational context to make referents explicit. Listeners may infer from the situational context and from the movements, actions, and gestures of speakers a great deal of semantic information to augment and constrain what they derive from the language.

Written language tends to be out of situational context. The writer must make referents and antecedents explicit, he must create contexts through the language to replace those which are not present. He must furthermore address himself to an unseen and frequently unknown audience. He gets no immediate linguistic or visual feedback to cue him as to whether his communicative efforts are successful.

Written language is perfectable in that the writer may edit it to be sure he has said exactly what he wished to say. It isn't perishable in the sense that oral language is.

These differences should not obscure the basic similarities between the alternate language forms for literate language users, but they should make clear that reading and listening will employ variant psycholinguistic strategies to cope with the variant characteristics of the two forms. Reading employs a strategy of regression to reread, for example, whereas listening cannot employ a comparable strategy. The listener must ask the speaker to repeat and that is not always feasible.

One misconception which has caused considerable confusion in dealing with the reading process is the notion that meaning may be derived only from oral language. It is assumed by some that readers engage in a process of recoding graphic input as aural

input and then decoding. While this may, in fact, take place in beginning stages of the acquisition of literacy among some learners, it is not necessary or characteristic of proficient reading. An analogy can be found in the early stages of learning a second language. The learner may be going through a process of continuous translation into his first language before he decodes. But eventually he must be able to derive meaning directly from the second language with no recourse to the first. Just so, the proficient reader becomes as skillful at deriving meaning from written language as he is from the aural form with no need to translate one to the other.

It must be remembered that oral language is no less an arbitrary code than written language. Neither has any direct relationship to meaning and the real world other than that which its users assign it.

Alphabetic writing systems have a number of virtues among which is that there is a built-in correspondence to the units and sequences of the oral language form. But this is not an unmitigated blessing. A writing system which is directly related to ideas and concepts has the virtue that it can be used for communication by speakers of different languages. The system of mathematical notation has that advantage. $6 + 9 = 15$ is a mathematical statement that will be immediately understood by speakers of a wide range of languages, whereas *six and nine equal fifteen* can only be understood if the reader knows English.

The Chinese writing system may indeed have its faults but it has the virtue of being understood by speakers of oral languages which are not mutually comprehensible. And, of course, the Chinese writing system—once it is mastered—does function quite well for its users. Alphabetic writing systems are not in fact necessary for literacy.

The Reading Process

The readers of English I have studied utilize three cue systems simultaneously. The starting point is graphic in reading and we may call one cue system *graphophonic*. The reader responds to graphic sequences and may utilize the correspondences between the graphic and phonological systems of his English dialect. I should point out that these are not phoneme-grapheme correspondences but in fact operate on morphophonemic levels (that is spelling patterns relate to sound sequences).

In English as in other languages the spelling system is fixed and standardized. This means that correspondences will vary from dialect to dialect and that over time changing phonology will loosen the fit of even the tightest alphabetic system.

The second cue system the reader uses is *syntactic*. The reader using pattern markers such as function words and inflectional suffixes as cues recognizes and predicts structures. Since the underlying or deep structure of written and oral language are the same, the reader seeks to infer the deep structure as he reads so that he may arrive at meaning.

The third cue system is *semantic*. In order to derive meaning from language, the language user must be able to provide semantic input. This is not simply a question of meaning for words but the much larger question of the reader having sufficient experience and conceptual background to feed into the reading process so that he can make sense out of what he's reading. All readers are illiterate in some senses, since no one can read everything written in his native language.

These cue systems are used simultaneously and interdependently. What constitutes useful graphic information depends on how much syntactic and semantic information is available. Within high contextual constraints an initial consonant may be all that is needed to identify an element and make possible the prediction of an ensuing sequence or the confirmation of prior predictions.

Proficient readers make generally successful predictions, but they are also able to recover when they produce miscues which change the meaning *in unacceptable ways*.

No readers read material they have not read before without errors. It must be understood that in the reading process accurate use of all cues available would not only be slow and inefficient but would actually lead the reader away from his primary goal which is comprehension. In fact in my research I have encountered many youngsters who are so busy matching letters to sounds and naming word shapes that they have no sense of the meaning of what they are reading. Reading requires not so much skills as strategies that make it possible to select the most productive cues.

These strategies will vary with the nature of the reading tasks. For example, literature has different characteristics than discursive

language. The writer will use unusual terms and phrases rather than the more trite but also more predictable ones which would be used to express the same meaning in everyday conversation. The reader needs strategies that adjust to the very different constraints in literary materials.

Because reading involves visual input, characteristics of the visual system do affect the reading process. The material must be scanned from left to right, as English is printed, and the eye must focus at specific points since it cannot provide input while it is in motion. At each fixation a very small circle of print is in clear, sharp focus. Some have argued that only print in sharp focus can be used in reading. But there is a large area of print in the peripheral field at each point of fixation which is not seen clearly but is sufficiently seen to be usable in the sampling, predicting, confirming aspects of reading. The reader can, in fact, work with partial, blurred, even mutilated, graphic input to a considerable degree.

That, too briefly, is what my research has told me about the process of reading English among native American speakers. I have no reason to believe that this process would vary except in minor degrees in the reading of any language. Whether the graphic sequence is from left to right, right to left, or top to bottom would be of little consequence to the basic reading process. The reader needs to scan appropriately but he will still sample and predict in much the same way.

With alphabetical orthographies the regularity of correspondence rules for letter-sound relationships is not nearly as important as many people have believed. Readers are able to use syntactic and semantic cues to such a considerable extent that they need only minimal graphic cues in many cases. They can tolerate a great deal of irregularity, ambiguity, and variability in orthographies without the reading process suffering. There is, in fact, a wide range in which an alphabetic orthography may exist and still be viable. Only minor adjustments in the reading process are required to deal with any unusual correspondence features.

An example in reading English is the variability of vowel representation. This is particularly confused since the unstressed vowel schwa, may be spelled by any vowel letter. Readers learn to rely more heavily on consonants, particularly initial ones for their

minimum cues and to use vowel letters only when other information is inadequate.

I confess to know nothing about problems of reading non-alphabetic writing systems, but I strongly believe that readers of languages which employ them will still be sampling using minimal graphic cues to predict grammatical structures.

Grammatical patterns and rules operate differently in each language, but readers will need to use their grammatical competence in much the same way. Some special reading strategies may result from particular characteristics of the grammatical system. Inflections are relatively unimportant in English grammar but positions in patterns are quite important. In a highly inflected language the reader would find it profitable to make strong use of inflectional cues. In English such cues are not terribly useful.

Semantic aspects of the reading process cannot vary to any extent from one language to another, since the key question is how much background the reader brings to the specific reading.

To sum up, it would seem that the reading process will be much the same for all languages with minor variations to accommodate the specific characteristics of the orthography used and the grammatical structure of the language.

Learning to Read One's Native Language

In the personal history of each individual in a literate society he learns first to control the spoken language and several years later to control the written language. He masters speech with no organized instruction. Normally he learns to read and write in school. It's puzzling that far less success is achieved in learning to read than in learning to speak.

Obviously there is not time to explore this vexing problem. But several key points need to be made:

1. Children who learn oral language should be able to learn to read.
2. Children who know oral language should be able to use this knowledge in learning to comprehend written language.
3. Reading instruction should center on comprehension strategies.
4. The reading process cannot be fractionated into sub-skills to be taught or sub-divided into code-breaking and comprehension without qualitatively changing it.

5. Reading instruction should use natural meaningful language within the conceptual grasp of the learners. (This implies of course that the content should always be relevant as well.)
6. Where it is at all feasible the child should achieve initial literacy within his own language (in fact within his own home dialect)!

Reading a Second Language

From my study of the reading process here are some implications I see for learning to read a second language:

(a) Learning to read a second language should be easier for someone already literate in another language, regardless of how similar or dissimilar it is.

(b) Reading will be difficult as long as the student does not have some degree of control over the grammatical system.

(c) Strong semantic input will help the acquisition of the reading competence where syntactic control is weak. This suggests that the subject of reading materials should be of high interest and relate to the background of the learners.

(d) Reading materials in early language instruction should probably avoid special language uses such as literature and focus on mundane, situationally related language such as signs, directions, descriptions, transcribed conversations, etc. This would depend, of course, on the background of the learner. Scientists should do very well with materials dealing with their own interests.

(e) It will always be easier for a student to learn to read a language he already speaks. For young learners this clearly suggests a sequence of early focus on oral language and later introduction of reading, even in situations where the second language will be the medium of later education. But the motivation and needs of older highly literate students may suggest that oral and written language receive equal attention even at early stages.

(f) As in learning to read a first language, reading instruction should always involve natural, meaningful language and instruction should avoid the trivial and keep the focus on comprehension strategies.

This article is based on a speech by Dr. Kenneth S. Goodman at the Second International Congress of Applied Linguistics, Cambridge, England, September 1969.

The Genesis of the Russian *Grazhdanskii Shrift* or Civil Type—Part II

Ivan L. Kaldor

Part II of the Kaldor paper is based on the assumption that the first Russian modern type (i.e., Peter I's *grazhdanskii shrift*) was patterned after three basic models: (a) the late seventeenth- and early eighteenth-century Russian civil hands, (b) the outmoded *poluustav* type, and (c) the contemporaneous Western roman types. The impact of Western roman types appears to be the most significant. In his search for a particular work that might have served as a source, the author proposes the hypothesis that the roman type used in Matthias Dögen's *Architectura militaris moderna* and, to some extent, in Peter's favorite *Symbola et emblemata* were the models applied by the designer. A type-by-type analysis of the original three versions of *grazhdanskii shrift* is used to support the basic theory.

Part I of this paper (cf., *The Journal of Typographic Research*, III [October 1969], 315–344) offered a brief, documented history of the creation of *grazhdanskii shrift*, the first modern typeface used in Russia. It also surveyed the transitional types applied by Western typographers in Peter I's service and contemporaneous engraved texts with characters of potential prefigurations—all in search for a possible model used by Kühlenbach, a military engineer and designer of the new type. It was established that the final lines of *grazhdanskii shrift* had been determined by the Tsar himself. The Amsterdam and Moscow printers were given copies of the design and had but little freedom to interpret it creatively. The resulting types indicate that both groups strictly adhered to the pattern set by the designer (Figs. 1–3). Thus, it seems appropriate, that the continuing quest for the model should focus on the basic intellectual tools of the Tsar and his military engineer-designer; i.e., on the Russian hands of the era and on foreign, mainly Dutch, technical and military publications.

The ensuing type-by-type analysis of Figures 1–3 will show that the influence of both the late seventeenth- and early eighteenth-

Figure 1 [a–b]. Comparative display of the large-size characters of *grazhdanskii shrift*: I—Capitals cut in Amsterdam (1707): II—Original lower-case (1707) and additional or modified Amsterdam types (1708–1709); III—Lower-case characters cut in Moscow by Mikhail Efremov (1707).

Figure 2. Comparative display of the medium-size characters of *grazhdanskii shrift*: I—Types cut in Amsterdam (1707–1709); II—Types cut in Moscow by Mikhail Efremov (1707); III—Types cut in Moscow by Aleksandrov and Petrov (1708). Capitals (above) and lower-case.

Figure 3. Comparative display of the small-size characters of *grazhdanskii shrift*: I—Types cut in Amsterdam; II—Types cut in Moscow. Capitals (left) and lower-case.

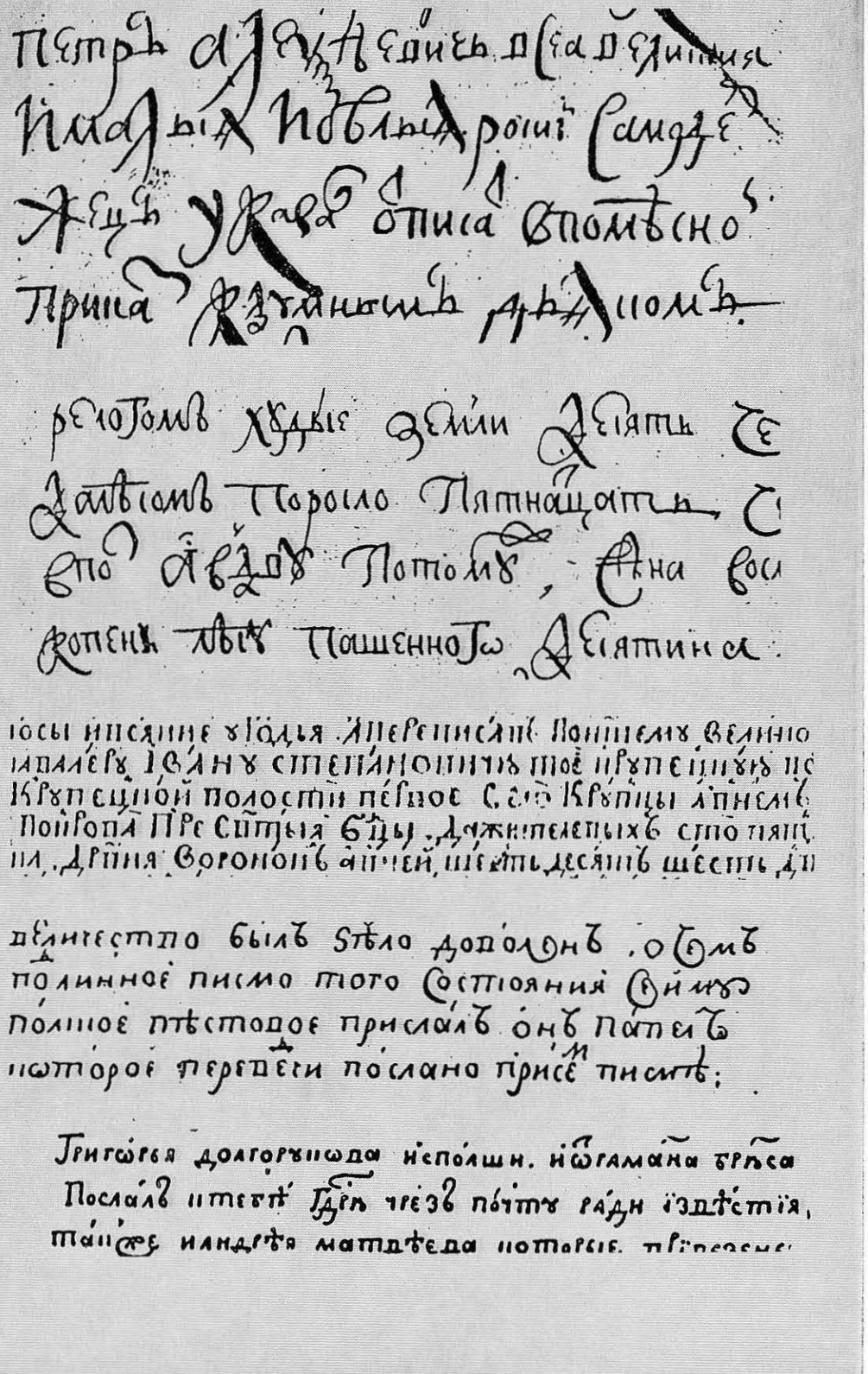
century Russian hands and the contemporaneous roman types is clearly detectable. There is, however, a significant difference in the *degree* to which the impact of each of these models has found its expression in the final design of *grazhdanskii shrift*.

Late Seventeenth- and Early Eighteenth-century Russian Hands

As a possible result of the intensification of diplomatic and commercial intercourse between Russia and certain European countries, the late seventeenth-century Russian cursive and the early eighteenth-century book hands show some indications of the influence of contemporaneous Latin hands.[1]

In the late seventeenth-century Russian cursive, the letter O becomes oval and approaches the shape of a diminutive circle. This is a rather sharp contrast when compared with the lozenge-shaped parallelogram of O of the earlier centuries.

The letters M and H also reflect the Western influence: they are more symmetrical with minims lying in a strict vertical position. Another salient feature of the change is the gradual establishment of a certain balance between curves and straight lines (Fig. 4[a]).



In the early eighteenth-century book hand the letter O approaches a perfect roundness. The perpendicular stems of capitals and also the minims tend to follow a strictly vertical stress. The crossbars take a clear horizontal position. Generally, most characters of the early eighteenth-century Russian book hand tend to be built in a strict symmetrical form (Figs. 4[b–e]).

The new vogue resulting from the influence of Latin hands and, above all, a vivid interest in non-cyrillic characters seem to be reflected in Karion Istomin's choice of alphabets for his illustrated spelling book[2] published in 1694. This album of engraved plates offers a parallel presentation of Slavic, Greek, Latin, and Polish (basically Latin) characters (Fig. 5). It might be of interest to note that Istomin himself was a proofreader and editor at Peter I's Moscow Printing Court.[3]

The changes in Russian hands gradually led to the development of certain characters which, in their turn, became extremely suitable models for a cleaner, more straightforward type.

The assumption that letters of late seventeenth- and early eighteenth-century Russian hands have influenced the Tsar and the designer is supported by references in Peter I's correspondence to the shape and lines of characters in contemporaneous cyrillic hands. For instance, in a communication dealing with his decision on the final versions of printed Д and Т, the Tsar distinguishes between specimens modelled after their counterparts in Russian hands and those based on the antiquated *poluustav* types.[4]

Furthermore, there are several characters in Kühlenbach's original design for *grazhdanskii shrift* which clearly indicate that their source is the early eighteenth-century Russian hand. Figure 6 shows six such letters and six types taken from early eighteenth-century manuscripts and from texts printed with the 1708 *grazhdanskii shrift* respectively.

Figure 4. Facsimile fragments of [top to bottom] (a) late seventeenth-century (1698) and (b) early eighteenth-century (1703) Russian civil cursive hands; and (c–e) early eighteenth-century Russian civil hands (1703).

Figure 5. A page of Karion Istomin's spelling book (1694) with Slavic, Greek, Latin, and Polish (basically a variant of Latin) versions of the letter "D."

Figure 6. Characters of Peter I's *grazhdanskii shrift* (top line) and letters of the eighteenth-century Moscow civil hand. Source: *Bol'shaia sovetskaia entsiklopediia*, 2d ed., Vol. XII.

Similar though not as clear-cut and impressive likenesses can be found when the cursive versions of the letters Гг, Д, Лл, Нн, Пп, Р, and the corresponding types of *grazhdanskii shrift* are compared.

The question of borrowing from contemporaneous hands becomes much more involved in the case of characters which are basically identical in both Latin and cyrillic writings and fonts. Later, within the type-by-type analysis of *grazhdanskii shrift*, frequent references will be made to certain aspects of this problem.

The Impact of Roman Type

Although some of the more complex letters of the cyrillic alphabet do not lend themselves to romanization, the general appearance of *grazhdanskii shrift* unmistakably indicates an adherence to the basic rules of the design of roman type: a sophisticated application of straight and curved lines, and circles and squares for the development of the dignified and restrained geometrical forms of characters. Indeed, even a superficial glance at any type page of *grazhdanskii shrift* would convince the reader that the designer of the new Russian type must have been influenced by roman type.

A survey of books and other printed matter which Peter I and his associates used or had access to reveals that most of those works had been printed in late seventeenth- and early eighteenth-century Holland, Germany, and France, with roman types then popular in Western Europe.

In an attempt to isolate works that would have the potential—typographically and circumstantially—to serve as models, title pages and texts of a number of contemporaneous Dutch, German, and French publications were analyzed. Since the designer of the new

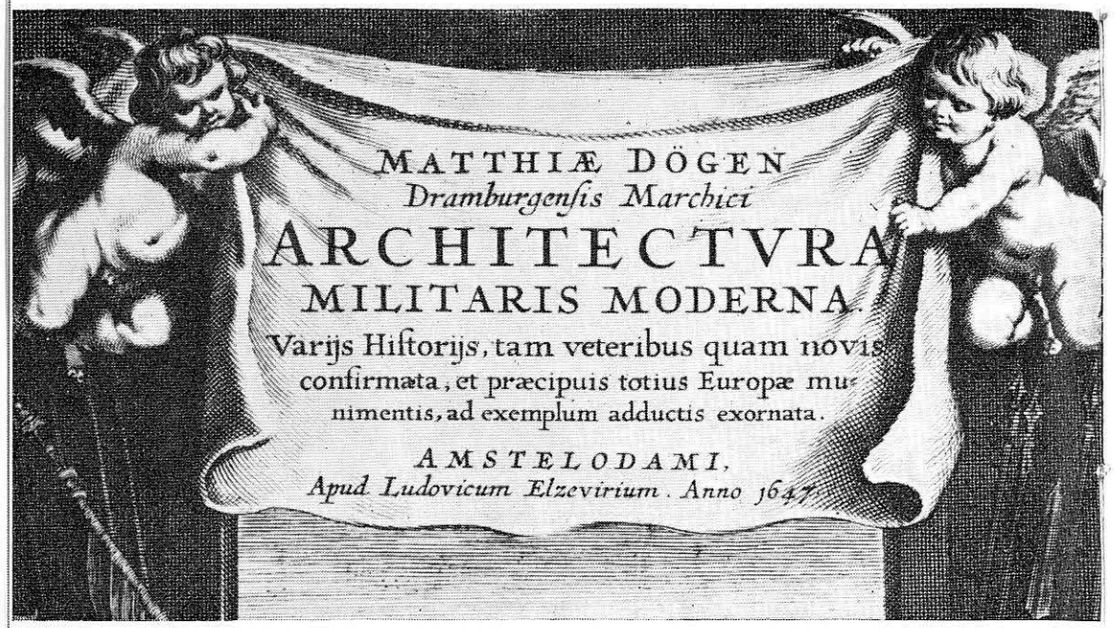


Figure 7. Illustrative fragments of Matthias Dogen's *Architectura militaris moderna* (Amsterdam: 1647); above—(a) text of engraved title page; opposite—(b) part of index and (c) sample text.

type was a specialist in the planning of fortifications, particular attention was paid to works on that subject. Repeated references in the Tsar's correspondence to works on the art of fortification make this approach even more plausible. Finally, the circumstances and the locale within which Kühlenbach, the military engineer-designer, actually had to produce the draft designs for Peter's type (i.e., during the war with Sweden, at Menshikov's headquarters in Zholkva) are further justification for such an approach.

There is one particular work with a title page and text designed and produced with characters and types that show definite resemblance to many types of Peter's *grazhdanskii shrift*.

The book in question is Matthias Dögen's *Architectura militaris moderna*.[5] It was published in 1647 in Amsterdam by Elsevier. This very successful work was reprinted several times and is considered as

Bibliopegus obſervet inſerendas tam Figuras, *notatas ſub calcem literis*

Quàm Urbes *in hoc opere conſpicuas.*

bitari, num plus loci in Hollandia Terra occupet; an vero Aqua. Et inſuper abundat illa regio tanto navium omnis generis, tamque grandi numero, ut adhuc magis poſſit in dubium vocari: num major hîc ſit numerus natatilium habitaculorum in aqua, quam ædium fixarum in terrâ.

Quantum verò firmitudinis accedat Hollandis ab his aquis, non ſemel eventu, haut cœco, probarunt; cum per ſua emiſſaria & catarractas, immiſſis aquis, hoſtem, jam in mediis patriæ viſceribus graſſantem, vel ſuffocârunt;

one of the basic tools of military engineers of the era. Thus, it is most probable that Kühlenbach was in possession of Dögen's work.

The characters and types on the engraved title page (Fig. 7[a]) and in the index and type pages (Fig. 7[b]) that show much similarity with their counterparts in *grazhdanskii shrift* are A, T, C, D, R, I, N, O, a, r, x, and to some extent also the type M. Further details concerning possible borrowings from this model are offered below.

Another possible model is Peter's favorite *Symbola et emblemata*, printed for him in Amsterdam by H. Wetstein, in 1705, just a year before the Tsar ordered Kühlenbach to design a new type. Certain capitals used in the well designed, but rather crudely executed title page (Fig. 9), carry some potential characteristics of models that might have been considered by the designer. Again, references to such characteristics are given *infra*, in the type-by-type analysis of *grazhdanskii shrift*.

If one adds to this the results of Thesing's attempts to produce a modified cyrillic type (Fig. 8) and the multitude of engraved characters in maps, "feierverk" plates,[6] engraved title pages and charts, it becomes clear that the impact of roman type must have been unique and overwhelming.

Until recently in the literature *grazhdanskii shrift* was referred to as "Russian antiqua" or "Amsterdam antiqua," reflecting the consensus of scholars of Russian printing that Peter I's type was built on the graphic and aesthetic foundations and structural principles of roman type. Some recent Soviet studies tend to emphasize the role of Russian hands as models for the new type.[7]

The Influence of Poluustav Type

Finally, mention should be made of the influence of the antiquated *poluustav* type. When dealing with characters completely alien to the Latin hands and roman types, the designer of *grazhdanskii shrift* had to reach for inspiration offered by the old-fashioned *poluustav* types—the only cyrillic printing type available prior to the introduction of *grazhdanskii shrift*.

The ensuing analysis of the individual types of *grazhdanskii shrift* supplies ample evidence to demonstrate this fact which is a reality frequently underplayed by certain authors.

An Analysis of Grazhdanskii Shrift

[Readers should refer to Figure 1 on pages 112 and 113 for a comparative display of the large-size characters of *grazhdanskii shrift* which are discussed individually in the following paragraphs.]

Capital A (*Az*) was occasionally used in early eighteenth-century civil book hand as a lower-case letter (Fig. 4[c]) and as an alternative to the "a" fashioned after the Greek "α" (Fig. 4 [d–e]). Since the *poluustav* capital A clearly follows the design of its Byzantine counterpart, the model for the civil type A must have been the identical roman type. It was one of the four capitals the designs for which were completed by Kühlenbach and were sent to the printers in 1707. Capital A in civil type has a pointed apex and a fine, horizontal center bar. Its hairline terminates in a flat serif. The stem has a peculiar flat right-hand half-serif which is one of the salient features of the 1708 civil type. It is interesting to note here that the intentions of the designer concerning the half-serif of the stem were fully understood and implemented by the Amsterdam type-cutters. Mikhail Efremov's specimen sheet indicates that in his capital A (Fig. 9, line 4, in Part I of the present paper) this aspect of the design was completely ignored.

In the late seventeenth- and early eighteenth-century Russian cursive hands the lower-case a followed the form of the Greek "α." The structure of a in *grazhdanskii shrift*, however, resembles the roman letter. The letter a in the original civil type has a main stem curving to a pointed end. The well-curved arc of the stem does not extend all the way to the left and it too has a pointed end. The fairly wide oval loop sits far down on the stem. Here again the large-size lower-case a of the Moscow Printing Court represents a variation: its open, round loop and clumsy foot final have nothing to do with the original design (Fig. 9, line 1, in Part I of the present paper). Strangely enough, the form of Efremov's medium-size lower-case a clearly indicates the designer's concept as it was perfectly reflected in the types cut in Amsterdam (Figs. 1–3).

The capital and lower-case б (*Buki*) both are based on the design of the lower-case version of this letter in the early eighteenth-century civil hand. The original (1707) designs of Peter's type did not include the capital version of this letter. The Tsar simply ordered the capital type made with the design of the lower-case б. This accounts for the aesthetically unacceptable oversize type. In 1708, when Peter I decided to have some additional and modified types cut, he included in his order a new version of this letter based on the *poluustav* Б—a character of Greek derivation (Fig. 14, the first letter in line 1, in Part I of the present paper). In the final version of civil type (Fig. 15 [1] in Part I of the present paper), however, the Tsar cancelled the modified Б and approved the original design of the identical capital and lower-case types. The oval bowl shows some tendency to a vertical stress. The top flag conveys a certain swash effect. The type б in the Amsterdam font is basically identical with Efremov's character. However, as was mentioned earlier, Efremov did not cut a capital б for his medium-size type.

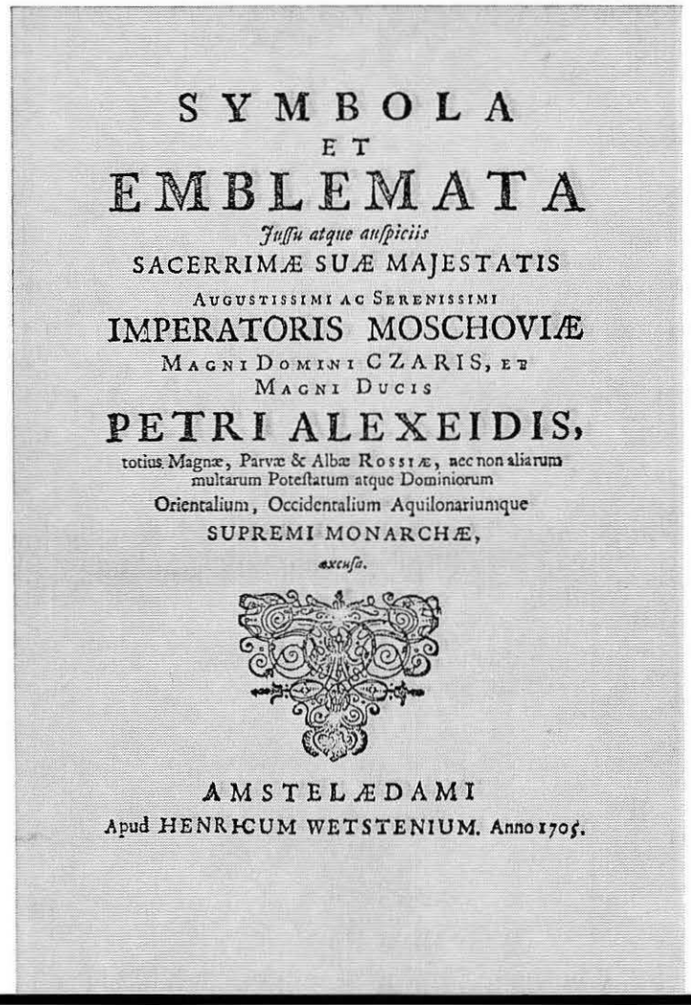
The design of the type В (*Vedi*) in both capital and lower-case versions is a clear borrowing from roman type. In *poluustav* type this character had some strange angular features and in the civil hand its form was reminiscent of the letter "О." It should be noted here that Jan Thesing had a somewhat cruder version (1699–1707) of В among his capitals (Fig. 8, line 1). The design of В in the Latin title-page of *Symbola et emblemata* printed for Peter I in Amsterdam (1705) bears a strong resemblance to the same character in the civil type (Fig. 9). В has vertically stressed modified circular bowls. The upper loop is small. There are flat hairline serifs at the head and foot of the stem. In Efremov's type the fine serifs of the design deteriorate into hardly visible bracketed serifs.

The design of Г (*Glagol*) may be based on civil hand (Fig. 4 [e]), or, with slight modification, on printed *poluustav*. Shitsgal[8] noted that printed versions of characters originating from the Greek such as Г occur in certain seventeenth-century books printed in Vilno, Kiev, and L'vov. The stem has a flat, hairline serif at the foot. The

А Б В Г Д Д Е Ж Ѕ З І І К
Л М N Ѡ О П Р С Т Ѫ Ц
Ч Ъ Ѧ Ѱ V

Figure 8. Jan Thesing's (Amsterdam, 1699–1707) capitals in his cyrillic font used in publications printed for Russian readers and exported to Russia.

Figure 9. Latin title page of *Symbola et emblemata* printed for Peter I in Amsterdam by H. Wetstein (1705).


SYMBOLA
ET
EMBLEMATA
Jussu atque auspiciis
SACERRIMÆ SUÆ MAJESTATIS
AUGUSTISSIMI AC SERENISSIMI
IMPERATORIS MOSCHOVIÆ
MAGNI DOMINI CZARIS, ET
MAGNI DUCIS
PETRI ALEXEIDIS,
totius Magnæ, Parvæ & Albæ ROSSIÆ, nec non aliarum
multarum Potestatum atque Dominiorum
Orientalium, Occidentalium Aquilonariumque
SUPREMI MONARCHÆ,
excusa.
AMSTELÆDAMI
Apud HENRICUM WETSTENIUM. Anno 1705.

bracketed serif of the horizontal bar is spurred and is sloped in outwards.

Capital Д (*Dobro*) is the second of the four characters the capital versions of which were designed by Kühlenbach in 1707. The vertical position of its stem is indicative of the influence of contemporaneous Russian civil hand (Fig. 4 [c] and [e]). This feature was ignored by Efremov whose medium-size capital Д with its sloping stem bears a strong resemblance to the early printed *poluustav* versions of that character (Fig. 9, in Part I of the present paper). Capital Д has a thick, flat serif at the head of its stem. There are tail-type bracketed beaks at each end of the arm. Thesing's capital Д was based on the old *poluustav* version of this character.

The lower-case д is a classical example of borrowing from the decorative minuscule used in early eighteenth-century engraved plates (Fig. 10). Its occurrence in civil hand is not as frequent as one might presume from the comments on this type by some Soviet authors and the *Large Soviet Encyclopaedia*.[9] The large, kidney-shaped lower loop which sits well to the left of the axis is in strong contrast with the upper bowl. The latter is of a modified circular form.

Both the capital and lower-case E (*Est'*) bear the clear characteristics of roman type. The capital E of Peter's type is reminiscent of the "E" in the Latin title page of *Symbola et emblemata* (Fig. 9). It was designed by Kühlenbach in 1706–07. Since the late seventeenth- and

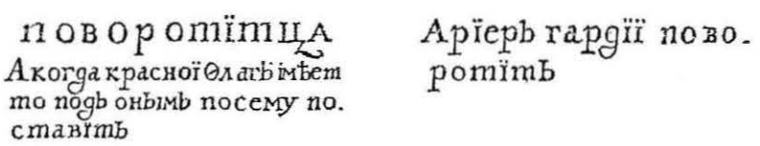


Figure 10. Text fragments from copper-engraved plates entitled "Ship Signals." The undated plates are to be found in the Russian Museum (Russkii muzei) under the numbers: 32309 and 38420. Source: A. Shitsgal.

early eighteenth-century civil hands fully imitated the extremely narrow, slightly rounded shape of the *poluustav* E (Figs. 4 [c]—[e]) they could not have supplied a model for Peter I's version of the letter E. The additional Amsterdam and Moscow types ordered by the Tsar in the summer of 1708 included another form of "Est'" which was based on contemporaneous civil hands (Figs. 14, in Part I of the present paper, and 4 [e]). Efremov in his large-size lower-case type substituted a replica of the capital E for this character. He, however, cut an e, with an open lower loop, for his medium-size type. The capital E of *granzhdanskii shrift* has hairline serifs at the head and foot of the stem. There is also a hairline serif on the short central arm. The upper and lower arms have lightly bracketed angular beaks. The upper arm is noticeably shorter than the lower arm. The lower case e of the civil type is unusually heavy in line. It has a very small counter and a light, high cross-bar. The lower curve protrudes decidely to the right.

Capital and lower-case Ж (*Zhivete*) indicate the influence of early seventeenth-century printed *poluustav*. There is a slight variation between the Amsterdam type and the character cut by the printers of the Moscow Printing Court (e.g., the ball and sheared terminals of the arms; in Figs. 1–2). In addition, Efremov's large-size lower-case version of this type is much lighter than its Amsterdam counterpart.

S (*Zelo*) in its design clearly follows the line of roman type. As far as the other early versions of this type are concerned, neither Thesing's heavy type, which lacks the graceful balance of the Amsterdam and Moscow civil characters, nor the rather compressed S in Polikarpov's *Primer* (Fig. 11) (nor the *poluustav* versions of this letter) could have had substantial influence on its design in *grazhdanskii shrift*. Both the capital and lower-case versions of S slightly lean to the left. The graceful line of the spine, the fairly open curves and the vertical spurred beaks give a light appearance to this type.

The design of the letter З (*Zemlia*) stems from the printed *poluustav* type. It is one of the additional characters ordered by Peter I in 1708 and was cut in Amsterdam in the lower-case version of the large- and small-size types (Figs. 1–2). Aleksandrov and Petrov at the Moscow Printing Court prepared the capital and lower-case editions of the medium-size type. There is a noticeable difference in the style between the Moscow and the Amsterdam versions of З, the latter being more archaic and complicated in its form (Fig. 14, in Part I of the present paper).

The letter I (*I desiaterichnoe*) is a clear replica of the roman "I": the printed *poluustav* version of this letter hardly ever had the characteristic serifs. In the original set of types cut in Amsterdam and Moscow in 1707 I did not have two dots above it. The change was ordered by Peter I on 8 May 1708. In his *ukaz* this type was referred to by the Tsar as "Izhe." The straight vertical stem of this type has hairline serifs at its head and foot.

И (*Izhe*) is a character which was not included in the original set of the Amsterdam types. It was ordered by the Tsar as an addition to the basic font in 1708. It was cut in Amsterdam, in the lower-case version of all three sizes, and in Moscow in the capital and lower-case versions of the medium-size, and in the lower-case edition of the small size. The design of this type can be considered rather as a variation of the elements of roman "N" than as a perfected form of the *poluustav* И. It might be of interest to note that Thesing's capitals included an "Izhe" modelled after the old *poluustav* or *ustav* (Fig. 8). The medium-size, lower-case Amsterdam and small-size, lower-case Moscow types have a wide, square appearance. There are slab serifs at the head and foot of the stems. The diagonal stroke joins the stems under and above the serifs. The types in both fonts are rather poorly executed.

Figure 11. Early eighteenth-century *poluustav* types in Fedor Polikarpov's *Primer* (1701).

The type К (*Kako*) was designed following the basic form of roman type but its elements were influenced, to a certain extent, by the characters of Russian and Dutch engravers (Fig. 3, in Part I of the present paper). Efremov's large-size, lower-case type in its appearance is more in the spirit of the general design of Peter I's type than the rather narrow version of this character made in Amsterdam (Fig. 1). The reverse is the truth for the medium-size, lower-case type. The stem of К has slightly bracketed serifs at its head and foot. The hairline arm has a spurred beak and the gracefully curved lower leg which protrudes to the right ends in a curved, pounted terminal. As opposed to the lower-case Latin "k," the lower-case version of this type is an exact replica of the capital and does not have any ascenders.

The design of Л (*Liudi*) does not follow the typographical pattern of an upright stem set by the civil hand and adopted by Thesing (1699–1707) in his independently developed modified *poluustav* capital type (Fig. 8). The design of the final version of Peter's Л is modelled after the *poluustav* type with the addition of a conspicuous right-hand flat half-serif which was seen in the case of the capital X. This type has a slightly bracketed serif projecting at the top of its stem. There is a flat serif at the foot of the stem, deteriorating into a hardly visible bracketed serif in the lower-case version of the large-size type and reappearing again—in a somewhat cruder form—in Efremov's medium-size capital Л. The Russian type-cutter, in the lower-case version of his large type, changed the direction of this half-serif by turning it to the left. There is a light curve in the lower end of the hairline which then ends in a ball terminal. In Efremov's large-size, lower-case type this could be described as a bulbous tail.

The type М (*Myslete*) in its design shows a peculiar similarity to Thesing's type (Fig. 8) and, to certain types of the Italian Renaissance. In Polikarpov's *Primer* (Fig. 11), just as in the majority of the roman fonts and in *poluustav* type, the vertex of the М tends to reach the base line. The М in *grazhdanskii shrift* is a square character. Its vertex is half way above the base line. There are half-serifs at the

apexes and full, flat serifs at the feet of the stems. Efremov's large-size, lower-case М is asymmetric because of a shift to the left in the position of its vertex.

The type Н (*Nash*) in its design relies on civil hand (Figs. 4 [b–d]) with some refinements borrowed from roman type. It is a rather broad character; with Efremov's lower-case, large-size type approaching a square. It has flat serifs and a hairline center cross bar. The medium- and small-size types were rather poorly executed by both the Amsterdam and the Moscow type-cutters.

The type О (*On*) reflects the changes in the early eighteenth-century Russian civil hands but is mainly modelled after its roman counterpart. This character has a slightly oval-shaped bowl with a vertical axis. Efremov's lower-case, large-size type has the shape of a perfect circle which makes it fit well into the group of types designed with a rounded body so characteristic of Peter I's type.

The character П (*Pokoi*) was designed under the influence of contemporaneous civil hands (Fig. 4 [c]). The peculiar curved extension of the head of the stem with its slightly bracketed serif gave to the early version of this type a conspicuously clumsy look. This effect was less accented in Efremov's character and in the medium- and small-size Amsterdam types. If preserved this type would have become one of the most characteristic letters of *grazhdanskii shrift*. Peter I, however, in his order for additional types in Amsterdam and Moscow (1708), included another design which in its form stood closer to the printed *poluustav* П (cf., Polikarpov's Primer, Fig. 11, lines 2 and 6) and was a wider and lighter version of the former. In the final edition of *grazhdanskii shrift* (Fig. 15 [2], in Part I of the present paper) approved by him on 29 January 1710, the Tsar deleted the early versions of this character and kept the design which had been borrowed from the printed *poluustav*. Thus, П in the civil type (1710) has rather heavy stems with short slab serifs at the foot. The horizontal stroke connecting the heads of the stems in certain

types projects to both left and right. There were no large- or small-size capitals of this type cut in Moscow or in Amsterdam.

The design of the first version of the letter P (*Rtsy*) reflects the influence of the civil hand (Fig. 4 [c]). The stem of this type had the same conspicuous extension as was seen in the case of the letter П. Here again the Tsar decided to revise this heavy character and, in his order for additional types (1708), he included a simpler version with certain elements of the roman "p." This additional character then was approved by Peter I in 1710, in the final version of his civil type (Figs. 14, line 1, and 15 [2], Part I of the present paper). P has a long descender and a modified, slightly open circular bowl. There is no head-serif or nick on the stem which displays a smooth transition into the curve of the loop.

Although the design of C (*Slovo*) shows the impact of both contemporaneous civil hand and of roman type, its final edition bears a stronger resemblance to the roman model, possibly the one used in the text of the title page of *Symbola et emblemata* (Fig. 9), than to any civil-hand versions. This well-designed type has a fairly large counter with an entrance narrowed by a spurred beak on the upper arm. The lower arm has a gradually tapering terminal which slopes upward. The lower arm slightly but noticeably protrudes to the right resulting in a backward stress. The large-size, capital version of the Amsterdam type has a spurred beak on the upper arm which is slightly sloped inwards. The lower-case medium and small-size characters do not have any spurs and tend to have something of the nature of a ball terminal on the upper arm.

T (*Tverdo*) was doubtless designed on the roman model. In the 1710 version of his type Peter I approved the design of the large-, medium-, and small-size capital T modelled on roman type and, for the lower-case version, he preserved a rather crudely designed character with three stems apparently based on the contemporaneous civil hand (Fig. 4 [c–e]). The capital T has its stem ending in a slightly bracketed

serif at the foot. The arm-serifs slope outwards. This type is one of the four capitals designed by Kühlenbach. The second, or lower-case version of T, is a crudely executed character with three stems and with an uneven horizontal stroke connecting their heads. To a certain extend it is reminiscent of the Latin cursive "m."

ѕ (*Uk*) is a type which was not included in the original (1708) set of characters. It was ordered by the Tsar as an additional type, perhaps as a gesture towards the printers of liturgical literature. Its design carries all the signs of the influence of *poluustav* type (Fig. 11). The round body of ѕ has two asymmetrical swash tail-type ascenders.

The type У was apparently modelled after the early eighteenth-century civil hand. Here again, Peter's order to design capitals, following the form of lower-case types produced by Kühlenbach, led to the creation of a type which is clearly over-size when compared to the rest of the set. The type У in its final form has a projection on its short arm and a flat, hairline serif on its long arm. Its long, oblique tail has a ball terminal. Efremov's large-size, lower-case character has a distinctive hook on its lower terminal ending in a ball.

The letter Ф (*Fert*) in its design basically follows the form established by the contemporaneous civil hands. It is a definite improvement on the ornate style of its printed *poluustav* version (Fig. 15 [3], columns 1, 3, and 5, in Part I of the present paper). Peter I's Ф shows also some resemblance to Skorina's type (1517–1519). The type Ф has an oval bowl which sits slightly high on the stem. The counter is cut in half by the vertical stem which has hairline serifs at its head and foot. Ф was not included in the original set of characters (1708) and was ordered by the Tsar at a later time.

X (*Kher*) in its designs shows a definite break with the printed *poluustav* where this type descends far under the base line. The civil type version of X is based on contemporaneous Russian hands with

some added refinements (e.g., serifs) borrowed from roman type. The diagonals meet half-way. The upward thin stroke has hairline serifs. Half serifs protrude from each end of the heavy diagonal. The diagonals in the medium- and small-size variants show some tendencies to curve.

There are certain cyrillic characters which, by virtue of their typographical presentation in civil type, can be treated as two groups of types with identical features and components. The first group includes:

The characters Ц (*Tsy*), Ш (*Sha*), and Щ (*Shcha*) all are patterned after their civil hand models. Peter I ordered the design of the rather angular swash-tail of Ц and Щ to be changed into a more curved one (1708) (see Figs. 14 and 15 [4–5], in Part I of the present paper). The new variants were then approved by him as parts of the final version of *grazhdanskii shrift*, on 29 January 1710. All these types have straight vertical stems with unbracketed serifs. The horizontal strokes project to the right and end in swash tails. The second group of types consists of:

The types Ь (*Er*), Ы (*Ery*), Ъ (*Er'*), and Ѣ (*Iat'*) represent a salient feature in the design of civil type. The identical size of their bowls and the very similar treatment of the rest of their components suggest that, as far as typographical design is concerned, they should form a group. All four characters (1708) were later redesigned by Peter I's order. They were included in the group of additional and modified characters made in 1708–1709 (Fig. 14, line 1, in Part I of the present paper). The basic elements of types in this group include a stem with a serif at its head (except in the case of Ъ or "Er" where the head of the stem has a downward sloping curve projection to the left) and a modified bowl with a slightly flattened bottom curve which ends at the foot of the stem and which, as a rule, has a flat projection. The crossbar of Ѣ has slightly bracketed serifs sloped outwards.

The type Ч (*Cherv*) apparently originates from eighteenth-century Russian civil hands. It has a straight vertical stem with unbracketed serifs at its head and foot. The short arm curves sharply upward ending in a left-hand projection at the main line—in the case of the lower-case type.

Of the remaining types there are only two which hold some interest from our point of view; others are ѳ, ѯ, Ѱ, ѳ, ѵ, ѧ.

Ю (*Iu*) is a combination of capital I and O connected by a hairline horizontal stroke.

The second type which should be mentioned here is Я (*Ia*); in its design, it was clearly borrowed from roman type and is an apparent mirror-image of the roman "R." It has a straight vertical stem with a flat serif at its foot. Its left tail tapers to a point and its loop has a right-hand projection at the end of the stem.

Conclusions

Concluding this survey of the civil type there are some observations to offer concerning the artistic and typographical characteristics of the font, and also on the puzzle of the identity of the designer of *grazhdanskii shrift*.

A. The designer was faced with the difficult problem of trying to create a type duplicating the simplicity and cleanness of form represented in an admired model of another alphabet. In his adaptations, he either failed to understand or consciously rejected certain canons of consistency about stress, the use of serifs, and the use of ascenders and descenders held by western designers from the fifteenth century on. Nevertheless, in so far as his goal was simplicity of form, his adaptation of roman models was very successful in giving cleaner lines to the cyrillic letter.

B. All type designs, at least in the early stages of typography, have been influenced by the prevailing cursive or book hand. The designer of the *grazhdanskii shrift* was forced to rely on contemporary and

antique hands for many characters not in the Latin alphabet. In selecting models he seemed to prefer the contemporary civil hand, but on occasion he resorted to the old *poluustav*. Analysis shows that in choosing forms, he followed the ideal of simplicity. Nor was he oblivious of the needs for pleasing synthesis of form and keeping balanced proportions between capital and lower-case letters. In the final font, the dissimilarities in form between the native Russian letters and the adapted roman models are noticeable but not inconsistent with an artistic whole.

C. There may have been some discrepancy between design and execution. It appears, for instance, that serifs were intended to be thin and unbracketed. Some printed examples actually show hairlines. In many cases, however, where execution appears faulty, the serifs come out in print as slabs slightly bracketed. Whether this resulted from improperly cut punches, improper striking of the matrices, or poor presswork is impossible to judge from the evidence at hand of extant printed examples. Indeed, the whole supposition that execution lagged behind design may be based on too great an admiration for the creators of this type; however, the successful treatment of hairline serifs developed on a different handling of press, ink, and paper than commonly employed early in the eighteenth century.

D. Obviously, the *grazhdanskii shrift* was the product of the labor of many men—the precursors on copper plates, Russian draftsmen, Dutch engravers, Russian designers and craftsmen. The mixture of foreign participants led no doubt to some successes and also to one conspicuous failure. The casting of the soft and hard signs in sizes equal to the actual letters could have been the work only of designers not fully acquainted with the functions of these signs in the cyrillic alphabet.

E. The importance of the role played by Tsar Peter I in the creation of the *grazhdanskii shrift* is clear. The great reformer gave the orders which originated the project and commissioned workers to carry it out. He kept a careful eye on the development amidst all his other great responsibilities. He corrected specimen sheets in his own hand and approved the final outcome. Thus, it is not inappropriate to call *grazhdanskii shrift* Tsar Peter I's type.

F. The significance of Tsar Peter I's innovation is beyond doubt. It not only made printing simpler and easier and made Russian

books more attractive but, in the words of V. Ia. Adariukov, "the change in the lines [of type] bore an important meaning as the outward symbol of the liberation of the Russian tongue. . . ."[10] And indeed, it was one of the many factors working towards the elimination of the heavy influence of Church-Slavonic language and the creation of a living Russian literary tongue.

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1. A. Shitsgal, *Russkii grazhdanskii shrift 1708–1958* (Moskva: Gosudarstvennoe izd-vo "Iskusstvo," 1959), p. 72, and also

A. Shitsgal, *Graficheskaia osnova russkogo grazhdanskogo shrifta* (Moskva: Gosudarstvennoe Nauchno-Tekhnicheskoe Izdatel'stvo Tekstil'noi, Legkoi i Poligraficheskoi Promyshlennosti, 1947), p. 27.

2. The 43 engraved plates of the *Bukvar'* are the work of Leontii Bunin. Each page deals with one character of the alphabet. The various characters are represented by postures of a human figure. Each character is written in its capital and lower-case, in printed and cursive forms as used in the Russian, Greek, Latin, and Polish. Pictures of a number of objects the name of which begins with the particular letter are presented. The lower part of each page carries ten lines of rhymes about the letter illustrated.

Facsimile reproductions of set of this copper-engraved plates are included in folder IV of D. Rovinskii's "Russkiia narodnyia kartinki." cf., *infra*.

Also cf., I. Tarabrin, "Litsevoi bukvar' Kariona Istomina," *Drevnosti*, XXV (1916), 249 and plates XVI–LII; and

D. Rovinskii, *Russkie gravery i ikh proizvedeniia s 1564 goda do osnovaniia Akademii khudozhestv* (Moskva: Izdanie Grafa Uvarova, 1870), p. 163, items 31–72; and also

D. Rovinskii, "Russkiia narodnyia kartinki," Tom 2. *Imperatorskaia akademiia nauk. Otdelenie russkogo iazyka i slovesnosti. Sbornik*, XXIV [483]–502; and

E. Gollerbakh, *Istoriia graviury i litografii v Rossii* (Moskva: Gosudarstvennoe izd-vo, 1923), pp. 25–26.

3. A. Sidorov, *Istoriia oformleniia russkoi knigi* (Moskva: Gizlegprom, 1946), p. 116; and

D. Rovinskii, "Russkia narodnyia. . . ." Tom 4, *Imperatorskaia akademiia nauk. Otdelenie russkogo iazyka i slovesnosti. Sbornik*, XXVI, 517 (Primechaniia i pr ilozheniia)

4. *Pis'ma i bumagi imperatora Petra Velikogo*, VIII/1, 289. Peter I's order says among others: "'Tol'ko "dobro," "tverdo" napechatat', kotorye skhodny k pechati, a ne k skoropisi. . . ."

5. Cf., S. L. Hartz, *The Elseviers and Their Contemporaries* (Amsterdam: Elsevier, 1955), p. 76; also
M. Dögen, *Architectura militaris moderna* (Amstelodami: Apud Ludovicum Elzevirium, 1647).

6. Commemorative plates depicting firework displays organized on various occasions such as Peter I's military victories. Cf., Gollerbakh, *op. cit.*, p. 6.

7. A. Shitsgal, *Graficheskaia. . . .*

8. *Ibid.*, 87.

9. *Bol'shaia sovetskaia entsiklopediia*, 2d ed., Vol. XII.

10. V. Ia. Adariukov, *Kniga v Rossii*, Vol. 1: *Russkaia kniga ot nachala pis'mennosti do 1800 goda* (Moskva: Gosudarstvennoe izd-vo, 1924), p. 139.

Directional Consistency in Form Identification

Jeremy J. Foster

An experiment is reported, the results of which are taken to support Kolers' theory of directional consistency in letter identification. The connection between this effect and a number of studies on the identification of tachistoscopically presented patterns is commented upon. The connection between the effect and the results of experiments on visual search is also noted.

Kolers (1969) has suggested that the differences in the speed with which letters subjected to geometrical transformations can be identified when read from left-to-right or from right-to-left may be accounted for by a hypothesized "directional consistency." In his experiment, subjects read lines of letters which had been transformed as shown in Figure 1. The direction of reading was varied, all transformations being read both left-to-right and right-to-left. Kolers found that left-to-right reading was faster for conditions N and I, right-to-left was faster for condition R, and there was no difference for condition M.

In attempting to account for these findings, Kolers noted that when transformations N and I are read from left-to-right, direction

Figure 1. Examples of the geometrically transformed texts used by Kolers (1969).

of reading is consistent with the direction of the letters, whose distinctive characteristics are to the right of the letter. Similarly, direction of reading and letter direction are consistent for conditions M and R when these are read from right-to-left. When N and I are read from right-to-left, and M and R are read from left-to-right, reading direction and letter direction are inconsistent. He therefore suggested that identification was assisted by directional consistency, defined as "whether the letters face in the direction in which they are named" (p. 158).

This suggestion can be related to a substantial amount of work which has been performed on the facility with which stimuli exposed tachistoscopically across the visual field can be identified. These studies may be summarized by saying that for directional stimuli, those shown in the left visual field are reported more accurately than those shown in the right visual field. This has been found with both right-to-left and left-to-right order of responding. Left-to-right responding gives more accurate responses overall (Bryden 1960; Harcum 1964). For non-directional stimuli—such as open and filled circles or geometric forms—left -to-right report leads to more accurate response to stimuli shown in the left visual field. Right-to-left report tends to produce more accurate responses for stimuli shown in the right visual field (Ayres and Harcum 1962; Bryden 1960; Harcum 1964). The reading habits of the subjects influence the results: those who are used to reading from right-to-left tend to show right-field superiority for both left-to-right and right-to-left report orders (Harcum and Friedman 1963). Both the subjects' reading experience and the nature of the material effects the results of this type of experiment.

The task in these studies differs considerably from that studied by Kolers. The tachistoscopic experiments rely on brief exposures of the stimuli and short-term memory processes. Kolers' procedure is concerned with the identification of lines of stimuli which are processed serially by the subject at his own speed and without memory being involved to any significant extent. Nevertheless, it is interesting that in both types of situation, investigators should have emphasized the influence of stimulus directionality and report order on their data.

The tachistoscopic studies give some support to Kolers' theory,

since they provide further evidence that when directional (pointing right-ward) stimuli are processed in a left-to-right order, response accuracy is greater than when they are processed in a right-to-left order. Further indirect support comes from tachistoscopic studies which have presented stimuli to left or right of the fixation point in successive exposures. Harcum and Finkel (1963) demonstrated that for letters arranged in normal word sequence and in normal orientation, right-field stimuli were identified more accurately than those shown in the left visual field. When mirror-image words were used, left field stimuli were the more accurately identified. This may be interpreted as indicating that more accurate responses occur when scanning direction and stimulus direction are consistent. Harcum (1966) showed words (1) with letters in normal sequence and orientation, (2) with reversed orientation and reversed sequence, (3) with correct sequence and reversed orientation, and (4) with correct orientation and reversed sequence. The stimuli were exposed successively left or right of fixation. Right-field superiority was found for conditions 1, 3, and 4; left-field superiority was found for condition 2. Harcum concluded that "perceptual accuracy is greater when scanning tendencies produced by stimulus characteristics and by reading direction agree in direction" (p. 480).

A corollary of the directional consistency hypothesis is that where there is no directional consistency; i.e., where the stimuli have no directionality, processing sequence—which in the case of Kolers' procedure means order of identification—should not produce differences in performance.

The tachistoscopic experiments mentioned above are also relevant here. With non-directional stimuli (geometric forms), Bryden (1960) found that there was no difference between overall accuracy scores for left-to-right and right-to-left reporting. Ayres (1966) reports that with vertical lists of binary elements equal scores are obtained for top-to-bottom and bottom-to-top responding. For horizontal patterns, however, the left-to-right sequence gave more accurate responses than the right-to-left sequence.

Aim

Directional consistency means that letter direction and reading direction are the same. It follows that if directional consistency is a

determinant of identifiability, then where letters have no direction, reading direction should not effect the ease with which the letters can be identified. Due to previous reading experience, it may be that with both types of stimuli left-to-right reading is superior to right-to-left. But in this case the directional consistency hypothesis predicts that the difference between performance with the two reading directions will be less for non-directional stimuli.

Method

Eight of the upper-case letters which are non-directional (in that they are vertically symmetrical) were used to form displays containing forty letters. The letters used were X H Y M O T V W. Each occurred five times in the lists, of which there were two. In each, the order of letters was decided by a randomization process. Two further lists were made up from eight of the directional letters. The ones used were R L E F P B K D. The displays consisted of four lines of ten letters, typed on white cards. Examples of these displays are shown in Figure 2.

The lists were administered to 32 subjects who read one directional and one non-directional list in each reading direction. The subjects formed two groups, one of which performed the tasks in the order

List A

R E L R P P F K D B
L P R K L E D D R P
E B E D B F P D L B
F K F R L E F B K K

List B

R L E F E P B K L R
E R K D R P L B E L
P E D F F P F K D E
D B D R L K B P B K

List C

H M X O V X H Y W Y
T M T T X O M O Y X
W M W Y H V V H X H
Y T M W O V O T V W

List D

H V Y T M W H X M O
M X W T O M V H W V
X H T X Y W V Y O T
O Y M O X H T V Y H

Figure 2. Displays of directional and non-directional letters.

DNND, the other having the order NDDN. The pairing of list and reading direction was counterbalanced so that each list was read an equal number of times in each direction.

The subjects read the lists aloud, letter by letter, and the time taken was recorded.

Results

For each subject, the difference between the times taken to read the directional lists in the two reading directions and between the times taken to read the non-directional lists in the two reading directions were calculated. The null hypothesis states that the difference between left-to-right and right-to-left reading times for directional lists should exceed the difference between left-to-right and right-to-left times for non-directional letters of 50% of occasions. The observed frequency falls well above this: 23 of the 32 subjects showed a greater difference between reading times on directional than on non-directional lists. The data was analyzed using the chi-square test, and it was found that the observed frequencies differed significantly from those expected on the null hypothesis. It may therefore be concluded that there was a significant tendency for reading direction to have a greater influence on directional than on non-directional letters.

Discussion

The results of this experiment lend support to Kolers' hypothesis concerning directional consistency. For the majority of subjects, reading direction had a greater effect on directional than on non-directional letters.

Brown and Strongman (1966) report that in a visual search task, search times are shorter for horizontal rows of letters in which the letters are normally oriented than for rows in which the letters are turned through 90° in an anticlockwise direction. This finding can also be taken as support for the notion that stimulus directionality affects task performance.

Brown and Strongman also found that with vertical lists, those with correctly oriented letters (D) were searched more rapidly than ones with rotated letters ($\frac{D}{T}$). The former arrangement is counter

to directional consistency, the letters being right-pointing in the horizontal plane, the list being vertical. It is therefore to be expected, on the directional consistency hypothesis, that vertical lists with normal orientation will be searched less rapidly than normally-oriented letters in horizontal lists. This result was obtained by Brown and Strongman. If we consider the two vertical lists, the one with rotated letters is more counter to directional consistency than the other. Subjects had to search the lists from top to bottom. With the letters in the particular rotated orientation chosen, the direction of the letters was opposite to the direction of search. In the correctly oriented vertical lists, the divergence between letter-direction and search-direction was only 90°. Hence the directional consistency hypothesis would predict that the correctly oriented lists would be scanned more rapidly than the rotated letter lists. This result was also obtained by Brown and Strongman. One would predict that were the lists scanned from bottom to top, directional consistency would favour the incorrectly oriented vertical lists over the correctly oriented ones. Alternatively, had the letters been rotated in a clockwise direction and top-to-bottom search been employed, the incorrectly oriented lists would be searched more rapidly than the correctly oriented ones. We are at present testing these hypotheses experimentally.

Conclusion

The experiment reported gives support to Kolers' hypothesised directional consistency effect. The effect seems to have some resemblance to phenomena found in the identification of tachistoscopically presented patterns, and with the results obtained in an experiment on visual search. It is suggested that the directional consistency effect influences performance in these three kinds of tasks.

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The Case for a Standard Word Space

Some definitions from *On Human Communication* (Colin Cherry, MIT Press, 1968):

Sign a transmission, or construct, by which one organism affects the behaviour of another, in a communication situation.

Attribute any property of a phenomenon, thing, event . . . assumed by the observer to be significant.

Attribute space the (mathematical) hyperspace, the coordinates of which represent the attributes of some phenomenon. Also called "system space", "phase space", in certain cases.

Argument

When a particular typographical sign, say a lowercase roman s, of a particular sort (set, font) is repeated in the context of a meaningful sequence of signs, say a sentence, we expect the dimensional attributes of the sign to be consistent at every appearance. If it does not appear so, we replace it by a sign of the correct sort. (A sign can be said to be dimensionally consistent with another sign when all the coordinates used to describe the first sign can be mapped, one-to-one, onto all the coordinates used to describe the second sign.)

The particular sign we use to group other signs meaningfully within the context of a sentence is, by convention, the absence of a mark. We call this not-mark sign a "word space." We could replace this sign by a particular sort of mark which we would expect to be dimensionally consistent at every appearance. The fact that we prefer to use a not-mark sign does not change the need for particular signs to be dimensionally consistent.

By establishing a standard for the word space in the context of a sentence, we grant ourselves the freedom to use multiples of the norm for other functional purposes. Alternatively, we are free to continue the irrational practice of horizontal justification.

If we accept the argument for a standard word space and we agree that not-marks in the typographical mode of language are signs of a particular sort, we can go on to examine the implications of the argument for all not-marks which exist in the structure of the language, from the space which occurs between individual marks, upwards.

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Chairman, Rationalisation of Typographical Conventions and Terminology Study Panel, SIAD/STD Typographers' Computer Working Group (England).

Experimental Use of the Search Task in an Analysis of Type Legibility in Cartography

Barbara S. Bartz

Search was used as an experimental task to investigate one aspect of legibility in cartographic typography. Subjects searched a variety of maps under several different conditions. There are four major conclusions from this research. For random search of the maps containing only one typeface, the typographic variation from map to map did not produce a significant effect on average search time. On mixed-type maps, search is slowed if the user has no correct expectation of the appearance of the type in which the target name will appear. On these same maps, search is greatly speeded if the user has a correct expectation of the target name appearance. Search time in a one-name task is less a function of typography than it is of many other factors.

We have shown in two previous articles that legibility in cartography must be evaluated in some way other than with the speed-of-reading and comprehension measures normally used in text legibility studies. Search seems a likely task to use in evaluating map typography, and research was conducted which utilized the search task. This final article considers two major questions:

Part One: Are there type characteristic variations which might affect search time for an *entire map*?

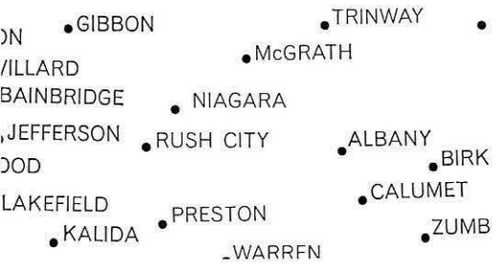
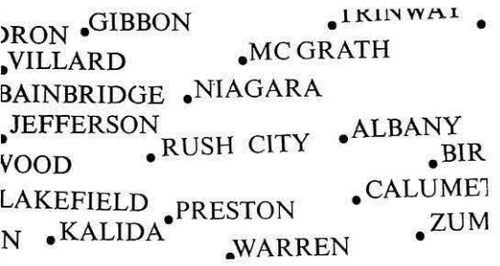
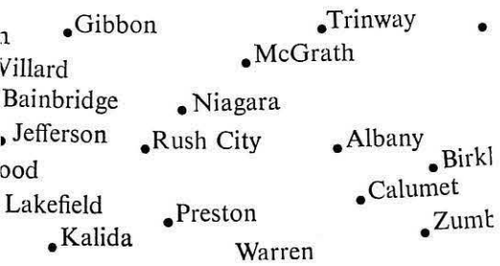
Part Two: Are there type characteristic variations which might affect search times for *individual names*?

The possibility exists that very different, even contradictory, answers might be found for these two questions.

Experimental Conditions

About 300 seventh- and eighth-grade students in Chicago, Illinois, and Lakewood, Ohio, were given lists of place names during individual interviews, and asked to find these names on 9 x 10-inch five-

TABLE 1. *Map and Test Characteristics, All Six-name Tests*

Type Sample	*Map Description*	*List Description*
	*Map One.* All names in 8-point light sans-serif face (Monsen Light), all capitals.	Typewritten
	*Map Two.* All names in 8-point light sans-serif face (Monsen Light), capitals and lower-case.	Typewritten
	*Map Three.* All names set in 10-point serif face (Times Roman), all capitals.	Typewritten
	*Map Four.* All names set in 10-point serif face (Times Roman), capitals and lower-case.	Typewritten

Type Sample	*Map Description*	*List Description*
	*Map Five.* All names set in 12-point bold sans-serif face (Venus Bold Condensed), capitals and lower-case.	Typewritten
	*Map Six.* Contains 85 names set in 5-point Monsen Light, capitals and lower-case, and 58 names set in 10-point Monsen Light, capitals and lower-case.	*Test 6a*: Typewritten *Test 6b*: List set to match type in which name appears on map. *Test 6c*: List set to match type in which name appears on map.
	*Map Seven.* Contains 47 names set in 5-point Monsen Light, 57 names in same face 8-point, and 36 names in same face 13-point, all capitals and lower-case.	*Test 7a*: Typewritten *Test 7b*: List set to match type in which name appears on map. *Test 7c*: List set to match type in which name appears on map.
	*Map Eight.* Contains 81 names set in 10-point Monsen Light and 58 names in 12-point Venus Bold Condensed, capitals and lower-case.	*Test 8a*: List set to match type in which name appears on map. *Test 8b*: Typewritten *Test 8c*: List set to match type in which name appears on map.

color lithographed maps (hypothetical names on an India base map, where the type was black, and the base area varied from white to brown to blue to green). Subjects were timed until they found the target names, and these times (in seconds) are the basis for all further comparisons. Eight different maps were used (see Table I). Maps One through Five each contain one typeface throughout, with this face varying from map to map. Maps Six, Seven, and Eight each include two or three type variations. The variations incorporated into these eight maps are only a few of the many which could have been tested; they were chosen in order to answer some urgent, practical map-making questions. These questions were specifically directed to an audience of adolescent map users, and included:

1. What is the difference in searching a map with names set in all-capitals and searching one set in the same face, but in capitals and lower-case?
2. What is the difference in searching a map set in a homogeneous stroke-width sans-serif face, and searching one set in a variable stroke serif face?
3. What is the difference in searching a map with names set in a light face and searching a map with names set in a bolder face?
4. What is the difference in searching maps containing all names set in the same typeface, and maps containing mixed typefaces?

While there were only eight maps, there were fourteen tests, since some of the maps could be searched in a variety of ways.

In order to find out about the type variations that might affect the searchability of the entire map (Part One), the six-name search task was used. A subject was timed until he found six names on various maps under a number of different conditions, including typographic variation on the lists searched from and on the maps themselves. In contrast, search times for individual names were measured (Part Two) while subjects searched for one name at a time, the one-name search task.

There was an additional variable which seemed to be relevant to an analysis of cartographic type variation: the possibility that expectation[1] may affect the ease with which names can be found on a map. If the searcher expects a name to appear on a map in a particular typeface, will this expectation also affect search time? An attitude of expectation was controlled by having subjects search from

Figure 1. Black and white reproduction of map used in testing.

two forms of lists: (1) from typewritten lists (since the names on the map are hypothetical, this can be assumed to be a "no expectation" condition); (2) from lists set to match the type in which the name appears on the map (subjects could thus be assumed to have an expectation about the appearance of names on the map.)

PART ONE: *Searching an Entire Map—Six-name Search Tasks*

There are three kinds of tasks involved in searching an entire map, and we are concerned with their effects on search-time measures (Table I):

Task One: Effect of typographic variation when all names on the map are set in one style of type (Tests 1–5).

Task Two: Effect of typographic variation when the names on the map are set in *more than one style of type* (called a mixed-type arrangement) and the searching is done from a typewritten list (Tests 6a, 7a, and 8b).

Task Three: Effect of typographic variation when the names on the map are set in *more than one style of type*, and the searching is done from *a list set to match the map type* (Tests 6b, 6c, 7b, 7c, 8a, and 8c).

Task One: Homogeneous Type Style (Tests 1–5)

While there is considerable variation in the amount of time it takes individuals to find a total group of six names on a randomly searched 140-name map, modal values do emerge. Frequency distributions of search time responses are near-normal for all tests, though there is the right-skewing that might be expected from the open-ended nature of the task. Medians are therefore usually somewhat lower than means. Table II summarizes pertinent data for Tests 1–5.

From the appearance of the summary statistics and the graphed ranked means (Fig. 2), it is clear that there are no major differences among the five type variations tested, as these differences affect the search time for six names. The largest difference existing in this group is that between Tests 1 and 3 (Monsen Light all-capitals versus Times Roman all-capitals), but a "t" calculation shows that this difference is not statistically significant at the .05 level.

On the basis of these results, two concluding statements can be made:

1. Using the rather ordinary typefaces tested, it is found that no tested type variation significantly speeded or retarded search. In fact, from this particular experimental situation we can say that if the subjects are presented with this map-type arrangement, it will take most (55%) of the subjects two to four minutes to locate any six names.
2. We might further conclude on the basis of this testing that if ease of search is a consideration in map-making, cartographers can feel relatively free to make type choices from a rather wide spectrum of available type. This is *not* to say that all of the type tested is equally "legible"; perhaps if the task had required that subjects turn the map away and accurately re-spell names, or try to remember what names they saw, or some other different (and equally reasonable) map use

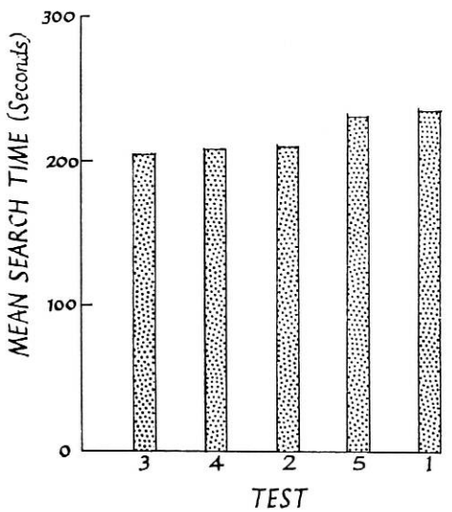


Figure 2. Mean search times, Tests 1 through 5.

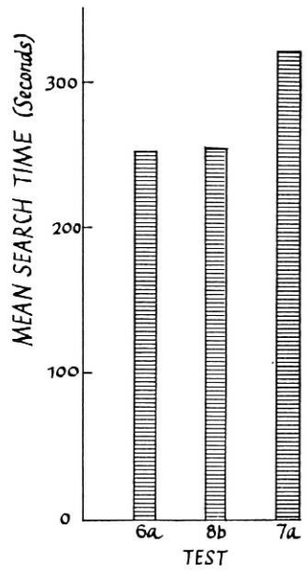


Figure 3. Mean search times, Tests 6a, 8b, and 7a.

TABLE II. *Summary: Mean Search Times, Task One—Tests 1 through 5*

Test	*No. of Ss*	*Range*	*Mean* (*all in seconds*)	*Std. Dev.*	*Median*
1	37	116–600+	234*	100	205
2	41	55–511	211	101	194
3	39	93–485	206	88	180
4	70	42–623	209	102	190
5	60	84–600+	232*	104	222

*For Tests 1 and 5, the means were calculated omitting the incompleted tests, there being one in each case.

TABLE III. *Summary: Mean Search Times, Task Two—Tests 6a, 7a, 8b*

Test	*No. of Ss*	*Range*	*Mean* (*all in seconds*)	*Std. Dev.*	*Median*
6a	29	83–645	253	109	250
7a	56	51–600+*	323	157	311
8b	30	90–600+*	255	98	248

*Means were computed excluding incompleted tests; there were two of these in 7a, one in 8b.

task, our findings might have been different. This conclusion is *task-specific.*

Task Two: Mixed-type Maps, Searching Done From Typewritten Lists (Tests 6a, 7a, 8b)

Search times have increased considerably in this situation (see Table III and Fig. 3). Apparently it takes a greater amount of time to search a mixed-type map than it does to search a single-type map, when there is no advance information or expectation on the appearance of the target names.

The mean search time for Map Seven is extraordinarily high; we note that while Maps Six and Eight contain two type style variations, Map Seven contains three. Exploring the effect of this additional type variation statistically, we find the results to be borderline rather than definitely conclusive. They are, however, strongly suggestive. Future research on this particular matter might be exceptionally valuable; the cartographer should know fairly precisely how much search difficulty he will induce with each additional category of type.

Task Three: Mixed-type Maps, Searching From Lists Set to Match Map (Tests 6b, 6c, 7b, 7c, 8a, 8c)

For these tests, search times have dropped markedly from Task Two, and they are generally below Task One as well. Test 8c emerges as a notable exception.

Clearly, an expectation of the exact appearance of the target name facilitates search, no matter what the typographic conditions. With the exception of Test 8c,[2] all of these search times are below those for any other tests.

Looking at the graphed mean search times for *all* tests (Fig. 5), the three kinds of tasks or testing conditions can be seen to group, with the exception of 8c. Discarding the 8c results for a moment, let us find out if there is a statistical basis for this apparent grouping. Clearly there is a common-sense basis for doing so, since the three tasks had already been distinguished from one another. Arranging the test mean scores in three groups (Table V), and then performing an analysis of variance using these mean scores, we find that $F = 24.4$ and conclude that there is a significant difference among groups above the .01 level.

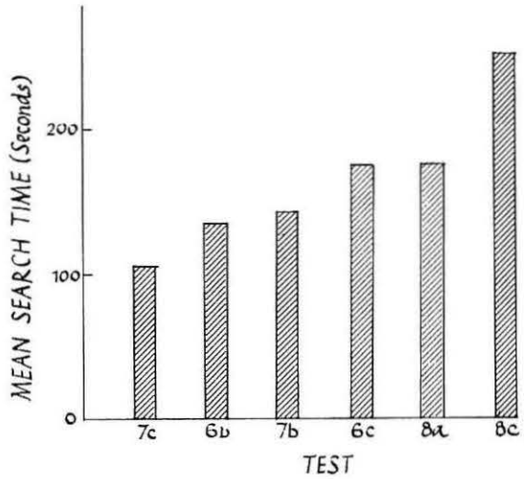


Figure 4. Mean search times, Tests 7c, 6b, 7b, 6c, 8a, and 8c.

TABLE IV. *Summary: Mean Search Times, Task Three—Tests 6b, 6c, 7b, 7c, 8a, 8c*

Test	*No. of Ss*	*Range*	*Mean* (all in seconds)	*Std. Dev.*	*Median*
6b	30	52–341	132	62	118
6c	32	66–440	174	74	165
7b	30	39–352	142	77	127
7c	29	27–273	102	52	94
8a	53	35–600+	176	95	248
8c	29	109–600+	242	99	256

TABLE V. *Test Scores Arranged in Groups, by Task*

Task One Homogeneous Type		*Task Three Mixed-type Maps Set List*		*Task Two Mixed-type Maps Typewritten List*	
Test	*Mean Search Time*	*Test*	*Mean Search Time*	*Test*	*Mean Search Time*
3	206	6c	174	6a	253
4	209	7b	142	7a	323
2	211	7c	102	8b	255
5	232	8a	176		
1	234	6b	132		

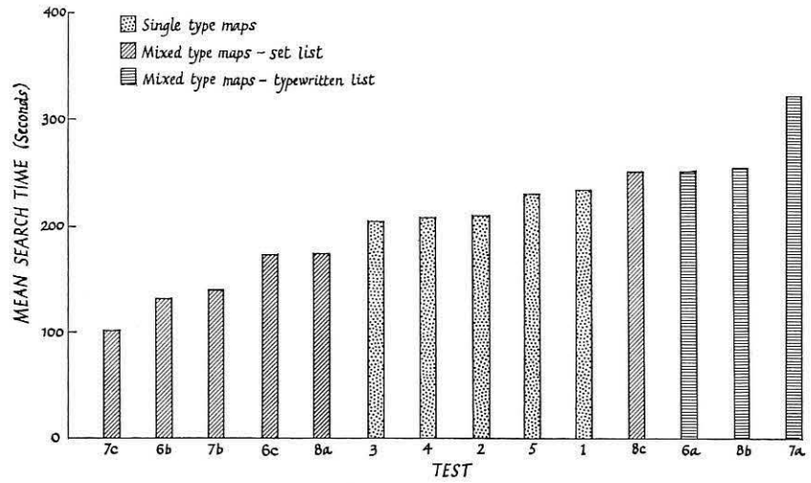


Figure 5. Ranked mean search times, all six-name tests.

Effect of Expectation on Search Task

We recall that in text legibility research considered in previous articles, differences among type conditions (with speed-of-reading measures) were often considered to be of practical and statistical significance when they were of the order of 5–15%. We were not expecting large differences to emerge from speed-of-search measures, given the enormous variation in individual search patterns. In fact, none were detected in this testing situation, using the given type variations. Yet, in spite of the great within-test variation, very noticeable general patterns do emerge. The difference between finding six names on Map Seven, Test 7c, and six names on Map Seven, Test 7a, is of the order of 300%! The map has not changed, the type has not changed, and the quality of the subjects has not changed. *Only the searcher's expectation about target appearance has changed.* The presence or absence of this expectation, apparently, has far more to do with success in finding names on the map than does any type variation tested.

In the realm of common sense experience, the role of expectation is familiar. When one approaches a reference map, it is very rare that there would be no expectation at all about the appearance of the name sought. The user has read or heard of a town or city—

from the context he makes certain guesses about the nature of its size or importance. A child, of course, would have less such expectation.[3]

In the process of searching for a target name, most of the total search time is spent in rejecting non-target names. Neisser has shown that the rejection of non-target names is a less complete process than is the ultimate recognition of target names.[4] That is, one may reject a name as, "that's not the one I want," without being able to report what the name actually was. There seem to be several levels of processing which may be carried out; if a preliminary processing will give the map user the information he needs, he does not carry the activity further, but goes on to another portion of the display.

From Task One it was concluded that there was no typographic form which was particularly superior to any other in providing cues which would speed the rejection of non-target names. We also observed, in the course of day-to-day testing, a possible explanation for this. When the subjects searched, they very often moved either their index fingers or the grease pencil lightly over the surface of the map. They were not asked to do this, but it seemed a natural response, and it proved helpful to us in observing search patterns. Generally, the course of the finger was a smooth, nearly continuous movement. It would stop momentarily when the subject thought he had found the target name. If he had, the brief pause was converted into the cross-out-the-name response. If he had made an error, he would continue (sometimes after re-checking the list, but sometimes after what appeared to be an internal check). The major point is that the error pauses were most often made when the "error" name had the *same initial letter* as the target name. Both experimenters observed this consistently. It is worth noting in future research, for if the initial letter should be an important cue to aid in deciding whether to "reject" or "examine further," it is fairly easy to understand why Tests 1–5 produced such similar results. Word form (i.e., the shape of the word when it is printed) becomes of little consequence; the serifs, which are thought to unite the word into a unit, are not particularly useful. Levin[5] found that beginning readers rely heavily on the information contained in the first letters of words. In a sense, the map user is more like a beginning reader than he is like the skilled reader of text. This is especially true when all the names on the map are unfamiliar to him, as they were in this testing situation.

But consider now quite another basis for rejecting non-target names. This research indicates that names can be very quickly and thoroughly rejected on other than a letter-by-letter basis. The basis for rejection is the appearance of the name, not its content. Search-time data provide evidence that a non-target name will be far more quickly rejected if it is in a form which the subject knows is not that of the target name.

By providing the searcher with an expectation about the form of the name (Task Three), we have greatly reduced the number of names on the map which he must subject to a more thorough processing.

Theoretical Search Times: Relevant versus Irrelevant Targets

We can examine our data in more detail to see what quantitative relationships exist among search times in different levels of processing. We can use the terms "relevant" and "irrelevant" targets in this way: *Irrelevant target* = a name set in a perceptibly different typeface from that of the target name. *Relevant target* = any name set in the same typeface as that in which the target name is set.

First, we can assume that an average processing rate for any relevant target can be calculated by using the mean search times obtained from Tests 1–5. The mean of these five means is 218 seconds. Since there were 143 relevant names on each map, and in searching for six targets we can consider the entire map a target which must be processed,[6] this gives a total of 858 names to process. We then find a processing rate to be .254 seconds per relevant name (since all names are set in the same face as the target name, they are all relevant).

It seems reasonable to assume that under testing conditions where (a) there are irrelevant and relevant names on the map, and (b) the searcher knows in advance which face is relevant (i.e., he is searching from a set list) the amount of time it takes him to find the six names will not be proportional to the *total* number of names on the map, but rather, will be approximately proportional to the number of *relevant* names.

Calculating the number of relevant names for each of the 14 tests (multiply the number of names set in the same face as each target times the number of targets set in that face), and then plotting mean

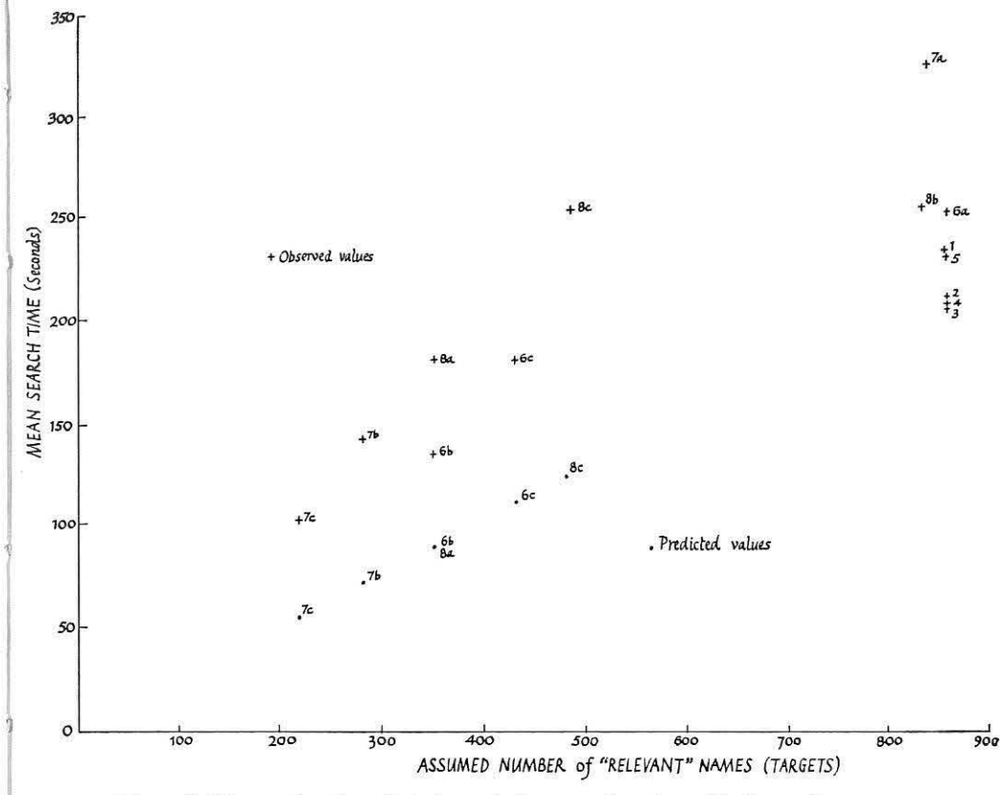


Figure 6. Observed and predicted search times as a function of "relevant" targets.

search times versus relevant names (Fig. 6) it appears that our assumption is true—the search times do vary almost as the number of relevant names. We also can see how our three testing conditions produce rather clearly different results on this graph.

In the calculation of an average processing rate, we assumed that the search times for Tests 1–5 fall on one point rather than being somewhat dispersed as they actually are. If this is a correct assumption, and if it is further assumed that on a mixed-type map the search time is proportional to the number of relevant targets, it should be possible to work backward and *predict* the search times for the mixed-type map as a check on this second assumption.

In order to do this, we can set up a table (Table VI) for all of the tests which involved mixed-type maps and set lists, showing the calculated number of relevant and irrelevant targets, as well as a

calculated theoretical search time (number of names which are relevant targets times .254 seconds per name).

The predicted search times are plotted on the graph (Fig. 6). While they vary in approximately the same fashion as the actual search times, they are consistently *too low*. This can be interpreted to mean that the processing rates for irrelevant targets must also be taken into account. The rate of irrelevant name processing for each test can be calculated from this equation:

$$RST + (IT)\ (IPR) = ST$$

where, RST = Predicted search time on basis of number of relevant targets
IT = Number of irrelevant targets
IPR = the unknown processing rate for irrelevant targets
ST = Actual mean search time.

Therefore, using the above data in this equation,

$$IPR = \frac{ST—RST}{IT}$$

we obtain the following irrelevant processing rates.

Test 6b: .083 seconds/name
Test 6c: .152 seconds/name
Test 7b: .127 seconds/name
Test 7c: .075 seconds/name
Test 8a: .179 seconds/name
Test 8c: .342 seconds/name

With the exception of Test 8c, the irrelevant target processing rates are found to be well below the relevant processing rate we assumed of .254 seconds/name. There are certain other conclusions which might be drawn from closer observation of these irrelevant processing rates.

First, the rates for tests conducted using Maps Six and Seven seem quite different from those found for the Map Eight tests. This suggests that the distinction between relevant and irrelevant targets when size is the factor has very different effects on search time than does the boldness difference on Map Eight. The reasons for this are certainly not clear, and warrant further investigation. Perhaps the bold face tends to command attention visually, though the subject is

TABLE VI. *Calculated Values: Relevant Targets, Irrelevant Targets, and Theoretical Search Time*

Test Number	*Number of categories of type on list*	*Number of categories of type on map*	*Number of relevant targets*	*Number of irrelevant targets*	*Predicted search time (in seconds)*	*Actual mean search time (in seconds)*
6b	1 (larger)	2	348	510	89	132
6c	2	2	429	429	109	174
7b	3	3	280	560	71	142
7c	1 (largest)	3	216	624	55	102
8a	1 (bold)	2	348	486	89	176
8c	1 (light)	2	486	348	123	242

intellectually aware that it is not relevant. Though this is conjecture, it is clear that processing rates have risen sharply for Map Eight.

Second, the rates for Maps Six and Seven are strikingly similar; it might be possible to assume from this that there is not very much difference in searching a map containing two sizes of type and one with three sizes of type. But how many sizes can occur on a map before the relevant/irrelevant processing rates are affected?

Further, if the rates for Tests 6b, 7c, 6c, and 7b are averaged, we find that the relevant rate is about 2.3 times the irrelevant rate. Working with target (numbers) type-size comparisons of 10–12, 10–14, and 10–18 points, and with a red/black distinction, Beller found that across all conditions average relevant rates were about twice those of irrelevant rates.[7] These factors are surprisingly close.

Third, the irrelevant processing rates for Tests 6b and 7c are nearly identical, while those of 6c and 7b are also similar. Looking at the tests, it becomes clear that there is a logical reason for this pairing. For Tests 6b and 7c, the lists contain only one kind of type; for each of the six target names, the subject can consider the same categories of type irrelevant. However, for Tests 6c and 7b, the subject looks for more than one kind of type; the criterion for irrelevant targets changes during the course of the six-name search task. Notice how the irrelevant processing rate then increases considerably. It apparently takes more effort to reject names when the criterion for rejection varies during the course of the task. We would expect such a practice effect.

The search task proved to be a useful one for analyzing and comparing type characteristics which affect the searchability of the map as a whole. The results of using search time measures for the one-name task, we found to be less directly useful. They serve primarily to underscore the importance of *all* factors related to cartographic lettering, not just the characteristics of the type itself. Environmental contrast, location on the page, location relative to other figure-ground patterns, and other factors affect the amount of time required to find any one name.

There is an additional reason for including these one-name research data; it is an attempt to forestall possible mis-application of conclusions from the six-name task just described. One may *not* say that, "it doesn't matter" what typeface a particular name is set in; the one-name search data show that the "findability" of a *particular* name may indeed be related to its typographic appearance. It must also be remembered that there are many more name-use tasks, besides search, which must be considered in cartography.

Table VII summarizes median search times (in seconds) for each of the names on the maps on which it was to be found. (Each subject was timed while he searched for three names, one on each of three maps.) There is wide subject-to-subject variation in search time, but the distributions of search times do show more or less clear modal groupings.

Results: One-Name Search

These data are difficult to discuss in a general way. One must constantly refer to the specific appearance and environment of the name on the map.

For example, "Andover" search times are low for all three maps. It happens to be in a position that was encountered early in the random searching process, and it would have had low scores set in almost any typeface, simply because of its location. "Mayfield," on the other hand, is found easily on two maps, but has rather high median search times on others. On Map Six it is set in the larger type; there seems to be no apparent reason why it should be one of the hardest names to find on Map Three, and one of the easiest on Map Five.

TABLE VII. *Median Search Times (in seconds) for the One-name Task*

Name	*Map* 1	2	3	4	5	6	7	8
Andover	6					12	13	
Barton	38		24		27			
Clinton	22					53	33	
Coalton			23		24	16		24
Gibbon	30		23				27	
Glencoe	18					61	50	
Halstad	20		18		22			
Kensington			36		14	54		
Mayfield			40		18	13		33

There are a few general things which can be said, however. Environmental typographic contrast seems important. There would be evidence for this, for example, in the contrast between search times for "Mayfield" on Maps Three and Six, or "Kensington" on Maps Three (no contrast) and Eight (considerable contrast). Sheer visibility does not place names in the shorter search times category—the names set in Times Roman all-capitals and the names set in Venus Bold Condensed tend to fall about in the middle range; these would seem, *a priori*, to be the most visible type arrangements.

Within the range of type sizes tested, the names set in the largest faces are more easily found than those set in the smallest faces. On Map Six, for example, "Andover," "Coalton," and "Mayfield" are set in 10-point type, while "Clinton," "Glencoe," and "Kensington" are set in 5-point type. The median times for the 5-point names are 53–61–54 seconds. For the 10-point names, the medians are 12–16–13 seconds. In this range, a factor of approximately two for size increase has apparently produced a factor of four reduction in median search time.

Search patterns affect individual name "findability." There are preferred locations, which might also be termed more "accessible" locations. Search patterns were carefully observed during the course of the testing, and there were a few which were most often used. Most subjects started to search either in the Dover-Allenton-Mayfield area or in the Andover area. (Few of the names in other areas had

more than two or three search times under ten seconds.) Virtually no one started in the upper-left hand corner, as might perhaps have been expected if this had been a normal text-reading situation. Figure 7 shows typical patterns of search movement.

Various configurations of the brown-green-blue-white base map affected search patterns noticeably. Searchers tended to confine themselves first to a white area, then to a brown. Names which didn't fall clearly into one or the other tended to be ignored. This situation was accentuated by another search characteristic; names seemed to be examined in five- or six-name clumps, with the subject checking these names as a unit, then moving on to another clump. A name falling between two of these clumps (usually these were related to background) tended to be overlooked repeatedly. "Glencoe" was such a name. The names to the left of it, on the brown, were examined as a group, and the names to the right of it on the green and white were also so examined. "Glencoe" just happened to fall between two natural groupings in the search pattern. "Barton" also seemed to be in such a position.

While the one-name testing did not tell us a great deal that is immediately useful, it did point up how very complex is the relation between the typographic characteristics, the environment in which they occur, and the search process (or any other task) being used. The appearance and utility of the type on a map can be assessed only in the context of the actual position of the type on the map. Relationships seem to be more important than any absolute type characteristics.

Overall Conclusions

1. For random search of the five maps containing only one typeface, the typographic variation from map to map did not produce a significant effect on the average search times (six-name task). It seems that the rather ordinary typefaces tested are all about equal in "searchability." The serifs on the Times Roman face did not seem to speed search; the lightness of the sans-serif Monsen Light face did not impede it, nor did the boldness of the Venus Bold Condensed face. The four-point variation in type size from Map One to Map Five had no significant effect on search times.

Given approximately equal search times for two tests which they

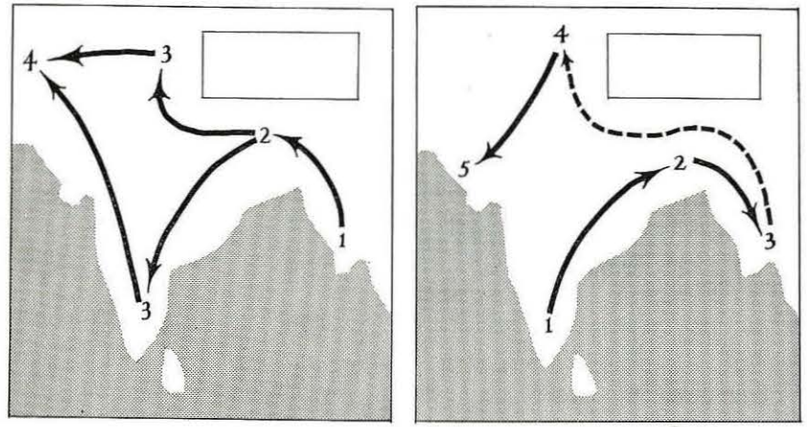


Figure 7. Typical patterns of movement during search.

had taken, subjects often *reported* that they felt differences in the ease of search, but approximately 50% would choose each of the equal-time tests as "easier." Only when differences approached the order of 30 seconds did subjects consistently pick the shorter test as "the easier."

2. On a mixed-type map (here with two or three different typefaces per map), search is slowed if the user has no correct expectation of the appearance of the type in which the target name will appear. This is the case when he is searching from a typewritten list. That is, if six names are searched for (at random) on a one-type map, and the same six names are searched for on a mixed-type map, search times will be conspicuously longer for the mixed-type map.

3. On mixed-type maps (again, two or three faces per map), search is *greatly* speeded if the user has a correct expectation of the typographic characteristics of the target names. This is the case when the subject searched from a list set to match the map type. There may be as much as a 300% difference in the time needed to find six names on the same map, depending on whether or not the subject is searching from a set list (compare mean search times for Tests 7a and 7c).

It seems that when a subject has a rather specific expectation about the appearance of the target name, it is almost as if the number of names on the map had been reduced to include *only* the names set

in the target face ("relevant" names). The search thus takes proportionately less time. The preliminary perceptual-cognitive process which separates the map into "relevant" and "irrelevant" targets takes very little time, compared to the amount of time it takes to decide that a particular name being examined is not the target name. Certain type variations seem to lead to almost spontaneous relevant-irrelevant categorization (as for example, red type versus black type), while other variations are more difficult (10-point versus 12-point type). If the map searcher has an expectation that the target name will appear in a particular visual category, and if the names on the map appear to him to be in distinctly different visual categories, his search will be greatly speeded. On the other hand, if he has not formed an expectation, or worse, has formed an incorrect one, his search will be impeded.

4. When the times are recorded for the one-name search task, it is found that the typography of a particular name is of less importance than are a great many other factors, including figure-ground environment, location on the page, typographic environment and contrast, and so on. Thus, while our data from the six-name search task have shown that it is possible to make general probability statements about the searchability of the *entire* map, it is not possible to do this for an *individual* name.

This study has attempted to throw light on some aspects of cartographic typography, with particular attention to the matter of selecting a task which might be expected to relate to conceptions of cartographic legibility. Search has proved to be a useful, if limited, task for this purpose. It seems clear at this point that text "reading" and map "reading" are not similar insofar as the use of type is concerned, and that results of research in the former cannot be directly applied to the latter.

1. In using the term "expectation" here, we are referring to a very specific expectation of the physical appearance of the type; there is always present a *general* expectation of the letter shapes and the total word shape, but in this discussion, the use of the term "expectation" is limited such that, for example, a subject would know that the target name would occur in bold, black letters of the largest type size, and so on. It is assumed that general expectation would be the same for any one name under all testing conditions.

2. An explanation for the very high 8c scores became apparent during the testing, as we observed the subjects search. Although the subjects *knew* they were looking for the "light" or "thin" or "little" names (as they put it), the bold lettering so commanded their attention that they frequently inspected it in detail, even though they knew they didn't have to.

3. It is interesting to note that in pre-testing with a group of adults, all college graduates, they found the random-search task rather more annoying and stressful than the children did. Apparently the children expect less redundant information on a map, and their ordinary searching activity is probably of a more nearly random nature.

4. Ulric Neisser, "Visual Search," *Scientific American*, CCX (1964), 94–102.

5. Gabrielle Marchbanks and Harry Levin, "Cues By Which Children Recognize Words," *Journal of Educational Psychology*, LVI (1965), 57–61.

6. One does not, of course, always process every name on the map before finding the target name, but since we assume this across all testing it will cancel out in the calculation of rates.

7. Henry K. Beller, *Stages of Processing in Visual Search* (Unpublished doctoral dissertation, Brandeis University, 1968).

Comment: Design Education

Arthur J. Pulos

There is a fresh wind blowing which promises to dissipate further the original concept of design education as the preparation of artists for industry. Despite the fact that industrial design has been primarily concerned for years with product aesthetics as a means of attracting buyers, there is evidence that consumers are demanding a deeper satisfaction from the products of technology. Manufacturers are beginning to press their liability for product safety and service on to the designer of the product. Therefore, if it is to continue to have relevance, design education must reaffirm its humanistic base.

Most efforts to do this have been delayed or confounded by the particular character and influence of two establishments, one academic and the other professional. In order to find a home in the academic landscape, design found it necessary to align itself with an established academic discipline. In most cases, design came to rest in schools or departments of art consistent with the conventional image of the designer as an artist. In other instances, it found a home in architecture, engineering, education, liberal arts, industrial arts, and home economics—taking on in the process the necessary academic coloration of its host. More often than not, design found itself in a fortress of specialized learning separated by a pedagogical moat from other disciplines. (It is peculiar to institutions of higher learning that they are organized traditionally along the disciplines of specialization.)

However, the concept of the university as an enclave of intelligence and a mausoleum of culture is changing to that of a dynamic technocultural plenum chamber for society—with citizens of all ages flowing in and out at every level as consumers and producers of knowledge and experience. It is not unlikely that the "unreal" world of education may become indistinguishable from the "real" world of practice as distinctions between student, faculty, and designer become meaningless. The repressive stratification of students into learning layers through which

they must claw to reach the surface of academic respectability may well disintegrate into an intercellular form of learning environment. It is inevitable that a workable system of internship for young designers will become established. By it, practicing designers will no longer be forced to rely upon student skills as the only measurable quality in considering them for employment.

Criticism Without Equality

In the second instance, the professional establishment has found it difficult to abandon its image of the design school graduate as a trained technician who must be reeducated to "think right." Not entirely unjustly, it has reacted to the fact that without agreed upon minima for design education, the quality from school to school would vary widely. It failed to realize that there were no minima for practice upon which educational minima could be based.

For nearly fifty years, designers have been living in a mechanized Garden of Eden wherein, like Adam in an affluent paradise, they have been as comfortable physically as they have been uncomfortable ideologically. It should not be surprising that this discomfort is beginning to influence the character of design education.

There are also other factors developing which counterweigh the pressure for academic and professional conformity. Dr. Maynard Hutchins has expressed a deep concern about the "enthusiasm aroused by more and more incomprehensible technology," which "serves to endanger freedom, law, and democracy" and warns that "prospects of humanity turn upon its ability to find the laws that will direct technology to human uses." Design students of the next generation will be more carefully attuned to a Design Ethic which holds human worth above material value and will insist on controlling and redirecting the flow of technology so as to benefit the whole of society. The design student will insist that design education establish a humanistic base which places more emphasis on fulfilling the physical needs of society rather than embellishing its products. . . .

Even now the student is disenchanted with product aesthetics which makes it awkward to suggest to one that he concern himself with selecting just the right shade of avocado green in class when his draft card is burning an olive green hole in his pocket. He is reluctant to undertake the shape of a blow-molded bottle or the graphics of a gasoline station sign when he feels that he may be contributing to the physical and visual pollution which plague the contemporary environment. And despite exhortations to create elegant automotive forms, he cannot forget

the fifty thousand persons who will die over the year in motor vehicle accidents. There is, therefore, an emerging Design Ethic which will redirect the emphasis of design education.

To Serve the Public

Design education of the future will not continue to confuse personal expression with public service. It will accept, perhaps reluctantly, the fact that aristocratic aesthetics have little value in the democratic world of design service. Both arts and man have been abused by the once prevalent notion that art is a commodity which can be spread over an object in order to imply quality which may, in fact, be absent. . . .

This is not to say that generations to come will not derive aesthetic value from utilitarian products of today. The culture of any civilization is inescapably bound into those objects which have served it most directly. Aesthetic value may be, in fact, the residue after functional purpose has evaporated. With good fortune, design education of the future will preach away from the queer game of eclecticism by which objects become enshrined as cultural artifacts in a museum before they have demonstrated their validity.

Mass vs. Class Products

For several decades, both practice and education for design have tended to confuse *mass* products made in great quantities with *class* products which are unique. The two have very little in common. In spite of the fact that early machines and products were once rare objects to be cherished and treasured, they are today available in such runaway quantities that the problems of design have shifted from those of production to those of consumption and control of product flow. Class products are those conceived for the conspicuous consumption of human energy either for ostentation and authoritarian display or for aristocratic indulgence. Mass products, on the other hand, tend to be temporary rather than permanent in nature and designed to be made as economically as possible, to serve their purpose well and then to disappear rather than persevere. Design education in the future will be relieved of the burden of teaching students to prepare costumes in order that mass objects may masquerade as class objects. Rather, objects conceived to be made in large quantities will be conceived as consumable elements in a larger service system.

The new design education will be intimately concerned with the problem of fitting products to people. Static and dynamic anthropometry and ergonomics which have been to this point largely reserved for the

development of space and defense hardware have produced a mammoth body of raw information which is often too specialized to be of much use for anything other than its original contract purpose. However, as this is culled and reduced to principles, it will provide more useful guidelines for designers than it does at present.

There is some question whether that traditional closed loop of learning, "learning by doing," will play as important a part in design education in the future as it has in the past. While repetition of techniques which are rooted in artisanship produces a hierarchy of increasingly elegant objects, it also encourages a state of impotence which cannot condone mutations and offers no license for experiment. Perhaps the new design education will encourage the concept of "learning by undoing." That is, by questioning every aspect of the design problem and the establishment in which it operates, designers may be able to strike out in a more useful direction unencumbered by old baggage. Moreover, the designer may no longer be able to "do" what he can conceive. . . .

Total System

The greatest change ahead in design education lies in its realization that an object-oriented scheme of education must give way to a system-oriented concept. Objects will be taken as components of a larger order conceived by man to provide an indispensable service. While most products of today are also part of a system—that system is, in fact, an open structure. That is to say, products entering at one end of the system come off the other end as disposable waste often with too little value to encourage reclamation. As a result they penalize society by despoiling matter which had been once carefully reclaimed and also be contributing to the general pollution of the environment. . . .

The designer of the future will have to work within an ethical dualism which balances public and private purpose. He must direct industry to do the most good for the whole, and at the same time protect the individual from that faceless anonymity which threatens him.

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Book Reviews

Jan Tschichold, *Treasury of Alphabets and Lettering*. New York: Reinhold Publishing Corporation, 1966. (Originally published in Germany, *Meisterbuch der Schriff*. Ravensburg: Otto Maier Verlag.) 234 pages (175 pages of illustration). $16.50.

Tom Gourdie, *A Guide to Better Handwriting*. New York: The Viking Press, 1967 (London: Studio Vista, 1967). 96 pages. $1.95.

Dana Atchley, *ABC Design*. New York: George Wittenborn, 1965. 30 pages of illustration, some hand-written text. $9.00.

L'Harl Copeland, *Design of the Roman Letters*. New York: Philosophical Library, 1966. ix + 66 pages, illustrated. $3.75.

Eric Lindegren, *ABC of Lettering and Printing Types*. New York: Museum Books. Produced by Eric Lindegren Gratisk Studio, Askim, Sweden. *Volume A:* 150 pages of illustrations, 4 pages of text, 1964. $12.50. *Volume B:* 293 pages of illustrations, 30 pages of text, 1965. $15.00. *Volume C:* 133 pages of illustrations with text, 1965. $15.00.

Jan Tschichold, *Treasury of Alphabets and Lettering.*

A really splendid production, with 170 illustrations all carefully arranged by the author, many the same size as the originals. It is stated that some are even better than their originals because of the artistry and understanding of the author who touched up the prints; I well believe this to be true. The illustrations are, in fact, the pick from lettering throughout the centuries, and no one is more qualified than Jan Tschichold to put before the public such a selection.

The text, sincere as it is, cannot match the illustrations. Indeed, this would not be possible. But need one rely so much on superlatives? Can one expect to be understood if one substitutes the word "beautiful" for a more reasonable description of qualities. Contrary-wise in describing that which does not give one pleasure, must one always speak of it as

being in bad taste? After all, much that is illustrated was done as daily work with the humble motive of earning a living.

Amongst the over enthusiasm there is a very great deal of sound sense; for instance, encouragement of the careful study of the roman letter, as prerequisite for all rational activity in letter design. At the same time, I find the author's condemnation of imagination in relation to the drawing of letterforms deplorable. Never has there been such a need to meet developments in printing techniques as there is today. Imagination alone can bridge the gap. However, to be fair he does say —a little grudgingly—that imagination can be excused if one has spent half a lifetime in the study of letterforms. He may be right at that.

In any case, this is a fine book, beautifully produced by one of the really great letterers of today, and it should find its way onto the shelves of all those who are interested in the subject.

Tom Gourdie, *A Guide to Better Handwriting.*

An excellent book for those who wish to tackle the formidable task of changing their scrawl to italic or Chancery script. The book is fairly well printed, considering the price, and the illustrations are copious, dealing as they do with almost any question that might arise in the mind of one who comes anew to this form of writing. It is, therefore, all the more of a shame that the book itself is not an exemplar of layout. The whole effect is cheapened by the miserable margins—giving the appearance of a book that has already been ruined by cutting and rebinding.

Then, of course, there is the whole question of what is legibility, because it is stated again and again that this is the reason behind learning Chancery script. But we are manifestly wrong if we think this is the hand that wears well. We all have friends who write to us in their tasteful—but illegible—Cancelleresca. No hand is more prone to make all letters similar with speed and laziness.

It is difficult to see how this book could be bettered apart from a more lavish use of paper. It may be one of the last to preach about the italic hand. Perhaps now we can at last expect a book on a form of letter that has features built in to withstand the ravages of speed and our lazier moments. For my money, I would think again of the Carolingian scribe.

Dana Atchley, *Abc design.*

A nice little book with bold illustrations in grey and red and in pleasant contrast; titles are hand-written, not calligraphied. Nevertheless it doesn't amount to very much. It is described by the author as "A modular alphabet," but I think she is cheating because you cannot see where to take the letters apart, as the modules over-lap.

L'Harl Copeland, *Design of The Roman Letters.*

The first chapter is devoted to the roman letter conceived as the result of mathematical formulas or, as the author says, dynamic symmetry. Unfortunately this idea has never appealed to me, and I have an unhappy knack of visualizing many hundreds of letter shapes that seem to carry a unity of design which the author would exclude. He speaks of that which does not follow the theory as being of poor taste. The theory of the golden mean and other root proportions has to be felt rather than applied in any art form. That there is something in it, I concede, but the arguments are too exclusive to carry any force. Vision is all important in letter design—we must not allow it to be narrowed by the intellect.

In contrast, I find the chapters on the Celtic and Middle Ages wide in their scholarly approach. The feeling Mr. Copeland has for uncials, Carolingian, and Gothic belongs very much to the seeing eye.

The last chapter is on the present period and, like the first, is too theoretical for serious artists to take; the language is altogether too dogmatic. The illustrations in this chapter reveal the paucity of the approach.

Eric Lindegren, *ABC of Lettering and Printing Types.*

A trilogy on lettering and types. "A" is devoted to lettering and includes calligraphy, engraving (wood and metal), letter-cutting (wood and stone), drawn and painted letters. "B" is devoted to printing types. "C" is an historical survey.

All three are quite superbly produced. Color enhances many of the illustrations, apart from making the whole edition desirable and immediately exciting. I have been the proud possessor of "A" since it came out, and never tire of looking through it and showing it to my friends. "A" has a short introduction to the pen and the roman letter, but otherwise the illustrations are encouraged to speak for themselves. It is essentially a book for the eye.

"B," being of typefaces, is inevitably the least stimulating of the three, but there is an interesting section of text repeated nearly 200 times, each time in a different face—which should, if anything does, show the layman that not all alphabets add up to the same thing.

"C" starts with Egyptian hieroglyphs and proceeds through all developments of the alphabet to the present time.

Never before has so much material been assembled and all of such high quality. The dominant factor is in the choice of material by the author whose feeling for lettering and letterforms is renowned. Such authority can only come from the mature practitioner. These three books should find their way into every school to counter-act the many "dry as dust" alphabet books.

David Kindersley

David Kindersley (Chesterton Tower, Chapel Street, Cambridge, England) is a designer of letters for many media—calligraphic posters to street-name alphabets. A pupil of Eric Gill, he is best known for his stone cutting and, most recently, his invention of the Optical Letter Spacer.

Herbert Spencer, *The Visible Word*. London: Lund Humphries in association with the Royal College of Art, 1969. 107pp. 50s (New York: Hastings House, $7.95).

The author examines the past and the present situation in research and in printing against the latest methods of recording, broadcasting, and distributing ideas and information. This brings him very soon to the main object of his plea: "*that research should concern itself not merely with the printed word but with the visible word in all media and with the growing need for messages to be designed so that they may be freely converted from one medium to another over which the originator may have no control.*" This clearly suggests the extent to which format even more than typefaces is to be the determining factor in design and research in the future. It is further aptly illustrated by the fact that this opening of new perspective to research is presented in the individual typographical style well known to the readers of Herbert Spencer—and, more precisely, by the fact that this style is not in the least impaired for being set in IBM Multiprint.

The bulk of this booklet (pp. 13–81) consists of the presentation, the illustration, and the discussion of the main themes in past research and

past practice in design. We need not recapitulate them here. Suffice it to insist on the fact that it is all designed in such a way that it will help researchers as well as designers. But it is far more important to give due emphasis to two other issues that will concern our readers in the future. Namely, (1) the new machines and methods enable, for some purposes, the authors to become their own "compositors"; (2) spatial arrangements, as well as other factors, which have been established as optimum for the printed page held in hand need now to be reconsidered in relation to images projected onto a television screen or microfilm viewer. These two facts invite some reflection. To put it straight: the study of calligraphic and typographic tradition will no longer provide all the answers to those who mistake a sense of tradition with a need for rules, alias ready-made solutions. Now, figuratively: all the new opportunities make one wonder if we are not near or even beyond a point where traditional values, as they are called, will appear as a "windjammer" compared with a hovercraft.

Fernand Baudin

Ruari McLean, *Magazine Design*. London: Oxford University Press, 1969. 354 pp. £5.5.0.

The publisher's blurb may well be right in stating that this is the first book to be published on magazine design in any language. Then it is most fortunate indeed that this first attempt was made by a talented as well as an experienced magazine designer. To study the design of a magazine intelligently, it is desirable to know many things that cannot always be discovered; for example, whose money is invested in the magazine, with what intended return; its declared or undeclared editorial policy; its printing quantity; etc. This would be a severe handicap indeed for many authors who are not designers but economists or sociologists. In the case of Ruari McLean it is obvious that he has come in contact with about all that is known not only on the aesthetics but also on the design and production of magazines.

If the medium (not the contents) is the message, then it could be argued that the design of a magazine is more precisely what influences our lives, rather than the editorial policy. This is admittedly a Mc-Luhanism, yet more may be said in favour of this one, since it is at least probable that magazines are more looked at than read. Thus, they

are far more a part of our daily cultural environment than a part of our spiritual nourishment. Such is not the point of view of the author, who is far more modest and practical, and not paradoxical in the least. For him the designing of a magazine is merely an extension of editing it—which is the normal view, of course.

Three hundred of the 354 pages are devoted to reproductions illustrating over 150 magazines: glossies, weeklies, specialists, art, design, and industrial magazines. The remaining pages of text are divided into separate chapters, each of them concerned with one of the essential problems of design which are afterwards illustrated: cover design, contents pages, sequences, color, and special cases (such as typographic headings, picture headings, use of photographs, etc.). Far from being a shortcoming, it is an advantage that the text is so economic that it could be read at one sitting. Which is not the same as to say that the experience of a lifetime can be swallowed at one gulp and digested overnight. This lifelong experience enables the author to stick to common sense, yet to add the proper weight and perspective. Instead of theories—which are remarkably and fortunately absent—the text is bristling with sound and practical advice on every aesthetic or technical aspect.

To recapture some of the essence of a magazine illustrated in the sequence section, the author shows up to sixteen pages from a single issue. Similarly, in the case of the cover design, different styles of the same magazines are illustrated. Each sequence of illustrations for a given magazine is further accompanied by that kind of factual and precise information which takes so much care and time to collect and to harmonize: places, dates, names of producers, designers, etc.

Magazine Design will be an abundant source of information for students and a monument to by far the liveliest form of printing in our time, and maybe in any time.

Fernand Baudin

Fernand Baudin (64 rue du Village, Bonlez par Grez-Doiceau, Belgium) is a consultant with Culture & Civilization, a publishing firm in Brussels, and is a lecturer at La Cambre (Brussels art school) and at L'Ecole de Lure, France. M. Baudin is *The Journal of Typographic Research* book review editor for Europe.

Correspondence

The editors welcome comments on articles, reviews, and letters that have appeared in the Journal. Communications should be addressed to the Editor, c/o The Cleveland Museum of Art, Cleveland, Ohio, USA 44106.

To the Editor:

The recommendations by Allen G. Vartabedian in the July 1969 issue of *The Journal of Typographic Research* (pp. 249–258) for clear discrimination of the Oh (alpha O) and the zero (numeric 0) especially in the use for computer line printers, cathode ray tube display, etc., will bring additional problems. The distinctive marks are not only necessary between the capital letter O and zero, but also between the lower-case letter o and zero.

I do not agree that these symbols as shown in Figure 2 on page 256 for the Oh [with a loop on the upper part] and the zero as an oval form can satisfy all requirements for the unique discriminability between the Oh, the oh, and the zero. The proposed Oh in a line of capital letters would always look peculiar and unusual. In an alphabet with a very high x-height the differentiation between the oh [lower case o] and the zero [as an oval] would not be big enough, especially if we use a condensed form of an alphabet in which the oh is also an oval.

The placing of a loop on the upper part will add legibility problems in very small sizes, especially if this character is generated by a screen on CRT. The loop itself (either placed on an O or zero) is too fancy, unclear, and blurring (Fig. 1).

Figure 1. Proposal by Allen G. Vartabedian.

Proposal

With regard to Optical Character Recognition (OCR) in the future, and to find simple solutions for the requirements of the technical developments, my suggestions for rapid distinguishing between the mentioned symbols would be to add a short horizontal line to the right on the upper part of the zero (Fig. 2). (It could be designed a little more narrowed than the capital Oh, but not necessarily.) Leaving the traditional form of capital Oh unembellished. To add this short line on the zero looks much more logical and not so calligraphic as the proposed loop on the upper part of the Oh.

This simple design would not change the common shape of the zero and would not bring an unusual stylistic element into the whole group of alphanumeric characters. It would avoid the current conflict in slashing either the Oh or zero. The recognition of such critical forms could be easy enough both for the human eye and for OCR.

Hermann Zapf
Bernhard Mannfeld Weg 24, Frankfurt am Main, Germany.

Figure 2. Proposal by Hermann Zapf to change only the zero.

Reply by Allen G. Vartabedian

The arguments set forth by Hermann Zapf concerning the pair of proposed symbols for distinguishing between the oh and zero (*JTR*, July 1969, p. 256) make evident the great need for the standardization of the styles for these symbols. It is quite clear the abundance of opinion is for the elimination of marking either the oh or the zero with a virgule. As to the alternatives there is some disagreement. Dirk Wendt would leave both symbols unmarked and use basic size and shape (round for oh and oval for zero) as the distinguishing characteristics.[1] Where this is adequate, such as when the symbols are defined by format or context, this is an acceptable if not preferable solution to the problem of distinguishing between the pair. Often, however, this solution is not adequate for discrimination. This is especially true where symbol presentation is degraded such as with CRTs, teletypewriters, or computer printers. Moreover, it is often not possible to use shape effectively because of the constraints imposed by dot-matrix size or type-body width.

The question remains as to which symbol, oh or zero, to mark and by what means. The proposed pair of symbols indeed do not encompass the discrimination of the lower-case oh—there was no such intention. However, they by no means preclude the discrimination of the lower case oh. Presumably we mark symbols only when it is necessary to do so, and generally in the use of lower-case symbols it is not necessary.

Distinction between the shapes of alphanumeric symbols is most needed when no supporting cues are available to help distinguish among the symbols. In the use of alphabetic symbols such cues are available because of the constructive redundancy of natural languages.

The great need for discrimination is between the numerals where (generally) there is no redundancy and between both letters and numbers when used in alphanumeric codes where there is far less redundancy than in natural languages. One should not use lower-case letters and numbers for alphanumeric codes because the lower-case letters have been generally found to be less legible than their upper-case equivalents.[2] Indeed there can be confusions between the lower-case oh and zero. But there are important confusions between the lower-case oh and the lower-case letters a, e, and c. Moreover, one should not use upper-case and lower-case letters together in codes because of the linguistic confusability between the two. Generally the sensible construction of alphanumeric codes involves the use of numerals and upper-case letters alone and hence the need to distinguish between the upper-case oh and the zero.

The lower-case oh as it is generally used in natural languages requires little need for discrimination from the zero, even in alphabets of tall

x-lines. However, where the lower-case oh must be made very discriminal, distinctive marks can be placed upon it. Standards organizations both in the United States and Europe are currently working on this problem.

The argument that the loop will add legibility problems (that it is unclear, and blurring) is simply refuted by the evidence presented in the article. As to the aesthetics of the looped oh in text, the reader can judge for himself from the sample texts presented in Figures 1 and 2.

There are several reasons why the zero should not be marked, especially in the proposed manner. First, the zero marked with a horizontal line at its top would bear a striking resemblance to the lower-case Greek letter sigma. Second, to mark the zero would be in direct contradiction to the proposed American National Standard for the "Presentation of Alphameric Characters for Information Processing"[3] which presents an oh and zero essentially identical to the pair of proposed symbols. The use of two conflicting strategies of placing a mark (line or loop) at the top of both the oh and zero would place us right back to the problem of placing a virgule through both the oh and zero.

Perhaps the most compelling argument for marking the oh and leaving the zero alone is that the unmarked zero is part of a well established international graphic set, namely the numerals. Not all languages have the problem of distinguishing between the oh and zero. In those languages there is no need to modify the zero and hence it would not be done. In that situation some language groups would have marked, and others would have unmarked, zeros—a not too optimistic prospect for increased international communication. Hermann Zapf makes the point quite well in saying that, "the increasing importance of numbers . . . should not be underrated, especially since they are the only characters which can actually be 'read' by all people of this earth, regardless of language."[4]

Allen G. Vartabedian
Bell Telephone Laboratories, Holmdel, N.J. 07733

1. Dirk Wendt, "O or 0?", *Journal of Typographic Research*, III (July 1969), pp. 241–248.
2. G. C. Kinney and D. J. Showman, "The Relative Legibility of Upper-case and Lower-case Typewritten Words," *Information Display*, IV (September/October 1967), 34–37.
3. Proposed American National Standard, "Presentation of Alphameric Characters for Information Processing," ANSI Document X 3.6.3/6, 1968 September 20, published in *Communications of the ACM*, XII (December 1969), 696–698.
4. Herman Zapf, "The Changes in Letterforms Due to Technical Developments," *Journal of Typographic Research*, II (October 1968), 351–368.

Figure 1. Sample text showing looped oh produced with a teletypewriter.

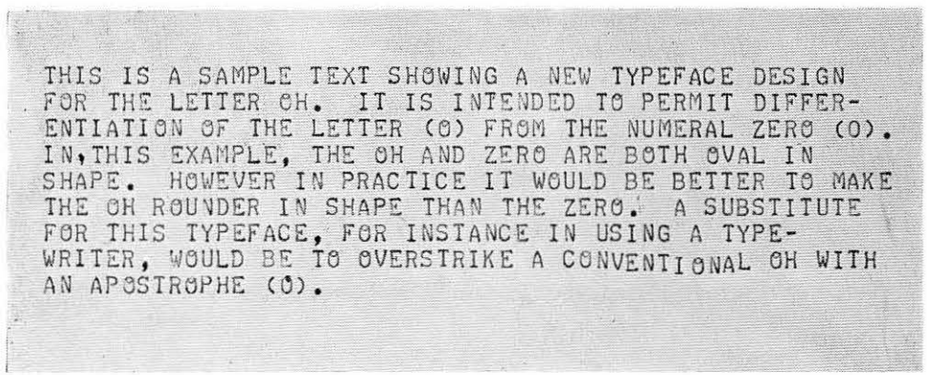
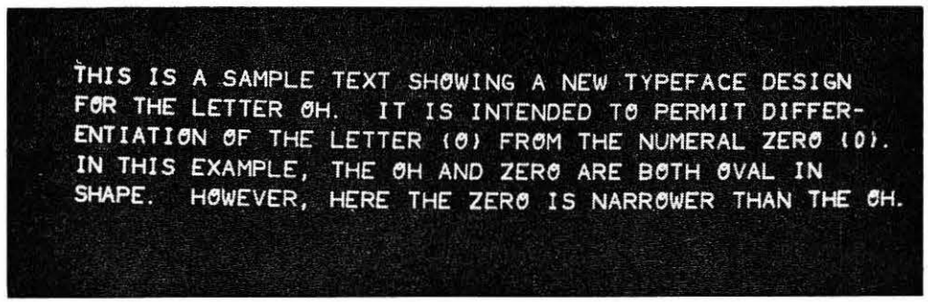


Figure 2. Sample text showing looped oh displayed on a cathode ray tube.



To the Editor:
I would like to respond to the comments by Hans Schmoller in his letter published in the January 1968 number of this Journal (p. 102).

Until the last century, writing and reading were the privilege of a few number of persons. The printing art, therefore, could remain a privilege of a few very cultivated printers. But as I am a human being living fully in the midst of the twentieth century, I just cannot and I would not be right in retiring to the refuge of personal aesthetics. Quite on the contrary, I feel responsible to the always increasing mass of readers and, consequently, to producers of printed matter.

I fully agree with Mr. Schmoller when he says that "the designer's task is to make new technologies his servant and he must not allow them to be his master." Nevertheless, he forgets that all technics, at the very beginning, had their imperfections; only through years of use did an aesthetic quality emerge. Two examples:

Concerning typewriters. Typewriters have been based—and surely will continue to be for years—on a fairly low aesthetic level due to the one-step unit system of letter width. However, recent modifications incorporating the proportional unit system considerably improve their typographic expression.

Concerning automatic character recognition. During the last ten years the concept of alphabets for machine reading has improved. Starting from the first states of very stylized letterforms which were hardly convenient to human visual requirements, more compatible solutions have been brought out during the last two years. I had the opportunity to design the OCR-B font, which still is to be considered as an intermediate phase, since the computers will be able, some day, to read all of our fine typographic faces.

It is, no doubt, difficult for an artist to feel compelled by a technology which restricts his freedom of expression. But if—confronted by this constraint—we simply refuse to collaborate, the modern world will continue reconstructing itself in spite of us—and without our help. If this occurred, within a few decades a small group of us would be living apart in a world of pure aesthetic style, exclusively reserved for the typography of belles lettres. And on the other hand would exist—in more or less haphazard form—the daily-increasing mass of published information. From a sociological point of view especially, who would refuse to acknowledge that the latter category is the more important area of activity for the designer?

Quoting once more Mr. Schmoller: ". . . otherwise we are back in the darkest nineteenth century." I believe, first of all, that his attitude is retrograde. It is as if he speaks from an ivory tower to which a certain typography and it advocates retire.

Engineers need aesthetes, technics need ethics. The two together create forms which may not compare with the richness of classical examples, but I consider today's expressions as transitory. We are all involved in a period of great mutation and gestation. Now, as in any period of printing history, we should not forget our most important goal: that every human being in this world should have the opportunity of reading the most appropriate typography for his individual and social needs.

Adrian Frutiger
23, Villa Moderne, 94 Arcueil, France

Editor's note: the "ethical dualism which balances public and private purposes" for the designer is also discussed by Arthur Pulos in his comments on design education, page 169.

To the Editor:
The papers by Barbara Bartz ["Type Variation and the Problem of Cartographic Type Legibility," *JTR*, III (April 1969), 127–144; "Search: an Approach to Cartographic Type Legibility Measurement," *JTR*, III (October 1969), 387–398] suggesting that search be the basis for measuring the effect of type variation in the cartographic context is particularly significant. The technology of cartography has gone from the use of hand lettering to electronic typesetting in some thirty to forty years and there remains a wealth of subjective opinion and conventional usage in the map making world held over from the days of the lettering artist. This cartographic folklore has frequently served to obscure the true purpose of map type. Undoubtedly, most cartographers select typefaces for their appearance when reproduced but Dr. Bartz has drawn to our attention indirectly that type is there to create an effect, to emphasize a feature or to hide it, and not for any inherent beauty in the face itself.

All type matter is not put on a map to be read at once. On many maps, particularly on thematic maps, it must be restrained, held in the background to supply information if and when required. As with all other type matter, map type cannot be isolated from the neighboring typefaces which occur, for example, in the map surround or in the facing pages of a book. Cartographers also have to use linear and areal symbols and to combine them with type and apply them in many colors. Both symbols and type matter must be read against a background

of other colors. The typematter has to be placed and read at all angles against a background of linear forms at all angles.

The placement of type and the selection of a form suitable to that placement against its background will have as great an effect on search as will the typeface itself, and I suggest that it is in this area that Dr. Bartz will have most difficulty in coming to meaningful conclusions. For example, town names on a map which is heavily covered by other similar names will probably stand out better if they are set in a condensed, fairly bold roman typeface than in a face of equivalent weight and point size but rounder. The blocky effect of the type plus the open space gained around the names more than offsets the possible loss in legibility by the use of a condensed face. However, a district or mountain range widely letter spaced should stand out better in an extended face than in a narrow face of the same size and weight. The eye is lead in the direction of the extended letterforms. Names consisting of two or more words indicating an extended feature are likely to be more legible if proportionately letter-spaced than if set solid. Names which read upwards to the right usually read more easily than names which read downward to the right. Names which read to points yet cannot be placed horizontally will be placed best if they follow the so-called butterfly wing pattern.

I have cited five common items of cartographic folklore handed down from the days of the engraver and lettering artist to which I would add one of my own. Sharpness of line, the so-called type quality, is a major factor. Detail on most maps is very small and fine. Line symbols can be reproduced down to .002-inch line width; typefaces are common down to 4-point and are used much smaller. The degree of fuzziness can be of paramount importance at such sizes.

It will be interesting to see what impact research of this nature will have on cartography. There is one problem. The public at large appears to like untidy, cluttered cartography. Possibly they enjoy the challenge of finding a place on a map. Maybe they feel that it is all very complex and they are getting more for their money.

J. A. M. Haddon, Chief Cartographer
Ontario Department of Mines
67 College Street, Toronto 2, Canada

Editor's Note

As a part of its overall coverage of current letterform research, *The Journal of Typographic Research* could perform a valuable services by publishing summaries of pertinent research in periodicals and special reports that might not be seen by Journal readers, and might be unobtainable after seeing a brief abstract reference. The summary below has been received from G. W. Ovink (Lettergieterij Amsterdam, Bilderdijkstraat 163, Amsterdam). The Journal encourages readers to follow Dr. Ovink's excellent example of sharing information on relatively obscure research reports. Summaries and related information should be addressed to the editor at the address given at the front of this number.

The Effect of Paper and Ink Gloss on Legibility

Light reflections from glossy paper and ink can seriously reduce reading speed and accuracy; readers actually experience them as disturbing. These are the findings of a study by H. Operbeck in the Institut für Medizinische Optik der Universität München and published in *Fogra-Mitteilungen*, the journal of Fogra-Institut (the West-German printing research institute), Bamberger Haus, Brunnerstrasse 2, München 13.

Five kinds of paper surface were compared: two high-gloss, two medium-gloss and one matt paper, each printed in three kinds of ink: high-gloss, medium, and matt. The "text" consisted of blocks of five lines each of twenty Landolt rings of 1 mm. diameter (which corresponds with the x-height of 6-point type). Subjects had to determine the position of a slit in the rings and speak his observations into a tape recorder. The observed positions were fed into a computer which compared them (by means of a program in ALGOL) with the real positions. The time taken to read each line was also recorded.
The size of the opening in the printed rings varied with the ink spread from between 0.130 and 0.145 mm. in the matt paper to between 0.145 and 0.160 mm. in the smoothest high-gloss paper. The position of the light source was such that the disturbing reflection was made to coincide with the reading area. The scores of all subjects, without exception, were found to be highest in all papers printed with matt ink; they do not differ to a considerable degree. The scores were lowest for all papers printed with glossy ink; next came those of the medium ink and then those of matt ink. Going from the glossiest paper to the matt paper, the scores for glossy ink become higher.

In a second part of the experiments twenty other subjects were asked to compare two papers at a time and to say which was found to be more agreeable; only one glossy, one medium, and one matt paper

being used, each printed with the three inks. The results were computed into a rank order of preference 1 to 9. Subjects were also asked whether in their opinion the reading of the rings was disturbed by gloss effects due to paper or ink. The high luminance of the glossy papers was felt to be disturbing. All subjects thought the matt papers gave the best results; this in spite of the good results in terms of legibility of the glossy papers with matt ink in the first part of the experiment.

The first series in the Helvetica family was presented to the British graphic arts community in 1963, and it rapidly achieved a popularity paralleling its acceptance on the Continent. This popularity has grown as additional series were completed and released, until, today, a total of 12 varieties of Helvetica are available. In addition, Linotype matrices have been manufactured of several weights and styles.

NOTE: Lintoype Helvetica is the same as Stempel Typefounders Helvetica Regular. Linotype Helvetica Bold is the same as Stempel Typefounders Medium. 6pt Linotype Helvetica equals Stempel Typefounders 8pt Small face, 8pt Linotype Helvetica equals 10pt Small face, 10pt Linotype Helvetica equals Stempel Typefounders 12pt, 12pt Linotype Helvetica equals Stempel Typefounders 14pt.

From a folder "Helvetica from Linoset" distributed by Linoset Ltd., Leicester, England.

Résumé de Articles

Traduction: Fernand Baudin

Les propriétés psycholinguistiques et universelles de la lecture *par Kenneth S. Goodman*

Tout homme cultivé, quelle que soit sa langue, dispose de deux niveaux de parole qui sont l'expression d'une même structure profonde et qui ont la même signification. Pour un lecteur exercé, la langue écrite devient parallèle à la langue parlée et n'en est nullement une représentation au second degré. L'audition et la lecture sont des activités au cours desquelles il choisit, retient et prévoit le sens d'après les signaux donnés. Le lecteur traite simultanément toutes les informations graphiques, grammaticales et sémantiques. Il se forge instinctivement un système de triage pour relier efficacement les signaux graphiques et la grammaire de sa langue aux concepts et aux expériences évoqués dans le texte. Ces propriétés essentielles de la lecture sont universelles.

Origine du caractère russe dit *Grazhdanskii* ou caractère laïque *par Ivan L. Kaldor*

La deuxième partie de l'article de M. Kandor est fondée sur une hypothèse selon laquelle le *grazhdanskii* de Pierre le Grand, qui est le premier caractère russe de style moderne, serait formé sur trois modèles: (a) l'écriture laïque courante en Russie, à la fin du dix-septième et au début du dix-huitième siècles, (b) le caractère *poluustav*, alors démodé et, (c) les caractères romains en usage dans l'Occident à cette époque. Ces derniers ont été les plus influents. Après avoir recherché quel serait l'ouvrage particulier qui pourrait avoir servi comme modèle, l'auteur pense l'avoir trouvé dans le caractère utilisé dans l'*Architectura militaris moderna* de Matthias Dögen, et, dans une certaine mesure, dans *Symbola et emblemata* qui était un des ouvrages préférés de Pierre le Grand. L'analyse détaillée, lettre par lettre, des trois versions originales du *grazhdanskii*, vient étayer la théorie de M. Kandor.

Influence du ductus dans l'identification des lettres *par Jeremy J. Foster*

Une expérience est décrite dont les résultats semblent confirmer la théorie de Kolers concernant l'influence du ductus dans l'identification des lettres. Ces résultats soulignent également la relation entre cette influence et un certain nombre d'études qui portaient sur des textes présentés au tachistoscope. De même que la relation entre cette influence et les résultats d'expériences optiques.

La recherche et l'analyse de la lisibilité des inscriptions cartographiques *par Barbara S. Bartz*

Cette recherche est consacrée à un aspect particulier de la lisibilité des inscriptions en cartographie. Une série de cartes ont été examinées sous différentes conditions.

Quatre conclusions se sont imposées. Si l'on lit au hasard des cartes où ne figure qu'un seul type de caractère, le temps de lecture n'est pas affecté par les différences de corps des inscriptions. Si plusieurs caractères sont utilisés, la lecture est ralentie lorsqu'on ne sait pas précisément dans quel caractère apparaîtra le nom que l'on cherche. Au contraire, le temps de lecture sera sensiblement abrégé lorsqu'on sait exactement dans quel caractère est exprimé ce que l'on cherche. Le temps de lecture est moins fonction de la typographie que de bon nombre d'autres facteurs.

Kurzfassung der Beiträge

Übersetzung: Dirk Wendt

Psycholinguistische Gesetzmäßigkeiten beim Lesen *von Kenneth S. Goodman*

Lesende Sprecher jeder Sprache haben zwei verschiedene Oberflächen-Sprachformen zur Verfügung, die beide Realisationen derselben Tiefenstruktur sind und Codierungen derselben Bedeutungen darstellen. Für den erfolgreichen Leser wird die geschriebene Sprache eine Parallelform der gesprochenen und keine sekundäre Vertreterin der ersteren. Hören und Lesen sind Prozesse, in denen Benutzer der Sprache Auswahl treffen, auslassen und Vorhersagen aufgrund der verfügbaren Signale machen können. Leser sind Sprachbenutzer, die graphische, syntaktische und semantische Information gleichzeitig verarbeiten. Leser entwickeln Strategien zum wirksamen Sammeln graphischer Signale unter Einbeziehung der Syntax ihrer Sprache, von Begriffen und Erfahrungen, die durch den Text angesprochen werden. Die wesentlichen Charakteristika dieses Lesevorganges sind allgemeine Gesetzmäßigkeiten.

Die Entstehung der russischen Graždanskijšrift oder Amtsschrift, II. Teil, *von Ivan L. Kaldor*

Der zweite Teil des Aufsatzes von Kaldor geht von der Annahme aus, daß die erste moderne russische Schrift (d.h. Peters des Ersten *Graždanskijšrift*) nach drei Grundmodellen geformt wurde: a) den amtlichen russischen Schreibschriften des späten 17. und frühen 18. Jahrhunderts, b) der veralteten *Poluustav*-Schrift und c) zeitgenössischen westlichen Antiqua-Schriften. Der Einfluß westlicher Antiqua-Schriften scheint am bedeutendsten zu sein. Bei seiner Suche nach einem bestimmten Werk, daß als Vorbild gedient haben könnte, bietet der Verfasser die Hypothese an, daß die Antiqua-Schrift in Matthias Dögens *Architectura militaris moderna* und (in gewissem Maße) Peters Lieblingsbuch *Symbola et emblemata* die Vorbilder des Schriftentwurfs gewesen sein könnten. Diese grundlegende Theorie wird durch eine buchstabenweise Analyse der drei Versionen der *Graždanskijšrift* belegt.

Richtungs-Konsistenz beim Formerkennen *von Jeremy J. Foster*

Es wird über ein Experiment berichtet, dessen Ergebnisse die Theorie Kolers zur Richtungs-Konsistenz beim Buchstaben-Erkennen stützen. Die Verbindung zwischen diesen Erscheinungen und dem Erkennen tachistoskopisch dargebotener Muster wird besprochen, außerdem die Beziehung zwischen der Richtungs-Konsistenz und den Ergebnissen von Experimenten mit visuellen Such-Aufgaben.

Experimentelle Anwendung der Such-Aufgabe bei der Analyse der Lesbarkeit von Schriften in der Kartographie *von Barbara S. Bartz*

Zur Untersuchung eines Aspektes der Lesbarkeit typographischer Kartographie wurde das Suchen als experimentelle Aufgabe verwendet. Die Vpn durchsuchten eine Vielzahl von Landkarten unter verschiedenen Bedingungen. Vier Hauptergebnisse dieser Studien: Beim Absuchen von Landkarten, die nur eine Schriftart enthielten, hatte die Typographie keinen bedeutsamen Einfluß auf die Suchzeit. Bei Karten mit gemischten Schriften ist die Suche verlangsamt, wenn der Benutzer keine genaue Erwartung hat, in welcher Schrift der gesuchte Name erscheinen wird. Die Suche wird aber sehr beschleunigt, wenn der Benutzer eine genaue Vorstellung von der Erscheinung des gesuchten Namens hat. Die Suchzeit bei der Suche nach einem einzelnen Namen ist weniger eine Funktion der Typographie als vielmehr abhängig von vielen anderen Faktoren.

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